RELATIVE EFFICIENCY OF THE INTERNAL CAPITAL MARKET IN A MULTI-DIVISION FIRM

by

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Relative Efficiency of the Internal Capital Market in a Multi-Division Firm

Abstract

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Research on the efficiency of the internal capital market (ICM) of multi-division firms has not been conclusive. While most studies use data developed from Compustat and find that the ICM is inefficient, a few studies examine data developed from government or trade publications and find an efficient ICM. Measures of investment opportunities (Tobin's q) and segments (SFAS 14 data) used in the Compustat-based studies have been criticized in the literature as biased due to measurement error. This dissertation suggests a theoretical model of the internal capital market based on game theory and develops hypotheses to test those factors that would resolve the "social dilemma" of the division managers and create an efficient internal capital market. A unique dataset, involving a combination of hand-collected and Compustat data that addresses the measurement issues of previous studies, is collected to test these hypotheses and then test the efficiency of the internal capital market to the external market. Empirical testing was hindered by the lack of explanatory power of multivariate tests and therefore only limited evidence is available to examine the hypotheses proposed.

Chapter 1 – Introduction

"Recall that the capital market has traditionally been expected to exercise controls of three types: metering, incentives, and displacement. The M-form organization partially supplants the capital market in each of these three respects. Indeed, the general management of an M-form enterprise may, for many purposes, be regarded as acting, in effect, as a miniature capital market" (Williamson, 1970, p. 177).

In *Corporate Control and Business Behavior*, Oliver Williamson proposed that multi-division firms that are properly structured (which he labeled M-form organizations) would form an internal capital market (hereafter, ICM) and replace the functions of the external capital market (hereafter, just "external market"). In this and later works developing transaction cost economics (Williamson, 1975, 1985), his "M-form hypothesis" suggests that, with specific control mechanisms in place, the resulting multi-division firm (M-form) would be more efficient at capital allocation than the external market. This dissertation examines Williamson's M-form hypothesis through a game theory lens, identifying and testing variables that determine the relative allocative efficiency of the ICM both across multi-division firms and compared to single segment firms where no ICM exists.

The concept of the ICM is critical to understanding the economics of organizations. Research has shown that over time, 73% of tangible capital investments are financed internally (MacKie-Mason, 1990). While internal financing is available to all profitable firms, the growth in conglomerate, multi-division firms over the past four decades suggests that much of this internal financing occurs in ICM's. Indeed, research suggests that one of the forces driving the establishment of M-form firms is the creation of an ICM for internal financing purposes (Hubbard & Palia, 1999; Matsusaka & Nanda, 2002; Russo, 1994; Stein, 1989; Teece, 1982).

The efficiency of the ICM is also of critical importance to accounting. In a general sense, all accounting information is used for performance evaluation. In the external market, it is accounting information which allows performance comparisons between firms and the valuation of each firm's performance to date and expected future performance in its price. While there has been considerable research testing the implications of this value relevance of accounting information for external market purposes (see summaries by Holthausen & Watts (2001) and Kothari (2001)), the relevance of accounting information inside the firm is potentially more significant. In the ICM, accounting information supplants the pricing system. Therefore the efficiency of the accounting system in the firm determines the efficiency of the ICM (Coase, 1990). Accounting research should therefore be particularly concerned with the question of ICM efficiency.

Although literature on the ICM begins with Williamson's development of the transaction cost economics theory of the firm, later theoretical models have examined the ICM using agency theory (Fama, 1980; Jensen & Meckling, 1976) or property rights theory (Grossman & Hart, 1986; Hart & Moore, 1990) approaches, and extend the model to consider the effects of corporate financial constraints, corporate agency problems, focus, and division rent-seeking behavior. Initial empirical studies focused on organizational form – suggesting that higher profit-based performance measures (ROA, ROE) of M-form firms versus other multi-division firms was evidence of an efficient ICM (Armour & Teece, 1978; Steer & Cable, 1978; Teece, 1981). More recent empirical work has generally found that ICMs are inefficient. Theses studies have used SFAS 14 segment data to look inside the firm and examine ICM activity (capital expenditures,

profits, cash flows) and based ICM efficiency judgments on market-based measures of performance such as Tobin's q (for example, Rajan, Servaes, & Zingales, 2000; Scharfstein, 1998; Shin & Stulz, 1998; Wulf, 2002b). Several papers find evidence of an efficient ICM using other sources of data and measures of efficiency such as government databases/productivity (Maksimovic & Phillips, 2002) or trade journals/productivity (Khanna & Tice, 2001). Evidence has suggested that the use of SFAS 14 segment data (Berger & Hann, 2003; Herrmann & Thomas, 2000; Street, Nichols, & Gray, 2000; Villalonga, 2004) and Tobin's q (Chevalier, 2004; Howe & Vogt, 1996; Whited, 2001) has led to significant measurement error in this research. This evidence suggests that a different theoretical approach, along with improvements in the methodology and measures may help to clarify ICM efficiency.

This dissertation suggests that game theory provides an alternative theoretical structure in which to analyze division manager actions in the ICM. "Game theoretic models allow economists to study the implications of rationality, self-interest and equilibrium, both in market interactions that are modeled as games (such as where small numbers, hidden information, hidden actions or incomplete contracts are present) and in non-market interactions (such as between a regulator and a firm, a boss and a worker, and so on)" (Gibbons, 1997, p. 127). In particular, the game theoretic structure seems applicable to the ICM because it is readily extended to multiplayer and multi-period environments, where market oversight of player actions is governed by evolving strategies developed within the particular structure of the game and its players.

An interaction is modeled as a game when the participants face a decision to "cooperate" (where the result of their decision is group enhancing) or "defect" (where the

result is self-serving) and where the dominant strategy from each participant's standpoint is to defect. Division managers face these types of decisions annually when they communicate and negotiate the investment projects they wish to have financed by the corporate (HQ) office. Cooperation by the division managers involves honest reporting of project returns and potential (no rent-seeking behavior) and may lead to fewer projects for the particular manager, but the best (defined as highest return, highest cash-flow, best strategic fit, etc.) projects for the corporation as whole and therefore provide the highest benefit for the group (corporation) as a whole. Over time, a pattern of division manager defection leads to less than first-best corporate profits and cash-flow and reduced resource availability to fund investments and potentially affects the viability of the firm as a whole. A multi-player game involving more than two players, such as would be found in a multi-division firm with an ICM, is labeled a "social" dilemma (Dawes, 1980; Olson, 1965; Taylor, 1987).

Social dilemmas can only result in cooperative solutions by attention to the structure and governance of the game. In particular, there must be a known probability that player interactions with continue from one play to the next (game length); the number of players affects the probability of cooperation (group size); there must be a realistic probability that defection will be discovered (monitoring and detection); and there must be effective penalties for defection when it is discovered (sanctions) (Axelrod, 1981; Bendor & Mookherjee, 1987; Taylor, 1987). Each of these attributes were analyzed in the context of the ICM of a multi-division firm and hypotheses generated.

Career concerns make the game length relevant to the division manager. They affect the division manager's view of the ongoing nature of their employment both within

their current firm and within the labor market as a whole. Holmstrom & Costa (1986) show how career concerns effect the investment choices made by subordinate managers due to their concerns about reputation (human capital) versus their superior's concern for financial capital. De Motta (2003) builds a model of the ICM that suggests that career concerns lead to an interplay of division manager attention to helping either the external market or corporate headquarters learn about division performance (and therefore their own performance). Firms can address division manager career concerns and therefore increase the chances of a cooperative solution through compensation contracts with the proper incentives (Gibbons & Murphy, 1992). They suggest that factors such as manager age, years to retirement, and job tenure reflect a manager's career concerns and show how those factors predict different incentive packages across firms. In addition, compensation packages are often balanced with both current and deferred compensation (i.e. stock options or deferred bonus payments) to properly focus the manager's decision horizon (Narayanan, 1996). This provides the background for H1:

H1: Firms that address career concerns of division managers will have a more efficient ICM.

Generally, experimental research on social dilemmas indicates that group cooperation decreases as group size increases (Bonacich, Shure, Kahan, & Meeker, 1976; Hamburger, Guyer, & Fox, 1975; Marwell & Schmitt, 1972) until some upper limit, which has been established at approximately seven or eight (Liebrand, 1984; Van Lange, Liebrand, Messick, & Wilke, 1992). In the ICM, it is the number of divisions that determine the group size. This suggests the first group size hypothesis:

H2a: The larger the number of divisions in the ICM of a multi-division firm the less efficient the ICM.

There are other variables related to group size that make it difficult to focus solely on the "number of players" as the variable of interest (Kollock, 1998a; Van Lange et al., 1992). Perceived efficacy – "The extent to which one believes that his or her own contributions help to achieve the collective goals" (Van Lange et al., 1992, p. 18) is one . As group size increases, it becomes easier for a player to conclude that their cooperation does not matter. In addition, particularly related to the ICM, relative size of the divisions may be a factor effecting perceived efficacy. A firm with one large division in either size or profitability and several small divisions may find it more difficult to find a cooperative solution. Managers of the smaller divisions may feel they have less to lose (more to gain) by defection (Scharfstein & Stein, 2000). The model of Rajan, Servaes & Zingales (2000) suggested that diversity of opportunities and resources among the divisions in an ICM leads to inefficient allocation of resources. Experimental evidence further supports the suggestion that relative "power" in a resource allocation game, as measured by diversity of profits, negatively effects the possibility of a cooperative solution (Mannix, 1993). This generates the second and third hypotheses relating to group size:

H2b: The more diverse the size of the divisions in a multi-division firm, the less efficient the ICM.

H2c: The more diverse the profits of the divisions in a multi-division firm, the less efficient the ICM.

Another variable associated with group size is group identity. This relates to the perceptions each player has about the other players in the game. If the individual player feels himself part of a "group" that is using the common resource (as compared to an individual or sub-group using the resource along with other individuals or sub-groups), experimental research has shown that the dilemma is more likely to be resolved

cooperatively (Bornstein, 1992; Kollock, 1998b; Kramer & Brewer, 1984). Williamson's (1975) conception of the ICM seems to suggest the formation of a group identity in an M-form firm as he describes the advantages of internal organization to "promote convergent expectations" (p. 25), develop efficient coding to summarize complex events "by using what may be called idiosyncratic language" (p. 25), and make allowance for "quasimoral involvements" (p. 38) among the divisions. In a multi-division firm, group identity would be enhanced by a strong "corporate identity" umbrella under which all of the divisions reside. Social identity theory suggests the importance of a strong organizational identity to overcome conflict among subunits (Ashforth & Mael, 1989). Group identity can also be enhanced by policies which reward group (corporate) effort and results over individual (division) effort and results, particularly in situations where there are strong interdependencies (Bushman, Indjejikian, & Smith, 1995; Datar, Kulp, & Lambert, 2001; Itoh, 1992). This provides the background supporting the forth and fifth group size hypotheses:

H2d: Multi-division firms which promote corporate identity will have a more efficient ICM.

H2e: Multi-division firms which promote corporate identity in their compensation practices will have a more efficient ICM.

Finally, larger groups allow individual players to "hide", such that their level of cooperation is not known to the other players. This reduces the incentives to cooperate (Dawes, 1980; Kollock, 1998a; Van Lange et al., 1992). Firms may be organized so there is limited knowledge among the division managers about each other or organized to promote communication and interaction among division managers. Experimental research on social dilemmas has consistently shown that allowing communication among

the players improves the rates of cooperation (Aquino & Reed II, 1998; Kollock, 1998b; Messick & Brewer, 1983). Beyond communication, the problem of identifiability can be resolved through "public" choice, such as the use of management or executive committees, where all top management personnel participate in corporate level decisions such as capital investment decisions. These committees would not only promote cooperation through enhanced group communication, but the nature of their decision making would make their individual choices "public". Experimental research has also provided strong support for "public" choice as a means to improve cooperation (Fox & Guyer, 1978). This leads to the final group size hypothesis:

H2f: Multi-division firms which promote communication and group decision-making among division managers will have a more efficient ICM.

In the centralized solution to a social dilemma, the group selects a central authority and empowers it to perform the necessary monitoring and sanctioning of the individual players. Although not necessarily "selected" by the division managers, the Corporate HQ performs that role in the ICM. Resolving the social dilemma requires that there be both a sufficient probability that the actions of the division be examined and a sufficient probability that upon examination the true nature of the division actions be known (Bendor & Mookherjee, 1987). Taylor (1987) shows how cooperation can be achieved in an N-person prisoners' dilemma (a social dilemma), but only in the presence of adequate monitoring by the group members. Bendor & Mookherjee (1987) show how, when monitoring is delegated to a central authority, it is sufficient to obtain a cooperative solution even when it is imperfect. This is particularly true in a "federal system" where groups or units are monitored instead of individuals (a situation similar to what would be

found in a multi-division firm). Williamson (1975) clearly identifies the necessity of monitoring by the corporate office (including specifically identifying the use of an internal audit function). He suggests that having divisions identified as separate economic activities enhances corporate HQ monitoring. Generally research on the ICM since Williamson has suggested that less diversity in the economic activities of the segments (a more focused strategy) leads to a more efficient ICM (Gertner, Scharfstein, & Stein, 1994; Liebeskind, 2000; Stein, 1997). This background leads to two hypotheses related to monitoring:

H3a: Multi-division firms which are less diversified will have a more efficient ICM.

H3b: Multi-division firms which have an internal audit function will have a more efficient ICM.

As noted above, sanctioning would be enforced by the central authority (Corporate HQ) in the ICM. The sanctioning ability of Corporate HQ is one of the significant advantages of the ICM over the external market since actions available to them would incur much greater cost if imposed by external shareholders or debtholders (Stein, 1997; Williamson, 1975). Sanctions imposed by corporate HQ might include a blanket prohibition on future allocations, reallocation of resources away from a defecting division to other divisions that actually had the higher value projects given truthful reporting, or direct "punishment" of the division manager. This background suggests the following sanctioning hypothesis:

H4: Multi-division firms which have an effective sanctioning system will have a more efficient ICM

Once the firms with the essential structural and governance functions are identified through the testing of all forms of H1 – H4, then the efficiency of the ICM can

be tested against the external market. To this point this dissertation has only examined factors affecting the efficiency of the ICM compared to other ICMs. The key test of Williamson's M-form hypothesis is the relative efficiency of the ICM to the external market. At this level of efficiency testing, both markets are subject to agency problems between HQ and debtholders/shareholders. Corporate managers that wish to consume perquisites, build empires, or fund pet projects would negatively affect the efficient allocation of resources in either an ICM or external market setting (Radner, 1986). In addition, models of both the ICM (Gertner et al., 1994; Inderst & Laux, 2000; Liebeskind, 2000; Matsusaka & Nanda, 2002; Stein, 1989, 1997) and external market (Jensen, 1986) indicate the level of financial constraint on the firm as a whole is an important factor in controlling agency problems at the firm level. Empirical research on agency costs and inefficient corporate investment has provided significant support for these theories (see Stein (2003) for a summary of this literature). One of the principle means used to reduce agency costs is to provide stock ownership to managers (through various forms of stock compensation – e.g., stock purchase plans, stock options, etc.) to align the interests of owners and managers (Himmelberg, Hubbard, & Palia, 1999). This supports the following final hypotheses, which test the efficiency of the ICM compared to the external market:

H5: A properly structured ICM is more efficient at resource allocation than the external market.

H6: Stock ownership by management will positively affect the efficiency of resource allocation in any market.

H7: Higher financial constraints on the firm will positively affect the efficiency of resource allocation in any market.

This dissertation addresses the measurement issues of previous empirical research on the ICM in the proposed testing of these hypotheses. First the theoretical definition of segment investment is extended beyond capital spending to include investments in human capital, working capital, research and development and acquisitions. Although methodology was developed to measure investments in human capital at the segment level, a lack of data for the sample firms eliminated it from the final measure of segment investment. Unfortunately, data limitations also prevented the inclusion of investments in research and development in the final segment investment computation as well. The final computations of segment investment did include investments in working capital and acquisitions.

Secondly, this dissertation is based on segments reported under SFAS 131, which requires the management approach to identify reportable segments. As the introduction to SFAS 131 states, "The management approach is based on the way that management organizes the segments within the enterprise for making operating decisions and accessing performance." and "…focuses on financial information that an enterprise's decision makers use to make decisions about the enterprise's operating matters" (FASB, 1997, p. 5). The examination of segment investments under this structure provides a clearer picture of these allocations since they are based on the actual structure of the firm's operations. Under SFAS 14, segments were formed by SIC code, which may or may not have been the firm structure, and therefore may have "hidden" some investment decisions from analysis. Since SFAS 131 has only been required disclosure for firm years beginning after December 15, 1997, in order to obtain data for a long enough time series, this dissertation is based only on firms that did not change their segment

definitions in the conversion from SFAS 14 to SFAS 131. This allowed data to be collected for the period 1995 – 2002 for testing of the hypotheses and yielded a final sample of 84 multi-division firms. Although the original source of the sample firms came from the Compustat segment database, much of the data that was to be used in the empirical testing was hand-collected from corporate annual reports (10Ks) and proxy statements. Many of the variables identified for empirical testing, particularly those relating to the compensation or characteristics of the division manager, were not available across the sample firms and sample period and were therefore dropped from the empirical testing. One variable (*dvrprof*) was eliminated from the analysis due to the negative profits in the sample that drove the calculation to extreme values and limited its effectiveness as a measure of profit diversity. This prevented testing of H2c, which examined the effect of diversity of profits on the efficiency of the ICM. In spite of the data issues, there were empirical variables identified and collected that were available to test all the remaining proposed hypotheses.

Finally, in order to address the concerns with the use of Tobin's *q* in previous ICM research, this dissertation uses empirical methodology based on industry measures of changes in value added as a proxy for investment opportunities. This methodology was successfully used by Wurgler (2000) in a country level analysis of investment efficiency relative to financial market development. In its basic form, the coefficient on a regression of changes in segment investment on changes in industry value added provides a measure of the "elasticity" of investment – what this dissertation called the Opportunity Response Coefficient (ORC). This coefficient essentially measures the response of investment to industry investment opportunities in the marketplace.

Unfortunately, the application of even the basic regression to the data in this dissertation failed to provide meaningful results. The regression was statistically significant, but the R^2 indicated that it provided no explanatory power. The failure of the basic empirical methodology prevented multivariate testing of any of the proposed hypotheses. In particular, this prevented any testing of H5, the comparison of the efficiency of the ICM to the external market, because this test relied solely on multivariate analysis. For the other hypotheses, univariate analyses were performed, with only limited support found for H1 (attention to division manager career concerns) and H2e (promotion of corporate identity through compensation practices). All other hypotheses were not supported by univariate tests. These tests are summarized in Table 48.

In spite of the failure of this dissertation to provide empirical testing of the proposed hypotheses, it still provides a number of avenues that warrant further attention. First, the failure of the empirical methodology itself warrants further investigation. While the basic empirical regression did not yield results that provided any explanatory power over the whole sample, there were 13 companies within the sample that individually had statistically significant and substantively important regressions. This suggests that there may be some validity to the empirical methodology. These companies should be analyzed further to determine why their results differ so dramatically from the rest of the sample. Although Wurgler (2000) was a country level analysis, the basic concept of a measure of "increasing investment in industries that are 'growing' and decreasing investment in industries that are 'declining'" (p. 194) would seem to apply equally well within a country. One concern is that the measure of value added growth is not a good proxy for investment opportunities. Wurgler reported highly significant

correlations of industry value added growth to other measures of investment opportunities (average q, log price-earnings ration, and log sales growth) in his country analysis. The U.S. based data used for this project does not show this relationship. The lack of consistency needs further analysis to understand its origins and to determine if the methodology can be salvaged for a within country analysis. It is possible that this analysis may provide insight into the debate on the importance of industry versus company strategy in the analysis of performance.

In addition, it is troubling that there is no relationship between changes in segment investment and segment historical performance in this data. It seems difficult to imagine that the historical profitability (or lack of profitability) of a segment has no statistically significant bearing on the changes in investment in the segment over a relatively broad sample of firms and industries. Certainly firm strategy may have some significant bearing on investment that may overshadow performance for a period, but at what point does the historical performance of the segment signal a change in investment strategy? This dissertation would suggest that there is never an overlap of segment performance and corporate strategy and that would seem to warrant further analysis.

The work done to build the theoretical model and apply empirical definitions to the model is still valid and potentially testable using different methodology or a larger sample. Other data sources would be required to measure most of the empirical variables related to the characteristics of the division manager and his/her compensation, however, if a source for this data could be found, it could be the basis of the sample of firms to be tested. In addition, the work done to calculate the investment variable suggests that a simple calculation of the change in total assets may well capture most of the elements of

investment suggested in this project – capital spending, acquisitions/dispositions, and changes in working capital. This variable could be computed without the extensive hand data collection related to acquisitions and therefore holds promise for extending this project to a sample of more significant size. There will soon be 10 years of SFAS 131 segment data and matching value added data under NAICS codes available, allowing a much broader sample (both of firms and time period) to test the hypotheses and perhaps the empirical methodology of this project more extensively.

This dissertation is organized as follows: Chapter 2 provides the literature review; Chapter 3, the theoretical model and hypothesis development; Chapter 4, the empirical model development; Chapter 5, the data, sample selection and variable measurement; Chapter 6, the empirical testing; and Chapter 7, the conclusions and implications for future research.

Chapter 2 – Literature Review

Internal Capital Market

Literature on the ICM begins with Williamson's development of the transaction cost economics theory of the firm (Williamson, 1970, 1975, 1985). This section will briefly summarize Williamson's model of the ICM as it was developed out of transaction cost economics. Second, it will present later theoretical models that examined the ICM using agency theory or property rights theory approaches, and extend the Williamson's original model by considering the effects of corporate financial constraints, corporate agency problems, focus, and division rent-seeking behavior. Then it will survey empirical work on the ICM. Initial empirical studies focused on organizational form – suggesting that higher profit based performance measures (ROA, ROE) of M-form firms versus other multi-division firms was evidence of an efficient ICM. More recent empirical work has generally found that ICMs are inefficient. These studies have used SFAS 14 segment data to look inside the firm and examine ICM activity (capital expenditures, profits, cash flows) and based ICM efficiency judgments on market-based measures of performance such as Tobin's *q*. Several papers find evidence of an efficient ICM using other sources of data and measures of efficiency such as government databases/productivity (Maksimovic & Phillips, 2002) or trade journals/productivity (Khanna & Tice, 2001). Finally, this section will discuss evidence that has suggested that the use of SFAS 14 segment data (Berger & Hann, 2003; Herrmann & Thomas, 2000; Street et al., 2000; Villalonga, 2004) and Tobin's *q* (Chevalier, 2004; Howe & Vogt, 1996; Whited, 2001) has led to significant measurement error in this research.

Williamson's Model

Briefly, transaction cost economics suggests that firms are created to economize on transaction costs associated with market failures. These market failures occur when particular human behavioral factors (opportunism and bounded rationality) are matched with particular environmental factors associated with transactions (asset specificity, frequency, and uncertainty) (Williamson, 1985). Williamson's theory suggests that the convergence of these factors leads to governance of the transaction via hierarchy (firm) versus market exchange. Williamson recognized that transaction governance problems do not disappear within firms, particularly as they grow in size. He therefore extended transaction cost economics by developing his M-form hypothesis, which suggests that as firms become larger and more complex due to internalizing transactions, the most efficient organization form is the multi-divisional structure. In particular, those multi-division firms that are organized with specific governance mechanisms qualify as M-form firms. These mechanisms are:

- Divisions must be identified by separate economic activities
- Divisions must be given "quasi-autonomous" standing. This means that the divisions are responsible for the operating decisions of the economic activities around which they are formed and are generally of the nature of a profit center.
- The corporate headquarters (HQ) must monitor the performance of the divisions utilizing objective measures (such as profit, ROI, ROA, or EVA) and an "elite staff" to both audit and advise divisions.
- The HQ must perform all strategic decision making and more importantly, ONLY strategic decision making. It should not be involved in any operating decisions.
- The HQ must award incentives to the divisions to motivate the achievement of the strategy
- The HQ must not automatically allocate division cash flows back to their sources, but expose them to internal competition and assign them to the highest yield uses (Williamson, 1975)

It is the process of exposing division cash flows to internal competition that creates the ICM within the firm. It is only when all of the control and capital market exchange mechanisms are in place that an M-form organization and ICM exist.

In effect, Williamson advocates the same control mechanisms (incentive, monitor and audit) as those available to the external market. He believed, however, that these governance mechanisms were superior within the M-form firm for two reasons. First, he believed that with these mechanisms in place, HQ managers become "psychologically committed" to long-term profit-maximization for the whole enterprise (Williamson, 1975), thereby also reducing agency costs between HQ and shareholders. Second, he believed that these mechanisms could be more effectively utilized in a hierarchical organization due to the organization's greater ability to overcome information asymmetry and opportunism (Alchian, 1969; Williamson, 1975, 1985). In particular, there are more extensive incentive mechanisms, which, although less high powered (i.e. status, promotion), can be managed to deeper levels in the organization to keep the organization focused on the same goal. Audit capabilities are significantly greater in internal organizations given that there is greater access to information (due to superior-subordinate relationship) and that their timing and detail is subject to more discretion. Investment proposals can be more efficiently reviewed and funded internally, utilizing a "real options" approach by decomposing the investment into stages, than might be economically possible externally. Finally, the correction mechanisms of the internal market are considerably more efficient than the external market. Even if the external market could overcome the problems of information asymmetry/opportunism noted above to discover that management was not pursuing a goal of profit maximization, there

would be significant costs in gathering the means to replace management, and there would be significant disruption involved in doing so. Internal organizations have much greater flexibility to discipline (and if necessary, replace) managers who are not pursuing the goals of the organization. As Williamson describes it, "this permits it [HQ] to intervene early in a selective, preventative way (a capability which the capital market lacks altogether), as well as to perform *ex post* corrective adjustments, in response to evidence of performance failure, with a surgical precision that the capital market lacks (the scalpel versus the ax is an appropriate analogy)" (Williamson, 1975, p. 159).

Theoretical extensions

Beginning in the mid-1990's additional theoretical work on ICM efficiency began to appear in the economics and finance literature. Generally using a lens of agency theory (Fama, 1980; Jensen & Meckling, 1976) or property rights (Grossman & Hart, 1986; Hart & Moore, 1990) this literature amplified or extended Williamson's ICM model in the following areas – the effect of financial constraints, agency problems at Corporate HQ, the extent of focus of the firm's business activities, and rent-seeking activities by division managers.

Numerous theoretical models assume or discuss the need for the firm to be financially constrained (more positive investment opportunities than available financing either internally or externally) in order for the ICM for function efficiently (Gertner et al., 1994; Inderst & Laux, 2000; Liebeskind, 2000; Matsusaka & Nanda, 2002; Stein, 1989, 1997). These papers incorporate the free cash flow theory of Jensen (1986) to an ICM setting, emphasizing that there can be "too much of a good thing" if diversification

creates an ICM of sufficient size that it exceeds the positive investment opportunities that it creates.

The "psychological commitment" of corporate managers, and therefore the reduction of agency costs between HQ and the external market suggested by Williamson has been a source of debate in post-Williamson theoretical work. "In particular, the assumption that top corporate executives have a psychological commitment to overall performance, and that this expresses itself as a commitment to maximizing profitability, are questionable" (Hill, 1985, p. 738). Liebeskind (2000) suggests that HQ agency costs will be exacerbated by an ICM, particularly in firms that have excessive free cash flow. Gertner, Scharfstein & Stein (1994) and Rajan, Servaes, & Zingales (2000) both suggest that agency problems between HQ and the external market may exist, but that they would not affect the efficient allocation of resources since managers would still wish to exploit all profitable opportunities to increase their potential agency rents. Scharfstein & Stein (2000) argue that agency problems at HQ would lead corporate managers to use capital allocation as incentives to the divisions (instead of allocating to the highest value use) in order to retain cash for their own perquisites, while Harris & Raviv (1996) counter that even if capital allocations are the only incentive, control mechanisms can be put in place to still assure efficient allocation.

Various models address the effect that the degree of "relatedness" of the businesses within a diversified firm has on the ICM. Gertner, Scharfstein, & Stein (1994) for example, suggests that there must be multiple *related* investment projects in order for the firm to take advantage (and obtain positive financial benefit) from its ability to re-deploy assets. This sentiment is echoed by Stein (1997), who notes that potential

investment projects will be correlated across divisions if a firm is more "focused". Therefore, when choosing which projects for investment in an ICM, relative ranking will be more efficient – which allows better "winner-picking", an advantage of the ICM over the external market due to its inside information. For Liebeskind (2000), the more focused firm will be at a greater advantage from the "Lender Effect" in a constrained firm because of its information advantages, particularly if there are no specialized external market lenders in that industry. Only the Matsusaka & Nanda (2002) model suggests that the value of the ICM is improved with more variability of investment options (less focus). In their model, the ICM creates a "real option" to shift resources among divisions to avoid the costs of external finance. Real option theory would suggest that, like financial options, it is the variability of opportunities that gives this option its value (Dixit & Pindyck, 1995).

Although Williamson's conception of the ICM suggests that rent-seeking behavior by division managers is controlled by the mechanisms he requires, several post-Williamson models disagree. Scharfstein & Stein (2000) propose that when divisions have disparate opportunities, the weaker ones will be inclined to rent-seek since it is less costly for them to forego productive activities. A similar point is argued by Rajan, Servaes, & Zingales (2000), who suggest that power struggles among the divisions lead to inefficient resource allocations. Wulf (2002a; 2002b) builds a model that has division managers using influence activities to skew capital allocations in their favor. In each of these theoretical models, HQ recognizes that division manager actions can lead to misallocation of resources and try to minimize the effect by "socialist" allocations – where strong divisions subsidize weak ones (Scharfstein & Stein, 2000). Capital

allocations are used as an incentive mechanism to prevent more extreme distortions from rent-seeking (Wulf, 2002a, 2002b) or self-serving investment (Rajan et al., 2000) behavior.

Empirical Work

Initial empirical work based on Williamson's M-form hypothesis generally provided strong support (Armour & Teece, 1978; Steer & Cable, 1978; Teece, 1981). However, in his synthesis of research in this area, Ezzamel (1985) noted that it focused on comparing the relative performance (based on profitability measures such as ROA, ROE, or Return on Sales) of similar multi-division firms with differing organization structures and, although the research had established a correlation between the two factors, the underlying cause could be due to other extraneous variables not captured by the models. Only Hill (1988), who uses a survey method to obtain information about the control mechanisms utilized by the firms in his sample, suggests that the M-form and ICM may not lead to superior performance.

Starting in the mid-1990's, empirical work began to address the methodological problems with the initial ICM studies. The availability of more than 10 years of SFAS 14 segment data allowed studies to directly examine the activity (capital expenditures, profits, cash flows) of the participants in the ICM (Berger & Ofek, 1995; Lamont, 1997; Shin & Stulz, 1998). In addition, recognizing the problems with using a profit-based performance standard (ROA, ROE) as a means of evaluating efficiency, studies began to use a market based measure - Tobin's q. Since q cannot be measured for divisions within multi-division firms, these studies use the median q of single segment firms in the same SIC code as a proxy (Berger & Ofek, 1995; Lang & Stulz, 1994; Shin & Stulz, 1998).

From this point, most research on the ICM makes use of q and SFAS 14 segment information as the means to examine and measure ICM efficiency. For example, Rajan, Servaes & Zingales (2000) test of their model of division power struggles (caused by diversity of resources and opportunities) using the industry average of SFAS 14 single-segment q as a proxy for within firm division opportunities and SFAS 14 segment assets as a proxy for division resources. Using a similar measure of investment opportunities, Scharfstein (1998) provides evidence of ICM inefficiency (most pronounced where there are agency problems between HQ and shareholders) in his examination of capital allocations in diversified firms. Wulf (2002a; 2002b), recognizing the problems with using q in these analyses, uses lagged segment profits as her main proxy for investment opportunities (what she calls the "public signal"). However, she also includes SFAS 14 single-segment q as an additional control in her regressions. She finds that ICM inefficiency is due to influence activities by division managers. Taking a somewhat different approach, Billett & Mauer (2003) develop a measure of the value of the ICM incorporating the exchange of resources between segments, the efficiency of those transfers, whether the segment receiving the resources would be financially constrained if it were a stand-alone firm. They find that efficient transfers to constrained segments increase the diversified firm's value; however, similar to the previous papers, many of their important variables ("fitted" q for opportunities, financial constraint) are proxied by values computed from SFAS 14 single-segment firms.

Several studies examine the efficiency of the ICM using event-type methodology. Peyer & Shivdasani (2001) examine the effect of highly leveraged recapitalizations on sensitivity of investment to segment q and cash flow. They find that prior to the

recapitalization, segment investment was more sensitive to q (investment went to the segments with the best opportunities), but after, investment was more sensitive to segment cash flow. This suggests that the ICM was less efficient after the recapitalization due to the constraints caused by the high debt level. Gertner, et al. (2002) examine the investment behavior of segments before and after spin-off from a parent firm and find that investment is more efficient after the spin-off. Both papers measure efficiency using SFAS 14 single-segment firm's q as a proxy.

Several papers use sources other than SFAS 14 segment data and measures other than Tobin's q to examine ICM efficiency. Khanna & Tice (2001) examine the reaction of diversified and non-diversified (focused) retail establishments to an exogenous "shock" – the entry of Wal-Mart to their competitive market. Their data comes from trade journals and other industry sources. They define sales/sq. ft., a common retail productivity measure, as their measure of segment opportunities. Their data allows this to be independently computed for segments of diversified firms and focused firms. They find that diversified firms make quicker exit decisions, but if they decide to stay, they invest more, and their investments are more sensitive to the segment productivity than focused firms. The authors conclude that this is evidence of an efficient ICM. Instead of relying on SFAS 14 data, Maksimovic & Phillips (2002) use plant-level information from U.S. government databases to create segment information. They measure the efficiency of investment in these segments using a measure of productivity generated from this data (instead of Tobin's q) and find evidence of efficient ICMs.

Measurement Error and Methodological Improvements

Considerable evidence suggests that there are significant measurement errors in the empirical work that has applied SFAS 14 segment data and Tobin's *q*. The implementation of SFAS 131, which uses the internal structure of the firm (the management approach) for segment reporting, provides evidence that SFAS 14 segment was manipulated in several ways that would affect this research. First, SFAS 14 single segment firms and segments within multi-division firms were often not truly single businesses (from an SIC code standpoint) (Berger & Hann, 2003; Herrmann & Thomas, 2000; Maksimovic & Phillips, 2002; Street et al., 2000; Villalonga, 2004). This suggests that that using data from single segment firms to proxy for a matching SIC code division of a multi-division firm may be prone to measurement error. In addition, even if they were properly classified from an SIC code standpoint, there is evidence that single segment firms are systematically different from divisions within a multi-division firm (Chevalier, 2004; Maksimovic & Phillips, 2002; Whited, 2001). Secondly, SFAS 14 segments did not correspond to the actual internal structure of multi-division firms, which suggests that ICM transactions may be "hidden" within the reported segments (Berger & Hann, 2003; Herrmann & Thomas, 2000; Street et al., 2000). Therefore this activity would not have been addressed by research utilizing SFAS 14 data.

The use of Tobin's *q* as a measure of efficiency (investment opportunities) is a significant potential source of bias in this research. Tobin's *q* (average) is theoretically defined as the ratio of the market value of the firm to the replacement cost of its assets and is a common proxy for the investment opportunity set of a firm in accounting and finance literature (Riahi-Belkaoui, 2000). There are several problems with this measure

of Tobin's q as it has been used by this research. First, average q is not the true measure of investment/growth opportunities – marginal q is. Howe & Vogt (1996) show how substituting average q for marginal q can result in significant measurement error – misclassifying firm's investment opportunities in approximately 50% of the cases. This is confirmed by Whited (2001), who finds that the proxies used for q in ICM research capture only 13-25% of the true marginal q.

In addition, there are several areas where methodological improvements could enhance the testing of ICM efficiency. Although the more recent research has opened the "black box" of the ICM to examine its contents, it suffers from other significant problems. First, the research now generally ignores the governance mechanisms that Williamson indicated were essential for a multi-division firm to be called M-form and therefore to have an efficient ICM. Secondly, virtually all this research defines capital allocation solely as investments in fixed assets – ignoring potentially significant investments in operating leases, advertising, R&D and human capital (expensed by accounting), as well as business expansion in current assets. These errors have two effects on the empirical analyses – they understate the level of investment occurring in the division and they understate segment profits. Only Khanna & Tice (2001), who use store expansion as a proxy for the level of investment, indirectly capture the additional resource allocations of human capital, inventory, leased assets, and working capital - as well as fixed asset capital for store fixtures and building. Finally, in each of these papers, the efficiency of investment in the ICM is measured on a year to year basis. This ignores several aspects of business operations that relate to efficiency. First, large projects may occur over multiple consecutive years, affecting the measure of investment

in years before the measure of efficiency. Secondly, a year to year analysis ignores the implementation of business strategy – the affects of which may only be analyzed over a longer period. This suggests that efficiency should be judged based on a longer time series.

The issues with variable measurement and methodology suggest that this research could be improved by (1) a theoretical approach which fully emphasizes all the governance mechanisms deemed necessary by Williamson to achieve an efficient ICM, (2) an empirical approach which considers the theoretical extensions to Williamson's original model, (3) an empirical approach using of SFAS 131 data, which presents data in the same format as the structure of the ICM, (4) an empirical approach that includes an expanded definition of capital allocations to include other long-term investments in research & development, working capital, and human capital, (5) an empirical approach that considers efficiency over a longer time series than one-year, and (6) an empirical approach that utilizes measures of investment opportunities or efficiency that can be independently computed for both single-segment firms and divisions within multi-division firms.

Chapter 3 – Theoretical Model & Hypothesis Development

In order to study the efficiency of the ICM, it is necessary to apply a theoretical structure to the model to develop testable hypotheses. In particular, the efficiency of the ICM must be tested *relative* to the external market, since it is on that basis that it is described. Williamson's transaction cost economics was developed as a theory of the firm, and although it provided a framework to define and describe the ICM, it is principally concerned with answering why a particular transaction is governed within a firm instead of some other means, such as market exchange (Shelanski & Klein, 1995). Although economizing on transaction costs may drive both the decision to govern a transaction within a firm and the decision to structure the firm as an M-form organization, these costs are difficult to define and measure empirically, particularly over a broad sample of firms and industries (David & Han, 2004; Shelanski & Klein, 1995). In addition, this study is not concerned with the transaction costs per se, but with the means by which they are economized given that the choice of firm or market has already been made. One of the principal assumptions of transaction cost economics is that, relative to market exchange, lower transaction costs within the firm are derived from reduced information asymmetry between the parties in the exchange. This is due to the more extensive and focused governance mechanisms available there (Williamson, 1975, 1985). Therefore, the main theoretical premise of this paper is that attention to the particular mechanisms of governance over exchange is crucial to the study of the efficiency of the ICM.

Just as they have become the basis for analysis of governance mechanisms in the external market, agency theory (Jensen & Meckling, 1976) and property rights theory (Grossman & Hart, 1986; Hart & Moore, 1990) have been used to model the ICM in both analytical and empirical research. Like transaction cost economics, property rights theory is principally concerned with the choice of firm or market for a particular transaction. Its focus is not on the particular mechanisms of governance over exchange after the choice made – although it can provide insights into the particular motivations of the parties involved. The basic agency model captures the importance of the information environment by modeling information asymmetry between the principal and the agent. Agency theory also captures the importance of governance mechanisms by emphasizing the trade-off of monitoring and incentives, although in most models the focus of incentives as the sole means of governance is problematic. However, although agency theory recognizes the incompleteness of contracts, its focus on contracting as a market structure and the limitations it creates where multiple agents are involved in a multiple period setting is a significant problem (Lambert, 2001). The reality of the ICM is that written contracts are virtually nonexistent (employment arrangements are in a constant state of negotiation), high-powered incentives are generally not utilized, interactions are repeated over many periods, and relationships among/between the division managers (the agents) play an essential role in the allocation process.

Game theory provides an alternative theoretical structure in which to analyze division manager actions in the ICM. For example, game theory has been used to model firm/manager behavior generally (Aoki, 1984; Radner, 1986), earnings management (Bagnoli & Watts, 2000), auditor quality (Grant, Bricker, & Shiptsova, 1996) and joint

ventures (Zeng, 2003). “Game theoretic models allow economists to study the implications of rationality, self-interest and equilibrium, both in market interactions that are modeled as games (such as where small numbers, hidden information, hidden actions or incomplete contracts are present) and in non-market interactions (such as between a regulator and a firm, a boss and a worker, and so on)” (Gibbons, 1997, p. 127). In particular, the game theoretic structure seems applicable to the ICM because it is readily extended to multiplayer and multi-period environments, where market governance of player actions is governed by evolving strategies developed within the particular structure of the game and its players.

Dilemma Games

The most common game theoretic model is a single period prisoner’s dilemma (Luce & Raiffa, 1957). This is a 2-player game where each player makes a simultaneous decision to cooperate or defect, with the appropriate payoffs made to each player depending on the intersection of both their decisions. Cooperation and defection are defined in terms of the particular setting that is being modeled, but generally the choice of cooperation is group enhancing and the choice of defection is self-serving. If T, R, P, and S are used to represent Temptation, Reward, Punishment, and Sucker, a prisoner’s dilemma would result if in the payoffs shown in Panel A of Table 1 (shown in normal form where, $T > R > P > S$ and $2R > (T + S)$ for each player). The mathematical requirement is that the group payoff (“2R”) is always higher with cooperation than with defection (“T + S”). An illustration with numerical values as shown in Panel B of Table 1 helps to visualize each of the player’s dilemmas.

Given that each player is unable to communicate and/or make credible commitments to each other, the dominant strategy of each player individually is to defect. This leads to an equilibrium solution that each regrets since both their individual payoffs and the total payoff would be higher if they both cooperated (see Table 1).

(Insert Table 1 about here)

When the prisoner's dilemma game is extended to a multiple player (n-player, where n > 2)) setting, it becomes a "social" dilemma (Dawes, 1980; Olson, 1965; Taylor, 1987). The mathematical structure of the game is essentially the same as the prisoner's dilemma with the payoffs now determined in the context of the entire n-player's cooperation/defection level. In a single period setting, the key concepts are that the individual defector's payoff is always higher than if he/she cooperated, but the group payoff would be higher if everyone cooperated than if everyone defected. Therefore, as in the 2-player game, defecting is the dominant strategy of each player resulting in a deficient solution for the group. An n-player game is more readily shown graphically (See Figure 1) than in normal form (although the normal form structure of any two players within the n-player game would be the same as the prisoner's dilemma shown above).

(Insert Figure 1 about here)

It is possible to improve on the deficient equilibrium of a dilemma game, but only by extending the game to multiple periods. Even in a multiple period game, there are

additional specific requirements that must be met in order to create the possibility of a cooperative solution.

Game Length

The play of the game must either be infinite in length or there must be a known probability that the game will continue from one play to the next. This makes the "shadow of the future" relevant to the players. If the timing of the end of the game is known, then by definition the game effectively reduces to the same structure as a single–period game. There would be no need to cooperate during the last play since there would be no repercussions from future plays. Knowing that, players would not cooperate in the time period just before the last play, and this would continue back to the first play (Taylor, 1987). In addition, the players cannot discount the future too highly. Since a rational player will consider the discounted value of future payoffs, the discount rate cannot be too high in order for the "shadow of the future" effect to bind (Bendor & Mookherjee, 1987; Taylor, 1987).

Group Size

Group size is important (Axelrod, 1981; Axelrod & Dion, 1988; Bendor & Mookherjee, 1987; Olson, 1965; Taylor, 1987). Olson (1965) suggested that cooperation was only possible in smaller groups (what he labels as either privileged or intermediate groups) because increases in group size decrease the size of the benefit each individual player receives from cooperation and because there are significantly larger costs of organizing (communication, bargaining) in large groups which reduce the net benefit of cooperation. This assumes that the benefit from cooperative behavior is either divisible or rival, such that the benefit available to any one player is affected by the benefits

received by other players. Taylor (1987) and Bender & Mookherjee (1987) agree that size is a factor, but principally because of the difficulty of monitoring as the group becomes larger. In addition, social incentives such as conscience (group approval/disapproval), group identity and group norms tend to work only in smaller groups since it is more difficult to remain anonymous (Dawes, 1980; Olson, 1965; Taylor, 1987)

Detection

There must be a realistic probability that defection is detected. Taylor (1987) suggests that it is not necessary that each player be able to monitor the decision of every other individual player, but that they at least must be able to examine the final result of all the player's decisions and know what that means in terms of group cooperation/defection. This is true for a "decentralized" solution of the dilemma, where the group is able to resolve the dilemma without resorting to a central authority. If a central authority is used, monitoring must be capable of detecting individual player defections (Bendor & Mookherjee, 1987). Bender and Mookherjee (1987) show that even with imperfect monitoring, the centralized solution will more likely lead to a cooperative equilibrium.

Sanctions

There must be effective sanctions for defection or incentives for cooperation to change the payoffs such that cooperation is the rational choice. In the decentralized solution, sanctions are effectively implemented via "punishment" by non-cooperative behavior in some number of future plays. For example, in a "Tit-for-Tat" strategy, the player detecting defection in other players would respond by defecting in the next round of play

and would continue to do so until the guilty party cooperated again. In centralized solutions, a central authority enforces sanctions on defecting players.

ICM as a Dilemma Game

The basic theoretical structure of the dilemma game fits well with the structure of a multi-division firm and ICM. Although theory has indicated that either decentralized or centralized solutions to social dilemmas are possible (Bendor & Mookherjee, 1987), the centralized solution more clearly matches the structure of the ICM. This dissertation first assumes first that the role of HQ in a multi-division firm is that of a "technology". In game theory, a "technology" always makes a choice based on the decision rules that apply to that choice. In the context of a centralized solution to the ICM, this would mean that HQ will always choose the most profitable resource allocation for the firm, based on the information provided. This suggests that no agency problems exist between HQ and shareholders (Gertner et al., 1994; Rajan et al., 2000) and that any inefficient resource allocation is due solely to the division manager's response to the dilemma they face. This is a basis for making a cross-sectional comparison of the efficiency of the ICM in multi-division firms. This assumption is later relaxed in testing ICM efficiency relative to the external market.

A description of the ICM of a multi-division firm provides the basis for comparing it to the theoretical structure of dilemma games. By definition, a multi-division firm contains $n > 1$ divisions, so meets the prisoner's ($n = 2$) or the social ($n > 2$) multi-player requirement. Divisions usually request capital allocations at least annually so that the corporate office can properly plan its cash flow requirements. Most often the capital allocation requests for the next year are submitted by each division manager

simultaneously and the corporate office reviews them and determines which projects will be funded. Allocation decisions are made based on expected cash flow availability, project type (maintain production, upgrade, expand or improve production, or new product), corporate strategy and estimated project returns (Riahi-Belkaoui, 2001). This suggests activity similar to the repeated game structure, which is based on simultaneous decisions made at the beginning of a regular interval.

Division cash flows (less expenses to maintain the corporate office) are the source of the accumulated funds that the HQ is re-allocating. Therefore, divisions immediately have incentives to seek their "fair" share of these resources, which at a minimum would be the amount that they contributed (less a pro rata share of corporate expenses). In addition, since most division managers are at least partially paid based on their division results (Bushman et al., 1995; Keating, 1997), they have incentives to obtain as much capital as possible for their division. In order to achieve as much capital as possible, division managers will engage in rent-seeking activities such as over-stating the estimated returns of submitted projects to improve the chances of their selection, using personal persuasion ("talk-up" their projects or "talk-down" others), or exercising relative power to influence the decision-making process (P. Milgrom & Roberts, 1988; P. R. Milgrom, 1988). These activities are costly to the firm both directly, by reduced division manager effort on running the current business, and potentially more seriously, by increasing the probability that capital allocation will not go to the highest value uses. These activities represent "defecting" actions by the division managers. This creates a dilemma for the division managers which is much like a collective resource trap (Messick & Brewer, 1983). If each division manager makes the rational choice to defect and rent-

seek to improve the capital allocation to his/her division, the collective firm cash-flows increase at a rate below first-best in future periods (and perhaps decrease if the rent-seeking behavior is serious enough), reducing resources available. In the long-term of course, this affects the viability of the firm as a whole.

Efficiency of ICM relative to other Multi-division firms

Williamson's defines allocative efficiency as the allocation of cash-flows to the highest value use. This would suggest that efficiency can be measured as the responsiveness of investment to growth opportunities. Firms that allocate more investment to opportunities in growing industries and allocate less investment or reduce investment to opportunities in declining industries would be more efficient – whether this occurred in an ICM or the external market. In the ICM, established as a dilemma game for division managers, this sensitivity of investment to opportunities will also be subject to the governance mechanisms (game length, group, monitoring, and sanctions) necessary to achieve a cooperative solution to the dilemma. Looking only at the cross-section of ICM's in multi-division firms, this would be described in the following relationship:

$$\Delta Investment = f\left(\Delta Growth\ Opportunities, ICM\ \ Governance\ Mechanisms\right)$$

Game Length

A basic assumption of financial accounting is that of "going-concern". Reporting on the activities of firms is based on the fact that they are expected to continue to exist into the foreseeable future. Unfortunately, this same assumption cannot be applied to the tenure of division managers of any one firm, either due to turnover of the division manager or due to divestment of the division. However, firms can provide incentives to managers to give attention to the future of their ongoing employment with the

organization. In particular, the compensation contracts of managers often contain incentives that are meant to address career concerns (Gibbons & Murphy, 1992). They suggest that factors such as manager age, years to retirement, and job tenure reflect a manager's career concerns and show how those factors predict different incentive packages across firms. In addition, compensation packages are often balanced with both current and deferred compensation (i.e. stock options or deferred bonus payments) to properly focus the manager's decision horizon (Narayanan, 1996).

Looking beyond a single firm, if division managers consider their whole career (both within the current firm and potentially beyond it) in calculating the probability of ongoing interactions it becomes easier to think of the game as (virtually) infinite in length. Fama (1980) suggests that it is the managerial labor market that provides a disciplining mechanism through adjustment in future wages based on judgments of past performance. He notes that "For purposes of the managerial labor market, the previous associations of a manager with success and failure are information about his talents" (Fama, 1980, p. 292). Recognizing that, managers consider current actions in terms of the effect on their total career wages – making the "shadow of the future" relevant. While research has generally considered reputation/career concerns associated with the external labor market at the level of corporate management (Berger & Hann, 2002; Hirshleifer, 1993; Holmstrom, 1999), it has also been considered particularly relevant for division management in a capital investment setting (Holmstrom & Costa, 1986). Fama (1980) notes that "all managers below the very top level have an interest in seeing that the top managers choose policies for the firm which provide the most positive signal to the managerial labor market" (p. 293). Beyond the signal provided to the labor market by

corporate performance, division managers are also aware that SFAS 131 segment reporting will more likely match the operating performance disclosure in the management discussion and analysis of the 10K and management letter of the annual report (Street et al., 2000), providing a window to the managerial labor market on their specific performance. Understanding this interaction, De Motta (2003) builds a model of the ICM that suggests that career concerns lead to an interplay of division manager attention to helping either the external market or corporate headquarters learn about division performance (and therefore their own performance). This suggests the following hypothesis:

H1: Firms that address career concerns of division managers will have a more efficient ICM.

Group

Generally, experimental research on social dilemmas indicates that group cooperation decreases as group size increases. Marwell & Schmitt (1972) find significantly lower cooperation in a three person social dilemma versus a two person prisoner's dilemma. Hamburger, Guyer & Fox (1975) find lower levels of cooperation in seven person versus three person social dilemmas and Bonacich et al. (1976) find similar results to Hamburger, Guyer & Fox in six person versus three person groups and then a further reduction in nine person versus six person groups. However, there appears to be some limit where the effect of group size stabilizes. For example, Liebrand (1984) finds no difference in cooperation rates between seven person and twenty person groups. Overall, experimental research seems to indicate that there is no further reduction in cooperation after the size of the group reaches seven or eight (Van Lange et al., 1992). Therefore the following hypothesis is proposed:

H2a: The larger the number of divisions in the ICM of a multi-division firm the less efficient the ICM.

There are many variables related to group size that make it difficult to focus solely on the "number of players" as the variable of interest (Kollock, 1998a; Van Lange et al., 1992). Factors suggested in the literature are:

- Perceived efficacy – "The extent to which one believes that his or her own contributions help to achieve the collective goals" (Van Lange et al., 1992, p. 18). As group size increases, it becomes easier for a player to conclude that their cooperation does not matter. In addition, particularly related to the ICM, relative size of the divisions may be a factor effecting perceived efficacy. A firm with one large division in either size or profitability and several small divisions may find it more difficult to find a cooperative solution. The managers of the smaller (or less profitable) divisions may feel that they have less to lose (more to gain) by defection (Scharfstein & Stein, 2000). The model of Rajan, Servaes & Zingales (2000) suggested that diversity of opportunities and resources among the divisions in an ICM leads to inefficient allocation of resources. Experimental evidence further supports the suggestion that relative "power" in a resource allocation game, as measured by diversity of profits, negatively effects the possibility of a cooperative solution (Mannix, 1993). Therefore the following hypothesis is proposed:

  H2b: The more diverse the size of the divisions in a multi-division firm, the less efficient the ICM.

  H2c: The more diverse the profits of the divisions in a multi-division firm, the less efficient the ICM.

- Group Identity – This relates to the perception each player has about the other players in the game. If the individual player feels himself part of a "group" that is using the

common resource (as compared to an individual or sub-group using the resource along with other individuals or sub-groups), experimental research has shown that the dilemma is more likely to be resolved cooperatively (Bornstein, 1992; Kollock, 1998b; Kramer & Brewer, 1984). As Peter Kollock notes, "the impact of group identity is manifold and profound" (Kollock, 1998a, p. 12). Williamson's (1975) conception of the ICM seems to suggest the formation of a group identity as he describes the advantages of internal organization to "promote convergent expectations" (p. 25), develop efficient coding to summarize complex events "by using what may be called idiosyncratic language" (p. 25), and make allowance for "quasimoral involvements" (p. 38) among the divisions. In a multi-division firm, group identity would be enhanced by a strong "corporate identity" umbrella under which all of the divisions reside. Research has suggested that "corporate branding" results from the desire to "create a sense of internal coherence in order to simplify internal cooperation" and to "express unity towards the outside world" (van Riel & van Bruggen, 2002). In addition, social identity theory suggests the importance of a strong organizational identity to overcome conflict among subunits (Ashforth & Mael, 1989). Group identity can also be enhanced by policies which reward group (corporate) effort and results over individual (division) effort and results, particularly in situations where there are strong interdependencies (Bushman et al., 1995; Datar et al., 2001; Itoh, 1992). Therefore the following hypotheses are proposed:

H2d: Multi-division firms which promote corporate identity will have a more efficient ICM.

H2e: Multi-division firms which promote corporate identity in their compensation practices will have a more efficient ICM.

- Identifiability – Larger groups allow individual players to "hide", such that their level of cooperation is not known to the other players. This reduces the incentives to cooperate (Dawes, 1980; Kollock, 1998a; Van Lange et al., 1992). Although the group size of the ICM is relatively small compared to some social dilemmas (e.g. pollution from automobile exhaust) where this would typically apply, firms may be organized so there is limited knowledge among the division managers about other division activities. At the other end of the spectrum are firms that are organized to promote communication and interaction among division managers. Experimental research on social dilemmas has consistently shown that allowing communication among the players improves the rates of cooperation. Communication appears to have four effects: (1) it allows the players to gather information on the potential choices of other players in the game, (2) it provides the opportunity for players to make explicit promises about their actions, (3) it provides a forum to use social or group norms as a means of persuasion, and (4) it reinforces group identity (which offsets the problem of anonymity) (Aquino & Reed II, 1998; Kollock, 1998b; Messick & Brewer, 1983).

  Beyond communication, the problem of identifiability can be resolved through "public" choice, such as the use of management or executive committees, where all top management personnel participate in corporate level decisions such as capital investment decisions. These committees would not only promote cooperation through enhanced group communication, but the nature of their decision making would make their individual choices "public". Experimental research has also

provided strong support for "public" choice as a means to improve cooperation (Fox & Guyer, 1978). This suggests the following hypothesis:

H2f: Multi-division firms which promote communication and group decision-making among division managers will have a more efficient ICM.

Monitoring

In the centralized solution to a social dilemma, the group selects a central authority and empowers it to perform the necessary monitoring and sanctioning of the individual players. Although not necessarily "selected" by the division managers, the Corporate HQ performs that role in the ICM. Resolving the social dilemma requires that there be both a sufficient probability that the actions of the division be examined and a sufficient probability that upon examination the true nature of the division actions be known (Bendor & Mookherjee, 1987). Taylor (1987) shows how cooperation can be achieved in an N-person prisoners' dilemma (a social dilemma), but only in the presence of adequate monitoring by the group members. Bendor & Mookherjee (1987) show how, when monitoring is delegated to a central authority, it is sufficient to obtain a cooperative solution even when it is imperfect. This is particularly true in a "federal system" where groups or units are monitored instead of individuals (a situation similar to what would be found in a multi-division firm). Williamson (1975) clearly identifies the necessary components of the ICM structure and organization to allow adequate monitoring to occur:

- Divisions must be identified by separate economic activities
- Divisions must be given "quasi-autonomous" standing. This means that the divisions are responsible for the operating decisions of the economic activities around which they are formed and are generally of the nature of a profit center.
- The corporate headquarters (HQ) must monitor the performance of the divisions utilizing objective measures (such as profit, ROI, ROA, or EVA) and an "elite staff" to both audit and advise divisions.

SFAS 131 requires that the segment data be reported "based on the way that management organizes the segments within the enterprise for making operating decisions and assessing performance" (FASB, 1997, p. 6). Therefore, segments reported under SFAS 131 provide an indication of separate economic activities and "quasi-autonomous" standing by definition. However, as noted earlier, theoretical extensions of Williamson (with the exception of Matsusaka & Nanda (2002)) suggest that the more related the firm's divisions (a focus strategy), the more efficient the ICM (Gertner et al., 1994; Liebeskind, 2000; Stein, 1997). In particular, model in Stein (1997) suggests that because HQ is unable to predict investment project outcomes with certainty (prediction errors), economic diversification leads to uncorrelated prediction errors and therefore the increased probability of errors in capital allocation. With this theoretical background, the following hypotheses are proposed:

H3a: Multi-division firms which are less diversified will have a more efficient ICM.

H3b: Multi-division firms which have an internal audit function will have a more efficient ICM.

Sanctions

As noted above, sanctioning would be enforced by the central authority (Corporate HQ) in the ICM. The sanctioning ability of Corporate HQ is one of the significant advantages of the ICM over the external market. Once defecting behavior is identified, Corporate HQ has several options available to sanction the division manager. It could reduce access to future resource allocations, redeploy past allocations to other divisions, or punish the division manager directly by affecting his/her compensation or

via demotion/termination. These same actions are available to external shareholders or debtholders but at a much greater cost (Stein, 1997; Williamson, 1975).

If Corporate HQ is performing its role properly (allocating resources to the highest value use) it is unlikely that there would be a blanket prohibition on future allocations since it is possible that the defecting division may have the best future projects. Where possible, Corporate HQ may try to reallocate resources away from a defecting division to other divisions that actually had the higher value projects given truthful reporting. While this may be feasible with human capital and perhaps R&D, it is unlikely, if the divisions are formed as separate economic activities, that fixed assets can be readily reallocated among the divisions. Since this method of sanctioning would manifest itself in the allocation process itself, it would be captured in the measure of efficiency. Therefore, it appears that the most likely sanctions applied would be direct "punishment" of the division manager. This suggests the following hypothesis:

H4: Multi-division firms which have an effective sanctioning system will have a more efficient ICM

Relative efficiency of the ICM to the external market

To this point this dissertation has only examined factors affecting the efficiency of the ICM compared to other ICMs. The key test of Williamson's M-form hypothesis is the relative efficiency of the ICM to the external market. At this level of efficiency testing, both markets are subject to agency problems between HQ and debtholders/shareholders. Corporate managers that wish to consume perquisites, build empires, or fund pet projects would negatively affect the efficient allocation of resources in either an ICM or external market setting (Radner, 1986). In addition, models of both the ICM (Gertner et al., 1994; Inderst & Laux, 2000; Liebeskind, 2000; Matsusaka &

Nanda, 2002; Stein, 1989, 1997) and external market (Jensen, 1986) indicate the level of financial constraint on the firm as a whole is an important factor in controlling agency problems at the firm level. This suggests the following relationship for examining the relative efficiency of the ICM versus the external market:

$$\Delta Investment = f\left(\Delta Growth\ Opportunities,\ Market\ Type,\ Agency,\ Financial\ Constraints\right)$$

In general, this model states that market efficiency is a function of market type (internal or external), corporate agency problems, and financing constraints. Where the market type is internal, the appropriate ICM governance mechanisms (which are examined in H1- H4) would also be included in the model. In this way, the model accounts for the governance structure required by Williamson for a multi-division firm to qualify as M-form, containing an efficient ICM. The model generates the following hypothesis:

H5: A properly structured ICM is more efficient at resource allocation than the external market.

Agency theory suggests that the separation of the ownership and management of firm assets lead to costs ("agency costs"), either in the form of excess perquisites consumed by management, inefficient use of firm resources (empire building, myopia, and overinvestment), or incentive and monitoring costs incurred by owners to prevent these occurrences (Jensen & Meckling, 1976). Empirical research on agency costs and inefficient corporate investment has provided significant support these theories (see Stein (2003) for a summary of this literature). One of the principle means used to reduce agency costs is to provide stock ownership to managers (through various forms of stock compensation – e.g., stock purchase plans, stock options, etc.) to align the interests of owners and managers (Himmelberg et al., 1999). This literature suggests the following hypothesis:

H6: Stock ownership by management will positively affect the efficiency of resource allocation in any market.

Jensen (1986) suggests that there are particularly high agency costs from "free cash-flow" due to inefficient over-investment by managers. Free cash flow problems are caused by insufficient debt levels (lack of financial constraint), leaving management with available cash to invest for empire building or other perquisites. This suggests the following hypothesis:

H7: Higher financial constraints on the firm will positively affect the efficiency of resource allocation in any market.

The differential effect of agency problems and financial constraints on the ICM vs. the external market related to resource allocations is an unanswered question. Recall that some theoretical models believe that agency problems have a greater negative effect on resource allocation efficiency in the ICM either due to greater opportunities (Liebeskind, 2000) or due to efforts to retain cash for perquisites at the corporate level (Scharfstein & Stein, 2000). Others suggest that agency costs in a multi-division firm should either be less (Williamson, 1975, 1985) or should not effect the efficiency of the ICM (Gertner et al., 1994; Rajan et al., 2000). There has not been a direct empirical test of the differential effect of agency on the ICM versus external market. Both Lundstrom (2003) and Scharfstein (1998) find evidence that agency costs are the cause of inefficiency in the ICM, but neither examine the effect relative to external market allocation.

Likewise, most theoretical work suggests that a lack of financial constraints (free cash-flow) will negatively affect the efficiency of ICMs in multi-division firms versus the external market due to the additional opportunities for overinvestment present in a multi-

division firm (Liebeskind, 2000; Matsusaka & Nanda, 2002; Stein, 1997). However Stein (1989) suggests that ICM's form to eliminate financial constraints (the need to access the external market more frequently) and allow HQ to manage the firm more efficiently. Empirical work has not provided any definitive evidence either way. Both Khanna & Tice (2001) and Wulf (2002b) have non-significant results on the financial constraint variable included in their regressions. Peyer & Shivdasani (2001) find that excessive constraint, caused by leveraged recapitalizations, leads to more inefficiency in the ICM due to the necessity of meeting cash flow requirements.

Since it is not clear what the hypothesized direction will be, no formal hypotheses are proposed related to the effect of agency problems and financial constraints on the efficiency of resource allocation in the ICM vs. the external market. However, empirical tests will be performed to determine if there is any differential effect of agency problems and/or financial constraints (individually and jointly) on these markets.

Chapter 4 – Empirical Model Development

There are two critical variables necessary to test the hypotheses generated from the theoretical model – efficiency and investment. Efficiency must be measured in a way that can be consistently calculated for both divisions within a firm and for single-segment stand alone firms. Investment is the measure of long-term resources allocated to a particular line of business and must include all long-term resource allocations, including capital expenditures, working capital, research and development, and human capital.

This dissertation uses a measure of efficiency adapted from Wurgler (2000). Wurgler examines the effect of financial market development on capital allocation efficiency in an international setting. His measure of efficiency (equation (1)) captures the extent to which each country increases investment in growing industries and decreases investment in declining industries.

$$\ln \frac{I_{ift}}{I_{ift-1}} = \alpha + E_f \ln \frac{V_{ift}}{V_{ift-1}} + \varepsilon_{ift} \qquad (1)$$

where I equals investment, V equals value-added growth, i indexes manufacturing industry, f indexes firm and t indexes year. The coefficient E_f represents the elasticity of investment to changes in value-added growth in manufacturing industry – which is the measure of efficiency. This might be called an Opportunity Response Coefficient (ORC) since it measures the response of firm investment to growth opportunities presented in the marketplace. As noted by Wurgler, the causality assumed by the regression – that current industry growth drives investment – is supported by research that shows that investments

in fixed assets take approximately two years to effect growth (Hall, Sims, Modigliani, & Brainard, 1977; Mayer, 1960).

Similar to Wurgler (2000), this dissertation uses *V* (value added growth) as a measure of investment opportunities. Value added is collected from the U.S. Census Bureau *Annual Survey of Manufactures* and is computed by subtracting the cost of materials, supplies, containers, fuel, purchased electricity, and contract work from the value of shipments (adjusted by the addition of value added by merchandising operations plus the net change between the beginning- and end-of-year inventories). Investment is measured using the following equation:

$$I_{ift} = CAPX_{ift} + R\&D_{ift} + workcap_{ift} + HC_{ift} + NetAquis_{ift} \qquad (2)$$

where *CAPX* is the capital expenditures, *R&D* is research and development expenditures, *workcap* is changes in working capital, *HC* is changes in human capital, and *Netaquis* is the net acquisitions/disposals for each industry (segment), firm, and year. Data for *CAPX* and *R&D* will come from the Compustat segment database, supplemented with data in each firm's Annual Report (10K) where necessary. The change in human capital (*HC*) will be computed as follows:

$$HC = \Delta EMP \times AVGCOMP \qquad (2a)$$

Where, ΔEMP equals the change in the number of employees from the Compustat segment database and $AVGCOMP$ equals the average employee compensation cost for the applicable industry and year from the *Annual Survey of Manufactures*.

The change in working capital will be computed in two ways. The first computation will be a "fitted" change in working capital (*WC1*), where the coefficients a_1

and b_1 are obtained from a regression of the change in working capital on the change in sales for all single-segment firms for each year and industry and applied to the change in sales of the segment ($\Delta SALES_i$)[1].

$$WC1_{it} = a_t + b_t \Delta SALES_{it} \quad (2b)$$

Method two involves several computational steps in order to estimate the change in each segment's net working capital. Since only asset values are available for each segment, the first step is to independently compute each of the sample segment's change in working capital assets for each year ($AChg_{ift}$) using this equation:

$$AChg_{ift} = \left(IA_{ift} - IA_{ift-1}\right) - CAPX_{ift} - NetAquis_{ift} + DEPR_{ift}$$ [2]

where *IA* represents the reported identifiable assets associated with the segment, *CAPX* represents the reported capital expenditures, *NetAquis* represents the net acquisitions identified with the segment, and *DEPR* represents the reported depreciation and amortization.

Since there is not available data for liabilities of segments, the actual change in working capital liabilities is collected and allocated to the segments based on the change in segment working capital assets computed above.

$$Lchg_{ift} = Achg_{ift} \Big/ \sum_{i=1}^{n} Achg_{ift} * Lchg_{ft}$$

The change in net working capital for the segment as the sum of the change in segment working capital assets and allocated segment working capital liabilities as follows:

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[1] Working capital is defined as receivables, inventories, and accounts payable. The change in these accounts will be obtained from the cash flow statement and sales will be adjusted for increases from acquisitions for the year to segregate growth in these amounts from other than acquisitions.

[2] Note that if the segment reports investments using the equity method, then changes in this amount from year to year will also be accounted for in this calculation.

$$WC2_{ift} = Achg_{ift} - Lchg_{ift} \tag{2b}$$

The results of the computations of working capital change by segment-year (equations 2a and 2b) are then summarized to determine a total firm change in working capital each year under each method. Finally, the computed changes in working capital for each firm-year determined by the segment data under both methods are compared to the actual change in working capital for the firm. The method that yields the smallest difference will be the source of the working capital variable by segment (*workcap*) in this analysis.

$$\begin{aligned} WC1_{ft} &= \sum_{i=1}^{n} WC1_{ift} \\ WC2_{ft} &= \sum_{i=1}^{n} WC2_{ift} \\ workcap_{t} &= \min\left(WC_{ft} - WC1_{ft}, WC_{ft} - WC2_{ft}\right) \end{aligned} \tag{2d}$$

Testing the Efficiency of the ICM

In order to test Hypotheses 1 – 4, this dissertation adapts Equation (1) to include proxies for the governance mechanisms required to solve the dilemma facing the division managers (the computations of the governance variables and the expected direction of the coefficients are described in Table 2). This regression examines the responsiveness of investment to value added, controlling for those factors in the ICM that may affect investment efficiency in the ICM and is run only on the sample of multi-division firms.

$$\begin{aligned} \ln\frac{I_{ift}}{I_{ift-1}} = \alpha + E_1 \ln\frac{V_{ift}}{V_{ift-1}} + l_y\left(\ln\frac{V_{ift}}{V_{ift-1}} * GameLength\right) \\ + g_y\left(\ln\frac{V_{ift}}{V_{ift-1}} * Group\right) + m_y\left(\ln\frac{V_{ift}}{V_{ift-1}} * Monitoring\right) \\ + s_y\left(\ln\frac{V_{ift}}{V_{ift-1}} * Sanctioning\right) + \varepsilon \end{aligned} \tag{3}$$

The coefficient E_1 should be positive and significant. As E_1 approaches (or exceeds) 1, it indicates that ICM is the more responsive to growth opportunities.

As Table 2 indicates, there are five variables that will be used to proxy for division manager attitudes toward continued interaction (game length). The coefficients on these, labeled $l_1 - l_5$ will test H1, the extent to which the shadow of the future is relevant to the division manager and the effect investment. Historical performance relative to the industry (*HistPerf*) measures the division managers' tendency to be myopic in their decision processes. Poor past performance relative to the industry would tend to drive short-term thinking and focus only on division performance versus corporate performance. The percentage of the division manager's compensation that is deferred beyond the current year (*Def%*) is an indication firm's efforts to make the "shadow of the future" relevant to the division manager. The division manager's age (*Age*) is relevant to his/her expectation of future employment either with the current firm or other firms – the "shadow of the future" will be less relevant to a manager as he nears retirement. The disposal (or announcement of the planned disposal) of the segment within two years subsequent to the current year (*Disp*) indicates that different decision rules were most likely applied to investment decisions in the current year. Decisions to dispose of divisions are most likely known or anticipated internally prior to their public disclosure and effect the allocation of resources to the segment and the division manager's decision options. The source of the division manager's hire (*Inside*) - promoted from within the firm or hired from the outside – is a measure of the manager's ties to the particular firm. Division managers promoted from within the firm will tend to have a greater tie to the

firm and therefore the expectation of continued employment by the firm would be higher (i.e. the shadow of the future would be more relevant to them).

(Insert Table 2 about here)

There are seven variables in Table 2 which proxy for group identity. The coefficients on each of these variables, $g_1 - g_7$ will test the hypotheses of group characteristics that effect efficiency. Hypotheses H2a – H2c are tested directly by the coefficients g_1, g_2, and g_3. Corporate identity in H2d is proxied by segments identification of themselves as "Divisions of…" the corporation (*CorpID* - tested by coefficient g_4) and by the division managers also having a corporate title such as Vice-President (*CorpOfficer* - tested by coefficient g_5). Hypothesis H2e (the relative weight of compensation on corporate versus division results – *Corp%*) is directly tested by coefficient g_6. Finally, the interaction among the division managers (H2f) is proxied by their membership on the corporate "executive committee" (*ExecCommittee*), or a group of similar function, and tested by coefficient g_7. Generally, the executive committee is involved in resource allocation decisions (Cooper, Morgan, Redman, & Smith, 2004), so this would allow the division managers to have direct knowledge of each other's requests and allocations and observe how each has played the "game".

Table 2 indicates that three variables capture monitoring by the division managers and HQ. The coefficients $m_1 - m_3$ provide tests of the monitoring hypotheses H3a and H3b. H3a, which tests the economic diversity of the divisions, is examined by two measures calculated by methodology developed by Fan & Lang (2000) – Relatedness

(*Related*) and Complementarity (*Complement*). *Related* (tested by m_1), examines the opportunity for vertical integration between two industries and *Complement* (tested by m_2) identifies the opportunities to share marketing and/or purchasing resources. The existence of an internal audit function in the firm is directly tested by coefficient m_3.

Finally, sanctions against a defecting division manager are more difficult to identify using externally reported data. Table 2 indicates only one variable to proxy for HQ sanctioning. This dissertation assumes that division manager turnover (*Turnover*) reflects sanctions on defecting managers – higher turnover reflects more defections - therefore the coefficient s_1 tests hypothesis H4a.

Testing the Efficiency of the ICM relative to the External Market

Hypotheses 5 - 7 examine the efficiency of the ICM relative to the external market. These hypotheses are tested with the regression described in Equation (4) on a combined sample of multi-division and single segment firms. Equation (4) introduces a Market-Type dummy variable (*Internal*), which takes a value of 1 for ICM divisions and 0 for single segment firms. It also captures the effect of those ICM governance controls that were significant from the results of Equation (3) on the sample of multi-division firms[3], so that the relative efficiency of the markets can be compared after controlling for these factors as well as those governance factors that affect both markets – agency problems and financial constraints. A description of these variables and their computation can be found below in Table 3.

[3] Note that this is shown in summary form in the equation as $b_n\left(\ln\frac{V_{ijt}}{V_{ijt-1}} * Internal * ICMGovernance\right)$

$$\ln\frac{I_{ift}}{I_{ift-1}} = \alpha + b_1 Internal + E_1 \ln\frac{V_{ift}}{V_{ift-1}} + E_2\left(Internal * \ln\frac{V_{ift}}{V_{ift-1}}\right) + b_n\left(\ln\frac{V_{ift}}{V_{ift-1}} * Internal * ICMGovernance\right) + a_1\left(\ln\frac{V_{ift}}{V_{ift-1}} * Ownership\right) + f_1\left(\ln\frac{V_{ift}}{V_{ift-1}} * FinConstraint\right) + \varepsilon_{ift} \quad (4)$$

The coefficient E_1 represents the efficiency of the external market, controlling for the effects of agency problems and financial constraints. As with E_1 in Equation (3) it should be positive and significant, indicating the investments are made to take advantage of growth opportunities. The coefficient E_2 represents a test of Hypothesis 5, the relative efficiency of the ICM (compared to the external market). This coefficient should also be positive and significant, indicating that there is an incremental positive relationship of investment and growth opportunities in the ICM versus the external market. A positive and significant coefficient supports the hypothesis that the ICM is more efficient at resource allocation than the external market.

Coefficient a_1 tests H6 – that management stock ownership will positively affect the efficiency of both the ICM and external market allocations. Note that ownership is measured as the percentage of stock held by other than management, so H6 is supported if this coefficient is negative and significant.

(Insert Table 3 about here)

H7 predicts that financial constraints positively affect efficiency and is tested by examining coefficient f_1. Since financial constraints are measured by the fixed charge coverage ratio, as this ratio increases, it indicates a relaxation of financial constraints. Therefore, similar to the test of H6, if coefficient f_1 is negative and significant, then H7 is supported.

Although not shown in the equation above, as indicated in the theoretical development, additional tests will be performed to examine the individual effects of management stock ownership and financial constraints by interacting the dummy *Internal* variable with each of the *Ownership* and *FinConstraint* variables. The coefficients on these interactions should provide an indication of the significance and direction of the effect of management ownership and financial constraints on the ICM vs. the external market. In addition, a joint test will be performed by interacting the *Internal*, *Ownership*, and *FinConstraint* variables together. The coefficient on this variable looks at the combined effect of management ownership and financial constraints on efficiency of resource allocation in the ICM versus the external market. As indicated earlier, no direction is predicted for these tests due to conflicting theoretical analyses, however it is hoped that these tests may provide some clarification of these research questions.

Chapter 5 - Data, Sample Selection and Variable Measurement

Sample Selection

This research relies on the ability to interpret data reported externally as indicative of the internal structure and decision-making of the firm. SFAS 131, *Disclosures about Segments of an Enterprise and Related Information* (FASB, 1997) changed the manner in which segment information is to be reported in external financial statements to the "management approach". As the introduction to SFAS 131 states, "The management approach is based on the way that management organizes the segments within the enterprise for making operating decisions and accessing performance." and "…focuses on financial information that an enterprise's decision makers use to make decisions about the enterprise's operating matters" (FASB, 1997, p. 5). This data, however, is only available for years beginning after December 15, 1997 (calendar year firms ending December 31, 1998 and thereafter). Since the sample requirements include a two year period before and after the data years analyzed, a sample drawn from the period since the implementation of SFAS 131 would provide only a minimum time series data period of three years (2000 – 2002). However, if a firm did not change its segment reporting structure in the implementation of SFAS 131, then this is strong evidence that the segment information reported under the previous requirements of SFAS 14, *Financial Reporting for Segments of a Business Enterprise* (FASB, 1976b), was consistent with the "management approach" required under SFAS 131. Therefore, in order to increase the time series, the sample will be limited to firms that did not change their segment structure

in the implementation of SFAS 131. Data will be collected for financial statement years from 1993 – 2004, with the data analysis period extending from 1995 – 2002.

The data and sample selection process began with an initial screening of company data from the Compustat segment database. The transition year to SFAS 131 will differ based on the month of the fiscal year-end of the company. Assuming that the firm chooses not to be an early adopter, firms with fiscal years that end in December through May will show a Compustat year of 1997 for their financial statement year prior to implementation of SFAS 131 and firms with fiscal years that end in June through November will show a Compustat year of 1998 for their financial statement year prior to the implementation of SFAS 131. Therefore, initially, the segment file was split into two files based on the month of the fiscal year-end of the company and reduced to just the appropriate transition years – the last year before the transition to SFAS 131 and the first year of implementation of SFAS 131. Both files were then stripped of non-operating, corporate, and immaterial aggregate segment (segments designated as "other") data in order to obtain a clearer comparison of the operating segment composition during the transition years. This was accomplished by removing segments based on key terms or portions of terms ("corp", "other", "unallocated", and "elimination") found in the segment name field. These terms were identified by a preliminary scanning of the segment database and trial and error. Since neither the Compustat industrial nor the segment databases contain a variable indicating if a firm is single or multi-segment, and if multi-segment, the number of segments in any given year, this must be computed from variables that are provided. In the segment database, Compustat does provide a unique numerical segment ID (SID), which "remains with a specific segment as long as the data

for that segment is comparable from one year to the next"(*Standard & Poor's Compustat User's Guide*, 2003, p. 269). Summing the SID by company and counting the number of SID's in both the year before SFAS 131 and the year of SFAS 131 implementation allowed identification of single segment vs. multi-segment firms and the consistency of the operating segment structure across the transition from SFAS 14 to SFAS 131. This initial screening provided a sample of approximately 250 firms for further scrutiny. Note that the small number of firms retaining their segment structure is consistent with research examining the impact of SFAS 131, which has found significant segment restructuring in the conversion to SFAS 131 (Berger & Hann, 2003; Herrmann & Thomas, 2000; Street et al., 2000).

The second stage of screening involved an initial examination of several of each firm's Annual Reports (10K) filed for the sample period to (1) verify that the initial screening had correctly selected firms that did not change either the number of segments or the composition of segments in the conversion to SFAS 131, (2) determine if there would be data available for the firm for the full sample period, and (3) determine that the firm remained multi-segment throughout the sample period. Generally this review included the 10Ks for 1995, 2002, and the applicable transition years (which varied depending on the fiscal month of the firm's year-end). Firms were dropped from the sample mostly for periods of time during the sample period where they were single segment or lacked data (often due to acquisition). This second stage of screening reduced the sample to 118 firms, each of which was then subjected to detailed data collection.

For each of the 118 companies remaining in the sample, the following documents were obtained in digital form (Adobe Acrobat © pdf files) using the web-based service 10K Wizard:

- Annual Report (10K) for each of the years from 1995 – 2004, including any amended reports (10KA) issued during that period.
- Proxy Statements issued during the years from 1995 – 2004

These documents comprised the most significant sources of the data collected about each of the companies. During the process of reviewing these documents and other sources for data collection, an additional 34 companies were deleted from the sample, leaving a final sample total of 84 companies. A complete listing of the companies selected for the sample is included in Appendix I. Companies were deleted from the sample for a variety of reasons associated with the availability of data in their Annual Reports, their organization structure, or issues associated with their industry as described in the next section.

Data Issues

Sixteen companies were deleted from the sample for data related issues. The major issue in this category was lack of data for the 2-year period before or after the period of analysis. Often this was due to the company issuing a 10KSB (Small Business) which requires only a single year of comparison data for the financial statements, making it difficult to obtain comparable data for both 1993 and 1994. However, several companies were missing Annual Reports due to delisting issues (Del Global) or pending investigations of accounting issues for multiple years for which restatements were expected (Terex). In addition, four companies did not provide capital expenditure data

for their segments. In three cases this seemed appropriate since according to SFAS 131, additions to long-lived assets are not required to be reported by segment if long-lived assets are not considered part of segment assets, but in at least one case (Dewey Electronics Corp), this appeared to be an improper implementation of SFAS 131. Finally, for two companies – Motorola and Teleflex – the disclosure of information related to acquisitions was deemed inadequate to properly segregate the acquisitions by segment. For example, in 1995 Teleflex had acquisitions totaling $17.6 million dollars (including assumed liabilities) and disclosed the following in its Annual Report:

> ACQUISITIONS AND JOINT VENTURE
> During 1995 and 1994 the company paid $9,202 and $4,485 to acquire the net assets of various businesses. The assets, liabilities and operating results of these businesses are included in the company's financial statements from their dates of acquisition. Liabilities of $8,400 and $18,000 were assumed in 1995 and 1994, respectively, in connection with the acquisitions. Results of operations would not have been materially different had the acquisitions occurred as of the beginning of the years acquired. (Teleflex, 1995)

A review of quarterly reporting (10Qs) and Lexis-Nexis news reports for this time period allowed identification of only $3.2 million dollars of the acquisition dollars. Disclosure of acquisition information in subsequent years was similar.

Structure Issues

There were 14 companies that were deleted from the sample due to issues with their organization structure. Based on management and organization information disclosed in their 10Ks, eight companies appeared to be U-form organizations for at least part of the analysis period. Since this dissertation is based on Williamson's M-form hypothesis, which suggests the superiority of the M-form organization over the U-form for a multi-division firm of appropriate size, these companies were deemed inappropriate for the sample. Three companies were multi-segment, but with the second segment a

joint venture accounted for under the equity method. There was no information disclosed on the capital spending of the joint venture – only the allocations (if any) of capital to the joint venture by the parent or return of capital from the joint venture as required. This limited allocation does not meet the complete definition of capital allocation tested in this project. For example, a company may make a single investment in a joint venture in the year that it is formed and then make no further cash transfers to that joint venture, while the joint venture continues to make capital expenditures by either drawing down the initial cash investment, drawing on its own borrowing capacity or by using its own cash flow. Capturing the cash flow from the parent to the joint venture does not capture the ongoing allocation of resources of the joint venture as it occurs, which is the focus of this dissertation.

The remaining three companies were each deleted for different structural problems. In 2000, Bausch & Lomb changed its organization to what appeared to be almost matrix in nature – a combination of geographic and industry structure. Although it still reported segment information based on industry, its reported management structure did not appear to match the segment reporting and therefore the basis of capital allocations within the firm might not be consistent with the segment structure reported. Paccar, Inc. is a 2-segment company with one segment that manufactures trucks and the second segment that finances the sales of these trucks. Because of the close association of these segments, there could not be a clear distinction of capital allocations between them. Finally, Valhi Inc. was deleted because it is essentially an investment company similar in operation to Berkshire Hathaway. Valhi and several other companies (Contran and Tremont are two of the more significant ones) are all controlled by one individual

and mutually own various companies in a variety of industries (fast food restaurants, chemicals, sugar, building products, waste management) – usually through investments in stock. The complexity of the interlocking structure of ownership of these companies indicates that Valhi did not qualify as an M-form organization as defined by Williamson.

Industry Issues

Two companies – Potlatch Corp. and Longview Fibre Co. - were deleted from the sample because there were no matching single segment firms in the industry of one of their segments. Both companies are classified as paper manufacturing (NAICS 322XXX) and each had a segment in the forestry and logging industry (NAICS code 113XXX), making them integrated manufacturers. There were no matching single segment firms in Compustat with comparative data in the forestry and logging industry at the NAICS 6-digit, 5-digit, 4-digit or 3-digit level. Without a matching single segment firm, there could be no test of the efficiency of allocation of resources within these companies to the external market allocation of resources.

In addition, two companies in the sample came from the oil industry – Conoco Phillips and Amerada Hess. The definition of investment in this industry has been a source of debate within the accounting profession for decades. The debate revolves around the choice of methods of accounting for pre-discovery (exploration) costs – known generally as full cost (capitalization) vs. successful efforts (expense). While the debate is similar to other research and development expenditures where the costs are potentially large and there may be a large amount of uncertainly, these accounting options are specific only to the extractive industry. In a sample of 86 companies an issue that is so large in magnitude and industry specific presents the potential to bias the data

analysis. While it is certainly possible to retain these companies in the sample and test the data with and without them, the difference in sample size (84 vs. 86) does not seem to justify the added complexity. Therefore these companies were also dropped from the sample.

Composition of the Final Sample

The 84 companies in the final sample are all designated as manufacturing firms based on their corporate NAICS code assigned by Compustat. At the 3-digit NAICS code level (subsector - which corresponds to the 2-digit SIC code level), there are 17 manufacturing subsectors represented (see Table 4 below).

(Insert Table 4 about here)

In addition there is one company (Textron) which is considered an industrial conglomerate – meaning its diverse interests were such that it could not be readily classified into any particular NAICS sector or subsector. Although there is considerable acquisition/disposal activity by these companies during the test period (detailed below), the corporate NAICS code assigned to each company does not change, which would indicate that each company's most significant business activity did not change during this period. Although there is diverse industry representation, approximately 45% of the sample companies are concentrated into 3 subsectors; 332 – Fabricated Metal Product Manufacturing, 325 – Chemical Manufacturing, and 336 – Transportation Equipment Manufacturing.

Although the sample companies are all designated as primarily manufacturing firms at the corporate level, 16 (19%) of the sample companies have segments that are classified as non-manufacturing. As can be seen in Table 5 below, the 299 segments in the sample are distributed into 33 NAICS subsectors, with approximately 12% of the segments falling into non-manufacturing NAICS subsectors (all subsectors that begin with other than 3).

(Insert Table 5 about here)

Tables 6 and 7 detail the status and growth of the sample companies in 3-year intervals – at the beginning (1996), midpoint (1999) and end of the test period (2002). The companies generally grow during the sample period, with both the mean and median values of assets, sales and book value of equity increasing in each period. Both assets and sales growth fall during the mid-point and end of the test period, with the 2000-2002 period sales growth falling dramatically relative to the other periods. Profits do not follow from the growth in assets or sales as both the profit as a percent of sales and return on equity fall from 1996 to 1999 and then again from 1999 to 2002. In addition, the mean profit growth is negative in each period displayed and the median drops dramatically (43.71% to 6.61%) from 1996 to 1999 and then goes negative in 2002 (-40.07%). The market seems to follow this trend since, although the mean market value of equity grows each period (the median does fall off slightly in 2002), the median Tobin's *q*, which measures the market value of the company relative to its replacement cost, drops in each period (the mean grows from 1996 to 1999, but drops below the 1996 level in 2002).

(Insert Tables 6 and 7 about here)

Table 8 presents data from Compustat on key activities of the sample companies at the corporate level in 3-year intervals – at the beginning (1996), midpoint (1999) and end of the test period (2002). The data presented in this table will not correspond exactly to the sample data presented later since this activity represents only information directly available in Compustat. For example, there is no direct way to obtain the value of businesses disposed in Compustat data, while the detailed analysis done from company 10K's did yield this information.

(Insert Table 8 about here)

Also, the acquisition activity presented in Table 8 represents the value disclosed on the cash flow statement for acquisitions. This value will by definition only represent a portion of the acquisition cost since it will not include the value of acquisitions made by stock or debt and will not include any acquisitions accounted for using pooling of interests (until it was eliminated in June 2001). This data is presented because it will be used to make comparisons to all other companies in Compustat (which could not be analyzed in detail from 10K's for obvious reasons) in later tables. In addition, it does provide a good overall perspective on the key activities of the sample companies.

It is first noted that even for capital spending, which shows an "N" of 82 or 83 in the years presented, not all 84 companies in the total sample are represented in this table.

This highlights one of the limitations of relying solely on Compustat data in a small sample. Capital spending was collected using Data128, which is capital expenditures from the cash flow statement. In all years presented, this data is "missing" for PPG industries because it is coded in Compustat as "combined" with another cash flow item.

A review of the 10K's for PPG indicates that capital spending is described on the statement of cash flows as "Additions to property and investments", meaning that it may include additions to investments accounted for using the equity method and therefore Compustat has coded it as "combined". The same issue occurs in 1998 for Aeroflex Inc., although a review of the 10K indicates the capital expenditures are separately disclosed and therefore this would seem to be a Compustat coding error. There was no correction of these omissions for the sample since the same types of problems are likely to occur in other companies and therefore the comparisons of the sample data with other Compustat companies performed below will be consistent.

Not surprisingly, all the dollar activity presented in Table 8 is considerably positively skewed. Given the range of company sizes in the sample (see the data in Table 6) one or several companies with high dollar values of capital spending, acquisitions, R&D, or working capital would likely drive the mean data notably higher than the median. Note however that at least capital spending as a percentage of average assets over each of the periods is not considerably skewed, indicating that the distribution of capital spending relative to company assets is similar throughout the sample. Both capital spending and acquisitions dollars grow from the 1994-1996 period to the 1997-1999 period and then drop off in the 2000-2002 period. This seems consistent with what you would expect given the drop in profits and the negative profit growth during this

period. The number of companies with acquisition activity per the cash flow statement (77 to79) is consistent with most of the sample companies participating in acquisition activity during the test period. Negative acquisition amounts occur in both the sample and throughout Compustat. These generally occur when there is a purchase price adjustment during the 3-year period that is larger than any acquisitions that occur during that period (the adjustment may relate to a prior period). In the case of the sample though, the large minimum "negative" acquisition amount in the 1994-1996 period is due to Temple-Inland's acquisition of a savings bank in 1994 with more cash than the cost of the acquisition to Temple-Inland. Approximately 64% of the sample reports R&D expense in each of the 3-year intervals presented, with the mean and median at about 3% and 2% of sales consistently throughout the sample period. Also note that during this final 3-year period the sample companies seem to be reducing working capital or, in the case of larger firms in the sample, increasing working capital at a somewhat slower pace.

Comparison of Sample to Compustat

Since this project involves such a small sample of companies that meet very specific requirements related to segment composition, it is necessary to determine how the sample differs (or is similar to) other companies in Compustat. Since the empirical work will be performed on a time series of data (1995 to 2002), it is also necessary to compare the sample to Compustat at intervals across the test period to see if there are any differences that appear only over time. In order to make meaningful comparisons, the Compustat data has been summarized at several different levels; (1) all firms in the Compustat Industrial file, and (2) firms that are designated in the same Industry Group (the 4-digit NAICS code level, which corresponds to the 3-digit SIC code level) at the

corporate level. Tables 9, 12 and 15 compare the corporate sample data presented in Tables 6, 7 and 8 above to several compositions of Compustat data for year 1996 and the 3-year period 1994-1996. Tables 10, 13 and 16 and Tables 11, 14 and 17 make the same comparisons for years 1999 (and the 3-year period 1997-1999) and 2002 (and the 3-year period 2000-2002), respectively.

(Insert Tables 9, 10 and 11 about here)

A comparison of the significance testing in Tables 9, 10, and 11, which represent the sample/Compustat company status at particular points in time (1996, 1999 and 2002), indicates that the sample mean is not significantly different from Compustat's mean in assets and book value of equity for all three years and market value of equity and return on equity for 1999 and 2002. The sample is significantly different from companies in the same corporate industries in all comparable statistics shown except for market value of equity. The median measures indicate generally larger companies in terms of assets, sales and equity (book value) than are in Compustat in total or in the same corporate industries. Given that both the sample and Compustat distributions are positively skewed, the median measure is likely to be the best comparative indicator[4]. The range of asset, sales and equity (book value) values in the sample fall slightly above the minimum and well below the maximum for all the Compustat measures, meaning that the sample distribution falls somewhere in the mid-range of the Compustat distribution. For market value of equity, the median values of the Compustat groupings remain virtually

[4] Although the t-test comparing means assumes normal distributions which are obviously not the case here, the sample sizes should be large enough to still provide a robust test.

unchanged from 1996 to 1999, while the sample market value grows by 20%. Then, although they all decline by 2002, the reduction in market value of the sample is only about 5%, versus 20-25% for both Compustat groups. This trend is also noted in the maximum values where in 1996, the sample maximum is about 40-50% of the comparable industry Compustat grouping, while by 2002 the sample maximum market value is 65-68%. This suggests that the sample (throughout the distribution) was selected from companies that were better able to grow and hold their market value in comparison to the rest of the market. This may be true simply because the average sample company is more profitable (and maintained its profitability) at each date than the average comparable Compustat company as measured by percent profit. The trend in median Tobin's *q* also supports the average sample company's ability to maintain market value. The sample Tobin's *q* begins at 1.55, roughly equal to or below the Compustat grouping measures of Tobin's *q*, but by 2002 at 1.33, had closed the gap such that it is above the full Compustat median of 1.27 and just below the corporate industry median of 1.36. The trend in Tobin's *q* also points out that although the average company in the sample may have held market value better than the average comparable Compustat company, they have invested more in assets than they have increased market value since the *q* has declined over time. Finally, the average sample company is not as financially constrained as the average Compustat company since the fixed coverage ratio is higher in each period, although the gap closes by 2002, at least as measured by the median.

(Insert Tables 12, 13, and 14 about here)

Tables 12, 13 and 14 provide comparative statistics for growth in assets, sales and profits over the 3-year periods ending in 1996, 1999 and 2002. A test of the equality of means of the groups shows that both the sample asset growth and sales growth are significantly different from the full Compustat and corporate industry groups in each of the three periods. Profit growth is not found to be significantly different across all three periods. Relative to Compustat, the sample median had approximately 1/3 less growth in assets and sales in the first 3-year period, but dramatically higher profit growth (44% vs. 6% and 9% for the comparative industry groupings). The median growth in assets (28%) and sales (23%) for the sample converged to the Compustat industry grouping in the second period, although the median asset growth for Compustat as a whole continued at a slightly highly level than the 1994-1996 period (38% vs. 34%). All the median profit growth group measures drop dramatically from the first to the second period, with the sample and full Compustat medians converging at approximately 6%. The firms with the same corporate industry designation as the sample firms show double-digit negative growth in the second period.

For the final 3-year period, all the growth measures continue to fall. The sample median asset growth falls to approximately 11% and is similar to all the Compustat medians, although it falls slightly below the full Compustat median of 14%. The relative change in sales growth is the same across the sample and Compustat medians. However, the median change in sample profit growth is much more dramatic – from 7% to (40%). While the Compustat medians are also all negative, this is the only period that the sample median is below all of the Compustat measures. These statistics seem to support the changes in sample market value relative to Compustat noted earlier – where the sample

seemed to grow and hold its market value better than the average Compustat company until converging somewhat by the end 2002.

(Insert Tables 15, 16, and 17 about here)

The final set of tables (15, 16, and 17) provide comparative statistics on key activity – capital spending, acquisitions, R&D expense, and changes in working capital – over the 3-year periods ending in 1996, 1999 and 2002. A t-test comparing the equality of means of the groups in each of the 3-year periods indicates that they are generally similar across many of the measures. The sample mean capital spending dollars are not significantly different from the full Compustat group in any of the periods, although as a percentage, capital spending is significantly different in all but the period ending in 1999. Although the sample mean capital spending dollars is significantly different from the Compustat industry group in all but the period ending 2002, the percentage of capital spending is not significantly different in 1996 and 1999. In addition, the median percent of capital spending to average assets between the sample and both Compustat groupings is reasonably comparable in all three periods. As in the other comparisons, the sample does not reach the minimum or maximum of the Compustat groupings, but still contains a significant range of data.

The sample mean acquisition dollars are not significantly different in two of the periods (1996 and 2002) from the mean of full Compustat group, and not significantly different from the comparable industry grouping in 1996. However as a percentage of assets, the acquisition means of both Compustat groups are not significantly different

from the sample in both 1996 and 1999. The median Compustat company had no acquisitions in any of the three periods, while the median sample company had between $2 - $9 million of acquisitions based upon the Compustat data item used for this comparison. Again, however, it is important to point out that the measure used here would not include any acquisitions financed by debt or stock or accounted for as pooling of interests during the periods shown. Therefore this may mean that the median sample company was either more likely to have made acquisitions or more likely to have made the acquisition with a cash payment.

The sample mean R&D expense and working capital dollar change is not significantly different from the Compustat groups across all three periods (with one exception – the working capital change compared to the full Compustat group in 2002). R&D expense as a percentage of sales, perhaps a better measure of the relative level of R&D expense, is significantly different between the groups in all periods (with one exception in 2002). Although the R&D expense dollars for the median sample company are higher than the median Compustat companies, the percent of sales for the sample (approximately 2% in each year) is below Compustat in all periods. While the total Compustat percent of sales ranges from 2.4% to 3.6%, which is not a large difference from the sample, the comparable industry groupings from Compustat show a range of R&D expense from 5-7% of sales, which is much greater. Unlike R& D expense, working capital activity as a percent of assets is reasonably consistent with the dollar comparisons. The sample means of working capital changes as a percent of average assets are not significantly different from the Compustat groups in two of the three years.

In summary, at the corporate level, the average (mean) sample company is reasonably similar to the full Compustat average company across the sample period (1995 – 2002) in size (assets, book and market value of equity), profit growth and key activity (capital spending, acquisitions, R&D expense, and changes in working capital). However the average (mean) sample company has significantly larger sales volume, is more profitable (as a percent of sales), but had lower asset and sales growth across the sample period than the average Compustat company. In addition, the sample tends to have a lower Tobin's *q* and not be as financially constrained as the average (mean) Compustat company. This analysis suggests that, on average, although the sample companies are more profitable and continue to invest at the same level as an average Compustat company, they have fewer growth opportunities within their existing business. Acquisitions would appear to be the best means of growth for these companies – particularly to diversify into other businesses. Although the statistical tests cannot reject the equality of the sample and Compustat mean acquisition dollars (and percent of assets), the absolute dollars are larger in every period (and the median dollars are also higher in every period), suggesting that the sample firms may be engaging in more acquisitions for this purpose. In addition, their superior profitability appears to allow them to finance this growth internally instead of relying on debt. Finally, it would seem that the average sample firm may be divesting more assets than the average Compustat firm in order for it to maintain similar investment patterns but lower asset growth over the period.

In summary, the average (mean) sample company has very little in common with other companies in Compustat with the same corporate industry designation (based on the

measures compared here). The sample company is much larger (assets, sales, book value of equity), more profitable, with a lower Tobin's *q*, and less financial constraint. In general, the companies in Compustat that match the sample corporate industry are not only smaller than the sample companies, but are also smaller than the average Compustat company. Only the market value of equity for these firms is larger than the average Compustat company, although still smaller than the sample (although not statistically different from the sample). Sales and assets growth are lower for the sample, but this may be explained by the higher base level of these values in the sample. Although the sample investment (capital spending, acquisition and working capital) dollars are higher, they are consistent with the Compustat industry match companies as a percent of assets Only R&D investment is similar in dollars, but with a lower percent of sales for the sample (due to the higher sales level). Since the sample comes only from multi-division firms, these differences may result from the "corporate" industry designation not adequately capturing the diversity of the sample companies or their matching industry counterparts in Compustat. Clearly though, for whatever reason, the sample is not representative of other Compustat companies designated with the same industries at the corporate level. A comparison of the individual segments in the sample companies to Compustat segments at the industry level may provide a more meaningful comparison.

Comparison of Sample Segment Information to Compustat

In order to compare the sample segments to the Compustat segment database, a process similar to the one used to draw the sample is applied to the whole database. Multi-segment firms (other than the sample firms) are identified after removal of non-operating, corporate, and immaterial aggregate segment (segments designated as "other")

for the whole sample period to compose the Compustat segment group. The NAICS code assigned to each segment is then matched by year to the sample (at the 4-digit NAICS code level) and these firms form the Matching Industry Segment group. Tables 18 (number of observations), 19 (assets), and 20 (sales) provide comparative data on the sample segments to the matching segments by 4-digit NAICS industry for three periods across the test period – 1996, 1999, 2002.

(Insert Table 18 about here)

Table 18 indicates that with only a few exceptions, the sample segments operate in relatively competitive industries with segments of other multi-segment firms. The exceptions fall mainly in two industries – 3274 (lime & gypsum product mfg), where there are only 4, 2, and 1 segments in 1996, 1999, and 2002 respectively, competing with the sample segment and 3326 (spring and wire product mfg) where there are only 3, 2, and 1 segments competing. In the case of industry group 3326, there are more segments in the sample (2) than exist in other multi-segment firms. There may, of course, be single segment firms that compete in each of these industries which are not included in this table. A Wilcoxon Ranked Sum test indicates that the distribution of the percentage observations by industry in the sample and Compustat is similar in each year (two-tailed test, approximate $p > 0.5284$ in 1996, 0.7271 in 1999, and 0.4969 in 2002).

(Insert Table 19 about here)

Table 19 shows the sample and multi-segment firm asset dollars (mean) of each 4-digit NAICS industry group[5]. There appears to be little consistency between the sample company segments and other multi-segment firms segments in the same industry in asset dollars. In general, the average sample companies are smaller than the average of other multi-segment companies in the same industry – approximately 67% of the industries exhibit this general trend in each of the years displayed. However, there are notable exceptions, particularly NAICS 4-digit 5221 (Depository Credit Intermediation) where the average sample company is 650 – 1100% higher than the average multi-segment firm in the same industry. In addition, approximately 78% of the sample company segments are consistently above or below the segments of other multi-segment firms in the same industry – meaning that if the sample segment assets are below (above) the industry in 1996, they remain below (above) the industry in 1999 and 2002 as well. Note though, that this comparison of assets may be inconsistent because the segment database may contain different definitions of "assets" by company, particularly under the different disclosure rules in place under SFAS 14 and SFAS 131. The data for 1996 would have been reported under SFAS 14, which required disclosure of the "identifiable assets" of each segment. These are defined as "those tangible and intangible enterprise assets that are used by the industry segment, including (i) assets that are used exclusively by that industry segment and (ii) an allocated portion of assets used jointly by two or more industry segments"(FASB, 1976b, p. 7). This suggests a reasonably consistent definition of assets for 1995 – 1997, when SFAS 14 was in effect. However, under SFAS 131, which was effective for years beginning after December 15, 1997 (calendar year

[5] Given the small number of sample observations in many of the industry years (many of which are 1), it is not possible to do meaningful statistical tests comparing the means of the sample segments to the other multi-segment firm segments for assets (Table 19) or for sales (Table 20)

1998), companies are required to disclose "only those assets that are included in the measure of the segment's assets that is used by the chief operating decision maker shall be reported for that segment" (FASB, 1997, p. 12). This measure of assets is company specific and therefore creates the possibility that it may differ from company to company – both within the sample and between the sample and other multi-segment Compustat companies. In the sample this concern is mitigated somewhat by the nature of the selection process. The firms in the sample were selected because they did not change their segments in the conversion from SFAS 14 to SFAS 131. Since this meant that they were managed under the same organization structure that they reported segments under SFAS 14, this would also make it less likely that the composition of the information they disclose for segments would change under SFAS 131. For the other multi-segment firms, the grouping by 4-digit NAICS industry group codes may provide some level of consistency within industry, but this cannot be accurately determined without examining the segment footnote disclosures of each company year.

(Insert Table 20 about here)

Table 20 provides a comparison of sales (mean) for sample company segments to other multi-segment firm segments by 4-digit NAICS industry codes. As with assets, there appears to be very little homogeneity within each industry comparison of sample segment sales to other multi-segment firm segment sales. Similar to the general trend in assets, approximately 65% of the segments of the sample companies have sales below the level of segments of other multi-segment firms in each of the years presented.

Approximately 79% of the sample company segments are consistently above or below the segments of other multi-segment firms in the same industry – meaning that if the sample segment sales are below (above) the industry in 1996, they remain below (above) the industry in 1999 and 2002 as well. The similarity of the sales percentages to the asset percentages lends some credibility to the reasonableness of the segment asset comparisons given the potential inconsistencies discussed earlier.

Tables 22, 23, and 24 provide comparisons of the status (number of segments, assets, sales, profit, and profitability) of the sample segments to all Compustat segments of multi-segment firms and to the Compustat segments of multi-segment firms in the same 4-digit NAICS industry groups as the sample segments for 1996, 1999, and 2002, respectively. Tables 25, 26, and 27 provide comparisons of growth and key activity for the same periods. The same caution related to segment assets applies to these tables as was discussed related to Table 19 earlier. In addition, a similar caution must be added related to profit and profitability measures displayed in Tables 22, 23 and 24. SFAS 14 requires disclosure of operating profit for each segment, while SFAS 131 requires disclosure of "a measure of profit or loss…for each reportable segment" (FASB, 1997, p. 11). The measure reported will depend on the measure reviewed by the chief operating decision maker "in accessing segment performance and deciding how to allocate resources…"(FASB, 1997, p. 12). Compustat allows for and reports the various measures of segment profit when they are disclosed by the reporting company. Table 21 shows the percentage of companies reporting these various levels of profit for segments within the sample, all Compustat, and matching industries to the sample segments for the period 1998 – 2002 (the period since the implementation of SFAS 131).

(Insert Table 21 about here)

Although the majority of companies continue to report operating profit at the segment level, a larger percentage of the sample companies continue it than do other Compustat companies. Note that a large percentage of the non-sample company segments report no profit measure based on the data in Compustat. This may be due to the chief operating decision maker of these companies not including a measure of profit in his analysis of segment results, the use of a measure other than one of the six that Compustat has chosen to capture, or an error by Compustat in recording company data. The 18 segment years within the sample that show no reported profit were due to errors in Compustat reporting. The profit measures were available when the 10K's for these companies were examined as part of the data collection process. This different distribution of measures of profits may cause the comparisons of average (mean) profit dollars and profitability measures across these groups to differ (or be similar) without measuring the true operating differences (or similarities) of the segments. As with the comparison of assets, this problem will only exist for the periods after the implementation of SFAS 131 (1998-2002).

(Insert Tables 22, 23, and 24 about here)

The comparison of the status of sample segments to all Compustat segments and matching industry segments in Compustat across the sample period (Tables 22, 23 and

24) shows that there are a similar average number of segments (approximately 3) within multiple segment firms across the periods – although they are not statistically the same except in 1996. The range of segments is a little smaller for the sample (reaching a maximum of 7, 6, and 5 segments in 1996, 1999 and 2002, respectively), while firms in Compustat and the industry matching group reach the maximum required disclosure limit of 10 segments in each of the years. In addition, based on the mean values, the sample segments appear generally smaller in asset size, but larger in sales (with 1996 the exception). Statistically, only segment profit is not different (between the sample segments and matching industry segments) across all the periods displayed, although both assets and return on assets are not statistically different in 1999 and 2002. The statistical similarity of profit across all the periods provides some evidence that the different measures of profitability used by segments subsequent to the implementation of SFAS 131 did not affect the comparability.

(Insert Tables 25, 26, and 27 about here)

There is more consistency between the sample segments and both Compustat groups in the growth and key variable tables (Tables 25, 26, and 27), although only profit growth is not statistically different over all three periods reported. Asset and sales growth for the sample segments are not statistically different from the industry match segments for both 1996 and 2002. The sample segments spend less capital in the 1994-1996 period than either Compustat group, but there is no statistical difference in capital spending dollars with the industry match group in the periods ending in 1999 and 2002. For R&D

expense, the sample segments spend dollars that are not statistically different from all other Compustat and industry matching segments that report R&D in both the three year periods ending in 1996 and 1999. Since there are no sample segments that report R&D expense for the full three year period in 2002, no statistical test can be performed. It is clear from the descriptive statistics that few companies report R&D expense by segment. In 1996, only 16% of the sample company segments and 13% of the Compustat and industry match segments reported R&D expense. Also, as noted in previous research, the percentage reporting R&D decreased after the implementation of SFAS 131 to approximately 10% in 1999 and below 5% in 2002 (Herrmann & Thomas, 2000), with none of the sample segments reporting data for the full three year period ending in 2002.

In summary, given the caveats related to the comparability of assets and profits under SFAS 131, the average (mean) sample company segments show more similarity to average other Compustat segments, particularly matching industry segments than was apparent at the corporate level. Although the sample segments seem to be generally smaller in asset size and larger in sales, with these differences noted consistently by individual industry too, they are not statistically different than the matching industry segments on the key variables of profits, profit growth, capital spending and R&D expense for all or two of the three periods displayed. In addition, although they are not statistically the same, the average (mean) number of segments for both sample and matching industry firms are very similar (approximately 3) throughout the period (the medians are exactly equal at 3 for all periods), indicating the average sample companies are similar in make-up to other companies that contain segments in the same industries.

Segment Research related to the sample selection

Segment disclosure has generated a large portfolio of research attention, particularly since 1996 related to the differences between SFAS 14 and SFAS131 and the effect of implementing SFAS 131. One of the major complaints from users of financial statement data was that under SFAS 14 companies exploited the flexibility of segment definition to suit their own financial reporting purposes (Knutson, 1993; Pacter, 1993). Early research based on disclosure literature (see Verrecchia, 2001 for a summary of this literature) suggested that under SFAS 14 companies would aggregate operations into single segments in order to either (1) hide profitable businesses in less competitive industries, or (2) hide poorly performing businesses to protect firm valuation (M. S. Harris, 1998; Hayes & Lundholm, 1996; Maines, McDaniel, & Harris, 1997). SFAS 131 was issued in response to these concerns, with the expectation that more companies would report segment information and that the information reported would be more disaggregated than under SFAS 14.

Research comparing samples of companies across the implementation period of SFAS 131 confirmed that more companies became multiple segment firms under SFAS 131, although the overall improvement in segment disclosure is disputed (Coller & Pierce, 1999; Herrmann & Thomas, 2000; Street et al., 2000). Seven of these companies in this sample (Danaher, Gillette, Johnson & Johnson, Lockheed Martin, PPG, Textron and United Technologies), were included in the sample used by Street, et al. (2000) selected from the *Business Week* Global 1000 in their review of changes in disclosures from SFAS 14 to SFAS 131 (their final sample was 160 companies). As more data reported under SFAS 131 became available, research concentrated on determining if the increase in the number of segments was due simply to the change in segment definition

(from line of business/industry under SFAS 14 to the management approach under SFAS 131) or due to the suggested concerns that companies had used SFAS 14 to "hide" operations within segments.

Berger & Hann (2003) use a sample of multi-segment firms in the first SFAS 131 reporting year (such that firms may have been single or multi-segment under SFAS 14) and find that analyst forecasts are improved by the new segment disclosures, suggesting that there was information hidden within the previous segment disclosures. They also note, as had previous research, that even under the management approach of SFAS 131, line of business (LOB)/industry segmentation still dominates (Berger & Hann, 2003; Herrmann & Thomas, 2000; Street et al., 2000), which indicates that firms tend to be organized and managed along LOB/industry lines. In an unpublished paper using the same sample data, they find evidence that it was poorly performing operations that were hidden under SFAS 14 (agency costs), but no evidence of highly profitable operations hidden for competitive advantage (proprietary costs) (Berger & Hann, 2007).

Botosan and Stanford (2005) sample from the opposite direction, looking only at firms that were single segment under SFAS 14 but became multi-segment under SFAS 131 to investigate if these firms either hid profitable operations in less competitive environments or masked poor performing operations using the flexibility of segment definition under SFAS 14. They find evidence that companies hid profitable operations in less competitive environments than the firm's primary industry, but no evidence of segment aggregation to mask poor performing operations. And finally, taking a different approach, Ettredge et al. (2006) investigate only firms that were multi-segment before and after the implementation of SFAS 131 for evidence that implementation of SFAS 131

improved segment disclosure. They find increased the segment cross-segment variability of profits (their measure of improved disclosure from reduced aggregation of operations) and more transparent segment disclosure (evidenced by the stronger relationship of cross-segment variability of profits to industry cross segment variability of profits), particularly for firms that rely more on external financing. However, they also find evidence that managers still employ some latitude in disclosure when there are proprietary (competitive) costs involved.

The sample for this project consists of companies that did not change their segment composition in the conversion from SFAS 14 to SFAS 131. Although maintaining LOB segmentation from SFAS 14 would not be considered unusual, the stream of research on segments discussed above all suggests (and finds evidence) that the majority of firms would change segment disclosures in the implementation of SFAS 131 unless they operated in highly competitive industries (no abnormal profits possible), operated in less competitive industries but did not have any proprietary or agency reasons to hide segments under SFAS 14 (no abnormal – higher or lower - profits earned), or relied extensively on external financing (incentive to disclose under SFAS 14). With a very few exceptions, Table 18 would indicate that in 1996 (under SFAS 14) the firms in this sample operated in competitive environments. There are only 13 industries with less than 10 segment observations in 1996 and only three with five or less segment observations. In each of the industries with five or less observations, there are single segment firms which increase the competitive environment above five observations (based on the sample of single segment firms used in later testing). Although this generally supports the existing segment research, the sample also contains two of the five

companies disclosing segment information in one of the least competitive industries (3326 – Spring & Wire Product Mfg), where it would be expected that none would report ; and there is only one of the least competitive industries (3366 – Ship and Boat Building) that shows an increase in the number of segments disclosed subsequent to the implementation of SFAS 131, while it would be expected that each of the least competitive industries would have increased segments as disaggregation occurred under SFAS 131. From a profit standpoint, the sample segments show profits that are below (statistically significant) industry profits for segments in the same industries in 1996 (Table 22). However, the evidence on abnormal profits from Berger & Hann (2007) relies on return on sales (ROS, shown as profit % of sales in Tables 22, 23 and 24 in this paper), and from Ettredge et al. (2006) relies on return on assets (ROA, also reported in Tables 22, 23 and 24), which for the sample companies are not statistically different from other segments in the same industry in 1996 (Table 22, although both the mean and median measures are larger than other segments in the same industries). Although both measures (ROS and ROA) are statistically different in 1999 after the implementation of SFAS 131, since the sample companies did not change composition this may indicate support for better disaggregation in segments of competing firms for either proprietary or agency reasons or simply a differential change in profitability between the sample companies and other segments in the same industries. In general, it appears that the sample selection does not conflict with existing segment research.

Data Collection and Sample Descriptives

Data for this project comes from a variety of sources. Table 28 shows the variables suggested by the theoretical model and their source. Annual (10K), quarterly

(10Q) and proxy (Def14) reporting for all the sample companies were obtained for all available periods 1994 – 2004 for the sample companies using 10K Wizard (www.10kwizard.com).

(Insert Table 28 about here)

Copies were also obtained of any restatements of 10K's issued by the sample companies for any of the sample periods. Where data came from Compustat, it was adjusted manually for any restatements issued by the sample firms based on data found in the restated 10K. In addition, data collected from Compustat was reviewed carefully for consistency with the financial statement year reported to assure the comparability of segment data across years where computations required it. Each year of segment data is actually reported three times since 10K reporting requires two years of comparable data for income statement and related data. For example, Table 29 details the segment sales reported by Standex over a 3-year reporting period in its consecutive 10Ks (in thousands).

(Insert Table 29 about here)

The change from the 2001 10K to the 2002 10K was due to a reorganization of the segment content – note that the total sales did not change, only the sales of the Consumer and Industrial segments. The change from 2002 to 2003 was due to both a reorganization and the reclassification of some operations in both Food Service an Industrial to

discontinued operations – which is why the total sales number is now less than that reported originally in 2001. Similar changes occurred in the other segment disclosures (profits, assets, depreciation, etc.). Because company segment compositions like this change often, any computation involving a "change" in values for a segment is only valid when the data comes from the same financial statement (10K) year. In addition, any computation requiring a comparison between segments is only valid if the data for each segment being compared was reported in the same financial statement (10K) year. The Compustat segment database provides a code for the source year of the financial statements from which the segment information is drawn, however this code was found to be inaccurate for much of the sample period. For the periods prior to 1999 there is only one year of reported data for each segment (instead of three years – once for each year the data is disclosed), so comparable information for each financial statement year had to be verified to the 10K's manually. Although three years of data are reported in 1999 and beyond, errors were also noted in the source years reported, requiring this data to be manually verified as well.

Investment (*I*)

This project defined investment more broadly than previous ICM research. Previous research generally defined investment as capital spending (*CapX*), while for this project, investment is defined as follows:

$$I_{ift} = CAPX_{ift} + R\&D_{ift} + workcap_{ift} + HC_{ift} + NetAcquis_{ift}$$

The expansion of the definition of investment required data collection and calculation beyond the information readily available by segment on Compustat. *CapX* is readily available in Compustat for each segment year. Except for the manual verification and

collection required to insure that the data was consistent across years and segments within a corporation, this variable presented no particular problems in collection. Each of the additional variables however, presented particular problems in the manual collection process or in their calculation.

Research & Development (*R&D*)

The research & development data obtained from Compustat for the sample segments for the period 1995 – 2002 contained data for segments of 23 of the sample companies for part or all of the sample period. A total of 241 segment years (11% of the sample) contained research & development expense data. However, the data for 12 of the companies (125 segment years) was reported as -.008 in Compustat, which appears to be the Fortran missing code for data that is "insignificant" (although it is not clear how this code leaked into the database since Fortran was not used for access and the normal missing code for insignificant data should have been ".I" based on the method of access). Also, a complete review of the applicable 10K's for these sample firms could not confirm that segment *R&D* was actually "insignificant" or simply not reported. After removing this erroneous data, the actual number of sample firms reporting research & development data for part or all the sample period in Compustat was only 11 firms (13% of the sample) and 116 segment years (5.4% of the sample). Manual data collection consisted of a detailed review of each sample company's 10K for every year of the sample period for information reported on *R&D* by segment. As part of this data collection process purchased in process R&D (IPRD) was identified and separated by segment. This represents a part of the acquisition cost that was expensed at the time of acquisition because it had not reached technical feasibility at the time of acquisition. In addition this

process yielded segment *R&D* data that was missed by Compustat and in some cases, there was information related to *R&D* spending in the 10K that allowed an estimate of at least a portion of the segment *R&D* dollars. Two good examples of this would be Aeroflex Inc. and Johnson & Johnson.

Although they reported no segment *R&D* spending in any of the sample years, Aeroflex provided information in their MD&A about where the changes in research spending occurred between years. For example in their 1995 10K (for the year ending June 30, 1995) they reported the following:

> "The Company's product development efforts primarily involve engineering and design relating to the improvement of existing products or the adaptation of such products to new applications. …These costs were approximately $2,389,000 and $694,000 for fiscal 1995 and 1994, respectively. The increased expenditures were primarily in the microelectronics product line, incurred to develop additional new products." (Aeroflex, 1995, p. 11)

Aeroflex had two segments in 1995 – Isolator and Electronics (of which microelectronics was a component). Since the investment variable (*I*) is ultimately a calculation of the change in spending this year vs. the prior year, this information allowed a usable estimate of this value without knowing the actual spending dollars by segment in any one year. If one assumes equal expenditures of *R&D* in the segments in 1994 (approximately $347,000 each), then one can approximate 1995 *R&D* spending by segment by allocating the increase in spending from 1994 to 1995 of $1,689,000 to the Electronics segment. Although admittedly it is a rough number, the change between years calculated from these numbers should approximate the change in spending for this component of investment. Similar disclosures are made in each of the sample years by Aeroflex, allowing estimated *R&D* spending by segment to be calculated each year.

Johnson & Johnson reported *R&D* by segment in its 10K for 1995 – 1997. Interestingly, they stopped reporting this information in 1998, the year of transition to SFAS 131, although it was not required under SFAS 14 either. Compustat reports the information as missing for the sample period 1998 – 2002. However, as part of the MD&A in its 1998 10K (for the year ending January 3, 1999), Johnson & Johnson discloses the following information:

> "Research expense as a percent of sales for the Pharmaceutical segment was 15.8% for 1998, 16.7% for 1997 and 15.2% in 1996, while averaging 6.1%, 5.7% and 5.6% in the other two segments."(Johnson&Johnson, 1998, p. 30)

Given that sales are disclosed by segment, it is possible to compute *R&D* by segment from this information. Although the data for the two segments other than Pharmaceuticals are combined as an average percentage, the Pharmaceuticals segment accounts for 67.5% of the research dollars, so the majority of the dollars are specifically identified. Similar disclosures are made each year by Johnson & Johnson for the period 1998 – 2002, allowing *R&D* to be calculated throughout the sample period.

Unfortunately, this level of manual data collection across all the sample firms was only able to provide *R&D* spending by segment for an additional 19 firms and 491 segment years for a total of 30 firms (35.7% of the sample firms) and 607 segment years (28% of the sample segment years).

Working Capital (*workcap*)

In order to compute the change in investment in net working capital by segment, it is first necessary to determine the change in net working capital for each sample firm by year. This was computed each firm-year using the Compustat industrial data for each sample firm:

$$WC_{ft} = \Delta AcctsRec + \Delta INV + \Delta AcctsPay$$

where $\Delta AcctsRec$ is Compustat data302 (sign reversed), ΔINV is Compustat data303 (sign reversed), and $\Delta AcctsPay$ is Compustat data304 (sign reversed) taken from each firm's cash flow statement. During this process it was noted that the data in Compustat for many of the sample firms (26 sample firms, 151 firm-years) contained ".C" for at least one of the data items, which indicates that the item is combined with some other line on the cash flow statement. Eleven (11) of the 151 firm-years had this code for two of the three data items used to calculate the change in net working capital. Accounts payable was missing the most often (139 times), followed by inventory (19 times) and accounts receivable (4 times). Because of the extent of the missing information, this data was manually collected from the cash-flow statements of the firms. In most cases it was apparent which cash flow line item was the "combined" item containing the information needed – for example often the change in accounts payable and accrued expenses (Compustat data304) was combined with the change in accrued income taxes (Compustat data305) or changes in other liabilities (Compustat data307). There were 12 firm-years (two firms – MTS Systems Corp and Lockheed Martin Corp) for which the cash flow data was too summarized to manually add the data (only an "Other" data item was available, which likely includes data that would not be part of net working capital), so no adjustment was made for these firms. Although this expands the definition of change in net working capital for these particular firm-years, it was felt that the calculations with the manual data added would be more accurate than if the information was not included (tests on the final results indicate that it improved about 60% of the firm-years where the adjustment was made as measured by a reduced

difference between the computed and actual change in net working capital). During this process, corrections were also made to the downloaded cash flow data from Compustat for two firms where the information on the cash flow statement from the 10K filed by the firm did not match the information downloaded from Compustat – this resulted in manual adjustments to a total of 141 firm-years (151 with missing data less 12 for which no adjustment could be determined plus 2 for which data was incorrect in Compustat).

Two methods were used to calculate the change in net working capital by segment in the sample to compare to the actual change computed above. Method one uses matching single segment firms to calculate a "fitted" net working capital change for each segment in the sample. Industry codes for each sample segment were matched to single segment firms by year. For years 1995 and 1996 the industry match was made based on segment SIC code and for 1997 and subsequent years the match was made based on NAICS code. The matching process began at the full code length (4-digit SIC and 6-digit NAICS) and, if there were not at least five matching single segment firms, reduced the matching search by a digit at a time until at least five matches were found. If there were not at least five matching single segment firms this method was not used. In addition, this method could not be applied to some to the non-operating segments (i.e. "corporate"), where no industry code is supplied in Compustat. Table 30 shows the distribution of industry matches using this method. This matching process created a set of single segment firms for each sample segment-year for which the actual change in net working capital could be computed from the corporate Compustat cash flow data.

(Insert Table 30 about here)

The computed change in net working capital was regressed on sales for each set of single segment firms that matched a segment-year in the sample as per this equation:

$$WC1_{it} = a_t + b_t SALES_{it}$$

The coefficients from these regressions were used to estimate the change in net working capital for each segment in the sample by year by inserting the actual sales of the sample segment into each applicable matched industry regression equation.

Method two involves several computational steps in order to estimate the change in each segment's net working capital. Since only asset values are available for each segment, the first step is to independently compute each of the sample segment's change in working capital assets for each year ($ACchg_{ift}$) using this equation:

$$ACchg_{ift} = \left(IA_{ift} - IA_{ift-1}\right) - CAPX_{ift} - NetAquis_{ift} + DEPR_{ift}$$ [6]

where *IA* represents the reported identifiable assets associated with the segment, *Capx* represents the reported capital expenditures, *NetAquis* represents the net acquisitions identified with the segment, and *Depr* represents the reported depreciation and amortization. In this equation, the industry subscript *i* carries the same meaning as "segment" for each company. There are instances within the sample where a company has multiple segments with the same industry designation in a year, but where this occurs, the equation is applied to each segment separately. Since there is not available data for liabilities of segments, the actual change in working capital liabilities (Compustat

[6] Note that if the segment reports investments using the equity method, then changes in this amount from year to year will also be accounted for in this calculation.

data304 or the amount collected manually to substitute for this data item) was allocated to the segments based on the change in segment working capital assets computed above.

$$Lchg_{ift} = \left(Achg_{ift} \Big/ \sum_{i=1}^{n} Achg_{ift} \right) * Lchg_{ft}$$

The change in net working capital for the segment is computed as the sum of the change in segment working capital assets and allocated segment working capital liabilities as follows:

$$WC2_{ift} = Achg_{ift} - Lchg_{ift}$$

The results of the computations of working capital change by segment-year were summarized to determine a total firm change in working capital each year under each method as follows:

$$WC1_{ft} = \sum_{i=1}^{n} WC1_{ift}$$

$$WC2_{ft} = \sum_{i=1}^{n} WC2_{ift}$$

Finally, the computed changes in working capital for each firm-year determined by the segment data under both methods were compared to the actual change in working capital for the firm. The method that yielded the smallest difference became the source of the working capital variable by segment (*workcap*) in this analysis.

$$workcap_{t} = \min\left(WC_{ft} - WC1_{ft}, WC_{ft} - WC2_{ft} \right)$$

The sample data consists of 84 firms and eight years of data (1995-2002) making 672 firm-years of data. Method two (the calculated working capital amount - $WC2_{ft}$) yielded the smallest difference in 551 (82%) of the firm-years and method one (the

"fitted" working capital amount - $WC1_{ft}$) yielded smallest difference for the remainder of the 121 (18%) firm-years. As you can see from Table 31 below, most of the calculations where $WC1_{ft}$ yielded the smallest difference were single firm-years (the number of firms approximates the number of firm years). In all, 25 of the 84 firms in the sample had $WC2_{ft}$ compute the closest approximation of the actual change in net working capital for all eight years and another 50 had it compute the closest approximation in seven of the eight year (in total, this is 89% of the sample). Although the minimum difference between the computed net working capital change using the two methods and the actual working capital change was the source of each firm-year *workcap* value, these differences are often large in both dollars and percentage. Table 31 describes the results of these computations in more detail and it is clear from these calculations that neither method of calculating the change in working capital by segment provides a consistent approximation of the total firm change in net working capital.

(Insert Table 31 about here)

For those firm-years where $WC1_{ft}$ provided the closest approximation of the firm change in net working capital, 60% of the firm-year calculations are more than 100% different from the actual firm change in net working capital. For those firm-years where $WC2_{ft}$ provided the closest approximation, the numbers are only slightly better – 49.4% of the calculations of net working capital change are more than 100% different from the actual change. There is not a statistically significant difference in number of segments,

assets or sales in the firm-years that fall under $WC1_{ft}$ vs. $WC2_{ft}$. Overall, 51.2% of the firm-year calculations of the change in net working capital were greater than 100% different from the actual change in net working capital for the year. Only 10.7% of the firm-year calculations are within 10% of the actual change in net working capital. Based on the data in the table, there does not appear to be a pattern to the differences in the working capital calculation. Each of the ranges of percentage differences displayed contains firm-years from throughout the sample period (1995-2002). Although the minimum and maximum dollar differences in each range indicate that each range contains a variety of size companies, the average (mean) company in the ranges with a 25% or less difference tend to be smaller in both assets and sales than the average (mean) company in the sample (1% - $p<.001$, 10% - $p<.001$, 25% - $p=.0138$ for sales, similar results for assets). In addition, the average (mean) firm in the worst range (> 500%) tends to be larger than the average sample company in both assets and sales ($p=.0248$ for sales and $p=.0165$ for assets).

Two different calculations of changes to segment net working capital are performed in order to address different problems with estimating net working capital changes at the segment level. Method one ($WC1_{ft}$) assumes that the segment relationship of sales to changes in net working capital is the same as the average industry relationship of single segment firms for that industry. This is a substantial assumption given that prior research has suggested that segments within firms are inherently different than their stand-alone counterparts (Chevalier, 2004; Maksimovic & Phillips, 2002; Whited, 2001). In addition, as noted earlier, research related to the implementation of SFAS 131 has indicated that firms classified as single segment firms under SFAS 14 may

not have been truly single segment from an industry standpoint (for example, Herrmann & Thomas, 2000; Maksimovic & Phillips, 2002; Street et al., 2000). This could bias the calculations of the industry relationships used to "fit" the change in net working capital to sales. Finally, although there is not complete consensus in the strategy literature, research generally supports that industry effects account for a smaller portion of performance than firm effects. A recent paper using different measures of performance suggests that the industry effect ranges from 6.5-11.4%, while the firm effect ranges from 27.1-35.8%, with an even greater firm effect if the particular firm is an industry "leader or loser" in the particular industry (Hawawini, Subramanian, & Verdin, 2003).

The method two ($WC2_{ft}$) calculation, which uses the available Compustat segment data supplemented by data manually collected to back into the segment change in net working capital, requires an assumption that it includes complete information on the change in segment assets other than the change in segment working capital assets. While there are strong assumptions required for both calculations, the assumptions are not similar and therefore the expectation was that if one set of assumptions failed, the other would hold well enough to provide a reasonable approximation of the change in net working capital by segment. Obviously, this did not occur and suggests that there was considerable overlap in the failure of assumptions under the two methods. A more detailed review of the problems with the $WC2_{ft}$ calculation suggests that the reasons for its failure are many and varied and therefore make any substantial improvement in the *workcap* calculation difficult.

1. As indicated earlier, there were a number of sample companies that had a code of ".C" in Compustat for one or more of the cash flow working capital data

items in one or more years for which manual data was collected to supplement the Compustat data (a total of 151 firm-years had this code and 141 firm-years were adjusted). Although the resulting calculations for the 141 firm-years that were adjusted improved the results (dollar difference from the actual change in net working capital) for 58% of the firms for which the manual data was added, it made a large minority (42%) worse. Analysis of the specific firm-years where the ".C" code was found indicates that, even after manual adjustment to most of the firms, 85 of the 151 firm-years (56%) fall into a range difference greater than 100% in Table 31.

2. Prior to the conversion to SFAS 131 companies were not required to reconcile the total assets by segment to the total corporate assets. Although many of the sample firms reported a "corporate" or "other" segment in their 10Ks, Compustat did not generally capture this data in its database. This data was also not included in the manual collection process for this project. Therefore, for the calculations of $WC2_{ft}$ prior to the implementation of SFAS 131 (which occurred in 1998 or 1999, depending on the fiscal year-end of the firm), there is no calculation of the change in assets for a "corporate" or "other" segment which may include working capital changes. This makes the accumulation of the change in segment working capital assets incomplete when compared to the total company change in working capital.
3. Virtually every firm in the sample shows an amount for disposal of assets in the investing section of their cash flow statement. This is not related to the disposal of businesses, but to the "normal" disposal and sale of fixed assets that

each business incurs annually. This data is not required to be disclosed by segment under SFAS 131 and therefore no firms do so (or at least none of the firms in this sample). Since $ACHg_{ift}$ attempts to calculate the change in working capital assets by segment as the difference in the change in total assets after accounting for all other changes, the disposal of assets cannot be accounted for and therefore ends up as part of the change in working capital assets for any segment that had disposals. For many firms in the sample this number may be significant – particularly in comparison to the change in working capital. For example, Gillette discloses the following information on its cash flow statement for the years ending December 31, 1999, 1998 and 1997 (amounts in millions).

	1999	1998	1997
Change in working capital – increase/(decrease)	31.0	486.0	468.0
Disposals of property, plant and equipment	127.0	88.0	59.0

With this data, even if the formula used to compute the segment change in working capital assets were completely accurate in all its other information, but did not have the data to account for disposals in the calculation, it would misstate the working capital assets by 410%, 18%, and 13% respectively in 1999, 1998 and 1997. The methodology worked in 1999, with the $WC1_{ft}$ calculation providing a smaller difference in working capital change to overcome the calculation problems with $WC2_{ft}$, however, the minimum difference was still 119% ($37million) different under $WC1_{ft}$.

4. The value of $NetAquis_{ift}$ in the calculation of $WC2_{ft}$ for each of the sample firm-years was difficult to determine completely and accurately (see later discussion). There were 15 pooling of interest transactions in the sample before this method of accounting for business combinations was eliminated under SFAS 141. These transactions were re-estimated using the purchase method for purposes of this project and this required adjustments to both the segment and corporate Compustat data used to compute the change in working capital. Where the estimation of the change in asset values using the purchase method vs. the pooling method failed, this would cause problems with the change in working capital calculation. All but two of the firm-year's where pooling occurred show working capital calculation differences exceeding 100%. In addition, it was not always possible to determine the full distribution of acquisitions and dispositions by segment or the asset value acquired or disposed (as compared to the NET asset value), both of which are necessary for the $WC2_{ft}$ calculation.

5. Many of the firms made impairment, realignment or restructuring adjustments during the sample period (for example, Ferro 1997, Johnson Controls 1997, MTS Systems 1999, Textron 2000 and 2001, Goodrich 2001). These adjustments were usually not disclosed in enough detail to determine the effect on particular segment assets. Where these adjustments involved asset write-downs that effected segment assets, but could not be accounted for in the $AChg_{ift}$ computation, there would be a misstatement of the change in working capital assets by segment.

Due to the problems with the *workcap* calculations, this variable will not be included as part of the investment variable (*I*) in this project as originally proposed. However, an additional calculation of investment will be added to the testing which would include the working capital component. This variable is discussed later under the heading of Total Assets.

Human Capital *(HC)*

The investment in human capital is estimated by the following equation (note that this equation has simply expanded the form of equation 2a, it has not changed the computation) :

$$HC_{fit} = \left(EMP_{ift} * AVGCOMP_{ift}\right) - \left(EMP_{ift-1} * AVGCOMP_{ift-1}\right)$$

The SEC's Regulation S-K (Item 101 (c) (xiii)) requires all firms to disclose the approximate total number of employees for the company as a whole in their 10-K. Just as with R&D, there is no requirement that the disclosure extend to the number of employees by segment. Data obtained from the Compustat segment database for this sample shows that 30 firms (34.5% of the sample) disclose the number of employees by segment for all or part of the sample period. Only eight (8) of the companies that disclose the employee data by segment do so for all segments and all years in the sample period. The 10K's for all firms were manually reviewed for every year of the sample period to obtain additional disclosure of this data that was missed within the Compustat segment database. Manual data collection did not find any additional sample companies that disclosed employee data by segment, but was able to complete the missing segment years for an additional 13 firms such that data for the complete sample period was obtained for a total of 21 firms (25% of the sample). This provides a total of 511

segment-years of employee data (23.6%) reported for firms that report for all of the sample period.

Initially, it was expected that the compensation data would come principally from the *Annual Survey of Manufactures* for manufacturing segments and similar annual government reports for non-manufacturing segments, however to assure consistency of the data across segments, all the compensation data was obtained from U.S. Department of Commerce Bureau of Economic Analysis (BEA). The BEA reports Gross Domestic Product by Industry (GDP) annually by industry group and this data is available either through interactive tables or for downloading at http://www.bea.gov/industry/ . Industry is defined at the NAICS 3 or 4-digit level for this report. As noted later, this report became a second source of the Value Added variable, but the reporting also includes components of value added, of which compensation of employees is one. Compensation is defined as "wages and salaries and supplements to wages and salaries accruing to labor as remuneration for domestic production" (http://www.bea.gov/industry/gpotables/Guide.cfm?anon=53144#Components_of_Value_Added_by_Industry_Group).

This appears to be consistent with the Bureau of Labor Statistics (BLS) definition of compensation, where "supplements to wages and salaries" consist of employer contributions for benefits such as medical and pension. In addition to this data, the BEA also reports the "Full and Part-Time Employees" for each industry each year, allowing the computation of average compensation per employee by industry. It also reports "Full Time Equivalent Employee" counts for years beginning in 1998. Full time equivalents would be the better denominator in calculating average compensation, however since this

data is not available for 1994 to 1997 only the "Full and Part-Time Employee" counts by industry were used for consistency across the sample period. Where the ratio of part-time to full-time employees differs substantially from industry to industry or year to year, this may cause some error in these calculations. However, the error is likely to depress the calculation of compensation by overstating the number of employees and therefore provide a more conservative measure of investment in human capital. Average compensation across the sample period for all industries (starting with 1994 since it is needed to compute the change in investment in human capital in 1995) using this method is as follows (in thousands):

1994	1995	1996	1997	1998	1999	2000	2001	2002
$32.825	$33.638	$34.591	$35.924	$37.713	$39.328	$41.596	$42.776	$44.200

Although there are some fluctuations year to year, the lowest average compensation generally belongs to NAICS 722 – Food Services and Drinking Places:

1994	1995	1996	1997	1998	1999	2000	2001	2002
$11.881	$11.845	$11.966	$12.642	$13.342	$13.730	$14.257	$14.656	$15.247

The highest generally belongs to NAICS 523 – Securities, Commodity Contracts and Investments:

1994	1995	1996	1997	1998	1999	2000	2001	2002
$86.815	$93.233	$105.845	$113.584	$122.845	$131.646	$151.766	$167.453	$161.317

The majority of the segments in the sample are in manufacturing industries. The average compensation across all manufacturing industries from the BEA report and, for comparison purposes, from the ASM for the sample period is as follows:

	1994	1995	1996	1997	1998	1999	2000	2001	2002
BEA	$42.529	$42.961	$43.603	$45.129	$47.189	$49.484	$52.626	$53.050	$56.962
ASM	$32.389	$33.336	$34.557	$33.907	$34.639	$36.047	$37.066	$37.347	$39.176

Several differences between the BEA and ASM methodology should be noted. The ASM definition of "payroll" (the compensation dollars reported on the ASM for all employees in manufacturing firms) does not include the cost of employer paid benefits. This would account for the substantial (26% to 45%) difference in average compensation each year. In addition, the ASM data for 1994 – 1996 is based on SIC code, while the BEA data is based on NAICS codes. Since there were some changes in the categorization of manufacturing industries, this may account for the reduction in the ASM average pay while the BEA average pay increased from 1996 to 1997. It is not clear why the BEA data grows at a quicker pace than the ASM data, although this may be due to the inclusion of benefit costs (particularly healthcare), which have tended to grow faster than wage rates. Overall, the BEA average compensation estimates seem reasonable in amount, distribution by industry and relation to the ASM estimates.

Net Acquisitions (*NetAcquis*)

The most significant manual data collection effort went to the identification of *NetAquis* by segment. The major sources of information used to determine the acquisitions and disposals by segment were the 10Ks, 10Qs and LexisNexis® *Academic* (hereafter LN). The search for this information began with the 10K of each firm for each year. Accounting standards governing segment reporting during the sample period (SFAS 14 – *Financial Reporting for Segments of a Business Enterprise* for 1995 – 1997 and SFAS 131 – *Disclosures about Segments of an Enterprise and Related Information*, subsequent to 1997), while requiring information about "capital expenditures" (FASB, 1976b, p. 12) or "additions to long-lived assets" (FASB, 1997, p. 11), do not require acquisitions or dispositions to be identified by segment. Likewise, accounting standards

governing business combinations (APB 16 - *Business Combinations* until 2001 and then by SFAS 141 – *Business Combinations*) did not require disclosure of acquisitions by segment. However, standards related to business combinations did require (for material acquisitions) disclosures related to the method of accounting (under APB 16, since the pooling of interest method was allowed), the name and a description of the company acquired and the cost of the acquisition. In addition, SFAS 141 required additional disclosure of similar information related to the aggregate of individually immaterial acquisitions. Disclosure of disposals of segments were principally governed by APB 30, *Reporting the Results of Operations – Reporting the Effects of Disposal of a Segment of a Business, and Extraordinary, Unusual and Infrequently Occurring Events and Transactions,* until 2002, when SFAS 144, *Accounting for the Impairment or Disposal of Long-Lived Assets* became effective. Both standards require classification of segment net assets as discontinued operations when they meet the definition of assets held for sale and include disclosure of a description of the assets held the segment in which the assets were a part.

Beyond footnote disclosure, the Statement of Cash Flows (including supplemental information requirements for non-cash transactions) provided information on the total net cost of acquisitions (for those recorded using the purchase method) and a total amount of disposals and therefore supplied a total for reconciliation purposes to insure that all (or most) acquisitions/disposals had been accounted for. Also, since the Narrative Description of Business in the 10K requires discussion to be by segment (§229.101 (c)) and the MD&A is required by segment "where in the registrant's judgment a discussion of segment information or of other subdivisions of the registrant's business would be

appropriate to an understanding of such business…" (§229.303 (a)), these sections often provided information to determine where (which segment) a particular acquisition/disposal belonged.

Where the 10K did not provide enough information to determine either the names and/or cost of each acquisition/disposal making up the totals in the Statement of Cash Flows or enough information to identify and convert pooling of interest transactions to purchase transactions, then the firm's 10Q's, LN, and 10K's of the selling companies (where they were also publicly traded) were consulted to try to "fill in the blanks". In particular, where acquisitions were immaterial in the full-year disclosures in the annual report (10K), there was often more information in the 10Q. Where there was not additional disclosure in the 10Q about acquisitions, the quarterly Statement of Cash Flows was used to identify the dollar amount of acquisitions/disposals by quarter. This information was then used in conjunction with a search of news about the particular firm on LN to identify the names (and often the cost) of net acquisition activity.

For purposes of this project, all business combinations were treated as purchase transactions in the year of acquisition, even if the transaction was accounted for as a pooling of interests as defined by APB 16. There were 15 pooling transactions by eight companies that occurred during the sample period. For these transactions, the acquisition was restated as a purchase by recognizing the fair value of stock issued by the acquiring company. This information was generally available in the firm's 10K and, if not available there, was verified by information in LN. In addition, since prior year comparison financial information is restated after a pooling to represent the newly combined company as if it had always been combined – this information was restated to

represent only the data from the acquiring company for data calculations. No effort was made to determine the proper allocation of the fair value of the purchase price to restate depreciation or determine goodwill and goodwill amortization as part of this process. If a company identified and expensed in process R&D as part of its acquisition, it was considered as part of the acquisition cost and therefore part of *NetAquis*. Other transactions such as investments, advances, or sales of companies that are accounted for using the equity method were also identified and considered acquisition/disposal transactions. Disposals of segments or portions of segments were treated as dispositions in the year of classification as a discontinued operation or disposal, whichever occurred first.

The following example may provide some insight into data collection process for acquisitions and disposals. In 1997, Crane Co. had seven operating segments – Wholesale Distribution, Fluid Handling, Aerospace, Engineered Materials, Crane Controls, Merchandising Systems, and Other (consisting of Crane Defense Systems). Their 10K for the year ending December 31, 1997 disclosed the following in the Description of Business section:

> ACQUISITIONS
> "In the past five years, the company has completed 18 acquisitions. During 1997, the company completed five acquisitions at a total cost of $82 million, including assumed debt. In March, the company acquired the transportation products business of Sequentia, Incorporated. This business, which produces fiberglass−reinforced plastic panels for the truck body, trailer and container market, has been integrated with the company's Kemlite subsidiary. Also in March, the company acquired Polyvend Inc., a manufacturer of snack and food vending machines. Polyvend was completely integrated into Crane's National Vendors division significantly expanding its sales distribution channels. In April, the company acquired the Nuclear Valve Business of ITI MOVATS from Westinghouse. MOVATS is a leading supplier of valve diagnostic equipment and valve services to the commercial nuclear power industry. In July, through its Huttig Sash & Door Company subsidiary, the company acquired MALLCO

> Lumber & Building Materials Inc., a leading wholesale distributor of lumber, doors and engineered wood products serving Arizona and the surrounding region. In December the company acquired certain operations and product lines of Stockham Valves & Fittings, Inc. The acquired product lines and related manufacturing operations will be integrated into the company's engineered valve business and its commercial bronze and iron valve business." (Crane, 1997, p. 4)
>
> DIVESTITURES
> "In the past five years, the company has divested five businesses. In 1997, the company sold its Valve Systems and Controls division for $7.5 million in cash and $1.5 million in preferred stock." (Crane, 1997, p. 5)

This information is essentially repeated (almost word for word) in the Letter to Shareholders (p. 31) and the footnote disclosure to the financial statements (p. 64). The Statement of Cash Flows investing section (p. 50) confirms the cash amounts (in millions) for both acquisitions ($81.665) and divestitures ($7.453). This information, along with information in the MD&A allows the acquisitions and disposals to be identified by segment:

Company Acquired/Divested	**Segment**
Sequentia (transportation assets)	Engineered Materials
PolyVend, Inc	Merchandising Systems
Nuclear valve business of ITI MOVATS	Fluid Handling
MALLCO Lumber & Building Materials	Wholesale Distribution
Stockham Valves & Fittings Inc	Fluid Handling
Valve Systems & Controls (divest)	Wholesale Distribution

There is no information in the 10K which indicates the cost of each individual acquisition. A search of LN for news related to Crane Co during all of 1997 provided confirmation of each acquisition (and that there appeared to be no additional acquisitions not specifically mentioned in the 10K), but no dollar amounts (each article indicated that the terms were "undisclosed"). A search of the selling company (Westinghouse, now called CBS Corp) 10K does not provide any additional information on the ITI MOVATS sale – probably due to its small size. Sequentia, MALLCO and PolyVend were all

previously privately held, so it was not possible to view the sale transaction from their financial statements since they were not publicly available.

A review of the 10Qs for Crane provided the following:

- The first quarter Crane 10Q indicates that "…the company paid $19.9 million in cash for PolyVend and Sequentia…" (p. 9)
- The second quarter Crane 10Q indicates "…the company paid $24.1 million in cash for the PolyVend, Sequentia, and MOVATS acquistions…"
- The third quarter Crane 10Q does not provide any additional information except for the year to date cash paid for acquisitions of $36.107 million from the Statement of Cash Flows.

This information, however when combined with the full year cash spent on acquisitions ($81.655 million) and the timing of the acquisitions described in the 10K would indicate the following:

- Only one acquisition occurred in the 4th quarter – Stockham Valve Systems. Its cash cost must have been the difference in the year to date cash flow amounts from the year-end Statement of Cash Flows and the 3rd Quarter Statement of Cash Flows: $81.665 – $36.107 = $45.558.
- Only one acquisition occurred in the 3rd quarter – MALLCO. Its cash cost must have been the difference in the year to date cash flow amounts from the 3rd quarter and 2nd quarter Statement of Cash Flows: $36.107 - $24.057 = $12.050.
- Only one acquisition occurred in the 2nd quarter – MOVATS. Its cash cost must have been the difference in the year to date cash flow amounts from the 2nd quarter and 1st quarter Statements of Cash Flows: $24.107 - $19.820 = $4.237.

- The 1st quarter cash acquisition amount of $19.820 must be somehow split between Sequentia (Engineered Material segment) and PolyVend (Merchandising Systems). Since there is no data available on the cost of either acquisition separately from the other, the change in total assets for the segments involved is used as a basis to allocate the total acquisition dollars. While other activities such as operating increases or decreases in working capital may bias this allocation, it seems to provide a reasonable method for making the allocation in the absence of any other available data.

(amounts in millions)		Engineered Materials	Merchandising Systems	Total
Total Assets	1997	$109.578	$109.190	
	1996	$102.035	$91.529	
Change		$7.543	$17.661	
+ Depreciation		$6.178	$6.426	
- Capital Spending		($8.210)	($5.089)	
Adjusted Change		$5.511	$18.998	$24.509
Percent		22.49%	77.51%	
Allocated Acquisitions Amount		$4.457	$15.363	$19.820

While the goal was to determine the value of the assets purchased, the only information for Crane available for 1997 was the net cash acquisition amounts by segment. Where liabilities were assumed in any of these acquisitions, the asset value of the acquisitions would be understated.

For data collection purposes, acquisition and disposal transactions were collected and categorized as purchase transactions (*Acquis*), pooling transactions (*Pool*), purchased in process R&D (*IPRD*), divestments of segments (*Divest*), and other investment/divestment activity (*OtherInv*). These were summarized into the *NetAcquis* variable. In some cases it was not possible to determine the complete list of companies acquired by a firm in a given year or the segments to which each acquisition belonged. In

these instances the value of these unaccounted for acquisitions were not included in *NetAcquis* and therefore the acquisition dollars are understated. This could work either for or against the test of the hypotheses. Since not all the investment dollars would be accounted for that may allow the test to fail because the investment allocations appear to be inefficient due to understatement of investment going to segments that have value added growth, or it may allow the test to succeed because the investment allocations appear to be efficient due to understatement of investment going to segments that have value added declines.

The magnitude of the acquisition/divestment transactions that occurred during the sample period supports the argument that defining investment solely by segment *Capx* dramatically understates the level of resources flowing to or from segments and therefore has likely biased the previous tests of efficiency. The following table (Table 32) shows the level of acquisition/disposal activity by year for the sample companies. In any year, 30-42% of the operating segments had acquisition/disposition activity. With two exceptions – Del Laboratories and Sifco – every company had at least one identifiable acquisition or disposition transaction during the sample period. At the low end of activity were Mueller, EXX and United Guardian – each with one identifiable acquisition transaction during the period, and Lexington Precision, Friedman and Servotronics – each with one identifiable disposal transaction during the period. At the high end, 23 (27%) of the sample firms had identifiable acquisition or disposal activity in every year of the sample period.

(Insert Table 32 about here)

For many of the larger firms in the sample, the activity in any one year consisted of multiple acquisitions of varying size. For example, Textron in 1999 had a total of $1.2 million of acquisitions for its manufacturing segments consisting of the following which could be identified: 1 company acquired for the Aircraft segment, 1 company for the Automotive segment (and 1 joint venture formation), 14 companies for the Industrial segment (and 1 joint venture formation).

Investment (*I*) Summary

The discussion of the components of the investment variable (*I*) indicates various problems with the collection process which require some adaptation in the calculation of investment. As indicated earlier due to concerns about the accuracy of its estimation, *workcap* is not included in the calculation of investment. In addition, the limited amount of data available for research & development (*R&D*) and human capital (*HC*) requires that investment be calculated both with and without these variables, since testing based on the full computation of investment will further reduce the sample size (only six companies in the sample have data for all components of investment). Finally, the magnitude of the value of the acquisition/disposal transactions requires that they be treated differently than the other components of the investment variable. Since it is the change in the investment variable from year to year that is the basis of testing, an acquisition in either year *t* or year *t-1* could distort the calculation. For example, a firm that otherwise increases capital spending and working capital from year t-1 to year *t*, may show a decrease in investment because an acquisition in year *t-1* was not repeated or was not repeated in the same magnitude in year *t*. Although the data shows them to be

relatively common in the sample data, clearly acquisitions and disposals are still singular events in the year they occur. Their size and occurrence are dependent on various factors which are not necessarily the result of management intention to increase investment in a particular segment/industry - availability of acquisition candidates, willing buyers and sellers and successful negotiations to name a few. Therefore these transactions should not be compared to the events of the previous year in calculating the change in investment made in a segment. In addition, where the data is available, large changes in human capital correlate strongly with acquisition/disposal transactions (.4869, $p <$ *.0001*). This is not surprising since the acquisition/disposal of a business will generally result in the gain/loss of the related employees. The effect is particularly strong for segment disposals, where the correlation is .61895 ($p < .0001$). Therefore the change in human capital variable (*HC*) will also be treated in the same manner as the acquisition/disposal variable (*NetAcquis*) in the calculation of the investment. Where an acquisition/disposal occurs in year *t-1*, both the *NetAcquis* and the *HC* amounts from year t-1 will not be included in the calculation of the change in investment (*I*) in year *t*.

In order to recapture some of what may be lost by excluding working capital from the computation of investment and also to more completely capture the effect of acquisitions in those situations where they could not be fully identified by segment, an additional calculation of investment will be added. Changes in total assets (*TA*) between years would capture the asset value of acquisitions and the changes in working capital by segment. If *IPRD*, *R&D* and *HC* are added, the calculation would fully capture the change in investment as it has been defined in this paper. However, as indicated earlier, the lack of data availability for *R&D* and *HC* would also cause a significant reduction in

the sample size, so these will not be included in the computation of this investment variable. One additional adjustment is also necessary to obtain an investment variable consistent with the previous definition. In the case of a pooling transaction, the value of total assets must be increased by the difference between the assets added by pooling (book value) and those that would be added under a purchase. When the pooling transaction is recorded, previous year's comparative segment disclosures are restated allowing the computation of the approximate value recorded in the pooling transaction (*POOLBV*). Since the *POOL* variable represents the computation of the purchase value of a pooling transaction, the difference can be computed and added to the change in *TA*.

The final computations of investment (*I*) were determined based on the formulas shown below – *I* represents the full calculation (but without *workcap*), *Ireduce* is the calculation without *workcap*, *HC* or *R&D* and *Ita* is the calculation based on the change in total assets. The segment, year, firm designations have been removed only to simplify the presentation.

Where there is no acquisition in year *t* or *t-1*:

$$I = CAPX + R\&D + HC$$

$$Ireduce = CAPX$$

$$Ita = (TA_t - TA_{t-1})$$

Where there is no acquisition in year *t* but there is an acquisition in *t-1*:

$$I = CAPX + R\&D$$

$$Ireduce = CAPX$$

$$Ita = (TA_t - TA_{t-1})$$

Where there is an acquisition in year t (the *NetAcquis* amounts represent only the activity occurring in year *t*, not the change in activity from year *t-1* to *t*)

$$I = CAPX + R\&D + HC + NetAcquis$$

$$Ireduce = CAPX + NetAcquis$$

$$Ita = (TA_t - TA_{t-1}) + IPRD + (POOL - POOLBV)$$

Two additional investment variables are computed – *Icapx*, for comparison to previous literature that only defined investment as capital expenditures, and *TAchg* a "pure" change in total assets for the sample without the adjustments for pooling, prior year acquisitions, and *IPRD*. This measure provides an advantage in testing the investment allocation of single segment to multi-segment firms if it proves to be highly correlated to the adjusted calculation, since the information to adjust the calculation for prior year acquisitions and for *IPRD* will not be available for single segment firms.

Value Added *(V)*

As indicated in the discussion of the empirical model, a key variable for the empirical testing is the measure of efficiency. The model selected measures efficiency as the coefficient of a regression of the change in value added to the change in investment for each segment-industry in the sample. Therefore, the measure of value added is a key variable in the measure of efficiency. Wurgler's original model was a country-based analysis applied to manufacturing firms, using value added data obtained from the United Nations *General Industrial Statistics* (INDSTAT-3 CD-ROM and hard copy volumes for more recent years) (Wurgler, 2000, hereafter JW2000). The industry classification used for the United Nations report is the three-digit ISIC (International Standard Industrial

Classification) code system, which corresponds approximately to the two-digit U.S. SIC code classification system.

Value added data for manufacturing segment-industries in the current sample comes from U.S. Government statistical sources similar in nature to the United Nations *General Industrial Statistics* report. The *Annual Survey of Manufactures*, issued by the Census Bureau provides information on the number of employees, total payroll dollars, the number, hours and wages of production workers, value added, cost of materials, and value of shipments for each manufacturing industry classification. The industry classification code in use for this annual report each year through 1996 is the SIC (Standard Industrial Classification) code system. Beginning in 1997, the reporting changed to the NAICS (North American Industry Classification System) codes. The value added data for the years 1994-1996 (SIC code basis) came from a database of economic time series data (including the *Annual Survey of Manufactures*) maintained by the University of Maryland (Inforum - http://inforumweb.umd.edu/Econdata.html). Limited testing to compare the data obtained from this database to hard copies of the *Annual Survey of Manufactures* reports available on the Census Bureau website (http://www.census.gov/mcd/asm-as1.html - Adobe pdf files are available for 1993-2004) indicated no exceptions, providing assurance that the data had been compiled accurately. The value added data for 1997-2002 came from the U.S. Census bureau "American Factfinder" website, which provides access to interactive data collected though the quinquennial business census and annual reports, such as the *Annual Survey of Manufactures* (http://factfinder.census.gov/home/saff/main.html?_lang=en).

Unfortunately the conversion from one classification system (SIC) to the other (NAICS) was not a "one-to-one" match in many instances and the Census Bureau also chose not to restate the 1996 data collected by SIC code on a comparable basis with the 1997 data collected by NAICS code. This presents a potential problem since this project requires the change in value added from year to year and the change computed from 1996 to 1997 may not be consistent due to the classification change. In order to insure some measure of consistency in the value added data through the whole sample period, a table of matching SIC-NAICS codes was created using the conversion information available on the Census Bureau website. This was merged with the value added data to create a continuous set of data from 1994 to 2002 for each matched set of SIC-NAICS codes. This was examined for consistency, particularly in the conversion years (1996-1997), and where necessary a "combined" SIC-NAICS code was created to consolidate the before and after value added data on a consistent basis. In addition, in several instances Compustat assigned only a 2 or 3-digit SIC or 3 or 4-digit NAICS (major group or industry group level classification) to a segment. In these cases, a matching SIC-NAICS code was created for that level by consolidating all the industry level data for the applicable codes. The value added data was merged with the Compustat segment information by matching the combined SIC-NAICS code in the value added table to the combined SIC-NAICS code assigned by Compustat to the segment by year. This also provided some measure of assurance that the industry classification assigned by Compustat was consistent with the conversion provided by the Census Bureau.

Approximately 7% of the segment years (34 segments across 20 of the sample companies) are classified as non-manufacturing based on their assigned NAICS code. For

non-manufacturing segments there were several sources of data used. These sources are generally consistent with the information used for the manufacturing segments (government data by industry) but also usually could only match the NAICS code at the three or four digit level. For retail segments (NAICS codes beginning in 44 or 45), value added was determined by the gross margin for the applicable NAICS code reported in the U.S. Census Bureau *Current Business Report-Annual Revision of Monthly Retail and Food Services: Sales and Inventories – January 1992 Through February 2006* (issued March 2006). A copy of this report was downloaded from http://www.census.gov/prod/www/abs/br_month.html. For wholesale segments (NAICS codes beginning in 42), value added was determined by gross margin for the applicable NAICS code reported in the U.S. Census Bureau *Annual Wholesale Trade Survey*. A copy of Table 2 – "Estimated Annual Purchases, Gross Margins and Gross Margins/Sales Ratios of Merchant Wholesalers, Except Manufacturers' Sales Branches and Offices, by Kind of Business: 1992 through 2004" was downloaded from the U.S. Census Bureau web site at http://www.census.gov/svsd/www/atspur.txt on April 13, 2006. For other non-manufacturing segments (NAICS codes beginning with 1, 2, 48, 5, 6 or 8), which consist of segments involved in forestry, mining, transportation, and services, the value added data was determined from the Bureau of Economic Analysis – GDP (Value Added) by industry. This data is reported for all industries at the NAICS 3 or 4-digit level and is available for download from http://www.bea.gov/industry/index.htm#annual.

Value Added (Vbea)

As noted earlier, JW2000's value added data came from United Nations statistical sources and the industry classification was ISIC (International Standard Industrial

Classification), which approximates the U.S. SIC classification at the 2-digit level (major group classification). The availability of the Bureau of Economic Analysis – GDP (Value Added) data for all industries at the 3 or 4-digit NAICS level provides another potential source of value added which is consistent across all industries and perhaps more consistent with the definition of industry used by JW2000. An industry classification at the 3-digit NAICS code level would be approximately comparable to the ISIC code structure used by JW2000 (Krishnan & Press, 2003). The reported GDP by industry is labeled as "value added" and corresponds closely to the measure used by JW2000. "Since the sum of value added across all firms is the economy is GDP, and economic growth is typically measured as growth in GDP, growth in industry value added is the most natural way to measure industry growth" (Wurgler, 2000, p. 194). Therefore a second value added variable (*Vbea*) is computed using this data source to determine if it provides results different from the value added data collected at the more detailed NAICS code level, particularly for the manufacturing segments in the sample.

Game Length Variables

Variables that help define the length of the game as viewed by the managers fall into two groups. The first set of variables relate to the segment itself - historical performance relative to the industry (*histperf*) and disposal of the segment within two years of the year examined (*disp*); or relate to the manager of the segment – age of the manager (*age*), if the manager was promoted to the position from inside the firm or hired from the outside (*inside*), and the amount of the manager's compensation that is deferred to future periods (*def%*). The variable *inside* is a dummy variable which takes a value of 0 if the manager was promoted from within the company and a value of 1 if they were

hired from the outside (or if they were "acquired" as part of an acquisition and subsequently named manager of the segment). The information on the firm related variables was collected from Compustat data (*histperf*) and from a review of firm 10K's for the sample period and for the two year's subsequent to the sample period (2003 – 2004) for segment disposals (*disp*).

histperf measures the performance of the segment relative to other firms in the same industry. The variable is calculated per the equation shown below and measures the percentage change in segment profits (the numerator – *SEGPROFCHG*) relative to the average percentage change in profits for other businesses in the same industry as the segment (the denominator – *INDPROFCHG*).

$$SEGPROFCHG = \frac{Profit_{ift-1} - Profit_{ift-3}}{Profit_{ift-3}}$$

$$INDPROFCHG = \sum_{f=1}^{n-1} \frac{Profit_{ift-1} - Profit_{ift-3}}{Profit_{ift-3}}$$

$$HISTPERF = \frac{SEGPROFCHG}{INDPROFCHG}$$

The industry data was summarized from both segment data and single segment firm data, since profits and industry are available at both levels. The profit change was calculated based on a three year period to assure that the segment information would be consistent when calculating the change in profits. Similar to the working capital data, the industry was matched on SIC code for 1995 and 1996 and NAICS code for 1997 and later (with similar statistics related to matching the codes at the various digit-levels, so they are not repeated here). Although the basic calculation was performed as described above, several

adjustments were made to assure the calculations resulted in data that properly described the relationships.

Where either *INDPROFCHG* or *SEGPROFCHG* were negative (but not both), the calculation was made as follows to obtain a value of the correct magnitude and direction

$$HISTPERF = \frac{SEGPROFCHG - INDPROFCHG}{abs(INDPROFCHG)}$$

Where both *INDPROFCHG* and *SEGPROFCHG* were negative and *SEGPROFCHG* was the greater value (less negative), the calculation was made as follows to obtain a value of the correct magnitude and direction:

$$HISTPERF = \frac{INDPROFCHG}{SEGPROFCHG}$$

Where both *INDPROFCHG* and *SEGPROFCHG* were negative and *INDPROFCHG* was the greater value (less negative), the calculation was made as follows to obtain a value of the correct magnitude and direction:

$$HISTPERF = -\left(\frac{SEGPROFCHG}{INDPROFCHG}\right)$$

The information related to managers proved more difficult to collect from the sources available for the project, which included 10Ks, Proxies, corporate web sites and LN. In some instances the problems related to identifying one manager responsible for a particular segment. Although the definition of segments in SFAS 131 suggests that "generally, an operating segment has a *segment manager* who is directly accountable to and maintains regular contact with the chief operating decision maker…" (p. 8), aggregation of operations into a single operating segment is still allowed. So, for example, the Engineered Components segment of AmCast Industrial appeared to be an

aggregation of 2-3 operations in each of the years it is presented – each with its own separate manager. This made it impossible to identify a single manager responsible for the reported segment. Out of the total of 1,837 operating segment-years in the sample, there were 81 (4.4%) that were identified with this problem. For several companies (Met-Pro, Thor Industries, Champion) this problem existed for all years and all segments during the sample period. Although it was possible to identify segment managers for portions of 50 (59.5%) of the sample firms and 837 (45.6%) of the segment years, it was only possible to identify all the managers for all the operating segment-years for 16 (19%) of the sample and for only one of those companies (Energy Conversion Devices) was the all the data available for both *inside* and *def%*. Since data would be needed for all operating segment-years of each firm to properly use these variables in this project, the limited availability requires that *age*, *inside* and *def%* be dropped from the analysis. The remaining variables *histperf* and *disp* should still provide an adequate test of the effect of game length on the allocation of investment funds. For information purposes, Table 33 below provides descriptive information on the variables dropped from the analysis. This table show that, where data was available, the average (mean) age of the segment manager is about 54 and this does not change throughout the sample period. The median (not reported in the table) is also 54, indicating that the maximum age in the 70's is not influencing the mean. Most (approximately 82% over the whole sample period) are promoted from within – although the trend is to move towards hiring from the outside. Finally, although the data is limited, there is a wide range of compensation practices, with an average of approximately 24%, but as much as 90% of a segment manager's compensation in some deferred form (stock options).

(Insert Table 33 about here)

In addition to the data presented in Table 33, correlations of these variables to the investment variables to be used in the analysis were also examined to provide some indication of their potential effect on the analysis compared to their predicted direction. None of the correlations were significant at any level below 10% and therefore the information is not presented here.

Group Size Variables

The group size variables consist of the number of segments of the firm (*nosegs*) and the diversity of those segments in size as measured by a herfindahl index based on sales (*dvrsale*) and one based on profits (*dvrprof*). The two measures of diversity were selected because it was felt that the effect of profit diversity may not correlate with diversity in absolute size of the segments (measured with sales). This data was all calculable from data available in Compustat. One problem was noted in the calculation of these variables. As shown in Table 34 below, the herfindahl index for *dvrprof* goes beyond the typical range of a herfindahl index (between 0 and 1).

(Insert Table 34 about here)

This is due to the persistence of segments with negative profits during the sample period. The calculation involves squaring the ratio of individual segment profits to the total profits of the company. If one segment has negative profits, the square of a negative ratio

is positive, causing the total of the squared ratios to go higher than 1. There are 108 firm-years (16% of the sample) with *dvrprof* measures larger than 1. The *dvrprof* variable is meant to capture the effect of having one segment of the firm with higher profits than the other segments on the allocation process. Such a situation may lead to the smaller profit segment managers to believe their contribution is discounted within the firm and therefore cause them to "defect" and provided information that may lead to less efficient allocation of resources. Although the variable provides more information by allowing it to calculate to extreme levels, the magnitude of the values, coupled with the relatively small sample size in this project suggests that this may bias the results. Additional research did not provide a similar measure that allowed for negative and positive components, but which didn't magnify the result so dramatically.

Additional work was performed in order to determine if the *dvrprof* variable seems to provide information in the analysis beyond what is provided by *dvrsale* or other diversity variables. First, a *dvrasset* variable (herfindahl index based on segment assets) was computed for comparison with the correlations of *dvrsale* and *dvrprof*. It is expected that *dvrasset* would likely be highly correlated to *dvrsale*, and have a correlation with *dvrprof* similar in magnitude to the *dvrsale – dvrprof* correlation. A comparison of these correlations should help to determine if the *dvrsale* and *dvrprof* variables are capturing different meanings of diversity. A second measure of diversity of profits (*dvrprof 2*) was computed which "winsorized" *dvrprof* at a value of 1. Descriptive statistics and correlations are shown below in Table 35.

(Insert Table 35 about here)

As expected, the correlation of DVRSALE and DVRASSET is high (.847), indicating that they likely capture the same relationships among the segments. DVRPROF is not significantly correlated to either variable; however, the "winsorized" version (DVRPROF2) is significantly correlated to both DVRSALE and DVRASSET (with similar values). This suggests that the extreme values are affecting the relationships among the variables – perhaps in ways that will bias the testing. It also indicates that using the "winsorized" variable will not accurately replace *dvrprof*, nor will it add any significant new information to the analysis. As an additional test, the correlations among the variables after the elimination of the firm-years that include the extreme *dvrprof* values (N = 564) were examined. The correlations of *dvrprof* to *dvrsale* is .725 ($p < .0001$) and the correlation of *dvrprof* to *dvrasset* is .615 ($p < .0001$). This provides further support that the extreme values significantly affect the relationships among these variables. As a result, the *dvrprof* variable will be dropped from the analysis and only the *dvrsale* value used to measure diversity.

Group Identity Variables

Four variables were selected to capture the concept of "group identification" as a means to help solve the social dilemma facing segment managers – (1) the segment bears the name of the corporation of which it is a part (*corpid*), (2) the segment manager has a corporate title such as Vice President (*corpofficer*), (3) the percentage of the segment manager's compensation that is based on corporate vs. segment results (*corp%*), and (4) the segment manager's participation on the committee responsible for corporate strategy and decision-making, which is often called the Executive Committee (*execcommittee*).

As with the game length variables, the three variables associated with the segment manager (*corpofficer, corp%, and execcommittee*) all proved difficult to collect given the resources available for this project. The *corpofficer* variable is a "dummy" variable with a value of 0 if the segment manager is not a corporate officer and 1 if he/she does have a corporate title. Generally, where the segment manager could be identified, the existence or lack of existence of a corporate title could also be determined. In some cases where there were multiple companies within a segment, where it was not possible to identify a single manager, it was still possible to determine that the various managers included in these segments held or didn't hold corporate titles. This resulted in information for portions of approximately 52 of the sample companies and 841 operating segment years or 45.8% of the operating segment sample. Of those identified, 72.7% of the segment managers held corporate titles such as Vice-President. Unfortunately, there are only 12 of the 52 sample companies with complete data for all operating segment years. The *execcommittee* variable is a "dummy" variable that takes a value of 0 if the segment manager is not a member of the Executive Committee of the corporation and a value of 1 if he/she is. This data was collected for portions of 46 of the sample companies and for 751 (40.9%) of the operating segment-years. Of those identified, 89.2% were identified as having membership on the corporate Executive Committee. The high percentage is simply because it was easier to make a positive determination of membership than a negative one with the information generally presented. Similar to *corpofficer*, there was complete data for all operating segment years for only 10 of the 52 sample companies. Results for data collection of *corp%* are similar to the compensation variable *def%* collected as a test of game length above. Data collection was limited to portions of 9

sample companies (97 operating segment years), with only one company (Provena Foods) yielding complete data for all segment years during the sample. The data collected indicates that on average 24% of the segment manager's compensation is based on corporate results. For the one company where data was available for all segment years, the average is much lower (2.75%) because there were only two years during the sample period where options or bonus dollars were paid to segment managers based on corporate results. The limited data availability for *corp%* means that this variable must also be dropped from the testing.

Data for *corpid* was more readily available for the firms in the sample from sources available for this project. This is a dummy variable that takes on a value of "1" if the components of the segment have names that identify them with the corporate entity (i.e. "Division of", or the name contains the corporate name, such as Textron Automotive for the automotive segment of Textron) and a value of "0" if it does not. There was information available to positively determine whether corporate identity was present for 1468 (80%) of the operating segments. In most cases where segments could be identified as having a corporate identity, it was possible to determine if all the segments of the sample firm had this identity or not. Therefore, there is data for all the operating segment-years for 65 (77%) of the sample companies, which, since this is the only remaining variable collected to examine group identity, appears to be of adequate size to examine its effect on allocation efficiency.

Monitoring Variables

Monitoring variables selected for this project measure the similarity of segment operations to one another (*related* and *complement*) and the existence of an internal audit

function (*iaudit*). Research has suggested that similarity of operations should allow HQ to better understand and monitor multiple operations (Stein, 1997) and the internal audit function is the specific monitoring device suggested by Williamson that HQ would use to assure more efficient investment allocation (Williamson, 1970, 1975, 1985). Fan & Lang (2000) (hereafter FL2000) proposed and tested the *related* and *complement* variables as an alternative to the common measure in use for diversification – shared two or three digit SIC code. As they point out – "The SIC-based measures of relatedness are unsatisfactory in several aspects. First they do not reveal relatedness types. Second, they are discrete and hence do not measure the degree of relatedness. Third, they are subject to classification errors" (Fan & Lang, 2000, p. 630). The change to an NAICS code basis is not likely to improve upon this type measure since it does not address any of these issues. Although they do not address the problem of classification errors, the FL2000 measures do address the other problems in several ways:

1. They provide two different measures from the same source. *related* measures the vertical relatedness of the operations. Specifically it measures how much of industry 1's output is used in industry 2 and how much of industry 2's output is used by industry 1. The final measure is the average of the two measures. COMPLEMENT provides a measure of how much two industries sell or buy from the same industries and therefore are complementary to each other.
2. Both measures are continuous and therefore provide degrees of relatedness among industries.

The source of the *related* and *complement* variables is the Bureau of Economic Analysis Input-Output Tables. These tables show commodity flows between industries (at the 5 or

6 digit NAICS industry level) based on every 5-year census. The Use Table is a matrix that shows, for each pair of industries *i* and *j*, the dollar value (valued at producers prices) of industry *i*'s output required to produce industry *j*'s total output, denoted a_{ij} (Fan & Lang, 2000, pp. 632-633). This project used the 1997 Benchmark Use Table available at http://www.bea.gov/industry/. The data was downloaded to a spreadsheet (GS-Calc, since Excel was unable to accommodate the number of columns required) and the industry by industry computations as described below were done there. The specific calculations are as follows (taken from FL2000, p. 633, except to change the variable designation from *V*, used by FL2000, to *R*, so as not to confuse it with the value added variable used in this project.):

> We divide a_{ij} by the dollar value of industry *j*'s total output to get r_{ij}, representing the dollar value of industry *i*'s output required to produce one dollar's worth of industry *j*'s output. Conversely, we divide a_{ji} by the dollar value of industry *i*'s total output to get r_{ji}, representing the dollar value of industry j's output required to produce one dollar's worth of industry *i*'s output. We then take the average of the two input requirement coefficients to obtain the vertical relatedness coefficient of industries *i* and *j*, $R_{ij} = 1/2(r_{ij} + r_{ji})$. R_{ij} can be intuitively interpreted as a proxy for the opportunity for vertical integration between industries *i* and *j*.
>
> To construct the complementarity coefficient, we measure the degrees to which industries *i* and *j* share their output and input. From the "Use Table", we compute for each industry the percentage of its output supplied to each intermediate industry *k*, denoted as b_{ik}. For each pair of industries *i* and *j*, we compute the simple correlation coefficient between b_{ik} and b_{jk}, across all *k* except for *i* and *j*. A large correlation coefficient in the percentage output flows suggests a significant overlap in the markets to which industries *i* and *j* sell their products. For each pair of industries i and j, we also compute a simple correlation coefficient across industry input structures (all *k* except for *i* and *j*) between the input requirement coefficients r_{ki} and r_{kj} of the two industries. A large correlation coefficient between the two suggests a significant overlap in inputs required by industries *i* and *j*. Hence, we define the complementarity coefficient as the average of the two correlation coefficients, that is, $C_{ij} = 1/2[\text{corr}(b_{ik}, b_{jk}) + \text{corr}(r_{ki}, r_{kj})]$. C_{ij} serves as a proxy for the degree of complementarity between industries *i* and *j*.

Once the variables R_{ij} and C_{ij} were computed from the Use Table data for all industries they were applied to the sample data in this project to determine the relationships among the segments for each company and each year of the sample period. Each segment was matched by industry (NAICS 6-digit level) to the computed R_{ij} and C_{ij} values and the *related* and *complement* variables were computed by using segment sales to weight the R_{ij} and C_{ij} values of all the other segments in that sample year. An example using the data from Aeroflex Inc. for 1997 will clarify the computation (subscripts will represent the segment ID's as provided below).

Segment	NAICS	ID	Sales (millions)	$R_{13,14}$	$R_{13,15}$	$R_{14,15}$	$C_{13,14}$	$C_{13,15}$	$C_{14,15}$
Isolator Products	332611	13	17.693	0.00258	0.00284		0.11496	0.15919	
Electronics	334416	14	28.144	0.00258		0.08181	0.11496		0.83558
Microelectronic	334413	15	48.462		0.00284	0.08181		0.15919	0.83558

$$Related_{13} = [(Sales_{14} * R_{13,14}) + (Sales_{15} * R_{13,15})]/(Sales_{14} + Sales_{15})$$
$$Related_{13} = [(28.144 * 0.00258) + (48.462 * 0.00284)]/(28.144 + 48.462)$$
$$Related_{13} = 0.0027444$$

$$Related_{14} = [(Sales_{13} * R_{13,14}) + (Sales_{15} * R_{14,15})]/(Sales_{13} + Sales_{15})$$
$$Related_{14} = [(17.693 * 0.00258) + (48.462 * 0.08181)]/(17.693 + 48.462)$$
$$Related_{14} = 0.060622$$

$$Related_{15} = [(Sales_{13} * R_{13,15}) + (Sales_{14} * R_{14,15})]/(Sales_{13} + Sales_{14})$$
$$Related_{15} = [(17.693 * 0.00284) + (28.144 * 0.08181)]/(17.693 + 48.462)$$
$$Related_{15} = 0.051328$$

$$Complement_{13} = [(Sales_{14} * C_{13,14}) + (Sales_{15} * C_{13,15})] / (Sales_{14} + Sales_{15})$$
$$Complement_{13} = [(28.144 * 0.11496) + (48.462 * 0.15919)] / (28.144 + 48.462)$$
$$Complement_{13} = 0.14294$$

$$Complement_{14} = [(Sales_{13} * C_{13,14}) + (Sales_{15} * C_{14,15})] / (Sales_{13} + Sales_{15})$$
$$Complement_{14} = [(17.693 * 0.11496) + (48.462 * 0.83558)] / (17.693 + 48.462)$$
$$Complement_{14} = 0.64285$$

$$Complement_{15} = [(Sales_{13} * C_{13,15}) + (Sales_{14} * C_{14,15})] / (Sales_{13} + Sales_{14})$$
$$Complement_{15} = [(17.693 * 0.15919) + (28.144 * 0.83558)] / (17.693 + 48.462)$$
$$Complement_{15} = 0.57449$$

Obviously, as the number of segments grow in any one year (the maximum number of segments in this sample in any year is seven), the calculations become more complex but follow the same pattern as the simple example presented above. As computed, the *related* variable represents the potential level of vertical integration of each segment with the other segments in the sample firm each year. The sales weight emphasizes the relationships with larger segments (as measured by sales level) over the relationships with smaller segments. The *complement* variable represents the potential ability of each segment to exploit either marketing or purchasing integration with the other segments, again with emphasis on the relationships with larger segments. Both variables range in value from 0 to 1, with 0 indicating no possible integration exists and 1 indicating the possibility of complete integration.

The value of the internal audit "dummy" variable (*iaudit*) was determined by a thorough review of sample company 10k's, Proxies, websites and LN. Generally, there was not "positive" determination of the presence of an internal audit function for every

year. Where it could be determined that there was an internal audit function in any year of the sample period, it was assumed that the department existed in all of the years of the sample period. There were 20 sample firms (23.8% of the sample) for which there was no information disclosed related to the presence or absence of an internal audit function. Of the remaining 64 sample firms, three (4.7%) were determined to have no internal audit function (Sifco, Allied Defense Group, and Atlantis Plastics) during the sample period, with the remaining 61 (95.3%) classified as having the function in place.

Sanction Variable

The only variable selected to measure sanctions imposed on defecting segment managers was segment manager turnover (*turnover*). As with other segment manager information, the source data for this variable was often difficult to capture from the sources available for this project. In order to compute the variable, it was necessary to confirm a change in segment management for either of the two years prior to the current year. *Turnover* represents the number of instances of segment manager change divided by the average number of segments over the two-year period. For virtually every firm in the sample, the earliest 10K and Proxy available electronically was for the 1995 fiscal year. The data necessary to compute the *turnover* variable for 1995 and 1996 involved disclosures of events that occurred in 1993 and 1994 and this information was often not available in the fiscal 1995 10K, Proxy, or Annual Report - which were generally the latest filings available electronically. The information related to changes at the division or segment level was also generally not available on LN. It was possible to make computations for 784 operating segment years (42.7% of the operating segment years), but there are only two firms in the sample for which the *turnover* variable is computed for

the full sample period. However, there are 43 companies (51% of the sample) for which the variable is computed for the period 1997 – 2002. This represents 774 operating segment years (42.1% of the sample operating segment years). Although the test of this variable cannot be performed adequately on the full sample period given the small sample size (2), the sample for the six-year period from 1997 – 2002 (43) should still be adequate to provide a test of its effect on allocation efficiency.

Agency Costs

Agency costs at the corporate level of the firm are measured by the percentage of non-executive ownership of corporate stock (*ownership*). Pursuant to Section 14(a) of the Securities Exchange Act of 1934, proxy statements filed with the SEC are required to contain information on the executive officer's beneficial ownership of company stock. This information includes both the quantity of shares and percentage of ownership by individual executive and in total. The total percentage beneficial ownership (*ben%*) was manually collected from the proxy statements filed by each company for each year in the sample period. Generally, the beneficial ownership information is provided at or near the date of filing of the proxy (as compared to the fiscal year-end of the company), but this difference is not expected to affect the tests of this variable. It should be noted that even with a detailed examination of the required disclosures in the Proxy statements for the sample firms, where several classes of stock are outstanding, it was often difficult to determine the overall beneficial voting ownership by held by directors and officers of the company. In all cases, computations were made to estimate the voting ownership percent of the directors and officers, since this is the key element of control over corporate action. The variable *ownership* is computed as *1 – ben%*.

For the matching sample of single segment firms in the same industries as the sample segments, *ben%* was obtained from Disclosure Inc., *Compact D/SEC* database available on CD-ROM. The data in *COMPACT D/SEC* is compiled from SEC reporting for all publicly held and traded companies that provide with at least 500 shareholders or $5.0 million in assets. Firms that do not provide "direct goods and services", such as management investment companies, mutual funds, and REITs, are excluded (Disclosure, 1998). This database includes the inside share ownership information gathered from Proxy Statements filed with the SEC, as well as CUSIP information that could be used to match the share ownership information with the matching sample of single segment firms derived from Compustat.

Financial constraint (*finconstraint*)

Originally, the financial fixed charge coverage ratio was chosen as the measure of a sample firm's financial constraint. This has been shown in the past to be a good predictor of bank classification of loans by default risk (Dietrich & Kaplan, 1982) , so likely captures the ability of a firm to take on more debt. The finance literature has used numerous measures for financial constraints, although generally these focus on grouping firms into either a "constrained" or "unconstrained" group by using such variables as dividend payout, size, age, level of investment, or debt ratings for classification (Cleary, 1999). This project requires a continuous variable in order to more completely examine the effect of financial constraints on the ICM. A firm is likely to be more or less constrained than another firm as compared to simply constrained or not constrained and the fixed coverage ratio would provide a measure of this variability of constraint across firms, as well a measure of variability of financial constraint for a single firm from year

to year. Although there are likely many versions of this ratio calculation – the one selected for this project (shown below) is the most complete, incorporating long-term lease payments as well as debt payments. This seemed appropriate given the extensive use of lease (off-balance sheet) financing. Research has shown that operating lease debt values range from 8-16% of firm market value in a sample of firms from 1981 – 1999 (Lim, Mann, & Mihov, 2002).

$$\frac{EBITDA + LTLeaseDue}{InterestExp + LTLeaseDue + LTDPmtsDue \Big/ (1 - TaxRate)}$$

However, this ratio calculation proved impossible to apply to all the sample firms due to missing data. Although SFAS 13 (1976a) requires disclosure of minimum lease payment commitments for multiple years, which was to be the source of the *LTLeaseDue* component of the fixed coverage ratio formula, 13 of the 84 companies in the sample did not disclose this information for all of the sample period and an additional 15 companies disclosed data for only part of the sample period. For these companies, Compustat assigned a "missing" code for the data. Several of the financial statements (10K's) of these companies were reviewed to confirm that the information was not disclosed. Although it is conceivable that the companies either had no operating leases or that the information related to these leases was not material, this seems unlikely in so many cases. For example, Williams Controls discloses rent expense under operating leases and future minimum lease commitments for the first time in its September 30, 2001 financial statements. However, as part of this disclosure they indicate that they had rent expense under operating leases of $749 and $463 million in the years ending September 30, 2000 and 1999 respectively. This disclosure was not made in the previous year's financials and it would indicate that there were existing operating leases in the previous years that

were not disclosed as required by SFAS 13 and therefore the "missing" coding by Compustat is likely correct. Similar issues were also noted with other sample companies that did disclose the information in some years, but not others (Clarcor, Inc. and Temple-Inland, for example).

Because of the extensive missing data, the options are to (1) calculate the fixed coverage ratio for each company, including the lease information where it is available and treating it as "zero" where it is not; (2) calculate the fixed coverage ratio for all companies in the sample, but drop the component which captures the coverage of operating leases; or (3) seek another variable to capture the level of financial constraint of the sample companies. Since the fixed coverage ratio has not been used alone in other finance or accounting research, the decision was made to select another variable as a measure of financial leverage. Although, as indicated earlier, the finance literature generally "categorizes" companies into two (or several) groupings of levels of constraint – most often "constrained" or "unconstrained" – several papers do this in a manner which present opportunities for a continuous variable. Kaplan & Zingales (1997) categorize 49 low dividend firms from 1970 to 1984 into five constraint groups (not financially constrained, likely not financially constrained, possibly financially constrained, likely financially constrained, and financially constrained) based on qualitative and quantitative information in their 10Ks and then use the classification to develop a logit prediction model of financial constraint. Lamont, et al. (2001) use the coefficients of a reduced version of this logit model (reduced to only quantitative data available on Compustat) to create an index of financial constraint for each company in their sample. However, instead of using the index as a measure of constraint, they use the index to categorize

their sample into three groups – the top third labeled as constrained and the bottom third labeled as unconstrained (the middle third is not labeled, although it is used in their testing). Finally, Cleary (1999) creates an index using the coefficients from discriminant analysis on a sample of firms from 1988 – 1994 and uses that to categorize his sample into three groups similar to Lamont, et al (2001). Cleary's method uses the following financial data in his discriminant analysis – current ratio, fixed coverage ratio (calculated as EBIT / [interest expense + preferred dividends x (1 / 1 – tax rate)]), slack (calculated as [cash + ST investments + (50% x inventory) + (70% x accounts receivable) – ST loans] / beginning net fixed assets), net income as a percent of sales, sales growth, and debt ratio. This methodology seems consistent with the spirit of using just the expanded version of the fixed coverage ratio originally selected.

In order to perform discriminant analysis, at least two groups must be identified for analysis. Cleary (1999) defines an "unconstrained" group of companies as those that have increased dividends from year 1 to year 2 and a "constrained" group as those that have decreased dividends from year 1 to year 2. He selects all firms from 1988 – 1994 that meet the data requirements of the variables he selected for discriminant analysis (detailed above), identifies each as a member of the "constrained" or "unconstrained" group (or neither group if there was no change in dividends) and performs discriminant analysis to determine if the variables are able to predict group membership. The result of discriminant analysis is a discriminant function, which is similar to a regression equation with a coefficient assigned to each variable in the analysis. When the values of each variable for a sample company are inserted into the function, the result is a Z score – which allows comparison of each company in the sample. Cleary uses the Z score to

categorize his sample into groups, but this dissertation will use the Z score directly as a continuous measure of financial constraint.

Since Cleary performed his analysis on a time period different than the sample in this project, the first step is to update the groups on which discriminant analysis will be performed. To be consistent with the sample data for this project, the discriminant sample is selected from all Compustat manufacturing or conglomerate firms (NAICS 31-33 and 99) for the period 1994 – 2001 (since the variables are calculated as of the beginning of the year) where data is available for all the variables used by Cleary (1999). The 84 firms in the sample for this project are excluded from the sample used to create the discriminant function. Dividend payouts are analyzed year to year to determine if each firm belongs in group 0 (no change in dividend payout), group 1 (reduced dividends) or group 2 (increased dividends). The discriminant sample consists of 3,043 firms with data for some or all of the 1994 – 2001 period (Cleary's sample consisted of 1,317 firms) for a total of 13,441 observations. The observations break down into groups as follows:

	Group	No. of Observations	Percent	Cleary Percent
No change in dividends	0	10,774	80.1%	58.0%
Decrease dividends	1	519	3.9%	6.9%
Increase dividends	2	2,148	16.0%	35.1%

Although the percentages in each group are different between this sample and Cleary's, the same basic distribution exists – far more firms show no change in dividends than increase or decrease dividends and there are 4-5 times as many firms that increase

dividends then decrease dividends. Discriminant analysis is run on the group 1 and 2 observations using the following variables as per Cleary (1999)[7]

$$Z_{FC} = \alpha + \beta_1 Current + \beta_2 FCCov + \beta_3 Slack + \beta_4 NI\% + \beta_5 SalesGrowth + \beta_6 Debt$$

Two discriminant functions are computed, with both showing statistical significance using Wilk's Lambda, Pillai's Trace and Hotelling-Lawley Trace (all $p < .0001$). Univariate statistics show that all the variables are significant at $p < .0001$ except *Slack* ($p = .0192$) and *Current* ($p = .2760$). This is the same as Cleary's results. The prediction accuracy of the discriminant function is 73.8% (versus 74% for Cleary), which is better than the proportional chance percentage of 68.7%. As an additional test of the discriminant function, the prediction accuracy was tested on the 84 companies in this dissertation's sample for the period and obtained an accuracy of 81.9% (Cleary did not test an out sample). The first discriminant function (shown below) was selected as the basis for calculating Z_{FC} values for each sample year of each company in the project sample.

$$Z_{FC} = -4.64385 + 1.65822(Current) + .03189(FCCov) + .01605(Slack) + 4.04950(NI\%) - 1.64382(SalesGrowth) + 20.88279(Debt)$$

Although the current ratio was not a significant contributor to the discriminant function, it was left it in the computation to be consistent with Cleary. Table 36 below shows comparable statistics for the project sample data divided into the same three groupings

[7] Note that the data is winsorized as per Cleary to prevent outliers from affecting the analysis. Sales growth is limited to ±100%, the current ratio is limited to ±10, the net income margin is limited to ±100%, and the fixed charge coverage ratio is limited to ±100.

used by Cleary. Median values are displayed instead of the mean values displayed by Cleary due to the small and skewed sample size used in this project. Clearly from the discriminant function used to calculate Z_{FC}, it is the debt ratio that drives much of the classification. Therefore it is not surprising that the NFC group has the lowest debt ratio and the FC group the highest – with the PFC group falling somewhere in the middle. However, a review of the other statistics tends to support the general classification. Although the NFC group has lower current ratios and slack (recall that univariate statistics showed that these variables were less significant in the discriminant function), it has higher fixed cost coverage, cash flow, and sales growth to support its ranking. Also consistent with the finance literature, these companies tend to be larger (as measured by fixed assets) and more highly favored by the market as measured by market to book ratio. The PFC group is (not unexpectedly) a mixed bag of the upper and lower groups. The firms in this group have similar cash flow and fixed cost coverage to the NFC group along with the higher current ratio and slack of the FC group. Although they have a slightly higher net income percent than the NFC group, it comes with lower sales growth. Taken together, the statistics in the table support the reasonableness of Z_{FC} as a measure of financial constraint.

(Insert Table 36 about here)

Descriptive Statistics

Table 37 below provides the descriptive statistics for all the variables in the model for the operating segments of the sample companies collected as described above. As

noted in the discussion above, the investment variable has been computed using five different methods and the value added variable using two different methodologies. The five investment variables (*I*, *Ireduce*, *Ita*, *Icapx*, and *TAchg*) represent the current year investment amounts (as previously defined). The value of *I*, which represents the original composition of the investment variable except for *workcap*, is reported only to show the limited availability of data. *Ireduce*, which further reduces the computation of investment by removing *R&D* and *HC* from the computation, is available for all operating segments in the sample period. *Ireduce* essentially defines investment as capital spending and acquisitions. *Ita* was developed as a way to reinstate *workcap* into the investment calculation, since it represents the change in total assets reported for the segment (as adjusted per the previous discussion) and therefore would include changes in working capital. *Icapx* and *TAchg* report the unadjusted capital spending and changes in total assets for each segment for comparison to prior literature (*Icapx*) and to test a simple, but relatively complete measure of investment that could be more easily applied across a broader sample of firms (*TAchg*).

(Insert Table 37 about here)

Based on these descriptives, it is difficult to tell if the various measures of investment are similar. Certainly, based on the comparisons of means and medians, they are all highly skewed. Ignoring *I*, which has too few observations to be meaningful, the mean values of each measure is not dramatically different from the others. *Icapx* has the smallest mean, which would be expected given that it includes no acquisition or working

capital values. The means, but more dramatically, the minimum and maximum values of *Ireduce*, *Ita*, and *TAchg* reflect the large effect of acquisitions and dispositions on the measure of investment – particularly the pooling transactions. This is evidenced by the higher maximums of *Ireduce* and *Ita*, which value the pooling transactions as purchases, over *TAchg*, which makes no adjustment for pooling vs. purchase transactions. The difference in mean values of *Ireduce* and *Ita* would seem to indicate that on average there was a reduction in working capital by the sample firms each year since the *Ita* measure was intended to capture the working capital investment that could not be independently measured with accuracy. The review of the correlations of these variables to each other which follows will provide a better indication of the consistency of measurement among them.

The difference in magnitude in the measures value added (*V* and *Vbea*) reflect the level at which they are calculated. *V* is generally calculated at the 4-digit or 6-digit NAICS level, while *Vbea* is calculated at the 2 or 3-digit NAICS level for all years. The maximum value for both *V* and *Vbea* are closer than might be expected because the source of the *Vbea* values is the same for certain industries (principally financial and professional services) that did not have value added data available at the 4-digit to 6-digit NAICS level from a source similar to the *Annual Survey of Manufactures*. It is also important to note here that the investment variables contain negative values, which will complicate the computation of the variables to be used in the basic regression upon which this research project is based due to the natural log conversion. This will be discussed more fully in the next chapter.

Histperf measures the relative performance (percent change in profits) of the sample segments to businesses in the same industry (both segments and single-segment firms) over the 2-year period prior to the sample year. The mean would indicate that the average sample segment was 6.5 times better than the industry segments. This value is obviously driven by the extreme maximum as the median indicates that the average sample segment is only 1.71 times better. This value may require some form of winsorization to eliminate the high minimums and maximums, but still provide the essential distribution of the data. This will be considered in the next chapter after the basic regression variables are computed and the relationships examined.

The small value of the dummy variable *disp* is indicative of the small number of segments disposed of during the sample period and the two years subsequent to the sample period. There were only 80 segments disposed of within two years of each sample year out of the 1,837 sample years. Although there were minor adjustments made to the reported numbers in Compustat in the segment composition (due to errors in Compustat, announced segment dispositions), the descriptive statistics for the *nosegs* variable are essentially consistent with the data reported on the overall sample statistics reported earlier. Since this variable is lagged, the minimum of 1 indicates that some firms in the sample were single segment firms just prior to the sample period.

Dvrsale, the herfindahl index of segment sales by firm-year, has been typically used as a measure of diversity of segment size within the firm in the literature. The average (both mean and median measures are similar) of 0.49 for this sample falls below similar measures from other published papers. Lang & Stulz (1994) and Comment & Jarrell (1995) report measures ranging from 0.68 to 0.91 for much larger samples and

earlier time periods (prior to 1990). Berger & Hann (2003) report a measure of 0.91 for segments reported under SFAS 14 and 0.83 for segments reported under SFAS 131 just before and after the transition year. However, Rajan, Servais, & Zingales (2000) use a measure based on assets (shown previously to be highly correlated to the sales measure) for their sample drawn from the period 1979 – 1993 and report a mean of 0.547. Generally this sample appears to have segments that are less diverse in size (as measured by sales) than those examined previously.

The value of dummy variable *corpid*, suggests that for those firms where it could be identified, the segments carried some form of corporate "branding" more than half the time. At least in this sample, there does not seem to be an overwhelming effort to tie the segments to the corporate identity in this fashion. However, the large mean value of the dummy variable *iaudit* expresses that virtually every sample firm could be classified as having an internal audit function. Although *turnover* could be determined for less than half of the sample operating segments, for those segments where data was available, there was a 15% mean *turnover* in segment managers over a 2-year period prior to the current year (recall that this data is almost exclusively for the period 1997 – 2002 and is calculated as instances of manager change divided by average segments over the period). Note however that the median is Zero, indicating that there were several segments with extremely high *turnover* (maximum is 100%) that skews the mean.

Relate and *complement* measure the vertical and horizontal relatedness of the firms based on methodology developed in Fan & Lang (2000). Although they developed and tested the measure based on the 1992 Use Tables, the results reported here based on the 1997 Use Tables seem consistent with those reported by Fan & Lang. They report an

average sales-weighted *relate* measure of 0.0216 for the period 1993-1997 versus the 0.01 value computed here. Likewise, for *complement* they report 0.3843 versus 0.31 reported here. The sample in this project seems only slightly less integrated than all multi-segment firms examined by Fan & Lang. To date, it does not appear that these measures have been used elsewhere in published literature - probably due to the onerous computations required.

Firm level variables consist of *finconstraint* and *ownership*. The value of *finconstraint* has no meaning in itself, but measures the relative financial constraint of a firm based on a discriminant analysis function. Higher values of *finconstraint* indicate higher levels of financial constraint, so the maximum value of 116.35 would indicate that this particular firm has a much higher level of financial constraint than the mean firm at 5.22. The *ownership* variable indicates that the average (mean) firm has about 80% of its stock held by shareholders other than officers and directors. There is quite a range of external ownership in the sample – extending from a minimum of 3% to a maximum of 100% (no internal ownership).

Table 38 below provides information on the correlations among all the variables that will be used in the analysis. Of particular interest are the correlations of the investment variables (*I, Ireduce, Ita, Icapx, TAchg*) to each other and to each of the other variables, since this would provide an indication as to whether the various computations change the measurement of investment. All the investment variables are highly related (correlation range is 0.295 to 0.9875) and significantly correlated (all $p < .0001$), indicating that they generally measure the same concept of investment. More importantly, since *I* cannot be used due to the limited data availability, the correlations

among *Ireduce*, *Ita* and *TAchg* (0.7085, .8951, and 0.9118) indicate that these computations of investment are virtually interchangeable. The correlations of these similar computations with *Icapx* are smaller in magnitude (range of 0.295 to 0.4663), confirming that the investment computations including acquisitions and working capital investment capture something different than just capital spending. In addition, although not as strongly related as the three investment variables, both computations of the value added variable (*V, Vbea*) show a strong (0.4336) and significant ($p < .0001$) correlation to each other.

Unfortunately, there are few strong relationships among the other variables with the investment variables other than *Icapx* or, more importantly, between the investment and value added variables, which are the components of the basic empirical regression which computes the efficiency coefficient. The only statistically significant relationship is between *Icapx* and *Vbea*, and the relationship is small and in the opposite direction from expectations (-.0853, *p = 0.0003*). Only *Icapx* shows a consistent statistically significant relationship with the independent variables, although often these are small and not always in the predicted direction. The correlations with *disp, relate, complement* and *iaudit* are statistically significant, but all below 0.10 and with *relate* in the opposite direction from the prediction (investment increases as the segments become less vertically related). The correlations of *Icapx* to *nosegs* (0.1283), *dvrsale* (-0.2087), *turnover* (0.1460), *finconstraint* (-.1229), *ownership* (0.2641) are stronger, but *nosegs* and *ownership* were both expected to have negative relationships with investment. There is some possibility that a correct relationship between the investment and other variables (particularly with value added) will develop when the full computation of the current year

values of investment and value added (the variables shown here) are divided by the prior year values in the empirical model, but that appears unlikely if there is either no relationship or a relationship in the wrong direction on a year by year correlation analysis.

(Insert Table 38 about here)

Among the independent variables, only the *ownership* and *nosegs* variables seem to have consistent statistically significant relationships with many of the other variables in the analysis. As external *ownership* increases, there are more segments (0.2204), there is a greater likelihood of an internal audit function (0.1443), less diversity in size (-0.2295) but more vertically integrated segments (0.0595) with corporate branding (0.0618), less financial constraint (-0.2616) and more investment (particularly as defined only as capital spending since *Icapx* has the highest correlation (0.2641), while the others are less than 0.10). This information is relatively consistent with the work of Stein (1989), who indicated that a focused strategy with similar size segments allows management to relax credit constraints and create more investment overall through "winner-picking".

Unlike previous research on the ICM, the sample for this project includes firms with both manufacturing and non-manufacturing segments. Of the 84 sample companies, 16 contain segments that are non-manufacturing. In order to determine if the non-manufacturing segments affected the correlation results, a second set of correlations of the investment and value added variable was separately run on the sample firms split

between those with non-manufacturing segments and those with only manufacturing segments (see Table 39 below). The firms with non-manufacturing segments (1408 segment years or 77% of the sample) had small (approximately 0.09) but statistically significant relationship between all the investment variables and *V*, which was not apparent in the full sample correlations. In addition, the firms with non-manufacturing segments seem to have caused the negative relationship between *Icapx* and *Vbea*, since the correlation is negative and relatively large here (-0.3236) and highly statistically significant ($p < .0001$). It is unclear why the relationship between capital spending and value added should differ so significantly between the two firm types. It is hoped that the calculation of the change in investment and the change in value added used in the basic empirical equation will resolve some of the issues noted here and there will be stronger relationships between the variables.

(Insert Table 39 about here)

Chapter 6 – Empirical Testing

Examining the model

Empirical testing begins with an examination of the basic empirical equation from JW2000 on which this research is based (see equation (1) repeated below).

$$\ln \frac{I_{ift}}{I_{ift-1}} = \alpha + E_f \ln \frac{V_{ift}}{V_{ift-1}} + \varepsilon_{ift} \qquad (1)$$

JW2000's paper examined, at the country level, the relationship of the change in investment spending to the change in value added by industry. The coefficient on this regression (E_f) is the estimation of efficiency, the focus of the current work. As noted earlier in the discussion of variables, the data JW2000 used in his paper came from United Nations statistical sources and the industry classification was ISIC (International Standard Industrial Classification), which approximates the U.S. SIC classification at the 2-digit level (major group classification). It is clear from this description that JW2000's research and use of equation (1) was at a macro-level of analysis. This current project is on a comparatively micro-level, since it attempts to apply the research methodology at a segment level within the company. This creates at least one problem in applying equation (1) to micro level data – how to handle situations where there is negative or "disinvestment" or where there are negative changes in industry value added.

JW2000's study used "gross fixed capital formation" as the measure of investment. This is defined by the UN Statistics Division as:

> capital formation, gross fixed [code 64]
>
> The total value of a producer's acquisitions, less disposals, of fixed assets during the accounting period plus certain additions to the value of non-produced assets realized by the productive activity of institutional

> units *(added by author - i.e. discoveries of mineral deposits or land improvements)*. Fixed assets are tangible or intangible assets produced as outputs from processes of production that are themselves used repeatedly or continuously in other processes of production for more than one year.
> Source: http://unstats.un.org/unsd/cdb/cdb_dict_xrxx.asp?def_code=64 (11/02/06)

This measure is generally consistent with the definition of investment used in this project, particularly the *Icapx* variable, which is computed solely on the changes in capital spending. The other variables add components to investment that JW2000 did not expressly consider in his analysis. Although the variable *I* represents the original conception of investment for this paper including acquisitions, R&D spending, and investments in human capital and working capital, because of the limited data availability, it is not considered further in this project. *Ireduce* includes the full value of acquisitions, which would include investments in other than fixed assets and *Ita* and *TAchg* include, in addition to the full value of acquisitions, additional investments in working capital. More importantly though, because of the macro nature of his study, JW2000 likely never encountered a situation where the gross fixed capital formation in any one year was negative (i.e. where disinvestment occurred). All the calculations of investment in this dataset (*Icapx, Ireduce, Ita, TAchg*) have instances where there is negative investment in either the current year or prior year change (or both). This makes the computation of the relative change in investment (I_{ift} / I_{ift-1}) problematic and makes the natural log of the computation impossible (unless imaginary numbers would be considered legitimate variables of interest).

The dataset contains 138 segment-years of data (approximately 8% of my data set) in which there is a divestment of all or a portion of a segment. These segment-years of data involve 51 different companies or 59% of the sample. In some years the

divestment is small enough such that total investment is still positive, but for the majority of the years, this results in negative investment for the segment-year. In addition, there are situations that occur in the data where investment is calculated by using the change in total assets (*Ita* and *TAchg*) which result in a negative calculation of investment in the current year or prior year (or both) because or reductions in working capital or because less investment was made in one period vs. the previous period. Table 40 shows the number of segment years where there are negative values in one or both of the years and where there is a zero in the prior year, making division impossible.

(Insert Table 40 about here)

The data in the table would indicate that, except for *Icapx*, the investment variables cannot use the natural log conversion without some form of modification and it will be necessary to determine a maximum value to use for those instances where there is division by zero.

While JW2000 may not have encountered the issue of disinvestment in his analysis, it is essential to the analysis here since it provides stronger evidence of the direction of investment related to the direction of the value added measurement for the industry. For example, if a firm has three segments and two of them are in industries where there this strong growth in the measure of value added, while the third shows a lower increase (or even a decrease, as there are instances where industry value added decreases year to year in the sample), it would be a stronger statement of efficiency to show disinvestment in the third segment (negative investment).

The natural log conversion of the dependent variable in equation (1) is there to readily and consistently provide a measure of direction and reduce to skewness in the data. If investment is increasing from year to year then the measure is positive and if decreasing, the measure is negative. Removing this conversion to eliminate the problem of imaginary numbers does not change what the variable measures – it changes the appearance of the result. Assuming investment in both periods is positive, where investment is decreasing the result will now be a number less than 1, and where it is increasing the result will be a number greater than 1. However, there is still an issue with negative investment, even with the natural log conversion eliminated. A simple example will explain the problem:

> Suppose the investment in year 2 is \$50 and in year 1 is -\$10 due to divesting part of a segment. In this case the Investment variable (I_{ift} / I_{ift-1}) calculates as -5. Likewise, if the investment in year 2 is -\$50 due to the divestment of the segment, but in year 1 was \$10, the Investment variable is also -5.

These two situations give the same mathematical result, but are very different empirically. The first represents a significant increase in investment and the second a significant decrease – so even beyond the elimination of the natural log conversion, further data transformation is needed to measure efficiency in this sample. In addition, the magnitude of the increase or decrease is not correctly stated since the change must also take into account the negative activity. In the first case, the change to \$50 from -\$10 is really an increase of 6 times (50 + 10)/10, not 5 times.

JW2000's methodology for computing the dependent and independent variables is easily interpretable, but essentially provides a continuous variable that measures both the scale and direction of the changes between years in investment and value added. With modifications the basic calculation can still be made to fit the data in this project and

provide the same information. The modifications are detailed below using *I* to generally represent any of the investment variable computed (*Icapx, Ireduce, Ita, and TAchg*). Where either I_t or I_{t-1} are negative (but not both), the calculation is made as follows to obtain a value of the correct magnitude and direction

$$\frac{I_t}{I_{t-1}} \textit{ is calculated as } \frac{I_t - I_{t-1}}{abs(I_{t-1})}$$

Where both I_t and I_{t-1} are negative and I_t was the greater value (less negative), the calculation was made as follows to obtain a value of the correct magnitude and direction:

$$\frac{I_t}{I_{t-1}} \textit{ is calculated as } \frac{I_{t-1}}{I_t}$$

Where both I_t and I_{t-1} are negative and I_{t-1} was the greater value (less negative), the calculation was made as follows to obtain a value of the correct magnitude and direction:

$$\frac{I_t}{I_{t-1}} \textit{ is calculated as } -\left(\frac{I_t}{I_{t-1}}\right)$$

Although the issue of negative values does not occur in the value added variables, the equation calls for both the investment and value added change to use the natural log conversion. For consistency, the change in value added is computed both with and without the natural log conversion. Descriptive data on the empirical variables follows in Table 41.

(Insert Table 41 about here)

The missing data is due to situations where I_{t-1} is zero, making division impossible. In addition, there are obviously extreme values calculated in the data (the maximum value of the *Ita*, in particular) that must also be dealt with. Deleting the companies which have missing values would require a reduction of 15 – 18 sample firms (18% - 21%,), depending on the investment variable used. In addition, the extreme value of the *Ita* calculation is caused by an extremely small (almost zero) divisor, which is similar to the problem of a zero divisor (which calculates to infinity). This suggests that some form of winsorization of the extreme values, where the maximum value is also "assigned" to the calculation of $\frac{I_t}{I_{t-1}}$ when the divisor is zero, may solve both issues and allow the full dataset to be tested. The missing values account for approximately 1-2% of the segment years, but would all fall on the upper extremes, so winsorization at the 5th and 95th percentiles seems appropriate to remove the effect of extreme values and assign reasonable values to the missing calculations. Descriptives and correlations of the investment and value added variables based on this method of winsorization follow in Tables 42 and 43, respectively.

(Insert Table 42 about here)

Winsorization seems to provide the desired effect of reducing the skewness of the data and should also dampen the effect of outliers on the relationships. The calculation of the value added variable from the BEA data $\left(Ln\left(Vbea_t / Vbea_{t-1}\right)\right)$ yields numbers that are comparable to JW2000 for the United States – mean of 0.022 and standard deviation of

0.091 (p. 193). The correlations between the unwinsorized and winsorized calculations of the investment variables are all relatively strong and highly statistically significant (*Icapx* - 0.49, *Ireduce* - 0.36, *TAchg* - 0.20, all at $p < .0001$) with the exception of *Ita* (0.08, $p = .001$), which is smaller and weaker, but still statistically significant. This would indicate that the winsorization did not significantly affect the variable measurement. The relationship of *Ita* is affected by the extreme outlier – without that one segment year, the correlation between the winsorized and winsorized values of *Ita* is much stronger (0.21, $p < .0001$).

The correlations in Table 43 indicate that the most complete calculations of investment change (those that contain capx, working capital and acquisitions), *Ita* and *TAchg* are the only variables that have statistically significant relationships with changes in value added – and these relationships are not very strong (0.066 to 0.087). This relationship is only significant for the change in *Vbea*, the value added variable computed at the 2 to 3-digit NAICS level, which is most consistent with JW2000. The natural log conversion of *Vbea* does not seem to affect the relationship, so this will remain in the empirical work to be consistent with JW2000.

(Insert Table 43 about here)

A separate analysis of the correlations of the value added and investment variables for the sample firms with manufacturing segments was also run and the correlations for the *Ita* and *TAchg* computed variables to the natural log *Vbea* computed variable was very

similar the above analysis indicating that the non-manufacturing firms are not influencing the results.

Correlations of all the variables to be included in the analysis follow in Table 44. Of interest here are the correlations of the additional independent variables to the potential dependent variables Ita_t / Ita_{t-1} and $TAchg_t / TAchg_{t-1}$, as well as the correlations of the independent variables to the change in value added variable $Ln\left(Vbea_t / Vbea_{t-1}\right)$ used in the empirical model. In addition, as indicated earlier, due to some extreme observations, *histperf* was winsorized at the 1% and 99% levels to determine if that had any effect on the correlations with the other variables in the analysis. Previous correlation analysis indicated that the current year values of *Ita* and *TAchg* had only limited correlations to the independent variables. *Ita* was significantly correlated with *dvrsale*, *complemen*t and *ownership* and *TAchg* was significantly correlated with *ownership*. However, the variables (Ita_t / Ita_{t-1} and $TAchg_t / TAchg_{t-1}$), which are used in the empirical analysis, only retain a statistically significant correlation with *ownership* (at approximately the same level of 0.06, with a slightly lower level of significance). Among the independent variables, the value added variable in the empirical analysis $Ln\left(Vbea_t / Vbea_{t-1}\right)$ retains statistically significant correlations with *nosegs*, *relate* and *complement*, although now the correlations of *relate* and *complement* both go in the same direction (negative), which would be the more expected result. However it loses significant correlations with *disp*, *finconstraint* and *ownership* and adds significant correlations with *dvrsale* and *turnover*. Recall that the empirical test for each of these variables will be to determine if they modify the efficiency as measured by the coefficient on the regression of change in investment

(either Ita_t / Ita_{t-1} or $TAchg_t / TAchg_{t-1}$) on change in value added ($Ln\left(Vbea_t / Vbea_{t-1}\right)$), so the greater concern is that they mostly show no significant correlation to the change in investment variables (dependent). Although the winsorized *histperf* variable does retain a strong correlation to the unwinsorized variable (0.67, $p < .0001$), and has additional statistically significant correlations with other independent variables (*disp* and *ownership*), it has no better relationship to the dependent variable, so is not considered further in the analysis.

(Insert Table 44 about here)

Regression Results

Two versions of the basic empirical equation (below) are run based on the information gained from the correlation analyses. The first uses the change in investment variable based on the adjusted change in total assets (*Ita*) and the second is based on the unadjusted change in total assets (*TAchg*). These were the only variations of the investment variable calculations with significant correlations to the value added variable. Both regressions were first run on the total sample. The results are shown in Table 45 below.

(Insert Table 45 about here)

Although both regressions are significant and the efficiency coefficient is also significant, the R^2 are such that the model has no explanatory power. These values should be comparable to the United States efficiency coefficient (0.723), standard error (0.069) and R^2 (0.126) obtained in JW2000 (p. 201). While the coefficient may differ because the

JW2000 used the Ln transformation on both the investment and value added variables and this project did not, the R^2 is of particular concern. The largest R^2 of this project (from regression 1b) is similar in size to Bangladesh, Columbia, and Fiji – which JW2000 indicates are developing countries where factors other than growth must drive investment. Certainly it would be unexpected to find a similar situation in a market economy such as the United States across a broad sample of industries.

It becomes meaningless to test any of the hypotheses proposed for this project using the JW2000 empirical methodology without results that provide any explanatory power on the basic empirical regression. The focus of this research is the coefficient (E_f), which represents the response of segment investment to a measure of changes in industry value added. Each hypothesis is tested by its effect on this coefficient, and although it is statistically significant in the basic regression, the lack of explanatory power in the regression suggests that the results provide nothing of substance to report. In an attempt to verify the lack of substantive results, the basic regressions in Table 45 were run separately for firms with only manufacturing segments vs. those with at least one non-manufacturing segment with no change in results. In addition, they were run without the natural log conversion of the value added variable, again with no change in the results. Neither of the detailed statistical results of these additional regressions are reported here.

The regression results reported in Table 45 are based on the value added variable (*Vbea*) determined at the NAICS 3 or 4-digit level. Although this variable is probably more consistent with JW2000's work, one concern is that since this project is at a much lower level of analysis (the segment within a firm), the 5 or 6 digit value added data may

be more consistent with the investment data used here. The correlation analysis (Table 43) provided evidence that there was no statistically significant relationship between the more detailed value added variable (*V*) and the any of various investment variables. However, this may be due to the choice of comparable "value added" data for segments in the sample that were not included in the *Annual Survey of Manufactures* because they operate in a non-manufacturing industry (such as wholesale, retail or service). In addition, as described in detail in the data collection section of this paper, because of the conversion from SIC codes to NAICS codes for reporting of value added information in the *Annual Survey of Manufactures*, a "blended" value added was created for those segments that were in manufacturing industries to be consistent in reporting across the whole sample period. This "blending" of SIC and NAICS codes may also have created a problem with the relationship of the independent and dependent variables in the analysis. To test the affect of these factors on the analysis, a separate set of correlations were run on just the firms with manufacturing segments after dropping 1997 from the analysis (since 1997 was the conversion year which required the "blended" SIC/NAICS value added computation). This would allow for a "pure" comparison of value added at the detail (4-digit) SIC level before 1997 and at the detail (5 or 6 digit) NAICS level after 1997 – where all data was sourced from the *Annual Survey of Manufactures*. Although this improved the correlations (see Table 46), indicating that there may have been some "noise" from the non-manufacturing segments and blending process, the results are not substantially improved from the correlations of the investment variables to the *Vbea* variable used in the regression, so this was not pursued further.

(Insert Table 46 about here)

Since the natural log conversion of the investment variables is not possible with the data set for this project, another comparable approach to calculating the change in investment which might be also applied to the value added change was sought to determine its effect on the basic regression. As indicated earlier, the natural log conversion has the effect of simplifying the direction of the change in investment and reducing skewness in the data. It also helps eliminate scale effects in the data since the value added data is determined at the industry level while the investment data is at the segment level. While not addressing the issue of skewness, sales is a variable that is readily accessible to scale both the investment and value added variables in this dataset. Sales is available to scale the investment value for each segment year from the Compustat segment database and the *Annual Survey of Manufactures,* which was the initial source of value added data in the dataset, contains a "value of shipments" for each industry reported. This is defined as "…net selling values, f.o.b. plant (exclusive of freight and taxes), of all products shipped, both primary and secondary, as well as all miscellaneous receipts…" (*Statistics for Industry Groups and Industries: Annual Survey of Manufactures*, 2001, pp. A-2), and therefore would appear to approximate sales for each industry. New sales scaled variables were calculated for the investment and value added change as the difference between year2 and year1 divided by the average sales over the 2-year period. The correlations (not reported) indicated no statistically significant relationships among the sales scaled investment and value added variables.

The cumulative effect of the above empirical testing indicates that JW2000 methodology does not seem to apply to the data available for this project, even using several alternative measures of investment and value added and different methods of variable transformation. The obvious difference is the level of analysis – with JW2000 analyzing data at the country level and this project at the firm/segment level. However, this sample is also of limited size due to the restrictions necessary to assure consistency of segment across the whole sample period. A better test of the JW2000 methodology at this level of detail would be to apply it to the whole Compustat segment database. *Icapx* is the most consistent investment variable to JW2000 and can be calculated on the full segment database and transformed using the natural log conversion. In addition, since the investment data is determined at the segment level, the more detailed value added variable (V) seems to be the appropriate independent variable in the analysis. To assure the greatest potential consistency of segment data, the analysis was run using only manufacturing firms for the period 1997 – 2002 (a total of 19,900 records). The following regression was run:

$$\ln \frac{Icapx_{it}}{Icapx_{it-1}} = \alpha + E \ \ln \frac{V_{it}}{V_{it-1}} + \varepsilon_{it}$$

The regression is significant with a coefficient of .4335 ($p < .0001$), but the adjusted R^2 of the regression is only .0015, which is less than the R^2 on the regression on this dataset (.0038, from Table 45). As an additional test, the regression was run again substituting the value added variable (*Vbea*), which is more consistent with JW2000's, for *V*.

$$\ln \frac{Icapx_{it}}{Icapx_{it-1}} = \alpha + E \ \ln \frac{Vbea_{it}}{Vbea_{it-1}} + \varepsilon_{it}$$

This regression (25,657 records) is also significant and provides a coefficient of .779 ($p <$ *.0001*), which is similar to the coefficient obtained by JW2000 for the United States (.723), but the adjusted R^2 on this regression of .0015 is still below the regression results for this project's data and substantially below JW2000's R^2 of .126. Although the coefficient from the second regression is similar in size and direction and both regressions are statistically significant, the R^2 from these regressions seems to support the suggestion that JW2000's methodology is not applicable to this level of analysis and therefore further empirical analysis using this methodology appears futile.

Univariate Tests of Hypotheses 1 – 4 (ICM efficiency)

With the failure of the application of JW2000's empirical methodology to this data, univariate statistics remain the only means to examine the proposed hypotheses. While univariate statistics cannot provide a full test of the hypotheses, they can reveal the strength and direction of the relationships proposed and provide some indication of the probable results of hypothesis testing using multivariate analysis. Hypotheses 1 – 4 focus on the governance mechanisms necessary to address the issues of game length, group size, monitoring and sanctions in order to resolve the social dilemma of the division managers and create an efficient ICM. In order to provide the most complete analysis possible, the relationships of the division manager variables (previously deleted from the empirical analysis due to limited observations) to the dependent investment variable should be included. The correlations of these variables (*age, def%, inside, corpofficer, corp%,* and *execcommittee*) to both calculations of the change in investment that survived to the empirical analysis (*Ita* and *TAchg*) can be found in Table 47 below.

(Insert Table 47 about here)

Table 48 provides a summary of the univariate testing performed on each of the hypotheses. Hypothesis 1 addresses game length and proposes that firms that address career concerns of division managers will make the "shadow of the future" relevant to them and therefore create a more efficient ICM. Variables relating to the historical performance of the division relative to the industry (*histperf*), disposal of the division in the future (*disp*), and division manager variables for age (*age*), percent of compensation deferred to future periods (*def%*) and source of hire into his/her current position (*inside*) were collected to test this hypothesis. Tables 44 and 47 detail the correlations of these variables to the investment variables used in the empirical analysis. Only *def%* has a significant correlation with *Ita* (0.3052, $p = .0024$) and *TAchg* (0.2228, $p = .0283$) for 97 observations (out of the total sample of 1,837). Although this is limited in scope, it suggests that this hypothesis would likely not be totally rejected. Firms that address career concerns of division managers via compensation practices would likely have a postitive impact on the efficiency of their ICM.

The second set of hypotheses (2a – 2f) address group size and related social incentives associated with group size.

- Hypothesis 2a proposes that firms with higher numbers of divisions will have a less efficient ICM. The variable *nosegs*, which is measured as the number of segments in the firm, has no significant correlation with either of the investment variables in the empirical analysis (see Table 44) and therefore this hypothesis would likely be rejected.

- Hypothesis 2b proposed that the more diverse the size of the divisions within a firm, the less efficient the ICM. The variable *dvrsale*, which measures the diversity of the divisions as the herfindahl index of sales, was collected to measure diversity of division size. It shows no significant correlation with either of the investment variables in the empirical analysis (see Table 44) and therefore this hypothesis would also likely be rejected.
- Hypothesis 2c suggests that the more diverse the profits of the segments of a firm, the less efficient the ICM. The variable *dvrprof* (calculated as the herfindahl index of segment profits) was collected to measure the diversity of profits, but was eliminated from the analysis due to negative profits within the sample that drove the calculation to extreme values and limited its effectiveness. Therefore Hypothesis 2c could not be tested.
- Hypotheses 2d and 2e proposes that multi-division firms that promote a corporate identity will have a more efficient ICM. Dummy variables that capture the corporate identity at the division level either through the division name (*corpid*) or the title of the division manager (*corpofficer*) were collected and found to have no significant correlation to the investment variables in the analysis (see Table 47). However, *corp%*, which measures the percentage of division manager compensation that is based on corporate vs. division results, has a significantly positive correlation to both investment variables (0.3021, $p = .0026$ with *Ita* and 0.2273, $p = .0256$ with *TAchg*). Although this significant result is based on limited observations (97), this does suggest the possibility that Hypothesis 2e

would not be rejected and that firms that promote corporate identity through their compensation practices would have a more efficient ICM.

- Hypothesis 2f, the final group related hypothesis, suggests that communication and group decision-making among the division managers would lead to a more efficient ICM. The variable *execcommittee*, which is a dummy variable indicating the division manager's membership in a corporate executive committee (the management group often responsible for capital allocation decisions), was collected for 751 observations (40% of the sample) and found to have no significant relationship with the investment variables in the analysis. Therefore, this hypothesis would likely be rejected in empirical testing.

Hypotheses 3a and 3b address the ability of the corporate office to monitor division manager actions to determine if there is defection in reporting of investment opportunities and Hypothesis 4 addresses the existence of an effective sanctioning system when defection is detected. Hypothesis 3a suggests that the corporate office is better able to monitor multiple divisions if they are more related to each other. The variable *relate* captures the vertical relationship (how the divisions' industries serve each other) of the divisions and the variable *complement* captures the horizontal relationship (how the divisions' industries use and/or serve the same industries). Neither variable has a significant correlation with the investment variables (see Table 44), so Hypothesis 3a would likely be rejected. Hypothesis 3b proposes that multi-division firms with an internal audit function would use this to their advantage in monitoring division manager actions and therefore have a more efficient ICM. All but three of the firms in the sample were determined to have an internal audit function during at least part of the sample

period so, although no significant relationship was found between the dummy variable measuring the existence of an internal audit function (*iaudit*) and the investment variables (see Table 44), the lack of variability of the measure in the sample would indicate that this is not really a true test of this hypothesis. A measure of division manager *turnover* measures the effectiveness of the sanctioning system for Hypothesis 4. This variable also shows no significant correlation to the investment variables (see Table 44), so would likely result in the rejection of Hypothesis 4.

Univariate Tests of Hypotheses 5-7 (ICM vs. external market efficiency)

Hypothesis 5 proposes that a properly structured ICM will be more efficient at resource allocation than the external market. This hypothesis was not empirically tested due to the failure of JW2000's methodology and it cannot be examined using the univariate statistics from this project. Hypothesis 6 draws on agency theory to suggest that increased management ownership of the firm will align the interests of shareholders (principal) and corporate management (agents) and provide more efficient resource allocation in any market. The variable *ownership* measures the percent of outside shareholder holdings and therefore the expected sign for the coefficient on this variable in empirical testing was negative since increasing external shareholder ownership means reduced management ownership. Although this was not examined for the external market, univariate statisitics show a significant positive correlation between *ownerhip* and *Ita* (0.0656, $p = .0049$) and *TAchg* (0.0571, p = .0145), which is the opposite direction from expectations. This suggests that Hypothesis 5 would likely be rejected in empirical tests. Hypothesis 7 relies on free cash flow theory to propose that increased financial constraints on the firm will increase the efficiency of resource allocation in any

market. Univariate statisitics for the ICM only suggest that there is no relationship between the measure of financial constraint used in this dissertation (*finconstraint*) and the investment variables and therefore this hypothesis would likely be rejected. This hypothesis was also not tested on data collected from the external market.

(Insert Table 48 about here)

Chapter 7 – Conclusions and Implications for Future Research

The internal capital market was first described by Oliver Williamson as the means by which multi-division firms would more efficiently allocate resources than the "external" capital market. He theorized that firms with specified structural elements (labeled "M-form), would have advantages over the external market in exercising control mechanisms (incentive, monitor, and audit) over the allocation of resources (Williamson, 1970, 1975, 1985). This theory has been subject to considerable testing since its inception, with a focus on the allocation of capital (investment) within multi-divisional firms, but results to date have been inconsistent.

This dissertation suggested that improved testing of the theory might result from expanding the definition of investment within the firm from capital spending only (the definition of investment used in virtually all previous research), to include spending on human capital, research & development, working capital, and acquisitions. In addition, this dissertation suggested that the implementation of SFAS 131 – *Disclosures about Segments of an Enterprise and Related Information*, which uses the "management approach" for segment reporting, provided segment (division) data that is more consistent with the structural elements required by Williamson to qualify as an M-form firm (and therefore have an internal capital market) than previous segment reporting under SFAS 14, which had been the source of much of the earlier research. However, because SFAS 131 had only been in place since 1998 (for calendar year firms), this dissertation focused on those firms that did not change segment structure in the conversion from SFAS 14 to SFAS 131 in order to obtain a time series of data (eight years) of a length that was

reasonable for testing. Finally, this dissertation proposed that an empirical approach based on the work of Wurgler (2000) would address many of the measurement issues that troubled previous empirical methodology.

Working with a model of the internal capital market using game theory, this dissertation proposed that division managers face a social dilemma related to their requests for capital allocation. Social dilemmas are only resolved (a cooperative solution achieved) by attention to the structure and governance of the game. Assuming a centralized solution to the dilemma, where the corporate HQ acts as a "technology" and always selects the most profitable resource allocation from the choices it is presented, it was suggested that the dilemma can only be solved by providing a structure of incentives and governance that

- addresses division manager career concerns, allowing them to focus on future interactions in their decision making
- provides division managers with some level of visibility to each other, group (firm) identity, and perceived efficacy related to the group (firm)
- provides HQ with the knowledge and tools to monitor and sanction division managers that choose to provide false information in order to improve their chances of obtaining more current resource allocations.

This theoretical model suggested four hypotheses related to the effect of structure and incentives on the efficiency of otherwise comparable internal capital markets. Then, with the results of testing of these hypotheses on internal capital markets as controls, an additional three hypotheses related to the efficiency of the internal versus the external

capital market were proposed based on existing empirical work describing firm attributes that might theoretically affect resource allocation in either the internal or external market.

Results

Data collection yielded 84 firms that met the requirements that (1) their reported segment structure remain unchanged after the conversion from SFAS 14 to SFAS 131 and (2) that had sufficient matching single segment firms in the same industry. However, there was insufficient reported segment data available to expand the definition of investment to include spending on human capital and research & development. In addition, the proposed computation of investments in working capital by segment also failed, although an alternative method to include working capital as part of the computation of investment was developed. Numerous other data issues forced seven variables to be dropped from the empirical analysis and a change in the method of computation of one other variable (*finconstraint*), although there remained at least one variable in the analysis to test all but one of the hypotheses. Hypothesis 2c was to be tested with the effect of dvrprof on the efficiency coefficient, however negative profits of some of the companies in the sample drove the computation of this variable to extreme values that limited its effectiveness as a measure of diversity of profits. Therefore this hypothesis could not be tested. The overall reduction in variable count would probably have been necessary in the final empirical analysis even without the data issues due to the small sample size in this dissertation. However in that case, statistical methods such as factor analysis would have been used to determine common measurements among the variables.

More significantly, although the basic empirical approach achieved statistically significant results, the regression R^2 indicated that these results provided no explanatory power. This meant that there could be no multivariate testing of any of the hypotheses, since they all relied on the efficiency coefficient (E_f) from the basic empirical model. In particular, this prevented any testing of H5, the comparison of the efficiency of the ICM to the external market, because this test relied solely on multivariate analysis. Numerous attempts were made to salvage the empirical methodology including five different computations of the major dependent (investment) variable and two different computations of the major independent (industry value added) variable, however none were successful in improving the explanatory power of the empirical test.

Therefore, for the hypotheses other than H2c and H5, univariate analyses were performed, with only limited support found for H1 (attention to division manager career concerns) and H2e (promotion of corporate identity through compensation practices). All other hypotheses were not supported by univariate tests. These tests are summarized in Table 48.

Limitations and Future Research Implications

The failure of the empirical methodology is troubling and warrants further investigation. Although JW2000 was a country level analysis, the basic concept of a measure of "increasing investment in industries that are 'growing' and decreasing investment in industries that are 'declining'" (Wurgler, 2000, p. 194) would seem to apply equally well within a country. One concern is that the measure of value added growth $\left(\ln \frac{V_{t}}{V_{t-1}}\right)$ is not a good proxy for investment opportunities. JW2000 reported highly significant correlations of industry value added growth to other measures of investment

opportunities (average *q*, log price-earnings ratio, and log sales growth) in his country analysis. The U.S. based data used for this project does not show this relationship. Correlations of Tobin's *q* and the value added growth computation using the BEA value added figures (which would be the most consistent with JW2000) are not significant for a sample of single segment firms in the industries present in this dissertation over the same time period of 1995 - 2002 (total of 14,038 records). This holds when the sample is reduced to only manufacturing firms (consistent with JW2000). Although no effort was made to look at the data set for outliers or other data issues, it seems unlikely that these (if present) would eliminate any existing relationship in the data given the size of the dataset. The lack of consistency with JW2000 needs further analysis to understand its origins and to determine if the methodology can be salvaged for within country analysis. It is possible that this analysis may provide insight into the debate on the importance of industry vs. company strategy in the analysis of performance.

In addition, it is troubling that there is no relationship between changes in segment investment and segment historical performance in this data. It seems difficult to imagine that the historical profitability (or lack of profitability) of a segment has no statistically significant bearing on the changes in investment in the segment over a broad sample of firms and industries. The historical performance variable does have a statistically significant relationship in the expected direction with the dummy variable that measures disposal of a segment within two years of the current year, although even that relationship is not very large. It may be that the selection process for this sample generated a sample of firms and industries that are somehow not representative of a broader sample of firms. Certainly, the comparisons of the sample to Compustat firms in

Chapter 5 did indicate some significant differences between the average firm in this sample and Compustat, but some of these differences (such as higher profitability and better maintenance or growth of market value) might lead to the expectation of a stronger relationship of historical performance and investment than another more "representative" sample. Further analysis of this relationship over a broader selection of firms and segments may yield some insight as to its origins. It would be interesting to examine the relationship at the corporate level for both multi-segment and single segment firms and then also look at the relationship at the segment level for the multi-segment firms over a longer sample period. In addition, it would be interesting to determine if the transition to SFAS 131 changed the relationship of performance to investment at the segment level.

Even if this dissertation had generated empirical results, the small sample size and the specific restrictions for sample selection would have limited the generality of those results. The restrictions on the firms chosen for the sample were necessitated by the need to extend the time series of the data beyond the available segment data reported under SFAS 131 – which was only five years at the start of data collection. In addition, the time period used for the sample required "blending" of value added data across the conversion from SIC to NAICS codes, which added an additional layer of potential data incongruence. Finally, the extensive hand collection of data required for the calculations of acquisitions, research & development, and human capital by segment, as well as the variables associated with the division managers (age, compensation, and deferred compensation), would preclude replicating this project on a larger sample.

However, the work done for this dissertation suggests that some of these variables (particularly the variables related to the characteristics of the division managers) are

simply not accessible using currently available sources and could be dropped from a larger scale study. In addition, the work done to calculate the investment variable suggests that a simple calculation of the change in total assets may well capture most of the elements of investment suggested in this project – capital spending, acquisitions/dispositions, and changes in working capital. This variable could be computed without the extensive hand data collection related to acquisitions and therefore holds promise for extending this project to a sample of more significant size. Finally, there are other transformation functions that could be applied to determine if they hold some promise to replace the natural log (Ln) used by JW2000. In particular, an inverse hyperbolic sine (IHS) transformation has been shown to perform in a similar fashion to the Ln transformation on data with similar limitations to the data in this project (Burbidge, Magee, & Robb, 1988). Finally, soon there will be 10 years of SFAS 131 segment data and matching value added data under NAICS codes available, allowing a much more extensive sample time period to test the hypotheses of this project.

While the basic empirical regression did not yield results that provided any explanatory power, there were 13 companies within the sample that individually had statistically significant and substantively important regressions (R^2 ranged from 0.1274 to 0.5931) across the sample period. These companies should be analyzed further to determine why their results differ so dramatically from the rest of the sample. In addition, the additional testing suggested by this dissertation could be applied to these companies and the hypotheses confirmed or rejected for this small sample as a basis for testing on a larger sample over a longer period.

Policy Implications

The extensive hand collection of data for this dissertation and the detail comparison of 10K information for the sample firms to Compustat provided considerable insight into the limitations of Compustat data. Numerous discrepancies were noted (some of them reported in Chapter 5) between data recorded in Compustat and the actual data reported in the reports of the sample firms. While no attempt was made to record each incident where there were discrepancies, the general impression from the data collection process was that they were more abundant than would have been expected from a data source that is used as extensively as Compustat. Of particular concern to this study was the lack of reliability of the "source year" information in the segment database, which required additional hand data collection. Since this was not a statistical sample of Compustat, there is no way to determine if the errors represent a serious concern with the reliability of Compustat generally, but if statistical sampling similar to that used in audit procedures have not been used to test and report on the reliability of Compustat data, this may be a worthwhile project.

In addition, the data collection process provided an unusually detailed look into the financial reporting for segments. This process generally confirmed what has been reported in the literature on the conversion from SFAS 14 to SFAS 131 - that SFAS 131 did improve the disaggregation of segments, but there is still much work to be done. There were many segments reported that were still aggregations of several different businesses with different managers. SFAS 131 still allows aggregation of segment information for reporting where operating segments exhibit similar economic characteristics (as defined in SFAS 131) and it appears that companies use this to their advantage. For example, the Aircraft Segment of Textron combines both Cessna Aircraft

and Bell Helicopter. While these are certainly common from the standpoint of serving the aircraft industry, they serve very different markets, are separately incorporated, and have separate officers that manage them. It is hard to believe that the Chief Operating Officer of Textron only reviews results at the Aircraft Segment level in order for these to be aggregated. Clearly, the SEC and public accounting profession should not simply accept the segment classifications of each firm without more scrutiny.

The data collection also suggests that there is material information that is currently not reported in detail by segment that perhaps should be. It has already been argued in the literature that research & development expense by segment would be useful information to investors. Unfortunately, this was eliminated from the requirements of SFAS 131 due to firm arguments about the competitive damage such information could cause. This dissertation also confirmed that in some instances the transition to SFAS 131 reduced disclosure, particularly in the case of research & development. Johnson & Johnson had disclosed research & development by segment under SFAS 14, but stopped doing so when it implemented SFAS 131.

Additionally, although SFAS 131 requires disclosure by segment of the amount of investment in equity method investees it does not require disclosure of other acquisition information by segment. This information is also not required by SFAS 141 – only goodwill by segment is required to be reported. This dissertation has shown that acquisitions are a significant source of investment activity by firms and the lack of disclosure by segment leaves a large gap in information available to investors. Finally, although investments in long-term assets other than financial instruments (which firms usually interpret as capital expenditures) are required to be disclosed by segment, there is

not a similar disclosure requirement for divestment of long-term assets (asset sales), except in the case of disposals of a segment or significant portion of a segment. Normal asset disposals were often of comparable magnitude to asset acquisitions (capital expenditures) on the cash flow statements of the sample firms in this project and therefore merit consideration for disclosure to investors. Standard setters should consider adding these disclosure requirements to segment reporting to improve the information available to investors.

Figure 1
Graph of Social Dilemma

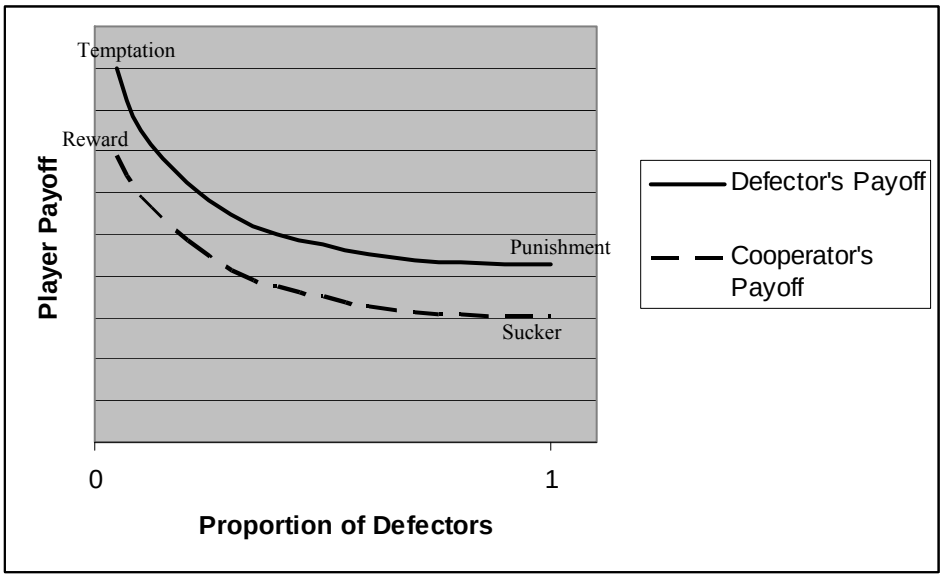

Table 1
Prisoner's Dilemma

Panel A

		Player 2	
		Cooperate	Defect
Player 1	Cooperate	(R, R)	(S, T)
	Defect	(T, S)	(P, P)

Panel B

		Player 2	
		Cooperate	Defect
Player 1	Cooperate	(2, 2)	(0, 3)
	Defect	(3, 0)	(1, 1)

Table 2
Description of Variables in Equation 3 – Tests of H1 – H4

Variable[8]	Description	Coeff	Predicted Direction
HistPerf	This measures the percentage change in profits for the division for the two-year period prior to the current year relative to the percentage change in profit for the same period for all other segments in the same reported industry. $\frac{\frac{Profit_{ift-1} - Profit_{ift-3}}{Profit_{ift-3}}}{\sum_{i=1}^{n-1} \frac{Profit_{ift-1} - Profit_{ift-3}}{Profit_{ift-3}}}$	l_1	+
Def%	Percentage of division manager compensation in period *t* that is deferred to future periods. Compensation is defined to include stock-based compensation such as stock options and stock grants. Compensation is valued and deferral is determined in the period the compensation is granted.	l_2	+
Age	Age of the division manager at the beginning of period *t*	l_3	-
Disp	"Dummy" variable with a value of 1 if the division was disposed of or classified as discontinued operations in either periods *t +1* or *t+2*, and a value of zero otherwise	l_4	-
Inside	"Dummy" variable with a value of 1 if the division manager was hired to his/her current position from outside the firm, and a value of zero otherwise	l_5	-
NoSegs	The number of divisions in the firm as of the beginning of period *t*	g_1	-
Dvrsale	Herfindahl index based on proportion of each division's sales to sum of division sales for each firm: $H_{Sales} = \sum_{i=1}^{n} \left(Sales_i \Big/ \sum_{i=1}^{n} Sales_i \right)^2$	g_2	-

[8] To save space, I have not shown the interaction of each variable with the growth opportunity proxy $\left(\ln \frac{V_t}{V_{t-1}} \right)$ in this table; however each of these variables is interacted with that proxy in the regression so that the coefficient represents the effect of each variable on the efficiency coefficient (E_1).

Table 2
Description of Variables in Equation 3 – Tests of H1 – H4

Variable[8]	Description	Coeff	Predicted Direction
Dvrprof	Herfindahl index based on proportion of each division's profits to sum of division profits for each firm: $H_{Profits} = \sum_{i=1}^{n} \left(Profits_i \Big/ \sum_{i=1}^{n} Profits_i \right)^2$	g_3	-
CorpID	"Dummy" variable with a value of 1 if, at the beginning of period *t*, the division name carries Corporate identification such as "A division of", and a value of zero otherwise	g_4	+
CorpOfficer	"Dummy" variable with a value of 1 if, at the beginning of period *t*, the division manager carries a Corporate title such as Vice President and is considered an officer of the Corporation, and a value of zero otherwise	g_5	+
Corp%	Percentage of division manager compensation in period *t* that is based on Corporate results versus division results. Compensation is defined to include stock-based compensation such as stock options and stock grants (which would be considered as Corporate-based compensation.	g_6	+
ExecCommittee	"Dummy" variable with a value of 1 if, at the beginning of period *t*, the division manager is a member of the Executive committee (committee responsible for corporate strategy and decision making), and a value of zero otherwise	g_7	+
Related *Complement*	Based on Fan & Lang (2000), this takes on two values: 1. "Relatedness" is a measure of vertical integration between two industries. It is computed as the average of the dollar value of industry *i's* output need to produce $1 of industry j's output and the dollar value of industry *j's* output need to produce $1 of industry *i's* output. Where there are more than two segments I will sales-weight segment *i's* relatedness to each other segment in computing the average. 2. "Complementarity" is a measure of industry's ability to share marketing and purchasing resources. It is computed as the average of (1) the correlation between the percentage of industry *i's* output used in each industry *k* and the percentage of industry *j's* output used in each industry *k* and (2) the correlation between the percentage of each industry *k's* input into industry I and the percentage of each industry *k's* input into industry *j*. As in the calculation above, where there are more than two segments I will sales-weight segment *i's* relatedness to each other segment in computing the average. All calculations will be based on the 1997 Benchmark Bureau of Economic Analysis "Use" Table.	m_1 m_2	+ +

Table 2
Description of Variables in Equation 3 – Tests of H1 – H4

Variable[8]	Description	Coeff	Predicted Direction
Iaudit	"Dummy" variable with a value of 1 if, at the beginning of period *t*, the firm has an internal audit function, and a value of zero otherwise	m_3	+
Turnover	Computed as the number of instances where a division manager has left the firm in periods *t-1* and *t-2* divided by the average number of divisions over that period. The divestiture of a division does not constitute a turnover event for purposes of this calculation.	s_1	+

Table 3 Description of Variables in Equation 4 – Tests of H6 – H8			
Variable[9]	Description	Coeff	Predicted Direction
Ownership	This is a proxy for agency problems at the Corporate level between HQ and shareholders. It is computed as 1 minus the percent ownership held by Corporate level managers (CEO, CFO, and the Board)	a_1,	-
		a_2	?
FinConstraint	Fixed charge coverage ratio: $\frac{EBITDA + LTLeaseDue}{InterestExp + LTLeaseDue + LTDPmtsDue / (1 - TaxRate)}$	f_1	-
		f_2	?

[9] Similar to Table 2, to save space, I have not shown the interaction of each variable with the growth opportunity proxy $\left(\ln \frac{V_{t}}{V_{t-1}} \right)$ or the "dummy" variable for *Internal* in this table.

Table 4
Sample Industries at the Corporate Level

Number	NAICS	Industry Description
2	311	Food Manufacturing
2	312	Beverage and Tobacco Product Manufacturing
1	315	Apparel Manufacturing
3	322	Paper Manufacturing
1	323	Printing and Related Support Activities
1	324	Petroleum and Coal Products Manufacturing
12	325	Chemical Manufacturing
4	326	Plastics and Rubber Products Manufacturing
5	327	Nonmetallic Mineral Product Manufacturing
5	331	Primary Metal Manufacturing
15	332	Fabricated Metal Product Manufacturing
5	333	Machinery Manufacturing
9	334	Computer and Electronic Product Manufacturing
3	335	Electrical Equipment, Appliance, and Component Manufacturing
11	336	Transportation Equipment Manufacturing
1	337	Furniture and Related Product Manufacturing
3	339	Miscellaneous Manufacturing
1	999	Industrial Conglomerate

Table 5
Sample Industries at the Segment Level

NAICS	Number of Companies	Number of Segments	Description
212	1	2	Mining (except Oil and Gas)
233	2	2	Heavy and Civil Engineering Construction
311	2	3	Food Manufacturing
312	3	6	Beverage and Tobacco Product Manufacturing
315	2	4	Apparel Manufacturing
321	2	2	Wood Product Manufacturing
322	6	9	Paper Manufacturing
323	3	2	Printing and Related Support Activities
324	1	1	Petroleum and Coal Products Manufacturing
325	18	26	Chemical Manufacturing
326	11	13	Plastics and Rubber Products Manufacturing
327	10	14	Nonmetallic Mineral Product Manufacturing
331	7	7	Primary Metal Manufacturing
332	25	38	Fabricated Metal Product Manufacturing
333	27	37	Machinery Manufacturing
334	23	36	Computer and Electronic Product Manufacturing
335	10	12	Electrical Equipment, Appliance, and Component Manufacturing
336	22	37	Transportation Equipment Manufacturing
337	1	1	Furniture and Related Product Manufacturing
339	13	16	Miscellaneous Manufacturing
421	6	7	Merchant Wholesalers, Durable Goods
422	4	4	Merchant Wholesalers, Nondurable Goods
448	1	1	Clothing and Clothing Accessories Stores
511	1	3	Publishing Industries (except Internet)
512	1	1	Motion Picture and Sound Recording Industries
513	1	1	Telecommunications
522	2	2	Credit Intermediation and Related Activities
524	1	1	Insurance Carriers and Related Activities
533	1	1	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)
541	3	5	Professional, Scientific, and Technical Services
561	2	3	Administrative and Support Services
621	1	1	Ambulatory Health Care Services
622	1	1	Hospitals

Table 6
Comparison of Sample Balances Across the Test Period

	N	Mean	Median	Min	Max
Assets (in millions)					
1996	84	1,957.37	188.64	2.87	29,257.00
1999	84	2,425.07	269.03	2.96	30,012.00
2002	84	2,796.05	393.73	1.31	40,556.00
Sales (in millions)					
1996	84	1,941.18	249.29	0.69	26,875.00
1999	84	2,286.81	292.61	2.70	27,471.00
2002	84	2,532.68	375.56	1.01	36,298.00
Book Value of Equity (in millions)					
1996	84	623.58	102.33	(484.00)	10,836.00
1999	84	757.87	136.84	(881.00)	16,213.00
2002	84	818.38	153.06	(4,468.00)	22,697.00
Market Value (in millions)					
1996	84	2,602.95	196.58	5.85	66,291.08
1999	84	3,566.29	235.67	3.59	129,587.94
2002	84	4,022.60	223.98	1.14	159,427.12
Profit % of Sales (a)					
1996	84	4.12%	5.34%	-54.77%	33.86%
1999	84	2.69%	5.04%	-89.12%	31.61%
2002	84	1.05%	3.20%	-64.82%	21.70%
Return on Equity					
1996	84	15.02%	15.09%	-74.88%	164.53%
1999	84	12.72%	13.52%	-62.42%	233.71%
2002	84	-0.76%	9.40%	-1663.12%	577.72%
Tobin's *q* (b)					
1996	80	1.89	1.55	0.64	8.02
1999	80	1.69	1.30	0.78	6.90
2002	78	1.53	1.33	0.64	4.36
Financial Constraint (c)					
1996	55	4.73	3.72	(15.84)	27.35
1999	59	5.24	3.40	(4.10)	29.13
2002	66	4.66	2.43	(2.12)	40.46

(a) Profit is defined as Income before Extraordinary items

(b) Tobin's *q* is computed as:
[Mkt value of equity + total assets - (BV of common equity + deferred taxes)] / Total Assets

(c) Financial constraint is defined as the fixed coverage ratio calculated as:
(EBITDA + Lease Pmts) / (Interest Expense + Lease Payments + (Debt pmts / (1 - Tax rate))

Table 7
Comparison of Sample Growth Across the Test Period

	N	Mean	Median	Min	Max
Asset Growth (3 yr.)					
1994-1996	84	43.40%	24.43%	-56.27%	553.13%
1997-1999	84	37.31%	27.78%	-41.65%	189.88%
2000-2002	84	24.57%	10.71%	-68.93%	382.61%
Sales Growth (3 yr.)					
1994-1996	84	35.13%	27.02%	-40.05%	200.95%
1997-1999	84	35.38%	22.86%	-78.61%	587.86%
2000-2002	84	11.20%	4.55%	-76.47%	178.15%
Profit Growth (3 yr.)					
1994-1996	84	-26.93%	43.71%	-3612.50%	920.20%
1997-1999	84	-165.73%	6.61%	-6457.14%	1704.88%
2000-2002	84	-117.51%	-40.07%	-3608.86%	1368.42%

Table 8
Comparison of Sample Activity Across the Test Period

	N	Mean	Median	Min	Max
Capital Spending (in millions - 3 yr.)					
1994-1996	83	238.57	31.93	0.05	3,566.00
1997-1999	82	301.90	40.00	0.06	4,579.00
2000-2002	83	272.50	38.59	0.01	5,476.00
Capital Spending % of Avg. Assets					
1994-1996	83	18.36%	14.82%	1.84%	70.74%
1997-1999	82	19.40%	16.09%	2.16%	78.88%
2000-2002	83	12.28%	11.01%	0.52%	65.62%
Acquisitions (in millions - 3 yr.) (a)					
1994-1996	77	94.74	2.02	(100.00)	2,319.00
1997-1999	78	292.81	9.05	(0.63)	5,372.00
2000-2002	79	184.95	3.62	(7.08)	2,271.91
Acquisition % of Avg. Assets					
1994-1996	77	6.34%	1.70%	-0.80%	57.52%
1997-1999	78	11.02%	4.80%	-1.12%	62.34%
2000-2002	79	9.43%	2.21%	-6.11%	59.80%
R&D Expense (in millions - 3 yr.) (b)					
1994-1996	52	228.92	13.00	0.43	4,817.00
1997-1999	54	367.72	22.08	0.35	7,173.00
2000-2002	55	430.82	24.75	0.30	10,822.00
R&D % of Sales (b)					
1994-1996	52	3.14%	1.93%	0.17%	16.53%
1997-1999	54	3.29%	1.96%	0.10%	30.71%
2000-2002	55	3.33%	2.04%	0.11%	14.05%
Working Capital Change (in millions - 3 yr.) (c)					
1994-1996	83	41.07	6.86	(462.00)	930.60
1997-1999	83	39.14	6.76	(1,002.00)	1,907.00
2000-2002	84	(33.49)	(2.07)	(1,508.00)	752.00
Working Capital Change % of Avg. Assets					
1994-1996	83	5.84%	4.43%	-26.76%	38.98%
1997-1999	83	3.29%	2.71%	-18.68%	30.10%
2000-2002	84	-1.67%	-1.40%	-23.13%	27.64%

(a) Acquisitions are defined as Acquisitions (data129) from the Statement of Cash Flows

(b) R&D expense and R&D % of sales only computed for companies where R&D expense is < sales in each of the 3 years.

(c) Working capital change is computed from working capital changes recorded on the Statement of Cash Flows - accounts receivable (data302), inventory (data303) and accounts payable (data304). Positive numbers represent increases in working capital.

Table 9
Comparison of Sample to Compustat - 1996

	N	Mean	Median	Min	Max	t statistic significance *
Assets (in millions)						
Sample	84	1,957.37	188.64	2.87	29,257.00	
Compustat	9,511	1,880.50	94.56	0.00	626,966.00	0.8910
Corp. Industry	1,475	753.53	56.47	0.02	272,402.00	0.0388
Sales (in millions)						
Sample	84	1,941.18	249.29	0.69	26,875.00	
Compustat	9,466	855.52	64.21	(7.45)	160,121.00	0.0348
Corp. Industry	1,475	655.44	56.07	0.00	78,541.00	0.0170
Book Value of Equity (in millions)						
Sample	84	623.58	102.33	(484.00)	10,836.00	
Compustat	9,511	353.50	34.45	(3,053.47)	43,542.00	0.1177
Corp. Industry	1,475	266.37	30.35	(417.01)	31,125.00	0.0506
Market Value (in millions)						
Sample	84	2,602.95	196.58	5.85	66,291.08	
Compustat	8,593	897.51	90.40	0.00	162,604.09	0.0840
Corp. Industry	1,475	1,127.55	74.66	0.00	162,604.09	0.1399
Profit % of Sales (a)						
Sample	84	4.12%	5.34%	-54.77%	33.86%	
Compustat	9,235	-339.00%	3.43%	-868400.00%	12766.67%	0.0032
Corp. Industry	1,455	-253.97%	2.96%	-122892.59%	213.62%	0.0066
Return on Equity						
Sample	84	15.02%	15.09%	-74.88%	164.53%	
Compustat	9,448	-16.07%	8.52%	-76266.67%	28772.73%	0.0052
Corp. Industry	1,475	5.04%	8.19%	-3440.82%	28772.73%	0.6331
Tobin's *q* (b)						
Sample	80	1.89	1.55	0.64	8.02	
Compustat	7,112	4.49	1.55	0.08	8,947.40	0.0457
Corp. Industry	1,410	4.17	1.73	0.15	1,835.55	0.0834
Financial Constraint (c)						
Sample	55	4.73	3.72	(15.84)	27.35	
Compustat	5,890	2.01	1.64	(731.00)	753.17	0.0018
Corp. Industry	1,139	2.97	1.95	(111.00)	377.77	0.0647

* Test is two-tailed and adjusted for unequal variances where applicable

(a) Profit is defined as Income before Extraordinary items

(b) Tobin's *q* is computed as: [Mkt value of equity + total assets - (BV of common equity + deferred taxes)] / Total Assets

(c) Financial constraint is defined as the fixed coverage ratio calculated as:
(EBITDA + Lease Pmts) / (Interest Expense + Lease Payments + (Debt pmts / (1 - Tax rate))

Table 10
Comparison of Sample to Compustat - 1999

	N	Mean	Median	Min	Max	t statistic significance *
Assets (in millions)						
Sample	84	2,425.07	269.03	2.96	30,012.00	
Compustat	9,410	2,854.47	127.56	0.00	716,937.00	0.5291
Corp. Industry	1,590	966.13	57.92	0.00	405,200.00	0.0377
Sales (in millions)						
Sample	84	2,286.81	292.61	2.70	27,471.00	
Compustat	9,391	1,105.77	69.41	(16.15)	174,694.00	0.0652
Corp. Industry	1,590	761.68	51.20	0.00	110,832.00	0.0111
Book Value of Equity (in millions)						
Sample	84	757.87	136.84	(881.00)	16,213.00	
Compustat	9,401	488.38	41.05	(3,067.08)	78,927.00	0.3152
Corp. Industry	1,590	330.78	28.90	(1,014.90)	42,557.00	0.0774
Market Value (in millions)						
Sample	84	3,566.29	235.67	3.59	129,587.94	
Compustat	8,634	1,756.90	90.16	0.00	508,329.45	0.2796
Corp. Industry	1,590	2,300.14	74.45	0.00	508,329.45	0.4628
Profit % of Sales (a)						
Sample	84	2.69%	5.04%	-89.12%	31.61%	
Compustat	9,065	-443.97%	2.16%	-453000.00%	17263.92%	< .0001
Corp. Industry	1,555	-539.08%	1.39%	-336950.00%	4673.68%	0.0204
Return on Equity						
Sample	84	12.72%	13.52%	-62.42%	233.71%	
Compustat	9,337	16.28%	7.08%	-30300.00%	214988.24%	0.8852
Corp. Industry	1,590	-47.01%	5.58%	-30300.00%	12747.92%	0.0247
Tobin's *q* (b)						
Sample	80	1.69	1.30	0.78	6.90	
Compustat	6,992	8.48	1.50	0.08	3,847.10	< .0001
Corp. Industry	1,521	4.47	1.68	0.20	334.09	< .0001
Financial Constraint (c)						
Sample	59	5.24	3.40	(4.10)	29.13	
Compustat	5,787	(0.60)	1.16	(4,714.50)	509.42	< .0001
Corp. Industry	1,224	1.42	1.26	(371.69)	200.36	0.0002

* Test is two tailed and adjusted for unequal variances where applicable

(a) Profit is defined as Income before Extraordinary items

(b) Tobin's *q* is computed as: [Mkt value of equity + total assets - (BV of common equity + deferred taxes)] / Total Assets

(c) Financial constraint is defined as the fixed coverage ratio calculated as:
(EBITDA + Lease Pmts) / (Interest Expense + Lease Payments + (Debt pmts / (1 - Tax rate))

Table 11
Comparison of Sample to Compustat - 2002

	N	Mean	Median	Min	Max	t statistic significance *
Assets (in millions)						
Sample	84	2,796.05	393.73	1.31	40,556.00	
Compustat	8,027	3,886.81	162.86	0.00	1,097,190.00	0.1879
Corp. Industry	1,457	1,342.13	65.10	0.00	575,244.00	0.0864
Sales (in millions)						
Sample	84	2,532.68	375.56	1.01	36,298.00	
Compustat	7,999	1,306.91	81.43	(7.62)	245,308.00	0.1091
Corp. Industry	1,457	869.20	46.06	0.00	130,685.00	0.0179
Book Value of Equity (in millions)						
Sample	84	818.38	153.06	(4,468.00)	22,697.00	
Compustat	8,022	626.93	42.65	(22,295.00)	86,718.00	0.5375
Corp. Industry	1,455	452.74	34.73	(3,450.20)	63,706.00	0.2175
Market Value (in millions)						
Sample	84	4,022.60	223.98	1.14	159,427.12	
Compustat	7,584	1,336.41	71.03	0.00	293,137.30	0.1770
Corp. Industry	1,457	1,567.84	56.01	0.00	242,766.92	0.2209
Profit % of Sales (a)						
Sample	84	1.05%	3.20%	-64.82%	21.70%	
Compustat	7,591	-623.08%	1.70%	-517550.00%	55350.00%	<.0001
Corp. Industry	1,391	-544.83%	-3.09%	-142266.67%	55350.00%	0.0005
Return on Equity						
Sample	84	-0.76%	9.40%	-1663.12%	577.72%	
Compustat	7,978	-78.74%	7.04%	-903312.50%	385900.00%	0.5350
Corp. Industry	1,454	-56.30%	0.88%	-30450.00%	7154.90%	0.0871
Tobin's *q* (b)						
Sample	78	1.53	1.33	0.64	4.36	
Compustat	5,954	21.59	1.27	0.03	18,098.00	<.0001
Corp. Industry	1,394	9.41	1.36	0.20	4,338.73	0.0277
Financial Constraint (c)						
Sample	66	4.66	2.43	(2.12)	40.46	
Compustat	4,826	0.51	1.19	(796.60)	3,355.00	0.0003
Corp. Industry	1,149	(0.96)	0.86	(506.60)	160.97	<.0001

* Test is two tailed and adjusted for unequal variances where applicable

(a) Profit is defined as Income before Extraordinary items

(b) Tobin's *q* is computed as: [Mkt value of equity + total assets - (BV of common equity + deferred taxes)] / Total Assets

(c) Financial constraint is defined as the fixed coverage ratio calculated as:
(EBITDA + Lease Pmts) / (Interest Expense + Lease Payments + (Debt pmts / (1 - Tax rate))

Table 12
Comparison of Sample to Compustat - 3-year Growth 1994-1996

	N	Mean	Median	Min	Max	t statistic significance *
Asset Growth (3 yr.)						
Sample	84	43.40%	24.43%	-56.27%	553.13%	
Compustat	6,797	185.45%	34.09%	-100.00%	138871.43%	< .0001
Corp. Industry	1,475	120.27%	39.56%	-98.19%	5865.98%	< .0001
Sales Growth (3 yr.)						
Sample	84	35.13%	27.02%	-40.05%	200.95%	
Compustat	6,630	277.86%	37.18%	-2011.34%	296466.67%	< .0001
Corp. Industry	1,475	318.26%	41.66%	-100.00%	45734.88%	< .0001
Profit Growth (3 yr.)						
Sample	84	-26.93%	43.71%	-3612.50%	920.20%	
Compustat	6,753	2.19%	12.86%	-209772.73%	157700.00%	0.6994
Corp. Industry	1,475	156.36%	5.67%	-47633.33%	157700.00%	0.1895

* Test is two tailed and adjusted for unequal variances where applicable

Table 13
Comparison of Sample to Compustat - 3-year Growth 1997-1999

	N	Mean	Median	Min	Max	t statistic significance *
Asset Growth (3 yr.)						
Sample	84	37.31%	27.78%	-41.65%	189.88%	
Compustat	7,139	942.50%	38.48%	-100.00%	2074833.33%	0.0098
Corp. Industry	1,590	113.05%	27.99%	-100.00%	7871.40%	<.0001
Sales Growth (3 yr.)						
Sample	84	35.38%	22.86%	-78.61%	587.86%	
Compustat	6,935	1133.27%	35.94%	-167.77%	5506500.00%	0.1678
Corp. Industry	1,590	273.83%	29.05%	-100.00%	54888.00%	<.0001
Profit Growth (3 yr.)						
Sample	84	-165.73%	6.61%	-6457.14%	1704.88%	
Compustat	7,086	50.34%	5.73%	-111291.67%	258655.56%	0.1069
Corp. Industry	1,590	-174.05%	-11.40%	-81553.85%	89515.12%	0.9573

* Test is two tailed and adjusted for unequal variances where applicable

Table 14
Comparison of Sample to Compustat - 3-year Growth 2000-2002

	N	Mean	Median	Min	Max	t statistic significance *
Asset Growth (3 yr.)						
Sample	84	24.57%	10.71%	-68.93%	382.61%	
Compustat	6,808	627.83%	14.02%	-100.00%	2115372.86%	0.0729
Corp. Industry	1,457	91.54%	10.31%	-100.00%	15933.33%	<.0001
Sales Growth (3 yr.)						
Sample	84	11.20%	4.55%	-76.47%	178.15%	
Compustat	6,549	422.11%	15.02%	-1462.84%	663550.00%	0.0008
Corp. Industry	1,457	653.43%	7.27%	-100.00%	258163.64%	0.0130
Profit Growth (3 yr.)						
Sample	84	-117.51%	-40.07%	-3608.86%	1368.42%	
Compustat	6,760	135.50%	-12.91%	-442975.00%	1417700.00%	0.2899
Corp. Industry	1,457	-309.65%	-28.60%	-425088.00%	20342.30%	0.5217

* Test is two tailed and adjusted for unequal variances where applicable

Table 15
Comparison of Sample to Compustat - 3-year Activity 1994-1996

	N	Mean	Median	Min	Max	t statistic significance *
Capital Spending (in millions - 3 yr.)						
Sample	83	238.57	31.93	0.05	3,566.00	
Compustat	6,592	237.97	10.18	(34.14)	64,841.90	0.9926
Corp. Industry	1,475	113.06	7.01	0.00	21,699.00	0.0539
Capital Spending % of Avg. Assets						
Sample	83	18.36%	14.82%	1.84%	70.74%	
Compustat	5,944	21.06%	14.73%	-104.46%	734.83%	0.0685
Corp. Industry	1,475	18.37%	14.34%	0.00%	205.38%	0.9952
Acquisitions (in millions - 3 yr.) (a)						
Sample	77	94.74	2.02	(100.00)	2,319.00	
Compustat	6,135	60.18	0.00	(77.76)	13,763.00	0.3305
Corp. Industry	1,346	60.53	0.00	(35.50)	13,763.00	0.3657
Acquisition % of Avg. Assets						
Sample	77	6.34%	1.70%	-0.80%	57.52%	
Compustat	5,549	6.79%	0.00%	-144.69%	395.80%	0.7213
Corp. Industry	1,346	6.96%	0.00%	-18.26%	280.91%	0.6411
R&D Expense (in millions - 3 yr.) (b)						
Sample	52	228.92	13.00	0.43	4,817.00	
Compustat	2,932	116.08	4.02	0.00	24,323.70	0.3837
Corp. Industry	968	134.08	9.93	0.00	7,047.00	0.3924
R&D % of Sales (b)						
Sample	52	3.14%	1.93%	0.17%	16.53%	
Compustat	2,932	6.48%	2.44%	0.00%	84.38%	<.0001
Corp. Industry	968	8.57%	5.44%	0.00%	80.47%	<.0001
Working Capital Change (in millions - 3 yr.) (c)						
Sample	83	41.07	6.86	(462.00)	930.60	
Compustat	6,587	44.27	1.86	(2,917.32)	33,794.00	0.8722
Corp. Industry	1,445	30.19	2.49	(1,659.00)	4,371.00	0.5641
Working Capital Change % of Avg. Assets						
Sample	83	5.84%	4.43%	-26.76%	38.98%	
Compustat	5,946	5.68%	2.59%	-1200.00%	2294.12%	0.9007
Corp. Industry	1,445	9.14%	6.17%	-202.60%	1766.67%	0.0621

* Test is two tailed and adjusted for unequal variances where applicable

(a) Acquisitions are defined as Acquisitions (data129) from the Statement of Cash Flows

(b) R&D expense and R&D % of sales only computed for companies where R&D expense is < sales in each of the 3 years.

(c) Working capital change is computed from working capital changes recorded on the Statement of Cash Flows - accounts receivable (data302), inventory (data303) and accounts payable (data304). Positive numbers represent increases in working capital.

Table 16
Comparison of Sample to Compustat - 3-year Activity 1997-1999

	N	Mean	Median	Min	Max	t statistic significance *
Capital Spending (in millions - 3 yr.)						
Sample	82	301.90	40.00	0.06	4,579.00	
Compustat	6,677	297.49	11.85	(8.35)	95,085.00	0.9578
Corp. Industry	1,590	132.66	7.28	0.00	32,872.00	0.0432
Capital Spending % of Avg. Assets						
Sample	82	19.40%	16.09%	2.16%	78.88%	
Compustat	6,358	20.72%	13.98%	-83.52%	545.05%	0.4178
Corp. Industry	1,590	17.06%	13.55%	0.00%	155.07%	0.1543
Acquisitions (in millions - 3 yr.) (a)						
Sample	78	292.81	9.05	(0.63)	5,372.00	
Compustat	6,142	117.66	0.00	(4,043.10)	35,509.00	0.0827
Corp. Industry	1,458	86.59	0.00	(21.24)	35,509.00	0.0692
Acquisition % of Avg. Assets						
Sample	78	11.02%	4.80%	-1.12%	62.34%	
Compustat	5,857	10.69%	0.00%	-112.38%	539.06%	0.8337
Corp. Industry	1,458	9.84%	0.00%	-35.03%	177.06%	0.4751
R&D Expense (in millions - 3 yr.) (b)						
Sample	54	367.72	22.08	0.35	7,173.00	
Compustat	3,096	140.12	5.39	0.00	22,900.00	0.1001
Corp. Industry	1,014	176.04	13.60	0.00	8,873.00	0.2363
R&D % of Sales (b)						
Sample	54	3.29%	1.96%	0.10%	30.71%	
Compustat	3,096	8.05%	3.00%	0.00%	90.94%	<.0001
Corp. Industry	1,014	10.37%	6.44%	0.00%	82.22%	<.0001
Working Capital Change (in millions - 3 yr.) (c)						
Sample	83	39.14	6.76	(1,002.00)	1,907.00	
Compustat	6,681	38.72	1.35	(70,933.00)	40,671.73	0.9902
Corp. Industry	1,554	23.01	1.44	(3,668.00)	6,511.00	0.5731
Working Capital Change % of Avg. Assets						
Sample	83	3.85%	2.71%	-18.68%	30.10%	
Compustat	6,357	4.06%	1.91%	-616.32%	2933.33%	0.8458
Corp. Industry	1,554	2.84%	3.43%	-549.64%	146.86%	0.3900

* Test is two tailed and adjusted for unequal variances where applicable

(a) Acquisitions are defined as Acquisitions (data129) from the Statement of Cash Flows

(b) R&D expense and R&D % of sales only computed for companies where R&D expense is < sales in each of the 3 years.

(c) Working capital change is computed from working capital changes recorded on the Statement of Cash Flows - accounts receivable (data302), inventory (data303) and accounts payable (data304). Positive numbers represent increases in working capital.

Table 17
Comparison of Sample to Compustat - 3-year Activity 2000-2002

	N	Mean	Median	Min	Max	t statistic significance *
Capital Spending (in millions - 3 yr.)						
Sample	83	272.50	38.59	0.01	5,476.00	
Compustat	6,293	348.67	12.45	(0.35)	82,343.00	0.3750
Corp. Industry	1,457	164.65	7.68	(0.00)	42,838.00	0.2203
Capital Spending % of Avg. Assets						
Sample	83	12.28%	11.01%	0.52%	65.62%	
Compustat	5,919	18.60%	11.42%	-0.01%	3377.78%	<.0001
Corp. Industry	1,457	15.14%	10.74%	0.00%	125.20%	0.0063
Acquisitions (in millions - 3 yr.) (a)						
Sample	79	184.95	3.62	(7.08)	2,271.91	
Compustat	5,923	134.85	0.00	(5,912.00)	104,417.00	0.3612
Corp. Industry	1,349	83.36	0.00	(3,663.00)	36,331.00	0.0835
Acquisition % of Avg. Assets						
Sample	79	9.43%	2.21%	-6.11%	59.80%	
Compustat	5,612	6.40%	0.00%	-877.19%	995.00%	0.0713
Corp. Industry	1,349	5.42%	0.00%	-106.72%	109.53%	0.0196
R&D Expense (in millions - 3 yr.) (b)						
Sample	55	430.82	24.75	0.30	10,822.00	
Compustat	2,838	181.13	8.59	0.00	21,900.00	0.2422
Corp. Industry	932	258.55	19.48	0.00	14,458.00	0.4226
R&D % of Sales (b)						
Sample	55	3.33%	2.04%	0.11%	14.05%	
Compustat	2,838	9.59%	3.63%	0.00%	90.03%	<.0001
Corp. Industry	932	12.46%	7.13%	0.00%	88.22%	<.0001
Working Capital Change (in millions - 3 yr.) (c)						
Sample	84	(33.49)	(2.07)	(1,508.00)	752.00	
Compustat	6,271	55.22	0.00	(12,045.61)	88,379.85	0.0161
Corp. Industry	1,433	(2.91)	0.01	(5,955.00)	1,450.00	0.3315
Working Capital Change % of Avg. Assets						
Sample	84	-1.67%	-1.40%	-23.13%	27.64%	
Compustat	5,925	-15.34%	0.00%	-31145.45%	9227.27%	0.0363
Corp. Industry	1,433	-3.04%	0.04%	-666.93%	231.63%	0.3396

* Test is two tailed and adjusted for unequal variances where applicable

(a) Acquisitions are defined as Acquisitions (data129) from the Statement of Cash Flows

(b) R&D expense and R&D % of sales only computed for companies where R&D expense is < sales in each of the 3 years.

(c) Working capital change is computed from working capital changes recorded on the Statement of Cash Flows - accounts receivable (data302), inventory (data303) and accounts payable (data304). Positive numbers represent increases in working capital.

Table 18
Comparison of Sample to Compustat Segment Database (Multi-segment firms only) by NAICS 4-digit Industry - Number of Observations

		1996 Observations		1999 Observations		2002 Observations	
Industry	Description	Sample	Industry	Sample	Industry	Sample	Industry
2122	Metal Ore Mining	1	14	1	10	1	6
2331	Land Subdivision and Land Development	1	34	1	55	1	45
3116	Animal Slaughtering and Processing	1	8	1	19	1	18
3118	Bakeries and Tortilla Mfg.	1	7	1	17	1	17
3119	Other Food Mfg.	1	12	1	33	1	18
3121	Beverage Mfg.	3	8	3	15	3	13
3122	Tobacco Mfg.	3	7	1	3	1	7
3152	Cut and Sew Apparel Mfg.	3	10	3	46	3	44
3210	Wood Product Mfg.	1	22				
3211	Sawmills and Wood Preservation	1	5	2	8	2	9
3221	Pulp, Paper, and Paperboard Mills	2	34	2	41	3	33
3222	Converted Paper Product Mfg.	3	23	4	47	2	30
3231	Printing and Related Support Activities	3	21	3	49	3	45
3241	Petroleum and Coal Products Mfg.	1	38	1	30	1	24
3251	Basic Chemical Mfg.	7	56	6	66	5	74
3252	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Mfg.	2	26	3	48	2	43
3253	Pesticide, Fertilizer, and Other Agricultural Chemical Mfg.			1	24	1	22
3254	Pharmaceutical and Medicine Mfg.	5	48	5	156	5	121
3255	Paint, Coating, and Adhesive Mfg.	4	11	4	14	4	14
3256	Soap, Cleaning Compound, and Toilet Preparation Mfg.	4	28	3	46	3	25
3259	Other Chemical Product and Preparation Mfg.					1	39
3261	Plastics Product Mfg.	10	57	7	82	8	56
3262	Rubber Product Mfg.	2	13	2	17	2	12
3271	Clay Product and Refractory Mfg.	2	11	2	17	2	14
3272	Glass and Glass Product Mfg.	3	9	2	11	3	9
3273	Cement and Concrete Product Mfg.	8	10	8	12	8	8
3274	Lime and Gypsum Product Mfg.	1	4	1	2	1	1
3279	Other Nonmetallic Mineral Product Mfg.	1	12			1	11
3311	Iron and Steel Mills and Ferroalloy Mfg.	2	20	2	29	2	18

Table 18
Comparison of Sample to Compustat Segment Database (Multi-segment firms only) by NAICS 4-digit Industry - Number of Observations

		1996 Observations		1999 Observations		2002 Observations	
Industry	Description	Sample	Industry	Sample	Industry	Sample	Industry
3312	Steel Product Mfg. from Purchased Steel	2	14	2	16	2	17
3315	Foundries	3	7	3	15	3	7
3321	Forging and Stamping	1	14	1	16	1	8
3322	Cutlery and Handtool Mfg.	5	5	5	10	5	6
3323	Architectural and Structural Metals Mfg.	2	17	1	39	1	33
3324	Boiler, Tank, and Shipping Container Mfg.	3	12	3	19	5	8
3326	Spring and Wire Product Mfg.	2	3	2	2	2	1
3327	Machine Shops; Turned Product; and Screw, Nut, and Bolt Mfg.	1	9	2	9	3	6
3328	Coating, Engraving, Heat Treating, and Allied Activities	3	9	2	12	4	8
3329	Other Fabricated Metal Product Mfg.	8	25	8	40	9	37
3331	Agriculture, Construction, and Mining Machinery Mfg.	3	38	2	59	1	55
3332	Industrial Machinery Mfg.	1	26	1	58	1	52
3333	Commercial and Service Industry Machinery Mfg.	6	37	5	65	5	40
3334	HVAC and Commercial Refrigeration Equip. Mfg.	9	25	11	36	12	36
3335	Metalworking Machinery Mfg.	1	20				
3336	Engine, Turbine, and Power Transmission Equip. Mfg.	1	13	2	16	1	17
3339	Other General Purpose Machinery Mfg.	5	66	4	64	6	67
3341	Computer and Peripheral Equip. Mfg.	2	42	2	119	2	114
3342	Communications Equip. Mfg.	2	46	2	147	2	141
3343	Audio and Video Equip. Mfg.			1	15	1	14
3344	Semiconductor and Other Electronic Component Mfg.	9	53	8	183	10	172
3345	Navigational, Measuring, Electromedical, and Control Instruments Mfg.	17	96	15	210	16	192
3352	Household Appliance Mfg.	1	11	1	11	1	8
3353	Electrical Equip. Mfg.	5	19	5	41	5	33
3359	Other Electrical Equip. and Component Mfg.	4	29	3	65	3	57
3362	Motor Vehicle Body and Trailer Mfg.	2	18	2	26	2	19
3363	Motor Vehicle Parts Mfg.	11	51	9	95	9	77
3364	Aerospace Product and Parts Mfg.	12	25	13	49	14	48
3366	Ship and Boat Building	1	5	1	13	1	8

Table 18
Comparison of Sample to Compustat Segment Database (Multi-segment firms only) by NAICS 4-digit Industry - Number of Observations

		1996 Observations		1999 Observations		2002 Observations	
Industry	Description	Sample	Industry	Sample	Industry	Sample	Industry
3372	Office Furniture (including Fixtures) Mfg.	1	7	1	8	1	8
3391	Medical Equip. and Supplies Mfg.	6	42	6	104	5	87
3399	Other Miscellaneous Mfg.	6	37	7	81	6	54
4211	Motor Vehicle and Motor Vehicle Parts and Supplies Wholesalers	1	7	1	10	1	15
4213	Lumber and Other Construction Materials Merchant Wholesalers	1	3				
4215	Metal and Mineral (except Petroleum) Merchant Wholesalers	1	9	1	12	1	12
4217	Hardware, and Plumbing and Heating Equip. and Supplies Merchant Wholesalers	1	7	1	15	1	12
4218	Machinery, Equip., and Supplies Merchant Wholesalers	2	24	2	40	1	31
4221	Paper and Paper Product Merchant Wholesalers	1	7	1	12	1	6
4224	Grocery and Related Product Wholesalers	1	17				
4226	Chemical and Allied Products Merchant Wholesalers	1	5	1	10	1	9
5111	Newspaper, Periodical, Book, and Directory Publishers	1	66	1	81	1	60
5221	Depository Credit Intermediation	1	11	1	5	1	9
5222	Nondepository Credit Intermediation	1	107	1	200	1	132
5331	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)	1	42				
5413	Architectural, Engineering, and Related Services	1	39	1	51	1	48
5415	Computer Systems Design and Related Services	1	53			1	210
5416	Management, Scientific, and Technical Consulting Services	1	30	1	80	1	62
5612	Facilities Support Services	1	6				
5613	Employment Services	1	23				
5619	Other Support Services	1	6	1	23	1	29
6222	Psychiatric and Substance Abuse Hospitals	1	8				

Table 19
Comparison of Sample to Compustat Segment Database (Multi-segment firms only) by NAICS 4-digit Industry - Assets (Mean)

		1996		1999		2002	
Industry	Description	Sample	Industry	Sample	Industry	Sample	Industry
2122	Metal Ore Mining	10.19	563.98	0.50	432.65	0.35	588.32
2331	Land Subdivision and Land Development	29.00	134.12	18.35	339.64	3.13	236.03
3116	Animal Slaughtering and Processing	4.92	1,039.85	17.12	788.76	17.71	845.95
3118	Bakeries and Tortilla Mfg.	5.19	217.91	4.29	573.66	3.84	541.92
3119	Other Food Mfg.	102.61	1,870.23	133.10	237.30	182.82	296.52
3121	Beverage Mfg.	1,107.24	1,756.48	898.88	198.73	989.04	38.94
3122	Tobacco Mfg.	998.47	4,740.81	529.52	2,208.70	1,883.53	508.74
3152	Cut and Sew Apparel Mfg.	121.70	65.67	126.09	328.27	101.79	372.27
3210	Wood Product Mfg.	346.40	886.57				
3211	Sawmills and Wood Preservation	123.15	1,533.07	604.79	1,257.83	612.83	794.98
3221	Pulp, Paper, and Paperboard Mills	1,465.42	2,528.98	976.29	1,806.85	1,028.86	2,143.27
3222	Converted Paper Product Mfg.	377.77	762.00	381.08	432.58	1,064.10	1,166.47
3231	Printing and Related Support Activities	552.89	111.12	370.89	226.38	284.47	149.15
3241	Petroleum and Coal Products Mfg.	173.75	5,817.33	209.74	1,508.59	314.67	1,856.74
3251	Basic Chemical Mfg.	262.71	1,290.03	286.83	1,113.20	313.20	857.57
3252	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Mfg.	57.12	1,803.79	520.27	982.05	67.45	1,165.72
3253	Pesticide, Fertilizer, and Other Agricultural Chemical Mfg.			10.90	1,854.76	0.45	1,336.01
3254	Pharmaceutical and Medicine Mfg.	1,228.23	1,280.83	1,533.46	474.09	2,258.96	745.63
3255	Paint, Coating, and Adhesive Mfg.	582.47	940.11	1,271.71	178.72	1,316.52	537.91
3256	Soap, Cleaning Compound, and Toilet Preparation Mfg.	1,659.79	854.27	1,906.47	225.69	1,905.16	840.62
3259	Other Chemical Product and Preparation Mfg.					16.35	561.05
3261	Plastics Product Mfg.	129.97	399.57	168.50	435.53	157.43	851.22
3262	Rubber Product Mfg.	88.01	729.50	97.89	210.19	84.66	300.07
3271	Clay Product and Refractory Mfg.	622.50	197.07	1,063.00	203.30	1,144.00	861.61
3272	Glass and Glass Product Mfg.	1,155.74	708.46	1,029.68	889.00	1,006.27	943.89
3273	Cement and Concrete Product Mfg.	82.37	293.63	149.69	386.29	145.24	516.01
3274	Lime and Gypsum Product Mfg.	125.49	328.39	30.02	97.80	322.58	310.40
3279	Other Nonmetallic Mineral Product Mfg.	1,487.00	306.07			1,648.00	135.06
3311	Iron and Steel Mills and Ferroalloy Mfg.	529.32	623.41	1,014.14	739.00	984.10	913.67

Table 19
Comparison of Sample to Compustat Segment Database (Multi-segment firms only) by NAICS 4-digit Industry - Assets (Mean)

		1996		1999		2002	
Industry	Description	Sample	Industry	Sample	Industry	Sample	Industry
3312	Steel Product Mfg. from Purchased Steel	29.76	135.16	31.51	216.01	22.44	180.09
3315	Foundries	44.58	186.20	56.18	397.78	63.75	397.86
3321	Forging and Stamping	14.31	111.83	19.26	166.67	15.65	107.81
3322	Cutlery and Handtool Mfg.	737.95	394.43	956.46	470.93	847.05	1,230.98
3323	Architectural and Structural Metals Mfg.	9.50	111.06	32.90	113.20	255.33	130.84
3324	Boiler, Tank, and Shipping Container Mfg.	420.40	1,048.02	35.99	215.98	30.41	353.13
3326	Spring and Wire Product Mfg.	93.78	14.99	135.31	18.99	145.42	10.11
3327	Machine Shops; Turned Product; and Screw, Nut, and Bolt Mfg.	111.00	106.81	2,658.41	242.09	552.33	259.63
3328	Coating, Engraving, Heat Treating, and Allied Activities	60.83	63.92	94.90	66.19	46.68	87.03
3329	Other Fabricated Metal Product Mfg.	760.74	172.82	739.08	184.92	930.64	269.67
3331	Agriculture, Construction, and Mining Machinery Mfg.	67.53	573.80	137.59	324.20	87.40	466.13
3332	Industrial Machinery Mfg.	18.23	192.47	19.69	148.56	15.91	151.17
3333	Commercial and Service Industry Machinery Mfg.	70.25	168.32	50.75	227.11	28.90	232.58
3334	HVAC and Commercial Refrigeration Equip. Mfg.	659.07	149.16	838.36	156.97	941.93	244.61
3335	Metalworking Machinery Mfg.	1,811.00	193.31				
3336	Engine, Turbine, and Power Transmission Equip. Mfg.	296.70	1,091.63	173.07	807.32	273.30	1,167.77
3339	Other General Purpose Machinery Mfg.	569.35	357.39	1,040.04	300.20	976.50	337.88
3341	Computer and Peripheral Equip. Mfg.	4.82	48.71	10.45	1,156.71	13.31	617.32
3342	Communications Equip. Mfg.	3.85	474.35	8.73	586.41	16.34	345.09
3343	Audio and Video Equip. Mfg.			2.21	158.48	1.62	137.33
3344	Semiconductor and Other Electronic Component Mfg.	23.37	405.29	48.20	364.90	72.01	415.43
3345	Navigational, Measuring, Electromedical, and Control Instruments Mfg.	828.54	453.28	309.96	327.98	632.18	532.00
3352	Household Appliance Mfg.	1,533.80	1,116.39	1,602.00	465.15	1,065.00	1,151.47
3353	Electrical Equip. Mfg.	50.49	639.22	74.37	334.97	95.54	434.55
3359	Other Electrical Equip. and Component Mfg.	956.60	214.29	1,144.70	222.01	953.08	196.41
3362	Motor Vehicle Body and Trailer Mfg.	87.94	73.25	80.27	272.63	179.15	153.64
3363	Motor Vehicle Parts Mfg.	610.27	606.15	1,074.07	773.08	1,415.63	854.03
3364	Aerospace Product and Parts Mfg.	1,541.04	1,967.15	3,196.77	889.39	2,682.53	1,221.48
3366	Ship and Boat Building	10.65	483.42	10.16	255.49	93.98	1,228.38

Table 19
Comparison of Sample to Compustat Segment Database (Multi-segment firms only) by NAICS 4-digit Industry - Assets (Mean)

		1996		1999		2002	
Industry	Description	Sample	Industry	Sample	Industry	Sample	Industry
3372	Office Furniture (including Fixtures) Mfg.	330.58	84.18	678.50	183.98	494.56	209.75
3391	Medical Equip. and Supplies Mfg.	1,275.27	244.72	2,147.08	287.04	3,121.65	363.80
3399	Other Miscellaneous Mfg.	524.26	183.46	418.70	144.46	330.61	185.61
4211	Motor Vehicle and Motor Vehicle Parts and Supplies Wholesalers	49.61	309.11	61.73	305.01	50.93	343.63
4213	Lumber and Other Construction Materials Merchant Wholesalers	199.62	174.69				
4215	Metal and Mineral (except Petroleum) Merchant Wholesalers	19.47	148.76	18.18	138.10	21.85	142.18
4217	Hardware, and Plumbing and Heating Equip. and Supplies Merchant Wholesalers	73.00	70.04	94.80	148.16	168.50	161.93
4218	Machinery, Equip., and Supplies Merchant Wholesalers	28.41	412.99	4.83	205.35	1.28	187.98
4221	Paper and Paper Product Merchant Wholesalers	7.56	445.37	15.17	727.53	10.41	1,144.02
4224	Grocery and Related Product Wholesalers	2.61	1,186.82				
4226	Chemical and Allied Products Merchant Wholesalers	1.17	400.70	0.54	240.05	0.67	192.12
5111	Newspaper, Periodical, Book, and Directory Publishers	76.18	728.30	130.76	665.52	42.97	928.16
5221	Depository Credit Intermediation	9,335.10	1,092.55	13,321.00	2,054.13	18,016.00	1,596.94
5222	Nondepository Credit Intermediation	11,409.00	11,050.59	5,990.00	8,959.22	6,654.00	11,842.43
5331	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)	4.21	104.84				
5413	Architectural, Engineering, and Related Services	5.51	149.15	1,484.00	84.04	1,634.00	52.77
5415	Computer Systems Design and Related Services	6,111.00	83.66			10.83	432.21
5416	Management, Scientific, and Technical Consulting Services	1.54	77.03	3.38	57.13	2.55	125.45
5612	Facilities Support Services	3,824.00	125.74				
5613	Employment Services	0.04	57.99				
5619	Other Support Services	0.31	261.37	0.24	143.74	0.21	254.57
6222	Psychiatric and Substance Abuse Hospitals	49.05	123.85				

Table 20
Comparison of Sample to Compustat Segment Database (Multi-segment firms only) by NAICS 4-digit Industry - Sales (Mean)

		1996		1999		2002	
Industry	Description	Sample	Industry	Sample	Industry	Sample	Industry
2122	Metal Ore Mining	0.00	265.99	0.01	191.01	0.00	271.59
2331	Land Subdivision and Land Development	5.22	37.66	6.22	53.73	7.05	56.40
3116	Animal Slaughtering and Processing	19.68	3,264.89	13.26	2,272.74	32.31	2,184.84
3118	Bakeries and Tortilla Mfg.	9.22	305.59	7.37	573.43	5.67	544.30
3119	Other Food Mfg.	329.42	2,519.13	441.47	481.93	579.94	532.09
3121	Beverage Mfg.	687.59	2,302.76	861.69	183.10	907.31	54.73
3122	Tobacco Mfg.	929.96	6,708.73	1,309.57	1,387.94	1,447.09	649.20
3152	Cut and Sew Apparel Mfg.	215.54	99.74	251.69	432.07	194.28	486.79
3210	Wood Product Mfg.	562.60	1,450.77				
3211	Sawmills and Wood Preservation	231.71	1,127.45	508.35	549.36	505.20	453.26
3221	Pulp, Paper, and Paperboard Mills	1,149.04	2,162.39	1,018.12	1,511.33	989.96	1,507.79
3222	Converted Paper Product Mfg.	558.02	1,199.15	489.55	878.77	1,184.50	1,306.41
3231	Printing and Related Support Activities	438.18	193.41	514.90	335.05	431.80	271.54
3241	Petroleum and Coal Products Mfg.	178.38	10,691.80	278.92	3,160.46	459.67	3,482.11
3251	Basic Chemical Mfg.	369.91	1,207.63	368.56	865.87	458.45	717.45
3252	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Mfg.	91.66	1,900.87	489.55	1,085.96	94.93	1,116.70
3253	Pesticide, Fertilizer, and Other Agricultural Chemical Mfg.			1.70	1,014.35	0.04	806.23
3254	Pharmaceutical and Medicine Mfg.	1,466.62	1,363.39	2,173.10	738.16	3,467.34	1,229.07
3255	Paint, Coating, and Adhesive Mfg.	956.63	1,186.21	1,272.43	182.03	1,413.18	691.48
3256	Soap, Cleaning Compound, and Toilet Preparation Mfg.	2,185.66	1,184.89	2,709.83	747.83	2,554.62	1,270.99
3259	Other Chemical Product and Preparation Mfg.					22.92	762.80
3261	Plastics Product Mfg.	188.53	388.58	189.11	404.22	153.28	727.79
3262	Rubber Product Mfg.	151.84	1,254.15	171.79	280.80	167.02	435.91
3271	Clay Product and Refractory Mfg.	973.00	222.39	1,173.00	186.34	1,287.50	537.17
3272	Glass and Glass Product Mfg.	1,382.31	663.95	1,309.31	613.64	1,228.20	655.23
3273	Cement and Concrete Product Mfg.	113.33	309.45	183.90	428.14	177.85	512.67
3274	Lime and Gypsum Product Mfg.	72.18	543.96	55.49	113.03	212.79	232.70
3279	Other Nonmetallic Mineral Product Mfg.	2,687.00	362.62			3,573.00	112.15
3311	Iron and Steel Mills and Ferroalloy Mfg.	706.70	755.96	680.90	787.58	735.88	855.32

Table 20
Comparison of Sample to Compustat Segment Database (Multi-segment firms only) by NAICS 4-digit Industry - Sales (Mean)

		1996		1999		2002	
Industry	Description	Sample	Industry	Sample	Industry	Sample	Industry
3312	Steel Product Mfg. from Purchased Steel	76.00	206.72	71.95	252.52	51.89	243.37
3315	Foundries	66.25	220.56	71.31	390.75	81.63	496.88
3321	Forging and Stamping	27.12	153.54	34.35	201.94	33.16	127.13
3322	Cutlery and Handtool Mfg.	857.21	566.25	978.45	518.47	1,003.34	1,093.08
3323	Architectural and Structural Metals Mfg.	30.37	244.82	99.92	220.24	325.14	202.02
3324	Boiler, Tank, and Shipping Container Mfg.	653.55	918.26	1,111.38	289.59	705.86	461.10
3326	Spring and Wire Product Mfg.	147.67	29.95	150.67	43.16	168.65	33.51
3327	Machine Shops; Turned Product; and Screw, Nut, and Bolt Mfg.	130.72	106.94	2,309.47	211.95	589.74	225.30
3328	Coating, Engraving, Heat Treating, and Allied Activities	72.91	95.93	129.12	93.82	57.97	108.67
3329	Other Fabricated Metal Product Mfg.	853.90	228.65	1,086.97	248.09	1,146.68	331.69
3331	Agriculture, Construction, and Mining Machinery Mfg.	143.70	835.91	264.63	391.00	131.70	546.39
3332	Industrial Machinery Mfg.	44.39	250.23	30.47	157.25	28.67	135.60
3333	Commercial and Service Industry Machinery Mfg.	131.51	182.89	77.85	245.85	38.32	195.41
3334	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equip. Mfg.	1,229.45	278.55	1,249.83	247.15	1,329.93	329.25
3335	Metalworking Machinery Mfg.	2,196.00	218.47				
3336	Engine, Turbine, and Power Transmission Equip. Mfg.	564.10	1,381.98	386.56	1,068.09	432.30	1,641.12
3339	Other General Purpose Machinery Mfg.	1,158.33	368.48	1,460.63	303.60	1,480.26	343.68
3341	Computer and Peripheral Equip. Mfg.	4.01	63.20	12.84	1,490.78	19.84	1,043.11
3342	Communications Equip. Mfg.	18.50	664.08	20.78	601.73	26.16	336.67
3343	Audio and Video Equip. Mfg.			1.74	219.50	1.51	173.90
3344	Semiconductor and Other Electronic Component Mfg.	27.55	474.41	63.76	317.65	59.45	492.78
3345	Navigational, Measuring, Electromedical, and Control Instruments Mfg.	679.22	489.84	491.32	378.32	646.12	434.64
3352	Household Appliance Mfg.	1,773.40	1,893.50	1,583.00	851.23	1,056.00	1,948.89
3353	Electrical Equip. Mfg.	86.51	787.16	108.54	445.12	114.16	527.45
3359	Other Electrical Equip. and Component Mfg.	788.04	293.20	991.59	264.17	716.10	270.52
3362	Motor Vehicle Body and Trailer Mfg.	301.04	217.81	402.90	419.87	622.65	266.44
3363	Motor Vehicle Parts Mfg.	1,067.57	1,012.30	1,900.76	1,274.41	2,300.04	1,437.06
3364	Aerospace Product and Parts Mfg.	2,332.87	2,520.72	3,315.28	1,893.73	3,271.77	1,629.34
3366	Ship and Boat Building	47.58	1,204.45	55.20	631.69	219.46	1,294.78

Table 20
Comparison of Sample to Compustat Segment Database (Multi-segment firms only) by NAICS 4-digit Industry - Sales (Mean)

		1996		1999		2002	
Industry	Description	Sample	Industry	Sample	Industry	Sample	Industry
3372	Office Furniture (including Fixtures) Mfg.	887.30	192.15	1,504.42	239.40	1,279.06	272.71
3391	Medical Equip. and Supplies Mfg.	1,376.41	314.41	1,709.89	240.37	2,599.61	348.22
3399	Other Miscellaneous Mfg.	397.08	159.90	444.87	145.69	420.45	218.20
4211	Motor Vehicle and Motor Vehicle Parts and Supplies Wholesalers	136.53	507.92	161.83	489.63	154.03	417.00
4213	Lumber and Other Construction Materials Merchant Wholesalers	734.59	263.01				
4215	Metal and Mineral (except Petroleum) Merchant Wholesalers	52.94	421.74	42.43	276.15	45.67	274.55
4217	Hardware, and Plumbing and Heating Equip. and Supplies Merchant Wholesalers	213.40	139.16	230.40	331.25	286.70	506.68
4218	Machinery, Equip., and Supplies Merchant Wholesalers	25.86	358.47	4.51	315.46	0.00	285.77
4221	Paper and Paper Product Merchant Wholesalers	17.12	1,401.02	31.95	1,347.52	27.69	2,176.98
4224	Grocery and Related Product Wholesalers	17.48	2,671.31				
4226	Chemical and Allied Products Merchant Wholesalers	2.03	1,026.70	1.82	426.01	1.15	391.95
5111	Newspaper, Periodical, Book, and Directory Publishers	152.99	684.11	235.47	650.64	110.15	588.62
5221	Depository Credit Intermediation	815.40	160.47	1,116.00	97.40	1,144.00	95.67
5222	Nondepository Credit Intermediation	2,095.00	1,460.94	463.00	1,034.47	630.00	1,128.23
5331	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)	0.80	68.83				
5413	Architectural, Engineering, and Related Services	11.64	246.10	2,261.00	139.62	3,104.00	109.44
5415	Computer Systems Design and Related Services	5,863.00	109.36			4.03	607.39
5416	Management, Scientific, and Technical Consulting Services	0.00	137.79	0.00	133.13	1.23	211.06
5612	Facilities Support Services	807.00	207.00				
5613	Employment Services	0.00	233.97				
5619	Other Support Services	1.06	177.55	1.12	177.51	1.13	256.82
6222	Psychiatric and Substance Abuse Hospitals	43.01	193.90				

Table 21
Measures of Segment Profit

	Sample	Compustat	Industry
Operating Profit	87.56%	70.94%	73.72%
Operating Income after Depr.	2.36%	1.99%	2.48%
Operating Income before Depr.	0.18%	2.47%	2.26%
Pretax Income	7.72%	12.02%	10.45%
Income before Extraordinary Items	0.54%	3.12%	2.67%
Net Income	0.00%	1.40%	1.21%
None reported	1.63%	8.06%	7.21%

Table 22
Comparison of Sample Segments to Compustat Segments - 1996

	N	Mean	Median	Min	Max	t statistic significance *
Number of Segments per Firm						
Sample Segments	231	3.18	3.00	2.00	7.00	
Compustat Segments	4,022	3.07	3.00	2.00	10.00	0.2215
Matching Industry Segments	2,082	3.05	3.00	2.00	10.00	0.1670
Assets (in millions)						
Sample Segments	231	652.49	79.60	0.04	11,409.00	
Compustat Segments	4,007	1,611.98	94.78	(26.50)	191,127.00	<.0001
Matching Industry Segments	2,078	1,970.28	98.89	(26.50)	184,587.00	<.0001
Sales (in millions)						
Sample Segments	231	707.06	104.06	0.00	8,068.00	
Compustat Segments	4,013	897.46	97.39	(64.90)	133,168.00	0.1127
Matching Industry Segments	2,078	977.25	118.33	(64.90)	118,012.00	0.0365
Profit						
Sample Segments	231	91.53	11.50	(4.57)	2,477.00	
Compustat Segments	4,010	96.21	7.22	(507.00)	9,198.00	0.7834
Matching Industry Segments	2,077	105.12	8.88	(507.00)	8,717.00	0.4537
Profit % of Sales						
Sample Segments	211	10.71%	10.27%	-62.17%	62.41%	
Compustat Segments	2,750	-23.19%	9.56%	-33589.43%	1650.21%	0.0211
Matching Industry Segments	1,427	-3.41%	9.03%	-10468.18%	1650.21%	0.0721
Return on Assets						
Sample Segments	214	16.85%	14.75%	-42.72%	165.73%	
Compustat Segments	2,749	0.72%	9.22%	-10735.29%	1670.00%	0.0033
Matching Industry Segments	1,429	1.42%	10.64%	-7550.82%	510.64%	0.0234

* Test is two-tailed and adjusted for unequal variances where applicable

Table 23
Comparison of Sample Segments to Compustat Segments - 1999

	N	Mean	Median	Min	Max	t statistic significance *
Number of Segments per Firm						
Sample Segments	213	2.84	3.00	2.00	6.00	
Compustat Segments	8,093	3.30	3.00	2.00	10.00	<.0001
Matching Industry Segments	3,288	3.22	3.00	2.00	10.00	<.0001
Assets (in millions)						
Sample Segments	211	808.84	94.80	0.24	13,321.00	
Compustat Segments	6,683	1,333.19	63.70	(4,883.00)	345,018.00	0.0045
Matching Industry Segments	2,765	1,111.21	70.71	0.00	345,018.00	0.1914
Sales (in millions)						
Sample Segments	213	876.49	135.99	0.00	12,075.10	
Compustat Segments	8,060	560.91	54.21	(262.00)	135,073.00	0.0210
Matching Industry Segments	3,273	633.22	70.55	(25.06)	55,749.00	0.0816
Profit (a)						
Sample Segments	207	92.62	14.10	(11.94)	1,632.00	
Compustat Segments	7,051	63.90	3.78	(3,237.00)	8,495.40	0.0568
Matching Industry Segments	2,927	78.89	4.74	(3,237.00)	8,495.40	0.4036
Profit % of Sales						
Sample Segments	167	-222.01%	9.95%	-31600.00%	1728.43%	
Compustat Segments	1,232	-39.15%	8.81%	-21469.05%	4037.50%	0.3533
Matching Industry Segments	487	2.35%	8.47%	-2035.71%	4037.50%	0.2551
Return on Assets						
Sample Segments	168	48.26%	12.82%	-223.32%	5777.35%	
Compustat Segments	1,209	9.45%	8.24%	-3776.00%	7900.00%	0.2742
Matching Industry Segments	472	6.75%	9.89%	-1319.44%	806.45%	0.2320

* Test is two-tailed and adjusted for unequal variances where applicable

(a) Under SFAS 131 "Profit" can be reported at different levels within the segment database and therefore the information reported here is an amalgamation of various levels of reported profit. The table below shows the various levels of reported profit and percentages within the sample, Compustat and matching industry firms reported during the period 1998-2002.

	Sample	Compustat	Industry
Operating Profit	87.56%	70.94%	73.72%
Operating Income after Depr.	2.36%	1.99%	2.48%
Operating Income before Depr.	0.18%	2.47%	2.26%
Pretax Income	7.72%	12.02%	10.45%
Income before Extraordinary Items	0.54%	3.12%	2.67%
Net Income	0.00%	1.40%	1.21%
None reported	1.63%	8.06%	7.21%

Table 24
Comparison of Sample Segments to Compustat Segments - 2002

	N	Mean	Median	Min	Max	t statistic significance *
Number of Segments per Firm						
Sample Segments	223	2.97	3.00	1.00	5.00	
Compustat Segments	6,894	3.24	3.00	2.00	10.00	0.0002
Matching Industry Segments	2,841	3.17	3.00	2.00	10.00	0.0083
Assets (in millions)						
Sample Segments	220	872.48	108.11	0.00	18,016.00	
Compustat Segments	5,604	1,803.20	85.15	(2,788.25)	487,718.00	0.0001
Matching Industry Segments	2,293	1,079.66	72.78	(3.87)	307,531.00	0.4137
Sales (in millions)						
Sample Segments	223	958.55	136.26	0.00	17,151.00	
Compustat Segments	6,882	674.25	71.43	(530.00)	134,425.00	0.0711
Matching Industry Segments	2,839	653.74	77.63	(37.41)	36,360.00	0.0560
Profit (a)						
Sample Segments	223	127.53	9.75	(48.63)	5,787.00	
Compustat Segments	5,923	64.17	4.09	(32,476.00)	14,671.00	0.0515
Matching Industry Segments	2,450	77.94	3.78	(3,348.10)	12,920.00	0.1347
Profit % of Sales						
Sample Segments	179	-3.74%	7.16%	-1183.33%	58.87%	
Compustat Segments	3,299	-58.81%	7.44%	-36314.29%	14495.15%	0.0117
Matching Industry Segments	1,362	-29.22%	7.04%	-8351.37%	7150.00%	0.0951
Return on Assets						
Sample Segments	179	-11.69%	9.75%	-3042.86%	120.70%	
Compustat Segments	2,925	-22.09%	6.97%	-16725.00%	2987.50%	0.6193
Matching Industry Segments	1,205	-19.78%	7.61%	-12083.33%	2987.50%	0.7272

* Test is two-tailed and adjusted for unequal variances where applicable

(a) Under SFAS 131 "Profit" can be reported at different levels within the segment database and therefore the information reported here is an amalgamation of various levels of reported profit. See the table included with Table 23 which shows the various levels of reported profit and percentages within the sample, Compustat and matching industry firms reported during the period 1998-2002.

Table 25
Comparison of Sample to Compustat (Segments) - 3-year Activity 1994-1996

	N	Mean	Median	Min	Max	t statistic significance *
Asset Growth (2 yr.) (a)						
Sample Segments	214	37.91%	15.23%	-65.77%	1366.67%	
Compustat Segments	2,763	63.33%	14.04%	-6430.65%	23071.37%	0.0680
Matching Industry Segments	1,434	47.38%	15.24%	-226.83%	6830.61%	0.3540
Sales Growth (2 yr.) (a)						
Sample Segments	212	26.37%	17.53%	-100.00%	835.66%	
Compustat Segments	2,750	185.30%	16.66%	-66150.00%	212230.00%	0.0990
Matching Industry Segments	1,430	23.73%	17.12%	-66150.00%	24166.67%	0.9589
Profit Growth (2 yr.) (a)						
Sample Segments	214	80.34%	16.36%	-1367.42%	11437.50%	
Compustat Segments	2,755	49.08%	15.99%	-23475.00%	45444.25%	0.6774
Matching Industry Segments	1,433	44.10%	16.43%	-17725.98%	16016.96%	0.5785
Capital Spending (in millions - 3 yr.)						
Sample Segments	211	92.05	13.81	0.00	1,407.00	
Compustat Segments	2,511	224.22	16.19	(28.75)	25,195.00	<.0001
Matching Industry Segments	1,274	178.07	12.55	(28.75)	16,689.00	0.0008
Capital Spending % of Avg. Assets						
Sample Segments	211	19.54%	15.50%	0.00%	85.15%	
Compustat Segments	2,508	23.80%	16.81%	-25.62%	402.75%	0.0003
Matching Industry Segments	1,273	19.56%	15.08%	-25.62%	402.75%	0.9903
R&D Expense (in millions - 3 yr.) (b)						
Sample Segments	34	143.23	(0.01)	(0.02)	2,821.04	
Compustat Segments	378	30.12	0.00	(0.02)	3,025.76	0.2260
Matching Industry Segments	185	54.32	0.00	(0.02)	3,025.76	0.3496
R&D % of Sales (b)						
Sample Segments	34	1.20%	0.00%	-1.09%	15.15%	
Compustat Segments	377	0.58%	0.00%	-266.67%	29.39%	0.4961
Matching Industry Segments	184	2.10%	0.00%	-2.35%	29.39%	0.1402

* Test is two tailed and adjusted for unequal variances where applicable

(a) Growth is only computed on a 2-year basis for segments since reporting is only assured of being consistent for 3 consecutive years.

(b) R&D expense and R&D % of sales only computed for companies where R&D expense is < sales in each of the 3 years.

Table 26
Comparison of Sample to Compustat (Segments) - 3-year Activity 1997-1999

	N	Mean	Median	Min	Max	t statistic significance *
Asset Growth (2 yr.) (a)						
Sample Segments	168	30.37%	11.90%	-86.85%	397.22%	
Compustat Segments	1,214	80.36%	14.91%	-100.00%	3952.45%	<.0001
Matching Industry Segments	471	59.21%	13.94%	-100.00%	3952.45%	0.0181
Sales Growth (2 yr.) (a)						
Sample Segments	167	19.01%	10.52%	-97.33%	231.77%	
Compustat Segments	1,244	83.12%	14.12%	-100.00%	8869.19%	<.0001
Matching Industry Segments	488	68.16%	12.19%	-100.00%	8869.19%	0.0180
Profit Growth (2 yr.) (a)						
Sample Segments	168	-418.94%	6.64%	-69813.33%	322.71%	
Compustat Segments	1,245	44.20%	3.52%	-137994.12%	117944.44%	0.2896
Matching Industry Segments	490	89.32%	5.81%	-5350.75%	11762.50%	0.2255
Capital Spending (in millions - 3 yr.)						
Sample Segments	163	89.47	15.54	0.00	1,335.00	
Compustat Segments	1,058	142.17	15.23	(3.48)	5,856.00	0.0326
Matching Industry Segments	416	92.43	12.30	(0.02)	3,053.00	0.8853
Capital Spending % of Avg. Assets						
Sample Segments	159	21.05%	18.44%	0.00%	107.29%	
Compustat Segments	1,043	29.96%	16.19%	-2.17%	3673.58%	0.0491
Matching Industry Segments	410	19.48%	13.83%	-0.03%	189.28%	0.3671
R&D Expense (in millions - 3 yr.) (b)						
Sample Segments	17	2.84	0.00	(0.02)	21.32	
Compustat Segments	127	6.12	0.00	(0.02)	590.60	0.5035
Matching Industry Segments	39	3.91	0.00	(0.02)	55.30	0.6287
R&D % of Sales (b)						
Sample Segments	17	0.72%	0.00%	-0.02%	3.34%	
Compustat Segments	126	1.08%	0.00%	-1.51%	26.05%	0.4060
Matching Industry Segments	39	2.41%	0.00%	-1.51%	26.05%	0.0786

* Test is two tailed and adjusted for unequal variances where applicable

(a) Growth is only computed on a 2-year basis for segments since reporting is only assured of being consistent for 3 consecutive years.

(b) R&D expense and R&D % of sales only computed for companies where R&D expense is < sales in each of the 3 years.

Table 27
Comparison of Sample to Compustat (Segments) - 3-year Activity 2000-2002

	N	Mean	Median	Min	Max	t statistic significance *
Asset Growth (2 yr.) (a)						
Sample Segments	180	5.91%	-4.01%	-100.00%	495.09%	
Compustat Segments	3,074	93.95%	-0.80%	-3620.93%	175787.80%	0.1371
Matching Industry Segments	1,260	38.15%	-3.84%	-138.53%	30500.00%	0.1973
Sales Growth (2 yr.) (a)						
Sample Segments	178	10.98%	-1.26%	-87.04%	449.68%	
Compustat Segments	3,734	62.42%	0.26%	-411.66%	38535.09%	0.0011
Matching Industry Segments	1,509	22.89%	-4.14%	-287.91%	6926.32%	0.1544
Profit Growth (2 yr.) (a)						
Sample Segments	180	-3.66%	-12.45%	-2156.78%	1412.49%	
Compustat Segments	3,368	-33.11%	-15.88%	-30294.12%	46737.14%	0.5267
Matching Industry Segments	1,383	-68.59%	-21.13%	-30294.12%	7400.00%	0.1582
Capital Spending (in millions - 3 yr.)						
Sample Segments	170	115.26	14.11	0.00	2,345.00	
Compustat Segments	2,512	183.60	13.49	(48.65)	27,675.00	0.0248
Matching Industry Segments	1,088	118.63	14.39	(28.00)	8,602.00	0.8995
Capital Spending % of Avg. Assets						
Sample Segments	169	13.95%	11.24%	0.00%	60.76%	
Compustat Segments	2,391	22.05%	12.19%	-29.85%	2249.22%	<.0001
Matching Industry Segments	1,037	17.60%	11.44%	-22.32%	802.42%	0.0139
R&D Expense (in millions - 3 yr.) (b)						
Sample Segments	0					
Compustat Segments	198	44.55	0.00	(0.02)	3,394.59	n/a
Matching Industry Segments	40	111.34	3.27	(0.02)	2,200.00	n/a
R&D % of Sales (b)						
Sample Segments	0					
Compustat Segments	198	2.02%	0.00%	-0.02%	35.30%	n/a
Matching Industry Segments	40	4.65%	1.19%	-0.02%	28.15%	n/a

* Test is two tailed and adjusted for unequal variances where applicable

(a) Growth is only computed on a 2-year basis for segments since reporting is only assured of being consistent for 3 consecutive years.

(b) R&D expense and R&D % of sales only computed for companies where R&D expense is < sales in each of the 3 years.

Table 28
Data Collection Sources

Variable (annual)	Part of Variable	Theory	Variable in Analysis	Source
By Segment				
CapX	Investment		*I*	COMPUSTAT
R&D	Investment		*I*	COMPUSTAT
Change in Working Capital	Investment		*I*	COMPUSTAT
No. of employees	Investment		*I*	COMPUSTAT
Acquisitions	Investment		*I*	10K's, 10Q's, Lexis-Nexis
Dispositions	Investment		*I*	10K's, 10Q's, Lexis-Nexis
Profits		Game Length	*Histperf*	COMPUSTAT
Segment disposed (dummy)		Game Length	*Disp*	10K's, 10Q's, Lexis-Nexis
% of manager compensation deferred		Game Length	*Def%*	10K's, Proxies
Age of manager		Game Length	*Age*	10K's, Proxies, Lexis-Nexis
Manager hired inside (dummy)		Game Length	*Inside*	10K's, Proxies, Lexis-Nexis
Sales		Group Efficacy	*Dvrasset*	COMPUSTAT
Assets		Group Efficacy	*Dvrsale*	COMPUSTAT
Profits		Group Efficacy	*Dvrprofit*	COMPUSTAT
Name Carries Corp. ID (dummy)		Group ID	*CorpID*	10K's, Lexis-Nexis
Manager Has Corp. Title (dummy)		Group ID	*CorpOfficer*	10K's, Proxies, Lexis-Nexis
% of Manager Compensation based on Corp results		Group ID	*Corp%*	10K's, Proxies, Lexis-Nexis
Manager part of Corp. Exec. Committee (dummy)		Group ID	*ExecCommittee*	10K's, Proxies, Lexis-Nexis
Measure of Vertical Integration		Monitoring	*Related*	COMPUSTAT, BEA 1997 Benchmark Use Table
Measure of Horizontal Integration		Monitoring	*Complement*	COMPUSTAT, BEA 1997 Benchmark Use Table
Turnover of manager		Sanctions	*Turnover*	10K's, Proxies, Lexis-Nexis
By Company				
No. of segments		Group Efficacy	*nosegs*	COMPUSTAT
Has Internal Audit? (dummy)		Monitoring	*Iaudit*	10K's, Proxies
Financial Constraint			*finconstraint*	COMPUSTAT
Inside Ownership			*ownership*	Proxies, Compact D/SEC (Thomson)
By Industry				
Value Added			*V*	See variable discussion
Value Added			*Vbea*	BEA - GDP (Value Added) by Industry
Avg. compensation per employee	Investment		*I*	See variable discussion
Profits		Game Length	*Histperf*	COMPUSTAT

Table 29 Segment Sales Reporting by Standex 2001-2003			
Reported in 2001 10K			
	2001	2000	1999
Food Service	$ 146,793	$ 144,089	$ 151,782
Consumer	212,737	220,724	216,272
Industrial	240,622	272,236	273,346
Total	$ 600,152	$ 637,049	$ 641,400
Reported in 2002 10K			
Food Service	$ 146,793	$ 144,089	
Consumer	115,615	115,276	
Industrial	337,744	377,684	
Total	$ 600,152	$ 637,049	
Reported in 2003 10K			
Food Service	$ 143,075		
Consumer	115,615		
Industrial	327,836		
Total	$ 586,526		

Table 30
Net Working Capital Calculations - Industry Match Statistics

	Number	Percent	Overall Percent
SIC match (1995 - 1996)			
4-digit	193	40.2%	8.9%
3-digit	154	32.1%	7.1%
2-digit	113	23.5%	5.2%
No match: operating segment	13	2.7%	0.6%
No match: non-operating segment	7	1.5%	0.3%
Subtotals	480	100.0%	22.1%
NAICS match (1997 - 2002)			
6-digit	396	23.5%	18.3%
5-digit	350	20.7%	16.1%
4-digit	277	16.4%	12.8%
3-digit	314	18.6%	14.5%
No match: operating segment	43	2.5%	2.0%
No match: non-operating segment	308	18.2%	14.2%
Subtotals	1,688	100.0%	77.9%
Totals	2,168		100.0%

Table 31
Net Working Capital Calculation Statistics

Source Method	Range Percent Difference	Number of Firms	Number of Firm-Years	Percent of Total	Mean Percent Difference	Mean $ Difference (millions)[a]	Minimum $ Difference (millions)[a]	Maximum $ Difference (millions)[a]
WC1	0-1%	2	2	1.7%	0.4%	0.05	0.021	0.07
	>1% - 10%	11	12	9.9%	5.2%	2.98	0.236	14.63
	>10%-25%	11	11	9.1%	16.3%	6.39	0.522	25.79
	>25%-50%	9	9	7.4%	33.5%	36.56	0.619	252.91
	>50%-100%	14	15	12.4%	71.9%	18.95	0.264	124.63
	>100%-250%	24	29	24.0%	151.0%	75.23	0.189	725.42
	>250%-500%	11	15	12.4%	351.1%	127.32	0.395	680.22
	>500%	24	28	23.1%	639.8%	462.04	0.362	8541.58
	Total		121	100.0%				
WC2	0-1%	6	7	1.3%	0.5%	0.05	0.003	0.15
	>1% - 10%	30	51	9.3%	4.8%	1.65	0.012	47.00
	>10%-25%	44	69	12.5%	17.5%	5.45	0.031	119.00
	>25%-50%	47	71	12.9%	36.0%	13.82	0.136	186.00
	>50%-100%	53	81	14.7%	71.6%	40.48	0.008	717.00
	>100%-250%	63	114	20.7%	160.8%	84.61	0.169	1578.00
	>250%-500%	50	81	14.7%	370.3%	79.21	0.222	1758.00
	>500%	52	77	14.0%	3142.5%	292.90	0.049	4817.20
	Total		551	100.0%				

[a] Amount shown is the absolute value of the difference between the computed and actual working capital change

Table 32
Acquisition/Disposal Activity by Year for the Sample

			Mean Amount (in millions)				
Year	Number of Operating Segments	Number with Acquisition Activity	*Acquis*	*Pool*	*IPRD*	*Divest*	*OtherInv*
1995	238	83	37.05			(27.50)	2.81
1996	233	86	122.69	111.86	0.27	(24.16)	(0.16)
1997	234	95	56.21	21.57	0.95	(72.94)	0.26
1998	227	97	109.12	7.77	1.95	(55.63)	0.48
1999	224	88	120.92	87.62	0.51	(31.74)	0.38
2000	224	83	74.47		0.65	(51.18)	7.13
2001	228	93	66.98	131.98	1.16	(41.64)	1.45
2002	229	73	123.75		2.76	(5.26)	8.40

Table 33
Descriptive Statistics - Game Length Variables Dropped

Variable	N	Missing	Mean	Min	Max
1995					
AGE	101	137	52.624	33.000	77.000
INSIDE	105	133	0.114	0.000	1.000
DEF%	16	222	18.69%	0.00%	91.11%
1996					
AGE	94	139	53.713	34.000	73.000
INSIDE	98	135	0.143	0.000	1.000
DEF%	13	220	33.02%	0.00%	90.09%
1997					
AGE	95	139	53.821	32.000	74.000
INSIDE	98	136	0.194	0.000	1.000
DEF%	9	225	24.48%	0.00%	81.71%
1998					
AGE	94	133	54.053	33.000	75.000
INSIDE	98	129	0.194	0.000	1.000
DEF%	11	216	18.37%	0.00%	70.07%
1999					
AGE	94	130	54.309	34.000	74.000
INSIDE	97	127	0.175	0.000	1.000
DEF%	11	213	25.64%	0.00%	91.97%
2000					
AGE	92	132	54.011	35.000	77.000
INSIDE	97	127	0.206	0.000	1.000
DEF%	12	212	18.74%	0.00%	86.40%
2001					
AGE	93	135	53.946	36.000	78.000
INSIDE	99	129	0.212	0.000	1.000
DEF%	12	216	28.65%	0.00%	89.41%
2002					
AGE	94	135	53.723	36.000	79.000
INSIDE	98	131	0.204	0.000	1.000
DEF%	13	216	26.69%	0.00%	73.24%

Table 34
Descriptive Statistics - Diversity Variables

	N	Mean	Min	Max
DVRSALE	672	0.528	0.178	1.000
DVRPROF	672	7.125	0.209	1130.000

Table 35
Descriptive Statistics - Diversity Variables II

Variable	N	Mean	Minimum	Maximum
DVRASSET	672	0.535	0.186	1.000
DVRPROF2	672	0.647	0.209	1.000
Correlations				
	DVRSALE	*DVRASSET*	*DVRPROF*	*DVRPROF2*
DVRSALE	1.000	0.847	0.013	0.597
prob		<.0001	0.7298	<.0001
DVRASSET		1.000	(0.045)	0.494
prob			0.2446	<.0001
DVRPROF			1.000	0.148
prob				0.0001
DVRPROF2				1.000

Table 36 Medians by Constraint Group of Z_{FC}			
	NFC Not Constrained (Bottom Third)	PFC Partially Constrained (Middle Third)	FC Constrained (Top Third)
Current	1.707	2.224	2.630
FCCov	7.446	7.575	4.139
Slack	0.564	0.796	0.798
NI%	0.047	0.054	0.042
SalesGrowth	0.084	0.068	0.059
Debt	0.109	0.196	0.329
Begin Net Fixed Assets	91.607	69.488	51.883
Market to Book	2.404	1.865	1.456
Cash Flow	0.420	0.427	0.351
Z_{FC}	1.255	3.956	7.906

Table 37
Descriptive Statistics - Sample Variables

Variable	N	Mean	StdDev	Median	Minimum	Maximum
I	147	13.61	50.39	1.57	(32.20)	419.64
Ireduce	1,837	74.06	486.95	5.08	(3,572.30)	13,009.00
Icapx	1,837	36.21	91.14	4.11	(0.12)	1,414.00
Ita	1,837	59.55	573.88	1.06	(8,125.00)	13,059.20
TAchg	1,837	46.60	438.17	1.06	(8,125.00)	7,494.00
V	1,837	22,086.55	58,769.10	5,404.43	274.40	482,277.00
Vbea	1,837	119,569.86	101,726.05	103,694.00	20,913.00	615,365.00
histperf	1,793	6.54	44.92	1.71	(456.36)	1,144.23
disp	1,837	0.04	0.20	0.00	0.00	1.00
nosegs	1,837	3.06	1.24	3.00	1.00	7.00
dvrsale	1,837	0.49	0.17	0.50	0.18	1.00
corpid	1,468	0.63	0.48	1.00	0.00	1.00
relate	1,837	0.01	0.02	0.00	0.00	0.09
complement	1,837	0.31	0.20	0.29	0.00	1.00
iaudit	1,476	0.96	0.19	1.00	0.00	1.00
turnover	778	0.15	0.23	0.00	0.00	1.00
finconstraint	1,837	5.22	8.10	3.94	(10.67)	116.35
ownership	1,837	0.80	0.23	0.89	0.03	1.00

Table 38
Correlations of Sample Variables

	lreduce	lcapx	lta	TAchg	V	Vbea	histperf	disp	nosegs	dvrsale	corpid	relate	complement	iaudit	turnover	finconstraint	ownership
l	0.9875	0.9839	0.9289	0.9289	(0.0289)	(0.2055)	(0.0237)	(0.0679)	(0.2047)	(0.1177)	0.2189	(0.0833)	(0.1616)	0.1690	(0.1387)	0.2071	0.1718
prob	***<.0001***	***<.0001***	***<.0001***	***<.0001***	*0.7283*	*0.0125*	*0.7791*	*0.4138*	*0.0129*	*0.1557*	***0.0123***	*0.3156*	***0.0505***	*0.1156*	*0.2906*	***0.0118***	*0.0374*
lreduce		0.4663	0.9118	0.7085	(0.0020)	(0.0283)	(0.0110)	(0.0010)	0.0356	(0.0830)	0.0285	(0.0353)	0.0703	0.0328	0.0488	(0.0551)	0.0989
prob		***<.0001***	***<.0001***	***<.0001***	*0.9328*	*0.2260*	*0.6415*	*0.9666*	*0.1272*	***0.0004***	*0.2758*	*0.1300*	***0.0026***	*0.2074*	*0.1737*	***0.0182***	***<.0001***
lcapx			0.3442	0.2950	(0.0289)	(0.0853)	(0.0055)	(0.0505)	0.1283	(0.2087)	0.1202	(0.0589)	0.0995	0.0844	0.1460	(0.1229)	0.2641
prob			***<.0001***	***<.0001***	*0.2155*	***0.0003***	*0.8154*	***0.0304***	***<.0001***	***<.0001***	***<.0001***	***0.0116***	***<.0001***	***0.0012***	***<.0001***	***<.0001***	***<.0001***
lta				0.8951	0.0324	(0.0023)	(0.0172)	0.0167	0.0143	(0.0505)	0.0191	(0.0338)	0.0457	0.0229	0.0030	(0.0420)	0.0678
prob				***<.0001***	*0.1652*	*0.9228*	*0.4662*	*0.4747*	*0.5410*	***0.0304***	*0.4656*	*0.1473*	***0.0504***	*0.3804*	*0.9338*	*0.0721*	***0.0036***
TAchg					0.0329	(0.0011)	(0.0197)	0.0223	0.0120	(0.0405)	0.0156	(0.0291)	0.0344	0.0233	(0.0116)	(0.0416)	0.0680
prob					*0.1593*	*0.9625*	*0.4041*	*0.3402*	*0.6086*	*0.0828*	*0.5517*	*0.2126*	*0.1406*	*0.3709*	*0.7459*	*0.0748*	***0.0036***
V						0.4336	(0.0104)	0.1036	0.1988	(0.0458)	0.0611	(0.0338)	(0.1925)	(0.0466)	0.0450	0.0223	0.0485
prob						***<.0001***	*0.6589*	***<.0001***	***<.0001***	***0.0498***	***0.0192***	*0.1477*	***<.0001***	*0.0737*	*0.2104*	*0.3400*	***0.0375***
Vbea							(0.0253)	0.1046	0.0974	0.0331	(0.0196)	0.0676	(0.1715)	0.0143	0.0150	0.1014	(0.0864)
prob							*0.2853*	***<.0001***	***<.0001***	*0.1557*	*0.4522*	***0.0037***	***<.0001***	*0.5825*	*0.6753*	***<.0001***	***0.0002***
histperf								(0.0268)	(0.0149)	0.0067	0.0204	(0.0198)	0.0093	0.0187	0.0953	(0.0064)	0.0150
prob								*0.2560*	*0.5282*	*0.7772*	*0.4393*	*0.4011*	*0.6927*	*0.4776*	***0.0086***	*0.7867*	*0.5258*
disp									0.1064	(0.0315)	(0.0663)	(0.0030)	(0.0330)	0.0037	(0.0083)	(0.0226)	0.0001
prob									***<.0001***	*0.1775*	***0.0110***	*0.8995*	*0.1578*	*0.8879*	*0.8177*	*0.3322*	*0.9976*
nosegs										(0.6420)	(0.1424)	(0.0651)	(0.1563)	0.1371	0.1790	(0.0833)	0.2204
prob										***<.0001***	***<.0001***	***0.0052***	***<.0001***	***<.0001***	***<.0001***	***0.0004***	***<.0001***
dvrsale											0.0309	0.0125	0.0452	(0.1092)	(0.1456)	0.1148	(0.2295)
prob											*0.2365*	*0.5930*	*0.0529*	***<.0001***	***<.0001***	***<.0001***	***<.0001***
corpid												0.0168	0.1036	0.0103	0.0121	0.0018	0.0618
prob												*0.5197*	***<.0001***	*0.7294*	*0.7557*	*0.9446*	***0.0178***
relate													0.3615	0.0820	0.0514	0.0708	0.0595
prob													***<.0001***	***0.0016***	*0.1520*	***0.0024***	***0.0107***
complement														(0.0075)	0.0082	0.0489	(0.0075)
prob														*0.7750*	*0.8192*	***0.0362***	*0.7488*
iaudit															0.1050	0.0188	0.1443
prob															***0.0068***	*0.4707*	***<.0001***
turnover																(0.0729)	0.2057
prob																***0.0420***	***<.0001***
finconstraint																	(0.2616)
prob																	***<.0001***

Table 39
Correlations by Firm Type

	Ireduce	*Icapx*	*Ita*	*TAchg*
Only Manufacturing Segments				
V	0.1034	0.0887	0.1004	0.0674
prob	**0.0001**	**0.0009**	**0.0002**	**0.0114**
Vbea	0.0092	0.0108	0.0181	0.0127
prob	0.7302	0.6850	0.4969	0.6348
Some Non-Manufacturing Segments				
V	(0.0377)	(0.1446)	0.0397	0.0392
prob	0.4360	**0.0027**	0.4119	0.4186
Vbea	(0.0599)	(0.3236)	0.0005	0.0004
prob	0.2156	**<.0001**	0.9911	0.9932

Table 40 Investment and Value Added Variables Negative Segment Year Data				
	Current Yr. Negative	Prior Yr. Negative	Both Yrs Negative	Prior Yr. Zero
Icapx	2	4	0	73
Ireduce	114	4	1	73
Ita	732	711	367	18
TAchg	732	663	352	21

Table 41
Descriptives of Variables for Basic Empirical Equation

Variable (Current Yr. / Prior Yr.)	N	Miss	Mean	StdDev	Minimum	Maximum	Median
Ireduce / Ireduce	1801	36	2.961	35.900	(331.000)	1,292.000	1.095
Icapx / Icapx	1804	33	1.577	4.710	(1.102)	139.529	0.988
Ita / Ita	1816	21	1.303E+12	5.552E+13	(3,259.000)	2.366E+15	1.083
TAchg / TAchg	1813	24	3.759	145.232	(3,259.000)	4,811.300	0.989
V / V	1837	0	1.033	0.263	0.070	9.538	1.030
Ln(V / V)	1837	0	0.014	0.202	(2.653)	2.255	0.030
Vbea / Vbea	1837	0	1.030	0.073	0.731	1.272	1.035
Ln(Vbea / Vbea)	1837	0	0.027	0.075	(0.313)	0.240	0.034

Table 42
Descriptives of Winsorized Basic Empirical Variables

Variable (Current Yr. / Prior Yr.)	N	Mean	StdDev	Minimum	Maximum	Median
Ireduce / Ireduce	1837	2.846	5.221	(1.734)	21.481	1.117
Icapx / Icapx	1837	1.318	1.227	0.000	5.307	1.000
Ita / Ita	1837	2.261	6.901	(8.587)	23.841	1.090
TAchg / TAchg	1837	1.916	5.997	(7.847)	20.897	1.013
V / V	1837	1.033	0.263	0.070	9.538	1.030
Ln(V / V)	1837	0.014	0.202	(2.653)	2.255	0.030
Vbea / Vbea	1837	1.030	0.073	0.731	1.272	1.035
Ln(Vbea / Vbea)	1837	0.027	0.075	(0.313)	0.240	0.034

Table 43
Correlations - Basic Empirical Variables (after winsorization)

$\frac{CurrentYear}{PriorYear}$	$\frac{Ireduce}{Ireduce}$	$\frac{Ita}{Ita}$	$\frac{TAchg}{TAchg}$	$\frac{V}{V}$	$Ln\left(\frac{V}{V}\right)$	$\frac{Vbea}{Vbea}$	$Ln\left(\frac{Vbea}{Vbea}\right)$
Icapx / Icapx	0.573	0.088	0.267	0.037	0.029	0.034	0.027
prob	**<.0001**	**0.0002**	**<.0001**	0.1095	0.2131	0.1477	0.2395
Ireduce / Ireduce		0.462	0.420	0.010	0.014	-0.009	-0.017
prob		**<.0001**	**<.0001**	0.6630	0.5602	0.7068	0.4655
Ita / Ita			0.908	0.050	0.024	0.068	0.066
prob			**<.0001**	0.4009	0.2973	**0.0037**	**0.0048**
TAchg / TAchg				0.029	0.032	0.089	0.087
prob				0.2188	0.1690	**0.0001**	**0.0002**
V / V					0.756	0.178	0.174
prob					**<.0001**	**<.0001**	**<.0001**
Ln(V / V)						0.212	0.209
prob						**<.0001**	**<.0001**
Vbea / Vbea							0.997
prob							**<.0001**

Table 44
Correlations of Variables for Empirical Analysis

	$\frac{TAchg_t}{TAchg_{t-1}}$	$Ln\left(\frac{Vbea_t}{Vbea_{t-1}}\right)$	*histperf*	*histperf (winsorized)*	*disp*	*nosegs*	*dvrsale*	*corpid*	*relate*	*complement*	*iaudit*	*turnover*	*finconstraint*	*ownership*
Ita / Ita	0.9076	0.0658	(0.0226)	(0.0168)	(0.0226)	(0.0334)	(0.0175)	(0.0093)	(0.0140)	0.0360	(0.0161)	(0.0076)	(0.0010)	0.0656
prob	***<.0001***	***0.0048***	*0.3395*	*0.4777*	*0.3326*	*0.1524*	*0.4525*	*0.7218*	*0.5497*	*0.1226*	*0.5368*	*0.8323*	*0.9649*	***0.0049***
TAchg / TAchg		0.0873	(0.0159)	(0.0051)	(0.0182)	(0.0122)	(0.0280)	(0.0174)	(0.0123)	0.0294	(0.0279)	(0.0096)	0.0170	0.0571
prob		***0.0002***	*0.5004*	*0.8296*	*0.4356*	*0.6003*	*0.2307*	*0.5042*	*0.5990*	*0.2076*	*0.2848*	*0.7888*	*0.4665*	***0.0145***
Ln(Vbea/Vbea)			(0.0024)	(0.0224)	(0.0103)	0.0929	(0.0667)	0.0332	(0.0754)	(0.1002)	0.0064	(0.1071)	0.0099	0.0261
prob			*0.9208*	*0.3422*	*0.6602*	***<.0001***	***0.0042***	*0.2035*	***0.0012***	***<.0001***	*0.8049*	***0.0028***	*0.6711*	*0.2644*
histperf				0.6677	(0.0268)	(0.0149)	0.0067	0.0204	(0.0198)	0.0093	0.0187	0.0953	(0.0064)	0.0150
prob				***<.0001***	*0.2560*	*0.5282*	*0.7772*	*0.4393*	*0.4011*	*0.6927*	*0.4776*	***0.0086***	*0.7867*	*0.5258*
histperf (winsorized)					(0.0472)	(0.0261)	0.0324	(0.0082)	(0.0029)	0.0115	0.0305	0.0663	(0.0154)	0.0439
prob					***0.0458***	*0.2691*	*0.1706*	*0.7561*	*0.9028*	*0.6277*	*0.2470*	***0.0679***	*0.5134*	***0.0631***
disp						0.1064	(0.0315)	(0.0663)	(0.0030)	(0.0330)	0.0037	(0.0083)	(0.0226)	0.0001
prob						***<.0001***	*0.1775*	***0.0110***	*0.8995*	*0.1578*	*0.8879*	*0.8177*	*0.3322*	*0.9976*
nosegs							(0.6420)	(0.1424)	(0.0651)	(0.1563)	0.1371	0.1790	(0.0833)	0.2204
prob							***<.0001***	***<.0001***	***0.0052***	***<.0001***	***<.0001***	***<.0001***	***0.0004***	***<.0001***
dvrsale								0.0309	0.0125	0.0452	(0.1092)	(0.1456)	0.1148	(0.2295)
prob								*0.2365*	*0.5930*	***0.0529***	***<.0001***	***<.0001***	***<.0001***	***<.0001***
corpid									0.0168	0.1036	0.0103	0.0121	0.0018	0.0618
prob									*0.5197*	***<.0001***	*0.7294*	*0.7557*	*0.9446*	***0.0178***
relate										0.3615	0.0820	0.0514	0.0708	0.0595
prob										***<.0001***	***0.0016***	*0.1520*	***0.0024***	***0.0107***
complement											(0.0075)	0.0082	0.0489	(0.0075)
prob											*0.7750*	*0.8192*	***0.0362***	*0.7488*
iaudit												0.1050	0.0188	0.1443
prob												***0.0068***	*0.4707*	***<.0001***
turnover													(0.0729)	0.2057
prob													***0.0420***	***<.0001***
finconstraint														(0.2616)
prob														***<.0001***

Table 45 Regression Results – Full Sample				
Equation 1a	$\frac{Ita_{it}}{Ita_{it-1}} = \alpha + E \ \ln\frac{Vbea_{it}}{Vbea_{it-1}} + \varepsilon_{it}$			
	F Value	Prob	Observations	Adj R^2
	7.99	0.0048	1,837	0.0038
	Parameter	Std. Error	t value	Prob
Intercept	2.09721	0.17081	12.28	< .0001
Efficiency (*E*)	6.06408	2.14541	2.83	0.0048
Equation 1b	$\frac{TAchg_{it}}{TAchg_{it-1}} = \alpha + E \ \ln\frac{Vbea_{it}}{Vbea_{it-1}} + \varepsilon_{it}$			
	F Value	Prob	Observations	Adj R^2
	14.09	0.0002	1,837	0.0071
	Parameter	Std. Error	t value	Prob
Intercept	1.72726	.14819	11.66	< .0001
Efficiency (*E*)	6.98717	1.86126	3.75	0.0002

Table 46
Correlations - Manufacturing Segments Only without 1997

	$\frac{Ireduce}{Ireduce}$	$\frac{Ita}{Ita}$	$\frac{TAchg}{TAchg}$	$Ln\left(\frac{V}{V}\right)$	Full Sample $Ln\left(\frac{V}{V}\right)$	Full Sample $Ln\left(\frac{Vbea}{Vbea}\right)$
Icapx / Icapx	0.561	0.266	0.276	0.050	0.029	0.027
prob	**<.0001**	**<.0001**	**<.0001**	**0.0799**	0.2131	0.2395
Ireduce / Ireduce		0.501	0.442	-0.035	0.014	-0.017
prob		**<.0001**	**<.0001**	0.2245	0.5602	0.4655
Ita / Ita			0.905	0.069	0.024	0.066
prob			**<.0001**	**0.0159**	0.2973	**0.0048**
TAchg / TAchg				0.067	0.032	0.087
prob				**0.0186**	0.1690	**0.0002**

Table 47
Correlations of Division Manager Variables to Investment and Value Added Variables

	age	*def%*	*inside*	*corpofficer*	*corp%*	*execcommittee*
Ita / Ita	0.0053	0.3052	0.0059	(0.0464)	0.3021	(0.0163)
prob	0.8841	**0.0024**	0.8696	0.1785	**0.0026**	0.6566
observations	757	97	790	841	97	751
TAchg / TAchg	(0.0097)	0.2228	0.0117	(0.0388)	0.2273	(0.0181)
prob	0.7894	**0.0283**	0.7432	0.2609	**0.0252**	0.6208
observations	757	97	790	841	97	751
Ln(Vbea/Vbea)	(0.0095)	(0.2583)	(0.0345)	0.0171	(0.3065)	0.0364
prob	0.7934	**0.0106**	0.3327	0.6210	**0.0023**	0.3199
observations	757	97	790	841	97	751

Table 48

Summary of Univariate Tests of Hypotheses

Hypothesis		Variables Tested[1]	Result
H1	Career concerns	*histperf, disp, age,* ***def%****, inside*	Limited support *
H2a	Number of divisions	*nosegs*	No Support
H2b	Diversity of division size	*dvrsale*	No Support
H2c	Diversity of division profits	*dvrprof*	Not Tested
H2d	Corporate identity	*corpid, corpofficer*	No Support
H2e	Compensation based on corporate results	***corp%***	Limited Support *
H2f	Executive committee	*execcommittee*	No Support
H3a	Related divisions	*relate, complement*	No Support
H3b	Internal audit	*iaudit*	No Support
H4	Division manager turnover	*turnover*	No Support
H5	ICM vs. External market efficiency	*internal*	Not Tested
H6	Management stock ownership	*ownership*	No Support
H7	Higher financial constraints	*finconstraint*	No Support

[1] Correlations with the investment variables *TAchg* and *Ita* were examined for all variables listed. Variables in **Bold** had significant correlations at the 1% level with *Ita* and 5% level with *TAchg*

* Support is limited due to the small number of observations for which data was available (97 out of the sample of 1,837)

Appendix I

List of Companies Included in the Sample

CUSIP	GVKEY	Company Name	Symbol	SIC Code	NAICS Code	Fiscal Year-End
007768104	1056	Aeroflex Inc	ARXX	3825	334416	June
017753107	1283	Allen Organ Co	AORGB	3576	334119	December
023395107	1372	Amcast Industrial Corp	AICOQ	3714	336340	August
349631101	1408	Fortune Brands Inc	FO	3490	332999	December
028740108	1533	American Pacific Corp	APFC	2810	325188	September
029712106	1567	American Standard Cos Inc	ASD	3585	333415	December
030710107	1593	Ameron International Corp	AMN	3270	327390	November
031100100	1598	Ametek Inc	AME	3823	334513	December
046433108	1823	Astronics Corp	ATRO	3640	336321	December
055607107	1943	Bmc Industries Inc	BMMI	3470	332812	December
057097107	1971	Bairnco Corp	BZ	2821	325211	December
058498106	1988	Ball Corp	BLL	3411	332431	December
067806109	2049	Barnes Group Inc	B	3490	332611	December
081437105	2154	Bemis Co Inc	BMS	2670	322221	December
529529109	2264	Lexington Precision Corp	LEXP	3060	326291	December
095180105	2271	Blount Intl Inc	BLT	3420	332213	February
963801105	2345	White Electronic Designs Cp	WEDC	3674	334413	September
115637209	2435	Brown-Forman	BF.B	2085	312140	April
123720104	2519	Butler National Corp	BUKS	3721	336411	April
179895107	3093	Clarcor Inc	CLC	3564	333411	November
211615307	3465	Continental Materials Corp	CUO	3270	327320	December
216648402	3504	Cooper Companies Inc	COO	3851	339115	October
224399105	3580	Crane Co	CR	3490	332912	December
235851102	3735	Danaher Corp	DHR	3823	334513	December
245091107	3840	Del Laboratories Inc	DLI	2844	325620	December
532187101	3916	Lifecore Biomedical Inc	LCBM	3843	339114	June
269305405	4162	E-Z-Em Inc	EZEM	2835	325413	May
270312207	4176	Earth Sciences Inc	ESCI	2870	325312	December
287456107	4251	Elkcorp	ELK	2950	324122	June
292659109	4352	Energy Conversion Dev	ENER	3690	335911	June
296056104	4448	Escalade Inc	ESCA	3949	339920	December

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CUSIP	GVKEY	Company Name	Symbol	SIC Code	NAICS Code	Fiscal Year-End
315405100	4622	Ferro Corp	FOE	2851	325510	December
358435105	4903	Friedman Industries Inc	FRD	3310	331221	March
371901109	5116	Gentex Corp	GNTX	3714	336399	December
375766107	5169	Gillette Co	G	3420	332211	December
382388106	5229	Goodrich Corp	GR	3728	336413	December
417119104	5505	Hartmarx Corp	HMX	2300	315222	November
404251100	5690	Hni Corp	HNI	2522	337214	December
478160104	6266	Johnson & Johnson	JNJ	2834	325412	December
478366107	6268	Johnson Controls Inc	JCI	2531	336360	September
502160104	6528	Lsb Industries Inc	LXU	2810	325188	December
513847103	6573	Lancaster Colony Corp	LANC	2030	311941	June
539830109	6774	Lockheed Martin Corp	LMT	3760	336414	December
553777103	6900	Mts Systems Corp	MTSC	3829	334519	September
563571108	6994	Manitowoc Co	MTW	3530	333923	December
577723109	7121	Maxco Inc	MAXC	3390	332811	March
590876306	7281	Met-Pro Corp	MPR	3564	333411	January
609031109	7512	Monarch Cement Co	MCEM	3270	327320	December
624752101	7602	Mueller (Paul) Co	MUEL	3443	332420	December
628464109	7636	Myers Industries Inc	MYE	3089	326199	December
69073F103	8214	Owens Corning	OWENQ	3290	327993	December
693506107	8247	Ppg Industries Inc	PPG	2851	325510	December
701094104	8358	Parker-Hannifin Corp	PH	3490	332912	June
707389307	8434	Penn Engr & Mfg Corp	PNN	3452	332722	December
732827100	8675	Pope & Talbot Inc	POP	2611	322110	December
754212108	8958	Raven Industries Inc	RAVN	3080	326113	January
775133101	9216	Rogers Corp	ROG	2821	325211	December
269282109	9319	Exx Inc	EXX.A	3621	335312	December
46121H109	9590	Intricon Corp	IIN	3842	334510	December
817732100	9619	Servotronics Inc	SVT	3621	335312	December
826546103	9698	Sifco Industries	SIF	3724	336412	September
854231107	10008	Standex International Corp	SXI	3443	332313	June
864159108	10124	Sturm Ruger & Co Inc	RGR	3480	332994	December

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List of Companies Included in the Sample

CUSIP	GVKEY	Company Name	Symbol	SIC Code	NAICS Code	Fiscal Year-End
871565107	10236	Synalloy Corp	SYNL	3317	331210	December
878555101	10374	Technitrol Inc	TNL	3679	334419	December
878895200	10386	Tecumseh Products Co	TECUA	3585	333415	December
879868107	10426	Temple-Inland Inc	TIN	2631	322130	December
882491103	10498	Texas Industries Inc	TXI	3312	331111	May
883203101	10519	Textron Inc	TXT	3721	336411	December
885160101	10549	Thor Industries Inc	THO	3790	336214	July
887389104	10581	Timken Co	TKR	3562	332991	December
910571108	10902	United-Guardian Inc	UG	2834	325412	December
902911106	10974	UST Inc	UST	2100	312229	December
913017109	10983	United Technologies Corp	UTX	3720	3364	December
989131107	11310	Zagreb Systems Inc	ZRBA	3690	335999	June
284853306	12094	Electric & Gas Technology	ELGT	3310	331221	July
019118108	13169	Allied Defense Group Inc	ADG	3480	332993	December
049156102	13680	Atlantis Plastics Inc	ATPL	3081	326113	December
743726101	13798	Proven Foods Inc	PZA	2013	311612	December
969465608	19911	Williams Controls Inc	WCON	3714	336322	September
001004100	21116	Adm Tronics Unlimited Inc	ADMT	2851	3255	March
158520106	26900	Champion Industries Inc	CHMP	2750	32311	October
26969P108	30032	Eagle Materials Inc	EXP	3270	327420	March
577128101	30477	Matthews Intl Corp	MATW	3360	331522	September

References

Aeroflex, Inc. (1995). Form 10-K. Retrieved March 24, 2005, from http://www.10kwizard.com/

Alchian, A. A. (1969). Corporate Management and Property Rights. In H. G. Manne (Ed.), *Economic Policy and the Regulation of Corporate Securities* (pp. 337-360). Washington DC: American Enterprise Institute for Public Policy Research.

Aoki, M. (1984). *The Co-operative Game Theory of the Firm*. New York: Oxford University Press.

Aquino, K., & Reed II, A. (1998). A Social Dilemma Perspective on Cooperative Behavior in Organizations: The Effects of Scarcity, Communication and Unequal Access on the Use of a Shared Resource. *Group & Organization Management, 23*(4), 390-413.

Armour, H. O., & Teece, D. J. (1978). Organizational Structure and Economic Performance: A Test of the Multidivisional Hypothesis. *Bell Journal of Economics, 9*(1), 106-122.

Ashforth, B. E., & Mael, F. (1989). Social Identity Theory and the Organization. *The Academy of Management Review, 14*(1), 20-39.

Axelrod, R. (1981). The Emergence of Cooperation among Egoists. *The American Political Science Review, 75*(2), 306-318.

Axelrod, R., & Dion, D. (1988). The Further Evolution of Cooperation. *Science, 242*(4884), 1385-1390.

Bagnoli, M., & Watts, S. G. (2000). The Effect of Relative Performance Evaluation on Earnings Management: A Game-Theoretic Approach. *Journal of Accounting and Public Policy, 19*(4-5), 377-397.

Bendor, J., & Mookherjee, D. (1987). Institutional Structure and the Logic of Ongoing Collective Action. *The American Political Science Review, 81*(1), 129-154.

Berger, P. G., & Hann, R. (2002). Segment Disclosures, Proprietary Costs, and the Market for Corporate Control. *Working Paper*.

Berger, P. G., & Hann, R. (2003). The Impact of SFAS No. 131 on Information and Monitoring. *Journal of Accounting Research, 41*(2), 163-223.

Berger, P. G., & Hann, R. N. (2007). Segment Profitability and the Proprietary and Agency Costs of Disclosure. *Working Paper*.

Berger, P. G., & Ofek, E. (1995). Diversification's Effect on Firm Value. *Journal of Financial Economics, 37*(1), 39-65.

Billett, M. T., & Mauer, D. C. (2003). Cross-Subsidies, External Financing Constraints, and the Contribution of the Internal Capital Market to Firm Value. *The Review of Financial Studies, 16*(4), 1167-1201.

Bonacich, P., Shure, G. H., Kahan, J. P., & Meeker, R. J. (1976). Cooperation and Group Size in the N-Person Prisoners' Dilemma. *Journal of Conflict Resolution, 20*(4), 687-706.

Bornstein, G. (1992). Chapter 15: Group Decision and Individual Choice in Intergroup Competition for Public Goods. In W. B. G. Liebrand, D. M. Messick & H. A. M. Wilke (Eds.), *Social Dilemmas: Theoretical Issues and Research Findings* (pp. 247-263). Oxford, England: Pergamon Press.

Botosan, C. A., & Stanford, M. (2005). Managers' Motives to Withhold Segment Disclosures and the Effect of SFAS No. 131 on Analysts' Information Environment. *Accounting Review, 80*(3), 751-771.

Burbidge, J. B., Magee, L., & Robb, A. L. (1988). Alternative Transformations to Handle Extreme Values of the Dependent Variable. *Journal of the American Statistical Association, 83*(401), 123-127.

Bushman, R. M., Indjejikian, R. J., & Smith, A. (1995). Aggregate Performance Measures in Business Unit Manager Compensation: The Role of Intrafirm Interdependencies. *Journal of Accounting Research, 33*(Supplement), 101-128.

Chevalier, J. (2004). What Do We Know About Cross-subsidization? Evidence from Merging Firms. *Advances in Economic Analysis & Policy, 4*(1), Article 3, 29 pp.

Cleary, S. (1999). The Relationship between Firm Investment and Financial Status. *The Journal of Finance, 54*(2), 673-692.

Coase, R. H. (1990). Accounting and the Theory of the Firm. *Journal of Accounting and Economics, 12*(1-3), 3-13.

Coller, M., & Pierce, B. G. (1999). The New Segment Information: Is it Any Better? *Journal of Financial Statement Analysis, 4*(2), 65.

Comment, R., & Jarrell, G. A. (1995). Corporate Focus and Stock Returns. *Journal of Financial Economics, 37*(1), 67-87.

Cooper, W. D., Morgan, R. G., Redman, A., & Smith, M. (2004). Capital Budgeting Models: Theory Vs. Practice. *Business Forum, 26*(1/2), 15-19.

Crane. (1997, March 27, 1998). Annual Report: Form 10-K. Retrieved May 10, 2005

Datar, S., Kulp, S. C., & Lambert, R. A. (2001). Balancing Performance Measures. *Journal of Accounting Research, 39*(1), 75-92.

David, R. J., & Han, S.-K. (2004). A Systematic Assessment of the Empirical Support for Transaction Cost Economics. *Strategic Management Journal, 25*(1), 39-58.

Dawes, R. M. (1980). Social Dilemmas. *Annual Review of Psychology, 31*, 169-193.

Dietrich, J. R., & Kaplan, R. S. (1982). Empirical Analysis of the Commercial Loan Classification Decision. *The Accounting Review, 57*(1), 18-38.

Disclosure. (1998). Guide to Database Elements: SEC Database. Retrieved March 9, 2007

Dixit, A. K., & Pindyck, R. S. (1995). The Options Approach to Capital Investment. *Harvard Business Review, 73*(3), 105-115.

Ettredge, M. L., Kwon, S. Y., Smith, D. B., & Stone, M. S. (2006). The Effect of SFAS No. 131 on the Cross-segment Variability of Profits Reported by Multiple Segment Firms. *Review of Accounting Studies, 11*(1), 91-117.

Ezzamel, M. A. (1985). On the Assessment of the Performance Effects of Multidivisional Structures: A Synthesis. *Accounting and Business Research, 16*(61), 23-34.

Fama, E. F. (1980). Agency Problems and the Theory of the Firm. *The Journal of Political Economy, 88*(2), 288-307.

Fan, J. P. H., & Lang, L. H. P. (2000). The Measurement of Relatedness: An Application to Corporate Diversification. *Journal of Business, 73*(4), 629-660.

FASB. (1976a). Accounting for Leases (December 31, 1976 ed.).

FASB. (1976b). Financial Reporting for Segments of a Business Enterprise (December 15, 1976 ed., pp. 40).

FASB. (1997). Disclosures about Segments of an Enterprise and Related Information (pp. 136).

Fox, J., & Guyer, M. (1978). "Public" Choice and Cooperation in n-Person Prisoner's Dilemma. *The Journal of Conflict Resolution, 22*(3), 469-481.

Gertner, R., Powers, E., & Scharfstein, D. (2002). Learning about Internal Capital Markets from Corporate Spin-offs. *Journal of Finance, 57*(6), 2479-2506.

Gertner, R., Scharfstein, D., & Stein, J. C. (1994). Internal Versus External Capital Markets. *Quarterly Journal of Economics, 109*(4), 1211-1230.

Gibbons, R. (1997). An Introduction to Applicable Game Theory. *Journal of Economic Perspectives, 11*(1), 127-149.

Gibbons, R., & Murphy, K. J. (1992). Optimal Incentive Contracts in the Presence of Career Concerns: Theory and Evidence. *The Journal of Political Economy, 100*(3), 468-505.

Grant, J., Bricker, R., & Shiptsova, R. (1996). Audit Quality And Professional Self-Regulation: A Social Dilemma Perspective And Laboratory Investigation. *Auditing: A Journal of Practice & Theory, 15*(1), 142-156.

Grossman, S. J., & Hart, O. (1986). The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration. *Journal of Political Economy, 94*(4), 691-719.

Hall, R. E., Sims, C. A., Modigliani, F., & Brainard, W. (1977). Investment, Interest Rates, and the Effects of Stabilization Policies. *Brookings Papers on Economic Activity, 1977*(1), 61-121.

Hamburger, H., Guyer, M., & Fox, J. (1975). Group Size and Cooperation. *Journal of Conflict Resolution, 19*(3), 503-531.

Harris, M., & Raviv, A. (1996). The Capital Budgeting Process: Incentives and Information. *Journal of Finance, 51*(4), 1139-1174.

Harris, M. S. (1998). The Association between Competition and Managers' Business Segment Reporting Decisions. *Journal of Accounting Research, 36*(1), 111-128.

Hart, O., & Moore, J. (1990). Property Rights and the Nature of the Firm. *Journal of Political Economy, 98*(6), 1119-1158.

Hawawini, G., Subramanian, V., & Verdin, P. (2003). IS PERFORMANCE DRIVEN BY INDUSTRY- OR FIRM-SPECIFIC FACTORS? A NEW LOOK AT THE EVIDENCE. *Strategic Management Journal, 24*(1), 1-16.

Hayes, R. M., & Lundholm, R. (1996). Segment Reporting to the Capital Market in the Presence of a Competitor. *Journal of Accounting Research, 34*(2), 261-279.

Herrmann, D., & Thomas, W. B. (2000). An Analysis of Segment Disclosures under SFAS No. 131 and SFAS No. 14. *Accounting Horizons, 14*(3), 287-302.

Hill, C. W. L. (1985). Oliver Williamson and the M-Form Firm: A Critical Review. *Journal of Economic Issues, 19*(3), 731-751.

Hill, C. W. L. (1988). Internal Capital Market Controls and Financial Performance in Multidivisional Firms. *Journal of Industrial Economics, 37*(1), 67-83.

Himmelberg, C. P., Hubbard, R. G., & Palia, D. (1999). Understanding the determinants of managerial ownership and the link between ownership and performance. *Journal of Financial Economics, 53*(3), 353-384.

Hirshleifer, D. (1993). Managerial Reputation and Corporate Investment Decisions. *Financial Management, 22*(2), 145-160.

Holmstrom, B. (1999). Managerial Incentive Problems: A Dynamic Perspective. *Review of Economic Studies, 66*(1, Special Issue: Contracts), 169-182.

Holmstrom, B., & Costa, J. R. I. (1986). Managerial Incentives and Capital Management. *The Quarterly Journal of Economics, 101*(4), 835-860.

Holthausen, R. W., & Watts, R. L. (2001). The Relevance of the Value-Relevance Literature for Financial Accounting Standard Setting. *Journal of Accounting and Economics, 31*(1-3), 3-75.

Howe, K. M., & Vogt, S. (1996). On "*q*". *The Financial Review, 31*(2), 265-286.

Hubbard, R. G., & Palia, D. (1999). A Reexamination of the Conglomerate Merger Wave in the 1960s: An Internal Capital Markets View. *Journal of Finance, 54*(3), 1131-1152.

Inderst, R., & Laux, C. (2000). Incentives in Internal Capital Markets: Capital Constraints, Competition, and Investment Opportunities. *SSRN Working Paper*.

Itoh, H. (1992). Cooperation in Hierarchical Organizations: An Incentive Perspective. *Journal of Law, Economics, & Organization, 8*(2), 321-345.

Jensen, M. C. (1986). Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers. *American Economic Review, 76*(2), 323-329.

Jensen, M. C., & Meckling, W. H. (1976). Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. *Journal of Financial Economics, 3*(4), 305-360.

Johnson&Johnson. (1998). Form 10-K. Retrieved March 24, 2005, from http://www.10kwizard.com/

Kaplan, S. N., & Zingales, L. (1997). Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints? *The Quarterly Journal of Economics, 112*(1), 169-215.

Keating, A. S. (1997). Determinants of Divisional Performance Evaluation Practices. *Journal of Accounting and Economics, 24*(3), 243-273.

Khanna, N., & Tice, S. (2001). The Bright Side of Internal Capital Markets. *Journal of Finance, 56*(4), 1489-1528.

Knutson, P. H. (1993). *Financial Reporting in the 1990s and Beyond: A Position Paper*. Charlotteville, VA: Association for Investtment Management and Research.

Kollock, P. (1998a). Social Dilemmas: The Anatomy of Cooperation. *Annual Review of Sociology, 24*(1), 183-214.

Kollock, P. (1998b). Transforming Social Dilemmas: Group Identity and Co-operation. In P. A. Danielson (Ed.), *Modeling Rationality, Morality, and Evolution* (Vol. 7, pp. 185-209). New York: Oxford University Press.

Kothari, S. P. (2001). Capital Markets Research in Accounting. *Journal of Accounting and Economics, 31*(1-3), 105-231.

Kramer, R. M., & Brewer, M. B. (1984). Effects of Group Identity on Resource Use in a Simulated Commons Dilemma. *Journal of Personality & Social Psychology, 46*(5), 1044-1057.

Krishnan, J., & Press, E. (2003). The North American Industry Classification System and Its Implications for Accounting Research. *Contemporary Accounting Research, 20*(4), 685-717.

Lambert, R. A. (2001). Contracting Theory and Accounting. *Journal of Accounting and Economics, 32*(1-3), 3-87.

Lamont, O. (1997). Cash Flow and Investment: Evidence from Internal Capital Markets. *Journal of Finance, 52*(1), 83-109.

Lamont, O., Polk, C., & Saa-Requejo, J. (2001). Financial Constraints and Stock Returns. *The Review of Financial Studies, 14*(2), 529-554.

Lang, L. H. P., & Stulz, R. (1994). Tobin's *q,* Corporate Diversification, and Firm Performance. *Journal of Political Economy, 102*(6), 1248-1280.

Liebeskind, J. P. (2000). Internal capital markets: Benefits, costs, and organizational arrangements. *Organization Science, 11*(1), 58-76.

Liebrand, W. B. G. (1984). The Effect of Social Motives, Communication and Group Size on Behaviour in a N-person Multi-Stage Mixed-Motive Game. *European Journal of Social Psychology, 14*(3), 239-264.

Lim, S. C., Mann, S. C., & Mihov, V. T. (2002). Off-balance sheet financing: How much debt lurks in the leases? *Working Paper*.

Luce, R. D., & Raiffa, H. (1957). *Games and decisions: Introduction and Critical Survey*. New York: John Wiley & Sons.

Lundstrum, L. L. (2003). Firm Value, Information Problems and the Internal Capital Market. *Review of Quantitative Finance and Accounting, 21*(2), 141-156.

MacKie-Mason, J. K. (1990). Do Firms Care Who Provides Their Financing? In R. G. Hubbard (Ed.), *Asymmetric Information, Corporate Finance, and Investment* (pp. 63-103). Chicago, IL: The University of Chicago Press.

Maines, L. A., McDaniel, L. S., & Harris, M. S. (1997). Implications of Proposed Segment Reporting Standards for Financial Analysts' Investment Judgments. *Journal of Accounting Research, 35*(3), 1-24.

Maksimovic, V., & Phillips, G. (2002). Do Conglomerate Firms Allocate Resources Inefficiently Across Industries? Theory and Evidence. *Journal of Finance, 57*(2), 721-767.

Mannix, E. A. (1993). Organizations as Resource Dilemmas: The Effects of Power Balance on Coalition Formation in Small Groups. *Organizational Behavior and Human Decision Processes, 55*(1), 1 - 22.

Marwell, G., & Schmitt, D. R. (1972). Cooperation in a Three-Person Prisoner's Dilemma. *Journal of Personality & Social Psychology, 21*, 376-383.

Matsusaka, J. G., & Nanda, V. (2002). Internal Capital Markets and Corporate Focusing. *Journal of Financial Intermediation, 11*(2), 176-211.

Mayer, T. (1960). Plant and Equipment Lead Times. *Journal of Business, 33*(2), 127-132.

Messick, D. M., & Brewer, M. B. (1983). Solving Social Dilemmas: A Review. *Review of Personality & Social Psychology, 4*, 11-44.

Milgrom, P., & Roberts, J. (1988). An Economic Approach to Influence Activities in Organizations. *American Journal of Sociology, 94*(Supplement), S154-S179.

Milgrom, P. R. (1988). Employment Contracts, Influence Activities, and Efficient Organization Design. *The Journal of Political Economy, 96*(1), 42-60.

Motta, A. d. (2003). Managerial Incentives and Internal Capital Markets. *Journal of Finance, 58*(3), 1193-1220.

Narayanan, M. P. (1996). Form of Compensation and Managerial Decision Horizon. *The Journal of Financial and Quantitative Analysis, 31*(4), 467-491.

Olson, M. (1965). *The Logic of Collective Action: Public Goods and the Theory of Groups*. Cambridge, MA: Harvard University Press.

Pacter, P. (1993). *Reporting Disaggregated Information*. Norwalk, CN: FASB Foundation.

Peyer, U. C., & Shivdasani, A. (2001). Leverage and Internal Capital Markets: Evidence from Leveraged Recapitalizations. *Journal of Financial Economics, 59*(3), 477-515.

Radner, R. (1986). The Internal Economy of Large Firms. *The Economic Journal, 96*(Supplement), 1-22.

Rajan, R., Servaes, H., & Zingales, L. (2000). The Cost of Diversity: The Diversification Discount and Inefficient Investment. *Journal of Finance, 55*(1), 35-80.

Riahi-Belkaoui, A. (2000). *Accounting and the Investment Opportunity Set*. Westport, Connecticut: Quorum Books.

Riahi-Belkaoui, A. (2001). *Evaluating Capital Projects*. Westport, Connecticut: Quorum Books.

Russo, M. V. (1994). The Multidivisional Structure as an Enabling Device: A Longitudinal Study of Discretionary Cash as a Strategic Resource. *Academy of Management Journal, 34*(3), 718-733.

Scharfstein, D. (1998). The Dark Side of Internal Capital Markets II: Evidence from Diversified Conglomerates. *NBER Working Papers*.

Scharfstein, D., & Stein, J. C. (2000). The Dark Side of Internal Capital Markets: Divisional Rent-Seeking and Inefficient Investment. *Journal of Finance, 55*(6), 2537-2564.

Shelanski, H. A., & Klein, P. G. (1995). Empirical Research in Transaction Cost Economics: A Review and Assessment. *Journal of Law, Economics & Organization, 11*(2), 335-361.

Shin, H.-H., & Stulz, R. (1998). Are Internal Capital Markets Efficient? *Quarterly Journal of Economics, 113*(2), 531-551.

Standard & Poor's Compustat User's Guide. (2003). Centennial, Colorado: Standard & Poor's.

Statistics for Industry Groups and Industries: Annual Survey of Manufactures. (2001). Retrieved. from.

Steer, P., & Cable, J. (1978). Internal Organization and Profit: An Empirical Analysis of Large U.K. Companies. *Journal of Industrial Economics, 27*(1), 13-30.

Stein, J. C. (1989). Efficient Capital Markets, Inefficient Firms: A Model of Myopic Corporate Behavior. *Quarterly Journal of Economics, 104*(4), 655-669.

Stein, J. C. (1997). Internal Capital Markets and the Competition for Corporate Resources. *Journal of Finance, 52*(1), 111-133.

Stein, J. C. (2003). Agency, Information and Corporate Investment. In G. M. Constantinides, M. Harris & R. Stultz (Eds.), *Handbook of the Economics of Finance* (Vol. 1A). Amsterdam: Elsevier/North-Holland.

Street, D. L., Nichols, N. B., & Gray, S. J. (2000). Segment Disclosures under SFAS No. 131: Has Business Segment Reporting Improved? *Accounting Horizons, 14*(3), 259-285.

Taylor, M. (1987). *The Possibility of Cooperation*. Cambridge: Cambridge University Press.

Teece, D. J. (1981). Internal Organization and Economic Performance: An Empirical Analysis of the Profitability of Principal Firms. *Journal of Industrial Economics, 30*(2), 173-199.

Teece, D. J. (1982). Towards an Economic Theory of the Multiproduct Firm. *Journal of Economic Behavior and Organization, 3*(1), 39-63.

Teleflex, I. (1995). Form 10-K (Annual Report) for December 31, 1995 filed March 25, 1996. Retrieved March 25, 2005

Van Lange, P. A. M., Liebrand, W. B. G., Messick, D. M., & Wilke, H. A. M. (1992). Chapter 1: Introduction and Literature Review. In W. B. G. Liebrand, D. M. Messick & H. A. M. Wilke (Eds.), *Social Dilemmas: Theoretical Issues and Research Findings* (pp. 3-28). Oxford, England: Pergamon Press.

van Riel, C. B., & van Bruggen, G. H. (2002). Incorporating Business Unit Managers' Perspectives in Corporate-branding Strategy Decision Making. *Corporate Reputation Review, 5*(2 & 3), 241-251.

Verrecchia, R. E. (2001). Essays on Disclosure. *Journal of Accounting & Economics, 32*(1-3), 97-180.

Villalonga, B. (2004). Diversification Discount or Premium? New Evidence from BITS Establishment-Level Data. *Journal of Finance, 59*(2), 479-506.

Whited, T. M. (2001). Is It Inefficient Investment that Causes the Diversification Discount? *Journal of Finance, 56*(5), 1667-1691.

Williamson, O. E. (1970). *Corporate Control and Business Behavior*. Englewood Cliffs, NJ: Prentice Hall.

Williamson, O. E. (1975). *Markets and Hierarchies, Analysis and Antitrust Implications: A Study in the Economics of Internal Organization*. New York: Free Press.

Williamson, O. E. (1985). *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*. New York: Free Press.

Wulf, J. (2002a). Influence and Inefficiency in the Internal Capital Market: Theory and Evidence. *SSRN Working Paper*.

Wulf, J. (2002b). Internal Capital Markets and Firm-Level Compensation Incentives for Division Managers. *Journal of Labor Economics, 20*(2-Supplement), S219-S262.

Wurgler, J. (2000). Financial Markets and the Allocation of Capital. *Journal of Financial Economics, 58*(1-2), 187-214.

Zeng, M. (2003). Managing the Cooperative Dilemma of Joint Ventures: The Role of Structural Factors. *Journal of International Management, 9*(2), 95-113.