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Mathias Arrfelt

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Ph.D. degree in Strategic Management

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INEFFICIENCIES IN THE INTERNAL CAPITAL ALLOCATION PROCESS – ANTECEDENTS AND PERFORMANCE IMPLICATIONS

By

Mathias Arrfelt

A DISSERTATION

Submitted to
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ABSTRACT

INEFFICIENCIES IN THE INTERNAL CAPITAL ALLOCATION PROCESS – ANTECEDENTS AND PERFORMANCE IMPLICATIONS

By

Mathias Arrfelt

In this dissertation, I examine the internal allocation of investment capital across business segments within the firm. Introducing a multilevel model that relies more on narrower and less distant measures of firm performance, I predict that a number of multilevel antecedents including performance aspirations, corporate governance variables, and environmental uncertainty affect the efficiency of the internal capital allocation process which, in turn, affects three important firm performance outcomes – the diversification discount, the corporate effect and firm ROA. Results suggest a pervasive effect of performance aspirations on the efficiency of the allocation process as well as a mainly positive effect of allocation efficiency on performance outcomes. Thus, by combining four distinct literatures on capital allocation, firm performance decomposition, diversification, and the diversification discount into a more integrated framework for looking at the efficiency of the capital allocation process, this dissertation should be viewed as an initial step in building knowledge about both antecedents to allocation efficiency as well as performance implications of allocation efficiency within the boundaries of the firm.

DEDICATION

To my patient parents and sister who provided much support on this eventful journey.

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This dissertation benefited from the advice and support of many. I thank the members of my committee for their skill and hard work in steering this dissertation to a successful conclusion. I am especially indebted to my mentor and friend, Bob Wiseman, who not only eased my entry into the program, but also supported me every step of the way on this journey. Great gratitude also goes out to fellow doctoral students, staff, and other faculty members at Michigan State University who contributed to making this difficult endeavor so much more enjoyable.

Finally, none of this would have been possible without my wonderfully supportive parents who insisted on us receiving our higher education in the Land of Dreams.

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INTRODUCTION

In this dissertation, the internal capital allocation process is studied in a different setting than what is customary in traditional financial and economic research. I take a behavioral perspective in re-examining the transaction cost economics (TCE) approach (Williamson, 1975: 1985: 1996) to internal capital allocation including viewing the capital allocation decision (i.e., the transaction itself) as the unit of analysis and emphasizing behavioral assumptions (opportunism and bounded rationality) that have traditionally been viewed as hindering complete market contracting and requiring firms to use internal governance structures to mitigate inefficiencies in the external capital allocation process.

According to Williamson, in order to mitigate such inefficiencies related to underlying behavioral assumptions regarding both human behavior and environments, diversified firms allocate capital using an internal capital allocation process – referred to as a 'miniature capital market'. That is, this internal capital allocation process substitutes for an external process by transferring the responsibility of allocating capital from external intermediaries (such as directly by capital markets, or by banks and other financial institutions) to the corporate headquarter and its agents. This will, Williamson argues, give the multidivisional firm multiple advantages including better information to base the capital allocation decision on, an internal competition for funds instead of funds being automatically returned to their sources, and the opportunity to implement a more sequential and thorough investment process relative to what may be feasible through the capital market.

Acknowledging the clear delineation between the external capital allocation process performed by external intermediaries and the internal allocation process performed by knowledgeable internal managers made by Williamson and many finance scholars (e.g., Scharfstein & Stein, 2000), I argue however that external and internal markets are related in many ways and may compliment instead of substitute for each other as much of the previous literature has assumed. That is, firms, regardless of structure (single or multi-segment), seek investment capital from external capital markets that they in turn reallocate to a number of potential uses within the firm, including allocations to business segments, dividend payments, firm stock buy backs, payment for mergers and acquisitions, as well as payment of corporate level expenses such as for corporate headquarters and corporate salaries. Thus, this view of external and internal markets for capital allocation conflicts with assumptions made by Williamson and the financial literature in at least two ways. First, firms are not passively allocated capital to – they actively seek different amounts as well as types of investment capital based on, at least to some extent, the attractiveness of their uses for such capital. Second, prior work on capital allocation (e.g., Williamson, 1975) effectively excludes alternative uses for investment capital (besides allocations to business segments) such as those described above.

In fact, it is the second assumption that enables the clear delineation between internal capital markets and diversified firms on the one hand, and external markets and single-segment firms on the other: single-segment firms do not need an internal allocation process because all capital investment is assumed to go to the single segment, while diversified firms use the internal structure to allocate capital between their business

segments. Thus, with a less restrictive view of how firms use their investment capital, I lessen the distinction between internal and external markets and allow single-segment firms to have internal allocation structures. That is, even single-segment firms have control over both the capital they seek from capital markets as well as how they use such capital. This extends Williamson's model of capital allocation to also include single-segment firms previously viewed as not having an internal allocation mechanism.

Notwithstanding that the potential benefits of an internal allocation process described earlier may also apply to single-segment firms, I argue that the internal market for capital allocation often put in place to attenuate opportunistic contracting under conditions of bounded rationality is not itself immune to those same influences that create inefficiencies in the external market for capital allocation. In fact, since firms may make the switch from traditional U-form structures (functional structure) to M-form structures for a number of reasons other than to achieve efficient capital allocation (including cheaper dispute resolution, more effective audits, and a beneficial division of labor between headquarters and divisions that allow each to focus on specific duties), we cannot conclude that the internal capital allocation process is efficient at all times, or even that it is always the most efficient way of allocating capital[1]. That is, market failures where capital is misallocated as a direct result of both human and environmental characteristics also applies to the *internal* market for capital allocation and thus also to the internal capital allocation process in single-segment and diversified firms.

[1] Williamson, on the other hand, assumes that the capital allocation decision is always performed at the highest possible level of rationality (still assuming bounded rationality) by giving agents perfect foresight to costlessly switch governance structure (from external to internal and vice versa) once they believe one structure may be beneficial over the other in response to upcoming contracting hazards. This is what he means by "semistrong form" (1996: 9) of rationality.

Therefore, to account for such human and environmental characteristics that may affect the efficiency of the internal capital allocation process, I look to a number of well-known theories of human behavior and decision-making including Prospect Theory (Kahnemann & Tversky, 1979), Behavioral Theory of the Firm (Cyert & March, 1963), Agency Theory (Jensen & Meckling, 1976: Fama, 1980: Fama & Jensen, 1983: Jensen, 1986), as well as to theories (e.g., Duncan, 1972: Dess & Beard, 1984) describing the environment's impact on decision making, in particular on its rationality. The listed theories support a number of business segment, firm and industry level antecedents that are posited to directly affect the efficiency and rationality of the capital allocation decision.

Furthermore, to account for and emphasize the increased importance of the corporate office for firm performance that an internal allocation process varying in efficiency implies, I model the efficiency of the allocation process as affecting important firm performance outcomes including the corporate effect, the diversification discount[2] (I will refer to the diversification discount as 'diversified firm value' from here on unless specifically referencing prior work within the diversification discount literature) and firm ROA. The corporate effect, in particular, should reflect this increasing importance of the corporate office by measuring how much value the corporate office creates or destroys by its actions including decisions to allocate capital. In sum, therefore, I argue that a number of multilevel antecedents affect the efficiency of the capital allocation process which, in turn, affects important measures of firm performance.

[2] Please note that the diversification discount, because of its conceptual construction, can only include effects of capital allocation efficiency for diversified firms, and is therefore constrained to only include such effects.

Overall, by incorporating a number of multilevel antecedents and performance outcomes into the study of the internal capital allocation process, this dissertation brings together a number of distinct literatures on firm performance decomposition, on diversification, on the diversification discount, and on capital allocation. Each literature offers unique insights, opportunities and challenges as it relates to the capital allocation process and its efficiency. First, the firm performance decomposition literature (e.g., Bowman & Helfat, 2001: Adner & Helfat, 2003: Misangyi, Elms, Greckhamer & LePine, 2006: Brush, Bromiley & Hendrickx, 1999: McGahan & Porter, 1997: Hough, 2006) answers the question of where firm performance is generated, i.e., by the industry, corporate office, or by the business segments themselves (see Bowman & Helfat, 2001, for a review of how firm performance is decomposed into industry, corporate and business segment effects). Although estimates vary of the relative importance of industry, corporation and business segments for firm performance, with the importance of corporate influences on firm performance especially contentious[3], a portion of that performance is generated by the corporate office and is therefore related to important corporate-level processes such as the capital allocation process (Bowman & Helfat, 2001: Misangyi *et al.*, 2006). That is, the more efficiently the corporate office allocates scarce resources such as capital, the more value it may be able to add to the business segments, thereby increasing the corporate contribution to firm performance as reflected in higher empirical estimates of such contributions, i.e., higher corporate effects.

[3] One group of firm performance decomposition studies points to very small corporate effects of around 4 percent (Schmalensee, 1985: Rumelt, 1991: McGahan & Porter, 1997), while another group of studies find substantially larger corporate effects of between 9 and 28 percent (Brush, Bromiley & Hendrickx, 1999: Roquebert, Phillips & Westfall, 1996: Hough, 2006). This lack of agreement reflects disagreement over both which methods are appropriate as well over what the resulting empirical estimates (corporate effects) actually mean (Bowman & Helfat, 2001).

Second, the literature on diversification discounts (e.g., Stein, 1997: Maksimovic & Phillips, 2002: Berger & Ofek, 1995: Servaes, 1996: Lang & Stulz, 1994) is also related to this dissertation and to the capital allocation process. Offering a comparison between actual firm values of diversified firms and their hypothetical values if all business segments instead were freestanding, the diversification discount literature has consistently shown that business segments are worth more freestanding than under the corporate umbrella[4] (e.g., Berger & Ofek, 1995: Servaes, 1996: Lang & Stulz, 1994). Therefore, based on the finding that firm values fluctuate based on level of diversification, a tie between capital allocation efficiency and the diversification discount may seem likely whereby inefficient allocation of capital across business segments may help to explain observed discounts.

Finally, the literature on diversification (e.g., Palich, Cardinal, & Miller, 2000: Montgomery & Wernerfelt, 1988: Bowen & Wiersema, 2005) is also related to this dissertation and the internal capital allocation process because increased diversification may increase the difficulty and salience of the capital allocation function. In other words, by diversifying into related and/or unrelated businesses, the allocation decision becomes more uncertain as corporate managers, limited in their ability to understand, process, and digest information, are facing an increasing amount of diverse information to gather, analyze and act upon. In addition, the salience of the capital allocation function may also increase as the number of allocation decisions as well as the impact of formal allocation

[4] Some argue (Campa & Kedia, 2002: Villalonga, 1999), however, that this discount may be partly due to the endogeneity of the diversification decision. That is, and as also discussed in more detail in the methods section, firms may diversify in response to specific firm characteristics (such as poor performance) that may make the opportunity cost of diversifying less.

rules often found in organizations (e.g., Bower, 1986: Shin & Stulz, 1998) both rise with increasing levels of diversification.

Against the background that the capital allocation function is related to, and has much in common with each of the three described literatures, it is surprising that so relatively little attention[5] has been paid to this potentially very important corporate-level process within the field of strategic management. In fact, the capital allocation process becomes a strategic question of fundamental importance as capital sought directly from capital markets as well as from banks and other financial intermediaries is effectively reallocated to important internal uses including allocations to business segments. Thus, the fundamental function of effectively allocating scarce resources, which otherwise could have been carried out by banks and other financial intermediaries (e.g., Williamson, 1975), is internalized. That is, for both single-segment and diversified firms, the burden of allocating capital to internal uses including business segments is effectively transferred from capital markets to the corporate office.

Also supporting the overarching importance of the allocation of financial resources for the firm, Donaldson (1984) argues that this allocation of scarce financial resources reflects the strategic priorities of the firm by entailing critical risky strategic decisions: "The most critical choices top management makes are those that allocate resources among competing strategic investment opportunities" (95). As such, the allocation decision becomes a core attribute of the diversified firm and a core activity of its corporate officers reflecting its importance for overall firm performance: "In many respects, this assignment of cash flows to high yield uses is the most fundamental

[5] A search for various derivatives of 'capital allocation' in major U.S. management journals returned fewer than 8 such studies.

attribute of the M-form enterprise" (Williamson, 1975: 148). Thus, based on the fundamental strategic importance of the allocation decision in diversified firms, the minimal attention given to capital allocation within strategic management contrasts sharply with the extensive coverage afforded in finance and economics. In those areas, the degree of optimality of the capital allocation process has been shown to affect both the performance of diversified firms and the observed differences in valuation between freestanding business segments and similar segments held under the corporate umbrella, i.e., the 'diversification discount' (e.g., Stein, 1997: Maksimovic & Phillips, 2002: Berger & Ofek, 1995: Servaes, 1996: Lang & Stulz, 1994), referred to as 'diversified firm value' in this dissertation. In addition, the capital allocation process has been found to be inefficient (e.g., Lamont, 1997: Shin & Stulz, 1998: Rajan, Servaes, & Zingales, 2000) as capital often is allocated relatively independent of business segments' prospects.

This relative lack of attention to the capital allocation process within strategic management is also a surprise because research on capital allocation may have stronger performance implications in the U.S. as compared to countries with institutional arrangements that emphasize an allocation process based less on future prospects than on available internal capital (Thomas III & Waring, 1999). That is, because U.S. firms tend to allocate capital based on future prospects of business segments to achieve "adequate returns on equity investments or face attacks from equity investors that can culminate in proxy battles and hostile takeovers" (Thomas III & Waring, 1999: 735), the allocation process should logically be much more strongly related to firm performance as compared to countries such as Germany and Japan, where investments are allocated more based on available internal capital and a broader bargaining process involving a number of long-

term partners with power to influence allocations, including labor, banks, and governments. Thus, the potential value of an efficient capital allocation process may be higher for firms in the U.S. than for firms in countries with different institutional environments.

Considering the fundamental importance of the internal capital allocation process, its close ties with a number of other literatures, and the lack of attention to this process within strategic management, my model of the internal capital allocation process in firms has the promise to offer insight and clarification into a number of issues raised (or omitted) by existing research within the area of capital allocation as well as by research within the other three related literatures (firm performance decomposition, diversification, and the diversification discount). First, a number of antecedents to the efficiency[6] of the capital allocation mechanism are investigated. Prior research on capital allocation within finance and economics (e.g., Scharfstein & Stein, 2000: Stein, 1997: Rajan, Servaes & Zingales, 2000) has largely ignored antecedents and looked strictly at the allocation process as a given, by assuming (varying levels of) optimality through ad hoc assumption. Thus, a key gap in existing research on capital allocation is how antecedents to a capital allocation process varying in efficiency have largely been overlooked. That is, we currently know very little about <u>why</u> misallocation of resources takes place in organizations. My model, therefore, extends existing research by viewing capital allocation as a decision-making process and investigating a number of behaviorally based antecedents to its efficiency. In addition, by relaxing the delineation

[6] Note that the use of 'efficiency' does not imply absolute optimality of the capital allocation process, only a relative comparison between firms' allocational efficiencies based on instances and magnitudes of over and underinvestment. In other words, a firm's allocational efficiency approaches optimality as there are fewer and fewer instances of over and underinvestment.

between internal and external capital allocation processes and allowing single-segment firms to have internal capital allocation processes, I can investigate antecedents to the internal capital allocation process also in single-segment firms.

In investigating antecedents to a capital allocation process varying in efficiency, I assume that corporate headquarters regardless of allocation process (see Bower, 1986, for a more formal discussion of the capital allocation process in organizations) have a final say (i.e., control rights in Stein's (1997) language) with regards to allocations, have the right to 'winner-pick' (Stein, 1997) by transferring investment funds from relatively less well-performing segments to those performing better, as well as have the right to allocate investment capital to other uses such as dividend payments, buybacks of stock, and to pay for acquisitions. The assumption that the corporate office has the right to winner pick, apart from being fairly reasonable and often found in studies published in finance, economics and other areas that model the mathematical relationship between the efficiency of the capital allocation process and firm performance (e.g., Stein, 1997: Maksimovic & Phillips, 2002: Rajan, Servaes & Zingales, 2000), also confirms that the allocation process is at its heart a decision-making process. It follows, therefore, that the capital allocation process, as an example of a strategic organizational decision-making process, may be susceptible to various influences or drivers at different levels in the organization.

A number of such multilevel drivers of behavior have been shown to affect decision-making processes in organizations. Greve (1998), for example, showed that social and historical aspiration levels affect behaviors at the individual level. Bethel and Liebeskind (1993) described how managerial ownership incentives affected decisions at

the corporate level, while Goll and Rasheed (1997) found that environmental munificence and dynamism at the industry level also affected decisions in the organizational context. Thus, following current research and recognizing that antecedents at business segment, corporate, and industry levels may affect organizational behavior and decision-making, I structured the current investigation to look at antecedents at all levels that could affect, are thought to be inherent in, or are thought to capture the capital allocation process – antecedents at business segment, corporate and industry levels.

Therefore, I will investigate four sets of drivers of behaviors at three different levels: at the business segment level, I am investigating historical and social segment performance comparisons capturing the tendencies of loss-averse decision makers to protect gains and try to reverse losses. At the corporate level, I am investigating a number of corporate governance variables – block holder ownership, institutional shareholder ownership, and contingent compensation that together capture how agency-theoretic prescriptions try to control self-interested and risk-averse decision makers in the context of the capital allocation process. Also at the corporate level, I am investigating how level of diversification may capture additional complications in the allocation process stemming from a lack of overview and expertise from diversification efforts into increasingly unrelated areas. In addition, environmental uncertainty at the industry level (Dess & Beard, 1984) may have a direct effect on the efficiency of the allocation decision as it captures dimensions of the task environment that may increase its uncertainty. Finally, environmental uncertainty may also have a moderating effect on some of the described relationships. In particular, it may exacerbate the effect of increased levels of

diversification as well as reduce the effectiveness of corporate governance variables in their respective relationships with capital allocation efficiency.

In sum, by investigating multilevel antecedents to the capital allocation process and relaxing strict assumptions of rationality and efficiency so often applied to research within finance and economics (Bromiley, 2005), this dissertation identifies a key gap in prior research on capital allocation by offering unique insight into what actually accounts for different degrees of efficiency of the allocation process. In addition, by relaxing previous strict assumptions made as part of most research on capital allocation thereby allowing single-segment firms to have internal allocation processes, antecedents to allocation efficiency apply also to firms with only single segments.

Second, this study addresses the firm performance decomposition literature by providing guidance on what accounts for or produces corporate influences on firm performance, i.e., the corporate contribution. Any such guidance is currently missing from that literature. In fact, the variety of single-level models most often used in decomposition research do not permit the investigation of antecedents to any of the three decomposed effects as measures of business segment, corporate and industry influences on firm performance (see Misangyi *et al.*, 2006, for a discussion of why only multilevel specifications allow such an investigation). This lack of guidance implies that we are not sure how, or even if, an important corporate-level process, such as capital allocation, affects firm performance. Without such knowledge, the natural connection between antecedents to the capital allocation process, the capital allocation process itself, and firm performance remain largely unknown. Thus, with a better understanding of how the capital allocation process affects firm performance outcomes, the study of antecedents to

the capital allocation process as well as policy prescriptions targeting the capital allocation process can be justified and become more meaningful.

Acknowledging this omission by the literature and responding to calls for research into what accounts for or determines individual decomposed effects (Bowman & Helfat, 2001: Misangyi *et al.*, 2006), this dissertation, therefore, will investigate how the capital investment allocation process is related to the corporate contribution as measured by corporate effects. Specifically, I posit that the capital investment allocation process is directly related to the corporate effect by measuring how effective the corporate office is in allocating capital among its potential uses including business segments. Said differently, this dissertation measures how much value the corporate office adds by allocating capital in a relatively more efficient manner. This relationship is not only intuitive, it follows logically based on the specific segment ROA decomposition process used in most studies (e.g., Brush, Bromiley & Hendrickx, 1999: McGahan & Porter, 1997: Hough, 2006) where overall firm ROA is used as a proxy for the corporate effect as individual business segment ROAs are regressed on this proxy. In other words, if firms allocate relatively more capital to segments with less favorable prospects and lower ROA, we would expect overall firm ROA to be negatively affected, leading to a lower corporate contribution as reflected by a lower corporate effect. Therefore, inefficiencies in the allocation process as found by a number of researchers (e.g., Berger & Ofek, 1995: David *et al.*, 2006) may reduce the corporate contribution and the corporate effect below what it should be with a more efficient allocation of capital. Thus, this study creates the connection between two related literatures (the capital investment allocation and the firm performance decomposition literatures) that Brush, Bromiley and Hendrickx (1999: 542)

alluded to in their study. At the same time, Brush, Bromiley and Hendrickx (1999) also suggest inefficient capital allocation as one possible explanation for the small corporate effects often found in the latter literature.

Also addressing the firm performance decomposition literature, a third contribution of this dissertation focuses on empirical estimates of the corporate contribution: corporate effects. Although the logic underlying associating a corporate-level process (the capital allocation process) with a measure of how effective the corporate office is in adding value is clear, a number of researchers have pointed out methodological problems with corporate effects that may confound or distort the relationship between corporate-level processes and the true contribution of the corporate level to firm performance, the corporate contribution (e.g., Bowman & Helfat, 2001: Adner & Helfat, 2003: Misangyi *et al.*, 2006).

These concerns focus on how sensitive the attribution of variance between business segment and the corporate level is to dispersion in business segment returns. They argue that empirical estimates of corporate contributions are likely to be biased by a high, but inappropriate, sensitivity to the patterns of returns across a firm's business segments. That is, ceteris paribus, at relatively higher levels of business segment return homogeneity, some of the variance that otherwise would be attributed to the business segment effect may now instead be attributed to the corporate effect, in effect overstating it relative to the corporate contribution. At higher levels of business segment return dispersion, the opposite is likely to happen as corporate variance instead is attributed to the business segment effect. To incorporate those concerns, multiple hypotheses are

offered that acknowledge that an unmeasured construct[7], the variance of business segment returns within firms, may in fact have a strongly distorting or confounding effect resulting in a null or even a positive relationship between inefficiencies in the capital allocation process and empirical estimates of the corporate contribution at low levels of return variance. To estimate this distorting or confounding effect and achieve a more satisfactory measure of the 'true' corporate contribution, I examine and measure the variance of business segment returns within each firm.

A fourth contribution of this dissertation is how it ties the efficiency of the capital allocation function to the level of firm diversification. Notwithstanding that level of diversification is one antecedent to the efficiency of the capital allocation process suggesting a negative impact of diversification on capital allocation process efficiency, the use of diversified firm value as a firm performance outcome provides an additional connection between capital allocation and diversification. That is, although single-segment firms in my model are assumed to have internal allocation mechanisms, the efficiency with which diversified firms allocate capital can still be estimated by looking at diversified firm values as the difference in value between free-standing business segments and those under the corporate umbrella.

Although many studies have looked at diversification discounts (e.g., Berger & Ofek, 1995: Lang & Stulz, 1994: Comment & Jarrell, 1995) and some have looked at how capital allocation efficiency affects the diversification discount (e.g., Berger & Ofek, 1995), few have looked at underinvestment and none has looked at antecedents to misallocations of capital. Thus, by more carefully measuring inefficiencies in the capital

[7] A search in major management journals failed to find even a single firm performance decomposition study that explicitly measures the dispersion of business segment returns.

allocation process, i.e., measuring both over and underinvestment, as well as more fully investigating behavioral antecedents to each, a more complete picture may emerge of how capital is allocated in firms and how inefficiencies in this process are tied to the level of diversification through diversified firm values. This puts M-form prescriptions emphasizing the efficiency[8] of the internal capital allocation function – diversified firms have more flexibility in accessing capital (because they can also access internal sources) (Lang & Stulz, 1994: Stulz, 1990) as well as superior access to information helping to optimize allocation decisions (Schleifer & Vishny, 1986: Servaes, 1996: Williamson, 1986) — against current evidence starting to point to M-form firms allocating relatively more capital to weak lines of business than their stand-alone counterparts (Rajan *et al.*, 2000), M-form firms being insensitive to the prospects of their divisions in allocating investment funds (Rajan *et al.*, 2000), as well as them being sensitive to cash flows of unrelated divisions (Scharfstein & Stein, 2000).

In sum, therefore, with the caveat that even single-segment firms may have an internal capital allocation function, this dissertation may be able to speak to the effectiveness of M-form prescriptions related to the allocation of capital. In addition, by investigating likely antecedents to this internal allocation process, I may also be able to determine why current evidence has shown diversified firms to be poor at allocating capital.

[8] Although it could be argued that observed discounts may be a function of costly internal capital allocation functions that are not able to add value in proportion to their costs, this is unlikely for a number of reasons. First, the capital allocation function is often not a separate function instead performed by regular members of the top management team (Bower, 1986), thus is unlikely to add substantial additional costs. Second, external capital allocation also carries costs in the form of transaction costs as capital is sourced and passed on to deserving free-standing firms.

As a fifth contribution, I provide guidance to the controversy within the firm performance decomposition literature regarding which method is most appropriate to model the inherently multilevel phenomena of decomposed firm performance. Several methods have been suggested and used by different researchers including nested ANOVA and variance components analysis (VCA), as well as the more recent use of multilevel specifications including models used by Hough (2006) and Misangyi *et al.* (2006). Although a number of specific issues, such as for example the lack of reliability and insensitivity to small effects in VCA, have been identified with the former two methods (Brush & Bromiley, 1997), the main drawback of the two single-level methods is that they assume independence between effects. That is, single-level models assume away the endogeneity that may for example exist as corporate parents, skilled at adding value to business segments, also are effective at selecting attractive industries in which to compete. Thus, this assumption not only fits poorly with underlying theories and data describing the nested structure of business segments, firms and industries, but it also effectively makes it impossible to advance theory and empirical work by investigating relationships between individual effects as well as investigating specific factors as antecedents to individual effects. In other words, multilevel specifications by controlling for, instead of assuming, independence enable extensions to theory by accounting for relationships among effects as well as for relationships within those effects. Applied to the context of my study, a multilevel approach becomes a necessary tool to investigate multilevel antecedents to the corporate effect.

Finally, since the use of firm performance has been criticized as being too far removed from corporate strategies and actions to reflect "distinctive advantages at the

process level" (Ray, Barney & Muhanna, 2004: 23), both the use of a corporate level process, the allocation of investment capital, as well as the use of the corporate effect as a measure of the corporate contribution may alleviate some of that criticism. In particular, the use of the capital allocation process (as an alternative to using firm performance as dependent variable) is in accordance with suggestions by Ray, Barney and Muhanna (2004) to alleviate concerns with differentiating between competing "competitive advantages in some business activities and competitive disadvantages in others" (Ray, Barney & Muhanna, 2004: 24). In other words, using firm performance we may not be able to differentiate between strategies and actions that increase firm performance and those that do not. In addition, because if its high level of aggregation, intervening 'power' (Westphal, 1998) and other processes may be more likely to distort and add noise to firm performance relative to closer processes. Therefore, we may have a better chance of picking up on their (governance variables) true effect by using a measure of "the effectiveness of business processes" (Ray, Barney & Muhanna, 2004: 24), i.e., the efficiency of the capital allocation process, which is likely to be more sensitive to firm strategies and decisions than overall firm performance.

In addition, using the corporate effect as a measure of the corporate contribution should enable a more precise relationship between corporate governance variables, the capital allocation process and firm performance with intervening industry and business segment effects excluded from the outcome measure. In other words, increased alignment as a result of better corporate governance should be more likely to increase performance at the corporate-level, thus primarily affecting the corporate effect. In sum, the use of a less distant process (allocation of capital) and a more narrowly defined firm performance

measure (the corporate effect) may increase the likelihood of finding true and precise relationships between corporate governance variables and firm performance outcomes.

In summary, with the goal of providing a better understanding of the internal capital allocation process, including its antecedents and effects on both diversified firm values, the corporate effect as well as on firm ROA, this dissertation is organized as follows. In Chapter 1, I discuss antecedents to the degree of efficiency of the capital allocation process including business segment historical and social performance comparisons, a number of corporate governance variables, environmental uncertainty, and level of diversification. Hypotheses are then advanced tying antecedents to the degree of efficiency of the allocation process.

In Chapter 2, I discuss how the degree of efficiency of the capital allocation process affects the corporate effect, diversified firm value as well as firm ROA. Several hypotheses are then advanced outlining possible relationships between the capital allocation process on the one hand, and the corporate effect, diversified firm value and firm ROA on the other.

In Chapter 3, I describe the testing of my multilevel model. Sampling, data collection, measures and data analytical decisions are all discussed in detail.

In Chapter 4, I review the findings including the extent to which the hypotheses are supported. In Chapter 5, finally, I discuss the findings themselves in detail including what they may mean for the literatures on firm performance decomposition, capital allocation, diversification, and diversified firm value as well as the overall conclusions that may be reached based on them.

CHAPTER 1: THEORETICAL MODEL DESCRIBING ANTECEDENTS TO CAPITAL ALLOCATION EFFICIENCY

Introduction

The central argument of this dissertation is that capital allocation plays a critical role in the performance of diversified (M-form) and single-segment firms, and that the efficiency of this process is related to a variety of characteristics at the business segment, firm and industry levels. Thus, the key construct in this study is capital allocation efficiency, which I define as the degree of over and underinvestment in individual business segments.

Noting that capital investment is a forward looking process that should be based on business segment prospects, not their past results, overinvestment is characterized as the allocation of capital to business segments with relatively worse prospects. Specifically, if more capital is allocated to business segments with relatively worse prospects than those with relatively better prospects, overinvestment is implied.

Following Jensen (1986), overinvestment is a potential source of value loss. That is, firms that are cash rich are likely to invest at least a part of that excess cash in unprofitable investments thereby reducing the value of the firm. In later work, Jensen (1989, 1991, 1993) also notes a tendency of conglomerates to cross-subsidize, i.e., an increased tendency (as compared to stand-alone firms) to invest in failing business segments. Both are characterizations of inefficiencies where too much capital is being allocated to relatively underperforming business segments resulting in a lower firm value.

Underinvestment, on the other hand, is characterized as the relative lack of investment in business segments with better prospects. Although effectively the flip-side

of the overinvestment construct, the underinvestment construct has not received much attention in the literature. Together, however, over and underinvestment more fully represent the degree of efficiency of the capital allocation process in that inefficient investment can both be because of 'too much' and 'too little' investment in business segments with relatively worse and better prospects, respectively.

The importance of the capital allocation process for diversified firms is suggested by Williamson's defense of M-form firms. Extending arguments by Coase (1937), Williamson (1975) advocates the multidivisional (M-form) of organization for efficiency reasons because the separation of duties between headquarters and divisions is thought to lower transaction costs by enabling headquarters to focus on important overarching functions such as overall strategy, control questions and allocation of capital, while divisions can focus mainly on business level strategies and operations. Williamson points to a number of beneficial outcomes of such separation, including a more efficient internal capital market where inefficiencies in external markets can be overcome through internal funding. Specifically, by internalizing transactions of capital, he argues, corporate managers may have more complete and better information than external providers of capital: "division managers are subordinates: as such, both their accounting records and backup files are appropriate subjects for review....the general office can expect knowledgeable parties to be much more cooperative than can an outsider...internal disclosure is affirmatively regarded as necessary to the integrity of the organization and is rewarded accordingly" (Williamson, 1975: 146). Thus, in line with the logic underlying his writings, it could be expected that internal managers are better able to identify and evaluate business segment prospects, therefore making more good investments and being

able to avoid bad investments to a higher extent. Because multiple uses for capital exist in modern firms, this logic can easily be extended to single-segment firms – internal managers with better information to base decisions on may be better also in identifying and choosing alternative uses for capital besides allocations to business segments.

Empirical evidence, however, has not corroborated Williamson's M-form prescriptions regarding capital allocation efficiency. First, there is overwhelming empirical evidence that internalized transactions of capital are executed in a less than efficient fashion. Berger and Ofek (1995), Scharfstein (1997), Shin and Stulz (1998), Bromiley (1986) and Schlingemann *et al,* (1999) find evidence pointing to the inefficiency of internal markets. Shin and Stulz, for example, find that business segment cash flows to a large extent determine future allocations of capital and that the amount of allocated capital is relatively insensitive to investment opportunities, while Bromiley finds a number of additional signs of allocation inefficiencies including stale investment hurdle rates and positively biased forecasts of capital expenditures relative to actual spending. As mentioned earlier, this points in the direction of a capital allocation process less driven by investment opportunities and without efficiency as its main goal. Instead, allocations may also be driven by available capital as managers may have a tendency to overinvest out of free cash flow (Jensen, 1986, 1993), by reputational concerns inducing managers to reject investments in riskier business segments and projects in favor of safer, but potentially less lucrative such investments (Hirscheleifer & Thakor, 1989), by political considerations such as herd influenced investment behaviors of adhering to established 'norms' of allocation (Scharfstein & Stein, 1990), and by investment

behaviors driven by the influence of rent-seeking divisional managers (Meyer, Milgrom & Roberts, 1992: Scharfstein & Stein, 2000).

Second, Berger and Ofek (1995) have suggested inefficiencies in capital allocation as a main reason for the established diversification discount. In other words, business segments under the corporate umbrella tend to be valued less than similar free-standing segments due to capital being misallocated at the corporate level. Notwithstanding that there may be differences in incentives and coordination costs between a business segment under the corporate umbrella and one that is not (Williamson, 1975), and that single-segment firms in my model are assumed to have internal allocation processes and thus may misallocate capital, the consistent findings of a diversification discount point in the direction of capital allocation inefficiencies at the corporate level.

Third, in finding small as opposed to large corporate effects, the firm performance decomposition literature (e.g., Schmalensee, 1985: Rumelt, 1991: McGahan & Porter, 1997) also seems to point in the direction of inefficient and wasteful capital allocation. Assuming in line with Williamson (1975: 148) that the process is important: "In many respects, this assignment of cash flows to high yield uses is the most fundamental attribute of the M-form enterprise", small corporate effects may logically be a function of assigning cash flows (less efficiently) away from its 'high yield uses'. In addition, a number of authors within the firm performance decomposition literature (e.g., Misangyi *et al.*, 2006: Bowman & Helfat, 2001: Adner & Helfat, 2003: Brush, Bromiley & Hendrickx, 1999) have suggested a relationship between the efficiency of the capital

allocation process and the size of the corporate effect[9] based on both theoretical and methodological[10] grounds. Brush, Bromiley and Hendrickx (1999: 524), for example, state that "wise allocation of capital across divisions may be one mechanism underlying how well-managed (profitable) corporations should positively influence the performance of their business segments". In other words, they argue for a positive relationship between efficient capital allocation and the corporate contribution as reflected by the size of corporate effects.

Based on described theoretical and empirical evidence, therefore, the capital allocation process in multidivisional firms and by extension also in single-segment firms may very well often be inefficient which, if we continue to assume that managers are not perfectly rational in choosing between governance structures, i.e., cannot perfectly judge when hierarchies are less costly than market exchanges[11], opens the door for M-form prescriptions to internalize the capital allocation function (as well as for internal allocation processes in single-segment firms) to negatively affect firm performance. Firms may allow, or even promote, the allocation of investment capital away from relatively deserving uses including business segments with better prospects in favor of less deserving uses including business segments with less favorable prospects. If so, the

[9] Note that this relationship is likely to be asymmetrical since the variance decomposition methodology truncates corporate effects at the left side. In other words, poor capital allocation will not cause a negative corporate effect because of how it is estimated within this stream of research.

[10] Note that a number of authors (e.g., Bowman & Helfat, 2001: Adner & Helfat, 2003) have emphasized problems with the measurement of the corporate contribution suggesting that the relationship between capital allocation and corporate effects may not be clear.

[11] Although contemporary organizational economics to a large extent continue to rely on the 'Coase' (Coase, 1937) assumption that organizations effortlessly and optimally replace market exchanges with hierarchy once the latter is less costly, this dissertation does not. In fact, the current investigation into the efficiency of the capital allocation process would make little sense under the 'Coase' assumption since managers, under that assumption, could always achieve optimal allocation by switching from market exchange to hierarchy and back.

use of the over and underinvestment construct implying varying levels of inefficiencies in the capital allocation process is valid and may capture those inefficiencies. In addition, once the capital allocation process is assumed to vary in efficiency, the ensuing investigation into antecedents to the degree of efficiency as well as performance implications of this process becomes meaningful.

Antecedents to the Capital Allocation Process

Notwithstanding that few studies have directly investigated antecedents to a capital allocation process varying in efficiency, my selection of antecedents was based on theoretical arguments and empirical results suggesting that business segments are embedded in both industry and corporate parent environments (e.g., Granovetter, 1985: McGahan & Porter, 2002: Misyngai *et al.*, 2006). The embeddedness of business segments in the two environments is important for at least two reasons. First, prior research has shown that both industry and corporate parents (in addition to business segment specific influences) are likely to influence business segment profitability (e.g., McGahan & Porter, 1997, 2002: Brush, Bromiley & Hendrickx, 1999). Thus, characteristics or factors at all three levels are likely to affect firm performance through the efficiency of the capital allocation process, a process that Williamson (1975) suggested may be the single most important or fundamental function of the diversified firm. Second, prior research has also argued that industry, corporate and business-segment effects (and by extension characteristics at those three levels) are not independent of each other (e.g., McGahan & Porter, 1997, 2002: Hough, 2006: Misangyi *et al.*, 2006). McGahan and Porter (1997: 838), for example, suggest "strong covariance between industry and corporate parent effects" implying that corporate parents may not

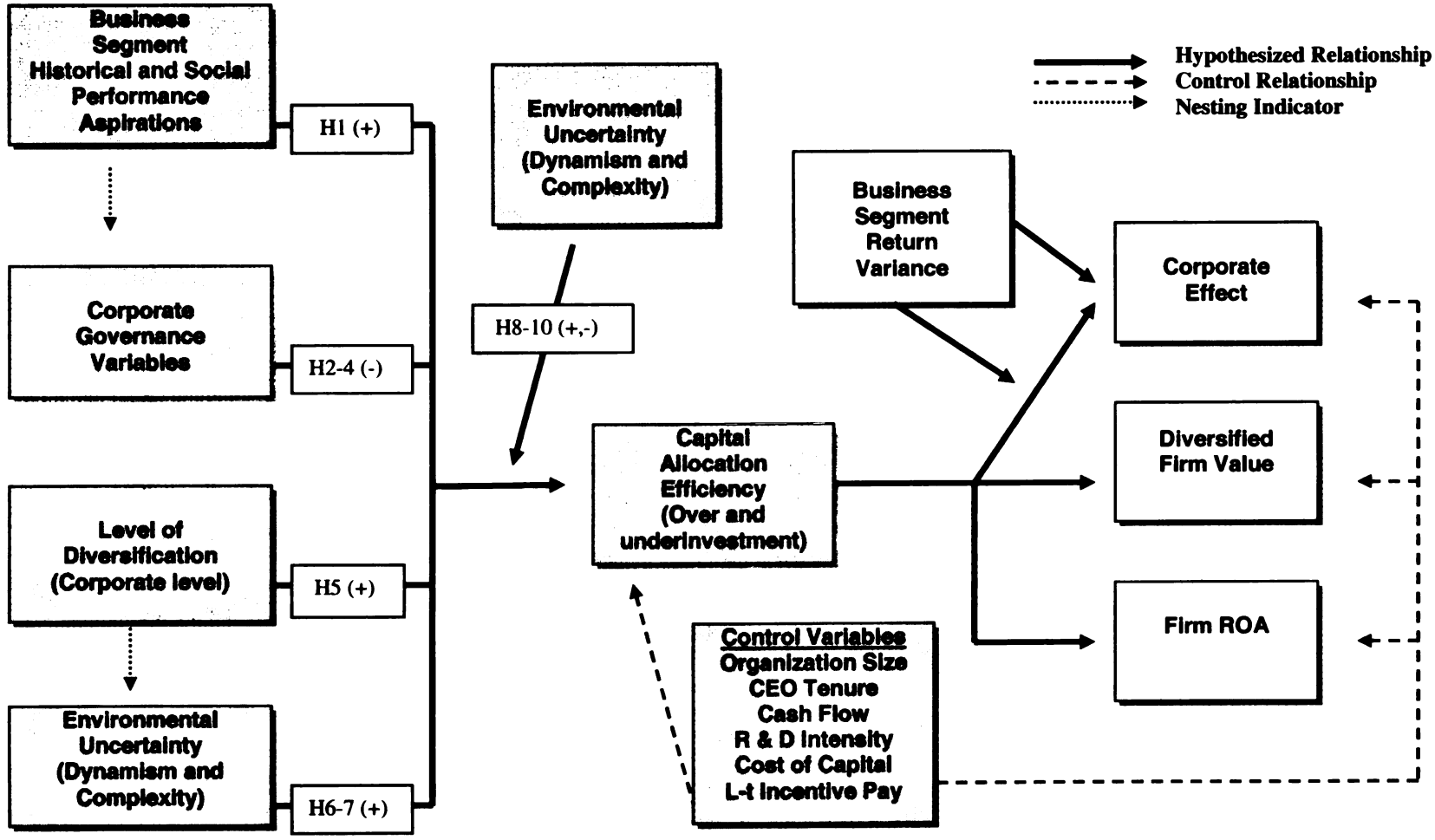
only be able to add value to their business segments by efficient corporate level actions such as control, auditing and capital allocation functions, but may also add value by choosing to enter industries with particularly attractive characteristics. Therefore, since the corporate capital allocation process is embedded in two additional environments, industry and business-segment environments, its efficiency may also be affected by variables at those levels. In sum, because characteristics at all three levels (business segment, corporate and industry) are likely to influence firm profitability (through the efficiency of the allocation process), as well as the strong embeddedness or covariance between characteristics at all three levels, I elected to include variables from each level as antecedents to the capital allocation process (Figure 1).

Specifically, based on the logic of aspiration-driven organizational behaviors (e.g., Festinger, 1954: Cyert & March, 1963: March & Simon, 1958: Levitt & March, 1988), business segment performance in relation to historical and social aspirations of such performance may affect the allocation decision by inviting different levels of investment depending on whether current performance happens to be above or below such aspirations. Thus, aspirations for business segment performance may reflect important business segment influences on the capital allocation process by affecting actual capital allocated to individual business segments.

To represent important corporate level influences on the capital allocation process and to reflect the importance of agency theory (Jensen & Meckling, 1976: Fama, 1980: Fama & Jensen, 1983: Jensen, 1986) in the area of corporate level strategies and decisions, three agency theoretical variables are suggested to affect the capital allocation

FIGURE 1

ANTECEDENTS TO CAPITAL ALLOCATION EFFICIENCY



process by decreasing the divergence between "the agent's decisions and those decisions that would maximize the welfare of the principal" (Jensen & Meckling, 1976: 308). That is, agency-theoretic characteristics of the corporate environment may limit possible inefficiencies in the capital allocation process. In addition, level of diversification is also included as an additional corporate-level influence on the efficiency of the capital allocation process.

Finally, environmental dynamism and complexity have been associated with uncertainty and difficulties in organizational decision making in a number of theoretical (e.g., Duncan, 1972: Dess & Beard, 1984: March & Simon, 1958: Mintzberg, 1990: Weick, 1979: Von Krogh, Roos & Slocum, 1994: Milliken, 1987, 1990: Child, 1972) and empirical contexts (e.g., Henderson, Miller & Hambrick, 2006: Li & Simerly, 1998: Simerly & Li, 2000: Goll & Rasheed, 1997: Wiersema & Bantel, 1993: Boyd, 1995, 1990). Thus, environmental dynamism and complexity were chosen to represent important industry characteristics influencing the capital allocation process.

Business segment historical and social performance comparisons

Performance cannot be judged as satisfactory without a point of reference. This point of reference, i.e., goals or aspirations, is a critical part of many models describing organizational behavior – both organizational learning models (e.g., Levitt & March, 1988) and aspiration models (e.g., March & Simon, 1958) are to a large extent driven by goals or aspirations. In the latter models, for example, current performance in relation to aspirations determines if outcomes are acceptable or unacceptable. Thus, judgments are not possible without some pre-established reference against which a comparison of current performance can be made.

It follows, therefore, that organizational behaviors are driven or affected by current performance in relation to aspirations or goals – organizations likely react differently depending on whether performance falls short or is above some aspiration level. This assumption that organizations set goals and subsequently adjust behaviors based on the relative performance in relation to those goals is in accordance with findings in organizational learning positing organizations as goal directed, rule based, and sensitive to prior performance history (Levitt & March, 1988). Thus, based on the assumption of satisficing (March & Simon, 1958: Eisenhardt & Zbaracki, 1992), without which the optimal choice would always be chosen leaving no room for improvement, performance feedback in relation to aspirations determines if performance is acceptable or not which, in turn, is associated with organizational decision-making and subsequent behavior.

Aspirations, in turn, may be in response to two different types of comparisons – social and historical. Social comparison is based on how people establish a sense of self-assessment based on comparison to a reference group of similar others (Festinger, 1954: Cyert & March, 1963). Historical aspiration levels, on the other hand, are established by the performance history of the focal firm or entity itself (Cyert & March, 1963), instead using prior performance as a guide to self-assessment and subsequent perceptions of success or failure. The latter aspiration levels have been related to a number of decisions in the organizational context including increased managerial risk taking in response to attainment discrepancies (Palmer & Wiseman, 1999), early entry into research and development consortia (Bolton, 1993), changes in organization strategy under different industry environments (Lant, Milliken & Batra, 1992), and decisions in simulated market

conditions (Lant, 1992). In addition, other studies (Bromiley, 1991: Lant & Montgomery, 1987) have used a more complex measure of aspirations based on the logic underlying the Behavioral Theory of the Firm (Cyert & March, 1963) where aspirations are represented by either past performance or the performance of competitors depending on whether current performance is above or below average industry performance. I initially incorporated this measure but later elected not to use this measure due to inconsistencies when used in conjunction with my measures of capital allocation efficiency. This is explained in further detail in the methods section. In sum, underlying theoretical arguments and empirical support point to the importance and usefulness of aspiration levels as determinants of behaviors in a number of different organizational contexts.

Translating the logic of aspiration-driven organizational behavior to the context of capital allocation in the multidivisional firm suggests that this process may be affected by aspirations for business segment performance. A number of researchers have indirectly looked at aspiration driven allocation behaviors without necessarily attributing subsequent inefficiencies to varying levels of aspirations – Shin and Stulz (1998), for example, use own and comparable single-segment firm cash flows as predictors of capital investment inefficiencies, while Rajan *et al.* (2000) predict and find that the dispersion in resources increases instances and magnitudes of inefficient capital allocation. Thus, based on the application of aspiration-driven behaviors to the particular context of capital allocation, performance below either aspiration level, i.e., performance shortfalls, should increase the urgency to change investment allocations to quickly get back above the reference point to achieve satisfaction or success. In particular, since failing to attain aspirations has been associated with increased risk taking both theoretically (e.g.,

Kahnemann & Tversky, 1979: March & Shapira, 1992) and empirically (e.g., Greve, 1998; 2003), business segment performance below aspirations implying a loss context may mean that managers at the corporate office may consider increasing investment allocations up and above what may be deemed reasonable to try to reverse losses. In fact, although corporate managers are assumed to have 'final' say in allocation decisions (Stein, 1997), business segment managers will likely also seek more investment capital in response to performance below aspirations, thereby contributing to this relationship. Thus, overinvestment ensues, which may *ex post* be viewed as risky since returns on additional capital allocated, especially capital going to business segments with poor prospects, are highly uncertain and may reduce firm performance further.

Managerial tendencies to escalate commitments or the reluctance of managers to withdraw from losing courses of action, projects, and businesses (Staw, 1976, 1981, 1997) may also contribute to overinvestment in business segments performing below aspirations. Thus, escalating commitments may reinforce and strengthen the tendency of loss-averse managers to keep constant or even increase investment allocations to poorly performing business segments. This tendency to keep constant or increase commitment is partly due to a failure of managers "in coming to terms with their failure" (Hayward & Shimizu, 2006: 541). That is, the potential costs of reversing course in the form of public embarrassment and humiliation (e.g., McNamara, Moon & Bromiley, 2002) may be so high that managers postpone this reckoning to a later date and continue on the chosen path. Ross and Staw (1993) emphasize that such psychological determinants of escalation behaviors, sometimes in conjunction with social norms emphasizing consistent and strong leadership, high closing costs and low salvage values at exit, and political support

for continuation, often lead to extreme strategic persistence in the face of growing concerns with the chosen strategy. They illustrate just how powerful these psychological drivers of escalation can be by describing how the Shoreham nuclear power plant on Long Island continued to receive investment funds over a 20-year period although the viability of the project was in question almost immediately and the cost-overruns were massive and increasing during the entire time period. Thus, based on underlying psychological and other reasons, managerial tendencies to escalate commitments may reinforce and increase overinvestment in poorly performing business segments once substantial sums have been contributed in the past. Escalating commitments and aspiration-driven loss contexts, therefore, provide complementary arguments for explaining overinvestment in poorly performing business segments.

For well-performing segments operating above aspirations implying at least some level of satisfaction and success, however, corporate managers may perceive less urgency to act, instead keeping allocations constant because additional allocations may be viewed as unnecessary and perceived as being better spent elsewhere in the organization. Alternatively, since segment performance above aspirations implies gain contexts and increased risk aversion on behalf of corporate managers, they may also consider reducing allocations since additional investments may be viewed as risky because the return on those funds is uncertain and could affect current segment returns negatively, thus lowering returns of well-performing segments.

Thus, I propose that effects stemming from performance aspirations and accompanying gain/loss context may lead to biased and non-optimal decision-making

where corporate managers overinvest in segments with less favorable prospects and underinvest in segments with relatively better prospects. Formally stated:

> *Hypothesis 1a: Current business segment performance below aspirations is positively associated with overinvestment.*
>
> *Hypothesis 1b: Current business segment performance above aspirations is positively associated with underinvestment.*

Agency-theoretic corporate governance variables

Agency-theoretic corporate governance variables including block holder ownership, institutional shareholder ownership and contingent forms of executive compensation may impact the investment allocation process. According to agency theory predictions (e.g., Jensen & Meckling, 1976: Fama, 1980: Fama & Jensen, 1983: Jensen, 1986), the above listed corporate governance variables will act to increase the alignment between principal and agent, thereby increasing the efficiency and performance of the firm. In other words, they will act to decrease the divergence between "the agent's decisions and those decisions that would maximize the welfare of the principal" (Jensen & Meckling, 1976: 308), or what governance researchers usually refer to as agency costs. Thus, one potentially important, yet not widely researched, avenue to increase this alignment and decrease agency costs is to increase the efficiency of the capital allocation process by allocating relatively more capital to better uses including business segments with better prospects. This would 'maximize the welfare of the principal' as capital is to a larger extent allocated to better uses, potentially raising overall firm returns and share price[12]. The following three hypotheses (H2-H4) with separate predictions for over and

[12] Although dividends are received by shareholders and as such should be of interest to this group of stakeholders, shareholders are likely more interested in share price appreciation because it avoids the 'double taxation' often cited as a reason to avoid dividend payments. In fact, based on the tax argument,

underinvestment will elaborate on how block holder and institutional shareholder ownership as well as contingent forms of executive compensation are associated with the efficiency of the capital allocation process.

Large shareholders may achieve efficient monitoring of managers, resulting in enhanced corporate performance. Both block holders and institutional shareholders have been suggested as efficient monitors of corporate insiders leading to increased firm performance through an increased alignment between the interests of corporate insiders and their organizations' shareholders (Hansen & Hill, 1991: Schleifer & Vishny, 1986: Kabir, Cantrijn & Jeunink, 1997). In other words, as argued by Jensen and Meckling (1976), Kroll, Wright, Toombs and Leavell (1996) and others, shareholder concentration may have positive effects on firm performance and firm share price.

This positive effect on shareholder wealth from an increase in shareholder concentration may be mainly due to its effect on decisions involving corporate risk taking. In other words, as suggested also by Schleifer and Vishny (1986), it may be that increased monitoring by large shareholders mainly affects firm performance through an increased level of risk taking – large shareholders are able to force value maximization, thereby decreasing agency costs, through their positive effect on firm risk taking. Thus, the risk differential that Coffee (1988) and others use to characterize the divergent interests between self-interested (risk-averse) managers and risk neutral shareholders may decrease as a result of monitoring by shareholders large enough to be able to influence risky firm decisions.

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dividends not only lower share prices but also unnecessarily destroy shareholder wealth by increasing the combined tax burden of the firm and the investor.

Although this relationship (between shareholder concentration and firm risk taking) has not been studied to the same extent as the relationship between shareholder concentration and firm performance, a number of researchers have found or suggested relationships. Hill and Snell (1988), for example, suggested a relationship between shareholder concentration and risk taking, implying that increased shareholder concentration may lead to fewer risk-reducing corporate strategies such as diversification. Furthermore, Bethel and Liebeskind (1993) suggested a similar reduction in managerial tendencies to engage in risk-reducing strategies, while Mikkelson and Ruback (1991) found support for a relationship between large shareholders and managerial decisions thought to positively affect shareholder interests. In addition, Wright, Ferris, Sarin and Awasthi (1996) found a positive relationship between level of institutional equity ownership and corporate risk taking for firms with growth opportunities. Their arguments and findings are consistent with Barclay and Holderness (1990), Brickley, Lease and Smith (1988), McConnell and Servaes (1990), Mikkelson and Ruback (1985) and Baysinger, Kosnik and Turk (1991), suggesting that large institutional investors are likely to enhance corporate value by supporting and increasing "growth-oriented risk taking" (Wright, Ferris, Sarin & Awasthi, 1996: 454). Thus, taken together, existing theoretical and empirical research seems to point in the direction of large shareholders enhancing firm value by not only emphasizing shareholder interests, but also by directly increasing the level of risk in managerial strategies and decision-making, and thus decreasing the risk differential (Coffee, 1988) between managers and shareholders.

Translating those findings and the logic underlying a positive association between monitoring by large shareholders and firm risk taking to the current context of the

internal capital allocation process, increased shareholder concentration should raise the level of efficiency of this process by forcing reluctant corporate managers to increase allocations to well performing business segments[13]. That is, because segments currently performing above aspirations may be perceived as operating in gain contexts requiring protection, corporate managers may be hesitant to increase allocations to such well performing business segments with relatively better prospects because additional allocations may be perceived as 'diluting' or jeopardizing already high business segment returns, therefore perceived as risky by corporate managers. Thus, based on a direct relationship between managerial risk aversion and the reluctance to invest, preferring to protect current levels of performance instead of aiming for additional performance gains, large shareholders may be able to decrease instances and magnitudes of such underinvestment by forcing managers to increase the level of investment to well-performing business segments. Formally stated:

> *Hypothesis 2a: Block holder ownership is negatively related to underinvestment.*
>
> *Hypothesis 2b: Institutional shareholder ownership is negatively related to underinvestment.*

Large shareholders may also be able to force value-maximization, and thereby enhance firm value by acting to control overinvestment related to corporate governance breaches and imperfections in less successful business segments. This is in accordance with Pound's (1988) efficient-monitoring hypothesis suggesting that large shareholders support managerial decisions enhancing firm value, but tend to oppose decisions

[13] Although the idea that managers are reluctant to invest in well performing segments may seem extreme and improbable at first, it closely follows theory (e.g., Prospect theory) as well as being in line with other risk-reducing managerial actions such as for example diversification outside the firm's main area of expertise.

detrimental to shareholders' interests. Jensen and Meckling (1976) and Kroll, Wright, Toombs and Leavell (1996) also argued for a theoretical association between stock holder concentration and firm performance. Supporting that theoretical association, Brickley, Lease, and Smith (1988) found support for large institutional shareholders opposing managerial decisions harmful to shareholders, while Mikkelson and Ruback (1991) found empirical evidence for large shareholders supporting managerial decisions deemed to positively impact shareholder interests. A number of other studies have also concluded similar relationships between shareholder concentration and shareholder interests (McConnell & Servaes, 1990: Barclay & Holderness, 1990: Mikkelson & Ruback, 1985). Thus, large shareholders efficient at monitoring self-interested and risk-averse corporate managers may be able to minimize instances of this type of overinvestment referred to as "allocational socialism" in a number of important studies (e.g., Rajan *et al.,* 2000: Scharfstein & Stein, 2000: Bernardo, Lou & Wang, 2006). Conceptualized as investment capital that is presumably allocated away from better uses including business segments with stronger prospects in favor of less favorable uses including segments with relatively weaker prospects, allocational socialism is measured similarly to how I measure overinvestment, i.e., as investment in business segments with relatively lower prospects. This way of measuring overinvestment recognizes that overinvestment often is independent of underinvestment in modern firms where capital can be used for a wide array of other uses such as for dividend payments, for buy-backs, and to acquire other firms (Dow & Gorton, 1997). Thus, as explained earlier, overinvestment extends to firms with only a single business segment as such firms still need to decide how much capital to allocate to business segments versus other potential uses.

To explain how large shareholders may be able to counter and control managerial tendencies to practice allocational socialism by overinvesting, a number of behavioral processes or reasons underlying these tendencies to overinvest need to be focused on. Thus, I suggest three such underlying behavioral reasons or processes that are likely to lead to overinvestment unless properly monitored – agency problems at the allocational level resulting from interactions between self-interested corporate managers and divisional managers (Scharfstein & Stein, 2000: Bernardo *et al.*, 2006), the tendency of loss-averse managers to prefer not having to realize losses whenever possible, as well as the tendency of managers to be influenced by escalating commitments where psychological, social and political reasons may make it difficult for them to withdraw from losing courses of actions, projects and businesses (Staw, 1976, 1981: see Staw, 1997, for a review). First, in addition to agency costs due to separation of ownership (Berle & Means, 1932), both Scharfstein and Stein (2000) and Bernardo *et al.* (2006) refer to a "second layer of agency costs", encompassing costs generated between corporate managers in charge of allocating investment funds and divisional managers receiving those funds. For example, unless efficiently monitored, corporate managers may view it as "less personally costly to distort investment in favor of those divisions whose managers require extra compensation, thereby conserving on cash payments to these managers" (Sharfstein & Stein, 2000: 2540). Thus, divisional managers running business segments with poor prospects may be able to extract "excessively large capital allocations" (Scharfstein & Stein, 2000: 2540), resulting in overinvestment in their divisions because corporate managers may, unless efficiently monitored by large shareholders, perceive additional allocations of capital as less costly than using

discretionary funds that the manager controls and can "potentially divert to himself" (Bernardo *et al.*, 2006: 3).

Instances of allocational socialism resulting in overinvestment may also be in response to managerial tendencies for loss aversion unless efficiently monitored. Loss aversion, the basis of Prospect theory (Kahneman & Tversky, 1979), suggests that people have strong tendencies to want to avoid realizing losses whenever possible. To do so, managers have been shown to make decisions they would not normally make, and accept elevated levels of risk that they would not normally accept (e.g., Kuhberger, 1998). Thus, although not often cited and addressed in the capital allocation literature, loss aversion may lead managers to overinvest to try to turn failing business segments around, thereby avoiding having to admit failure by drastically reducing investment rates or by divesting the particular business segment in question. That is, due to managerial loss aversion underlying risk seeking below an acceptable level of performance, unless efficiently monitored, managers may be tempted to try to increase allocations in the hope of using the increased leverage to reverse poor performance and avoid the embarrassment and potential threats to employment from admitting that the weakest divisions need to be divested or put on "much-needed diets" (Scharfstein & Stein, 2000: 2539).

A third reason underlying allocational socialism and overinvestment is, as previously discussed in H1, managerial tendencies to escalate commitments. Thus, unless efficiently monitored, managers may be very reluctant to withdraw from losing courses of action, projects, and businesses (Staw, 1976, 1981, 1997), instead preferring to continue overinvesting in poorly performing business segments.

In sum and in line with suggestions by previous researchers (e.g., Hansen & Hill, 1991: Schleifer & Vishny, 1986: Jensen & Meckling, 1976: Kroll, Wright, Toombs & Leavell, 1996: Pound, 1988: Brickley, Lease & Smith, 1988: McConnell & Servaes, 1990: Barclay & Holderness, 1990: Mikkelson & Ruback, 1985, 1991), large shareholders may be able to efficiently monitor inside managers, leading to an increased alignment between the interests of corporate insiders and their organizations' shareholders. In particular, by their influence, large shareholders may be able to counter and control managerial tendencies to generate agency costs at the allocational level by improperly using investment funds to reward divisional managers, as well as to control managerial tendencies related to loss aversion and escalation of commitment also leading to overinvestment. Thus, large shareholders may be able to contribute to a more efficient capital allocation process by efficiently monitoring the process. Formally stated:

> *Hypothesis 3a: Block holder ownership is negatively related to overinvestment.*
>
> *Hypothesis 3b: Institutional shareholder ownership is negatively related to overinvestment.*

Contingent forms of executive compensation (e.g., granted shares of stock and options) may have a similar efficiency increasing effect (as shareholder concentration) on the capital allocation process. Higher levels of contingent forms of compensation increase the alignment between the interests of shareholders and corporate managers by making the latter group share some of the costs of managerial self-interest and risk avoidance. Put differently, sharing ownership with corporate managers increases managers' potential opportunity costs of not maximizing shareholder wealth. Thus, higher levels of contingent compensation may not only reduce the risk differential (Coffee, 1988) by

making managers more interested in additional risk-taking, but may also reduce the frequency of other non-maximizing actions and decisions such as, for example, those suggested to underlie allocational socialism (H3).

Following that logic, contingent compensation would reduce instances of under and overinvestment alike. Underinvestment in business segments due to managerial risk aversion as well as to other reasons would increase opportunity costs as managers now to a larger extent are able to participate in firm success. That is, as the level of managers' contingent compensation increases, their wealth is now more strongly correlated with firm share price, which should make them more interested in maximizing share price by avoiding protection-minded underinvestment. Scharfstein (1997) supports this reasoning as he suggests that misallocation of capital is driven by a misalignment of incentives between outside investors and top management. In his sample of diversified firms, he points to an increased sensitivity of divisional investment to Tobin's q as top managers own increasingly larger equity stakes in their firms as evidence of misaligned incentives. Thus, he recommends high-powered (equity-based) incentives to increase the sensitivity of divisional investments to prospects and thereby reduce protection-minded underinvestment. Overinvestment, although not necessarily based on risk considerations[14], instead based on different self-interested actions such as the managerial tendency to prefer to compensate managers with extra allocations of investment capital instead of with cash payments, as well as the tendency to try to reverse poorly performing

[14] Note that the argument could be made, but seldom is, that contingent compensation may help to control excessive risk seeking below some reference point. Underlying the reluctance among scholars in pursuing that argument may be assumptions of risk aversion across gains and losses (expected utility theory) and the difficulty in prescribing additional risk-taking under some circumstances, but not others. In addition, equating overinvestment with risk seeking conflicts with how decision-makers likely perceive their actions below the reference point, i.e., actions resulting in avoiding having to recognize losses and expose themselves to employment risk may instead be perceived as risk reducing.

business segments by allocations over and above what may be deemed reasonable, may also be affected by contingent compensation through a process similar to the one whereby underinvestment is affected by contingent compensation. That is, with higher levels of share and option ownership, self-interested motives not maximizing shareholder wealth such as those described would increase opportunity costs, and therefore are likely to be perceived as more costly by corporate managers. This is in line with Scharfstein and Stein's (2000) model where "large socialist-type inefficiencies are especially likely to arise. . . when the CEO has low powered incentives" (Scharfstein & Stein, 2000: 2450). Thus, as a result of "more high-powered incentives", i.e., more contingent compensation, such actions may be avoided to a higher extent, leading to less overinvestment.

In sum, due to underlying arguments positing that opportunity costs of both risk-avoidance and other self-interested actions increase as a direct result of higher levels of contingent compensation, a negative relationship between executive contingent compensation and inefficiencies in the capital allocation process is likely. Formally stated:

Hypothesis 4a: Contingent compensation is negatively related to overinvestment.

Hypothesis 4b: Contingent compensation is negatively related to underinvestment.

Level of Diversification

Consistent with typical measures of diversification based on breadth and salience of business segments (e.g., Jacquemin & Berry, 1979), the level of diversification can be viewed as a continuum from one-segment focused firms to multi-segment conglomerates with a number of businesses in unrelated industries. Thus, two inflection points capture

two dimensions – the first dimension as an organization diversifies and is no longer operating only in a single industry, and the second one as the firm increases its diversification efforts into more and increasingly unrelated segments. Both dimensions are incorporated in this dissertation to investigate the impact of diversification on the capital allocation process.

Increasing levels of diversification can negatively impact the capital allocation process by making the allocation decision less clear (or more uncertain). That is, an increasing number of segments as well as their decreasing relatedness would likely increase the amount of information that needs to be gathered, analyzed and acted upon. Corporate managers may also be limited in their knowledge and understanding to just one or a few of the organization's business segments, likely those relatively closer to the core business of the organization. Thus, assuming bounded rationality (March & Simon, 1958), this increasing amount and diversity of information may quickly exceed the limited information processing ability of the centralized group of corporate managers in charge of allocating capital to business segments, thus making it less likely that decision-makers can gather and process the necessary information to make efficient decisions. In addition, this limited ability to process information may hamper efforts to achieve an overview of the firm's business segments which, as explained earlier, is necessary to achieve an efficient capital allocation. Thus, because of a limited ability to quickly analyze vast amounts of diverse information, and because the need to gather and analyze such information increases as the level of diversification increases, instances and magnitudes of inefficiencies in the capital allocation process may likely increase as the firm's level of diversification increases.

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Diversification may also lead to more capital allocation inefficiencies, i.e., more over and underinvestment, because higher levels exacerbate the effect of rigid bureaucratic allocation rules often found in organizations (e.g., Bower, 1986: Shin & Stulz, 1998). Business segments may, for example, be allocated investment funds based on their revenue which does not take segment prospects or actual "need" into account. Both Berger and Ofek (1995) and Lamont (1997) point to these bureaucratic tendencies in allocation polices as one reason behind the overinvestment and cross-subsidization[15] they find when exploring underperformance in diversified firms.

Building on their arguments, I argue that increased diversification likely exacerbates the problem of adhering to rigid rules of allocation because more diversified firms are likely to have more business segments being allocated capital (Argyres, 1996), thus more opportunity for inefficient allocation based on rigid allocation rules. In addition, the rigid allocation rules themselves are likely to impact performance more negatively as diversification increases. The latter needs elaboration – more over and underinvestment is likely since a corresponding divergence in business segment prospects is likely as a result of increased diversification. That is, the more a firm diversifies, the further it gets away from its core business, thereby likely increasing the divergence in business segment prospects and performance. Thus, rigid allocation rules disconnected from segment prospects (such as allocating investment funds based on relative segment revenue) are likely to fit even worse in that context, leading to increased inefficiencies in the capital allocation process.

[15] They use cross-subsidization to define the practice of re-allocating investment capital from well-performing business segments to failing ones. Since they only emphasize and measure the capital flow going to less well-performing segments, this definition is similar to my definition of overinvestment.

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In sum, increased diversification can lead to more inefficiencies in the capital allocation process by making the allocation decision itself more complicated and uncertain, as well as exacerbating the negative effects of rigid allocation rules. Based on those arguments, I expect that:

> *Hypothesis 5a: Level of diversification is positively associated with overinvestment.*
>
> *Hypothesis 5b: Level of diversification is positively associated with underinvestment.*

Environmental uncertainty

Duncan (1972) was one of the first to study characteristics of the environment that could contribute to organizational members experiencing uncertainty in decision-making. He identified two dimensions of the task environment that would likely increase decision makers' uncertainty – the static-dynamic dimension that measures the rate of change or instability of an environment and the simple/complex dimension that is defined as the number of factors involved in the decision process. Although he uses a 2 X 2 (static-simple, static-complex, dynamic-simple and dynamic-complex) and tests for both main and interaction effects, it is clear from his discussion that he is more interested in their (environmental dynamism and complexity) individual main effects on the decision-making process than a possible interaction between the two dimensions. In addition, he finds no evidence of any interaction between the two dimensions and argues that one dimension is a far more salient contributor to uncertainty than the other: "...the static-dynamic main effect is much higher (F=30.504) than the simple-complex main effect (F=10.438). The potency of the static-dynamic dimension in contributing to perceived

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uncertainty is further enhanced by the non-significant interaction effect between the two environmental state dimensions" (Duncan, 1972: 325).

Following Duncan, Dess and Beard (1984) build on those dimensions[16] and reaffirm the positive relationship between environmental dynamism and complexity on the one hand, and uncertainty in decision-making on the other. Subsequent empirical research has viewed environmental uncertainty as having both a direct relationship with a number of performance-related outcome variables (e.g., firm performance) (e.g., Wiersema & Bantel, 1993; Palmer & Wiseman, 1999) as well as a moderating effect on associations between firm level characteristics (including rationality of decision processes) and performance outcomes (e.g., Boyd, 1995: Henderson, Miller & Hambrick, 2006: Hough & White, 2003: Goll & Rasheed, 1997: Simerly & Li, 2000: Li & Simerly, 1998). The difference between the two approaches of viewing environmental uncertainty hinges on whether or not antecedents to performance outcomes are actually measured, or just assumed. That is, even when environmental uncertainty is modeled to have a direct effect on performance outcomes, the assumption is that some unmeasured antecedent affects the outcome variable differently depending on the level of environmental uncertainty. In effect, therefore, both direct and moderated relationships are indications of the same underlying relationships where decisions, strategies or actions undertaken have outcomes of varying rationality attached to them depending on the level of environmental uncertainty. Thus, in most cases, an investigation of direct effects is a necessary byproduct of the fact that only decision outcomes, not the decisions themselves, are measured and are found to vary based on the environment. Therefore, since I measure

[16] In addition, the authors suggest a third dimension (environmental munificence), defined as the abundance of resources in an environment. Since that dimension is more related to future prospects than decision-making uncertainty, it will instead be used to measure future prospects as an alternative to Tobin's q.

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both outcomes and factors affecting those outcomes, I provide hypotheses outlining both direct and moderated relationships involving environmental uncertainty in H6-7 and H8-10, respectively.

In addition, I do acknowledge a discrepancy between the level of rationality (bounded rationality) that is accompanying my antecedents and the higher level of rationality that is inherent in most measures of firm performance outcomes (e.g., stock price) used in prior research within strategic management. That is, most prior research has taken the efficiency of various firm performance measures for granted by assuming that they are indeed reasonably unbiased indications of how well a firm is performing. In effect, the difference in rationality stems from the implicit assumption that the level of rationality increases as more and more people are involved in a decision. That is, decisions performed by individual decision-makers or small groups of people may indeed be biased due to a number of powerful behavioral influences, while those influences may not have the same powerful effect, or may even out, as crowds grow into markets. Thus, the process underlying how, for example, stock prices are formed reflects collective perceptions that individually may be biased, but may be relatively more bias free at the level of the collective to be relied on as indications of performance. In fact, this assumption of rationality is a sufficient precondition for productive management research, including the investigation of antecedents to firm performance.

In this dissertation, however, I argue based on a signaling perspective that assumptions of rationality, although sufficient, may not be necessary for my market-related firm performance measures (diversified firm value, corporate effects, firm ROA). That is, under conditions of information asymmetry where executive intentions and

actions cannot be efficiently monitored, investors and boards look for signals to be able to gauge economic value (Carter & Manaster, 1990: Leland & Pyle, 1977: Spence, 1976) as well as executive contributions to such value. In addition, executives also look for credible signals to gain insight into what is valued by the market, including what "good" decisions should look like and what outcomes they should result in. Thus, the rationality of those signals may not matter, i.e., whether they are efficient or not, since top executives still are likely to pay close attention to them because their performance (as perceived by investors and boards) and, subsequently, their pay will to a large extent depend on them.

Translated to the current context, I argue that my measures of performance outcomes (diversified firm value, corporate effects, and firm ROA) contain such important signals. Following prior arguments, they are important both because executives can affect them by allocating capital in a relatively more efficient manner, and because they are, in turn, likely to affect executive pay. Diversified firm value, for example, conveys to investors and boards how much value executives add or destroy by diversification including the efficiency of the internal capital allocation process. As such, managers may pay close attention to diversified firm value (as well as to the other two measures) as important signals of what the firm is likely to reward and are therefore likely to adjust their behaviors accordingly.

Environmental dynamism has been associated with difficulties in decision-making (e.g., March & Simon, 1958: Mintzberg, 1990) both theoretically and empirically. A number of scholars (e.g., Duncan, 1972: Von Krogh, Roos & Slocum, 1994: Weick, 1979: Milliken, 1987, 1990) have suggested that environmental dynamism increases

environmental uncertainty, which in turn affects the rationality of decision-making outcomes of organizational members. This perspective, referred to as the "information uncertainty perspective", suggests that because the environment provides information for boundedly rational organizational decision-makers, the rate of change or instability of the environment should affect the availability and reliability of information. In other words, under conditions of high environmental dynamism, decision-makers intending to make rational decisions will face situations that are ambiguous in terms of both alternative actions and criteria to evaluate those alternatives. Thus, decision-makers will face "tremendous cognitive demands" (Wiersema & Bantel, 1993: 488) as they "constantly need to adapt their perceptions of the environment to fit the current reality" (Wiersema & Bantel, 1993: 488) when assessing both current and future states of the environment. In short, as environmental dynamism increases, they will face less useful information upon which to base their decisions, thereby complicating their decision process with potentially negative effects on decision outcomes.

This direct effect of environmental dynamism on decision outcomes including firm performance has been empirically studied by a number of scholars. Wiersema and Bantel (1993) investigate direct effects on a number of variables including firm performance, strategic change, and top management team turnover, while Palmer and Wiseman (1999) study effects of environmental dynamism on organizational risk. Both find significant direct effects on their respective outcome variables.

Translating the logic of an association between environmental dynamism and decision-making uncertainty to the context of capital allocation in multidivisional firms, environmental dynamism is related to the investment allocation process by having a

direct effect on capital allocation efficiency. That is, assuming boundedly rational decision-makers with individually fixed cognitive limitations, segment prospects may become harder to forecast as the environment becomes increasingly more dynamic and more apt to change unexpectedly in the future. The allocation decision therefore, in effect, becomes more uncertain since underlying information needed to make this decision (e.g., projections of segment prospects) may not be available, may be less reliable, and/or may be more likely to change in the near future. This increasing uncertainty in correctly assessing future prospects is likely symmetrical in its effect on the efficiency of the capital allocation process – overestimation of segment prospects (leading to overinvestment) may potentially be as common and severe as underestimation (leading to underinvestment). Thus, the efficiency of the capital allocation process may be adversely affected by increasing environmental dynamism, resulting in more instances and higher magnitudes of over and underinvestment.

Formally stated:

> *Hypothesis 6a: Environmental dynamism is positively associated with overinvestment.*
>
> *Hypothesis 6b: Environmental dynamism is positively associated with underinvestment.*

Environmental complexity refers to the heterogeneity of an environment including the range and variability of factors needed to be considered in strategic decision-making (Child, 1972). As such, increased heterogeneity leads managers to "perceive greater uncertainty and have greater information-processing requirements than managers facing a simple environment" (Dess & Beard, 1984: 56) because they must now operate in an environment with, for example, a larger number and variety of

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competitors using an expanded variety of inputs and outputs. In effect therefore, to achieve an overview (of a more complex environment) required for effective strategic decision-making may necessitate a much higher level of information processing on behalf of corporate managers. This was also suggested by Wiersema and Bantel (1993: 489): "Increased variety and diversity of a firm's business operations suggest that a wider range and greater quantity of information be processed for effective decision making, creating strains on the organization to achieve high quality decision making outcomes". Thus, at the very least, operating in a more complex environment is a much more difficult task requiring information processing resources that may not be available from existing corporate managers, therefore affecting performance outcomes of decision-making processes.

Although a search of major management journals returned only a few empirical studies that have investigated the direct relationship between environmental complexity and decision-making outcomes, Wiersema and Bantel (1993), and Palmer and Wiseman (1999) investigate this relationship by looking at how complexity affects firm performance/top management team tenure and organizational risk, respectively. Wiersema and Bantel find that environmental complexity decreases both firm performance and top management team tenure, the latter presumably because increasing complexity over time creates managerial demands current managers are unable to deal with. Palmer and Wiseman, however, find no support for their hypothesis of a direct positive relationship between environmental complexity and organizational risk.

Finally, Siggelkow and Levinthal (2003) and Siggelkow and Rivkin (2005) conclude that environmental complexity directly impacts the choice of optimal

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organizational structures, search routines, rewards and several other decisions in the organizational context. Thus, the described studies together suggest that environmental complexity increases the difficulty of top management decision-making processes with subsequent effects on turnover, firm performance, organizational structures, search routines and rewards.

This need to cope with an increasingly diverse and complex environment may be especially salient in regards to the capital allocation process since the allocation decision effectively involves all potential uses for capital including business segments in the firm. In particular, for boundedly rational decision makers to effectively execute the allocation decision, an overview of segments including information on both current and future segment prospects is needed. Thus, because the capital allocation process requires inputs from all segments and its efficiency is highly dependent on the quality of those inputs, it may be especially susceptible to complex environments, making the allocation decision increasingly difficult as the level of complexity increases. This implies that the complexity of the environment is likely to directly affect the efficiency of the capital allocation process by leading to greater inefficiencies. Formally stated:

> *Hypothesis 7a: Environmental complexity is positively associated with overinvestment.*
>
> *Hypothesis 7b: Environmental complexity is positively associated with underinvestment.*

Environmental uncertainty: moderation effects

The following three hypotheses (H8-10) will provide support for a number of moderation effects where environmental uncertainty moderates associations between level of diversification and corporate governance variables on the one hand, and capital

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allocation efficiency on the other. No hypothesis moderating the relationship between performance comparisons and capital allocation efficiency will be provided, however, because it is not clear how this relationship is affected by environmental uncertainty. On the one hand, it may be that managers are less likely to be able to determine gain or loss contexts, or view them as less sustainable, under conditions of high environmental uncertainty. That is, current business segment performance in relation to social and historical aspirations may be harder to estimate as well as likely to be perceived as less sustainable under more dynamic and complex environments leading to a weakening of the contexts, thus resulting in less inefficiencies in the capital allocation process. At the same time, however, managers may view some contexts as more worthy of protection under conditions of high environmental uncertainty. For example, gain contexts may be perceived as even more worthy of protection if viewed as harder to sustain in a highly dynamic and complex environment. Thus, because the moderating effect of environmental uncertainty on the associations between performance comparisons and capital allocation efficiency is not clear, I am not offering any formal hypotheses describing those relationships.

As described in hypothesis 5, the relationship between level of diversification and inefficiencies in the capital allocation process is explained by focusing on the uncertainty of the allocation decision as well as on rigid bureaucratic allocation rules. That is, increased diversification stretches decision-makers' limited information processing ability even thinner and exacerbates the problem of rigid allocational decision rules, thus, affecting the efficiency of the capital allocation process by leading to more over and underinvestment.

Building on those arguments, I suggest here that environmental dynamism and environmental complexity as previously defined[17] are likely to further exacerbate the negative effect of increased diversification on the efficiency of the capital allocation process through much the same processes as those described in H5. First, increased environmental dynamism and complexity by forcing decision-makers to face situations that are both more ambiguous, more likely to change more often, and that require more of an overview to make efficient decisions are likely to stretch decision-makers' already bounded information processing ability even thinner. That is, the processing of each piece of information in a more dynamic and complex environment is likely to take longer resulting in less information processed to support each decision. Put differently, as decision-makers face increasing difficulties, their available information processing capabilities are likely to be exceeded even earlier, resulting in more instances of over and underinvestment.

In addition, as the level of environmental change and complexity increases, rigid allocation rules observed and suggested by researchers (e.g., Bower, 1986: Shin & Stulz, 1998) are also likely to lead to increasingly more over and underinvestment. For example, as the environment becomes increasingly apt to change, i.e., increasingly dynamic, it follows that business segment prospects may also be more likely to change in unpredictable and sudden ways. Thus, following rigid allocation rules that are not flexible

[17] Environmental dynamism is the rate of change or instability of the environment, while environmental complexity refers to the heterogeneity of an environment including the range and variability of factors needed to be considered in strategic decision-making (Child, 1972).

enough to adapt to a changing environment[18] is likely to lead to additional instances of over and underinvestment as the level of environmental dynamism increases[19].

In sum, I argue that environmental dynamism and complexity likely moderates the relationship between level of diversification and the capital allocation process by, ceteris paribus, making it more difficult for decision-makers to allocate capital as well as exacerbating the negative effects of rigid allocation rules leading to increased inefficiencies as the level of environmental dynamism and complexity increases. Formally stated:

> *Hypothesis 8a: Environmental dynamism will moderate the positive association between level of diversification and inefficiencies in the capital allocation process such that a higher level of environmental dynamism will strengthen the relationship.*
>
> *Hypothesis 8b: Environmental complexity will moderate the positive association between level of diversification and inefficiencies in the capital allocation process such that a higher level of environmental complexity will strengthen the relationship.*

Underlying the direct effect between shareholder concentration and capital allocation efficiency (H2-3) is the suggestion that large shareholders are efficient monitors of top managers (e.g., Pound, 1988). That is, block holders and institutional shareholders are able to force value maximization by controlling and reducing instances of over and underinvestment in response to managerial risk aversion, self-interest, agency costs at the allocational level, and escalation of commitment issues.

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[18] Although not described, a similar mechanism accounts for how a more complex environment moderates the association between diversification and inefficiencies in the allocation process (see H7 for guidance).

[19] I acknowledge that decision heuristics such as rules and routines often are used to economize on cognition. However, this lack of independence is unlikely to affect the direction of the moderation effect since, ceteris paribus, increased use of rigid allocation rules, even as a result of bounded rationality, leads to increased capital allocation inefficiencies.

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Their monitoring effectiveness may, however, not remain constant across various levels of environmental uncertainty. As explained earlier when describing effects of environmental uncertainty on capital allocation efficiency (H6-7), just like the allocation decision becomes more uncertain as the level of environmental uncertainty increases, the monitoring of that decision may also face the same increasing uncertainty. That is, the effect on managers and large shareholders may be relatively symmetric in this respect since each face the same increasingly uncertain projections of future prospect (i.e., projections of future prospects may be less reliable, more likely to change in the near future, and/or may not be available at all) as the level of environmental uncertainty increases. Thus, since efficient monitoring presumes that large shareholders are able to differentiate between good and poor prospects, thereby being able to differentiate between efficient and inefficient (over and underinvestment) capital allocation, the monitoring process becomes compromised as they lose that ability. By extension therefore, their ability to monitor and enforce efficient capital allocation decisions becomes less pronounced in more uncertain environments. Support for this contention is provided by Li and Simerly (1998) and Zajac and Westphal (1994). Li and Simerly argue that "under conditions of greater environmental dynamism, the effectiveness of monitoring by owners of the behavior of top managers will be extremely difficult if not impossible" (171). Thus, as environmental uncertainty increases, owners are thought to be less able to "gauge whether the firm's goals and strategies are consistent with owners objectives" (171). In addition, Zajac and Westphal found that firm-specific risk affected the efficacy of managerial monitoring put in place to attenuate agency costs. Together, these studies indicate that the monitoring effectiveness of large shareholders may not

remain constant as the level environmental uncertainty changes. Therefore, I present the following hypotheses:

> *Hypothesis 9a: Environmental dynamism will moderate the negative associations between block holder and institutional ownership and inefficiencies in the capital allocation process such that a higher level of environmental dynamism will weaken the relationships.*
>
> *Hypothesis 9b: Environmental complexity will moderate the negative associations between block holder and institutional ownership and inefficiencies in the capital allocation process such that a higher level of environmental complexity will weaken the relationships.*

The direct negative relationship between contingent compensation and capital allocation inefficiencies (H4) requires that managers have access to reasonably accurate predictions of segments' future prospects. They need to be able to differentiate between segments with good versus poor prospects to be able to avoid misallocating capital. By extension therefore, as the uncertainty of the allocation decision increases because underlying business segment prospect information cannot be acquired, is more ambiguous, less reliable, and/or more likely to change in the near future, the power of contingent compensation to assure wealth maximization through efficient capital allocation is decreased. That is, managers driven by high powered incentives to avoid opportunity costs stemming from inefficient capital allocation may, under conditions of high environmental uncertainty, still not be able to avoid such costs, simply because they are less able to differentiate between segments with good versus poor prospects. Thus, as a result, the association between contingent compensation and inefficiencies in the capital allocation process weakens as the level of environmental uncertainty increases. Zajac and Westphal (1994) partially support this contention by finding that firm-specific risk

moderates the effectiveness of managerial incentives in controlling agency problems.

Therefore, I suggest the following hypotheses:

> *Hypothesis 10a: Environmental dynamism will moderate the negative association between contingent compensation and inefficiencies in the capital allocation process such that a higher level of environmental dynamism will weaken the relationship.*

> *Hypothesis 10b: Environmental complexity will moderate the negative association between contingent compensation and inefficiencies in the capital allocation process such that a higher level of environmental complexity will weaken the relationship.*

CHAPTER 2: THEORETICAL MODEL DESCRIBING PERFORMANCE IMPLICATIONS OF CAPITAL ALLOCATION EFFICIENCY

Performance implications of capital allocation efficiency

This dissertation has so far emphasized how an internal or miniature capital market put in place to attenuate market contracting hazards may itself be subject to a number of business-segment, firm, and industry characteristics that may affect its efficiency by resulting in internal market failures. As such, I have investigated a number of antecedents to internal capital allocation market failures (measured as over and underinvestment) including stronger and weaker prior firm and competitor performance, increased environmental uncertainty, and increased levels of diversification. At the same time, I have outlined arguments positing that three agency-theoretic corporate governance variables may lead to relatively fewer instances and magnitudes of inefficiencies in the process.

The preceding investigation of antecedents to an internal capital allocation process varying in efficiency illustrates the increasing importance of the corporate office for firm performance. By extension, and assuming in line with Williamson (1975) that the capital allocation process is important for firm performance, the importance of the corporate office for firm performance should increase as the efficiency of the capital allocation process now becomes an important corporate-level antecedent to firm performance. Thus, a natural next step of this dissertation is to investigate performance implications of this internal capital allocation process including how internal market failures, measured as over and underinvestment, are associated with the corporate effect as a measure of how much value the corporate office adds to business segments, i.e., a

measure of the corporate contribution. Hypotheses 11 through 13 outline how over and underinvestment are associated with the corporate effect, as well as how these associations may be moderated by the variance of a firm's business segment returns. In addition, associations between over and underinvestment on the one hand, and diversified firm value and firm ROA on the other, are examined in hypotheses 14 and 15, respectively (Figure 2).

This chapter's investigation into the capital allocation process and its performance implications begins with the ambiguous relationship between capital allocation efficiency and the corporate contribution with the latter measured, as in previous studies, by the corporate effect (e.g., Brush, Bromiley & Hendrickx, 1999: McGahan & Porter, 1997). On the one hand and as described next, theory suggests that corporate-level factors in general (e.g., Rumelt, 1974: Chandler, 1962: Hansen & Wernerfelt, 1989: Andrews, 1987: Hambrick & Mason, 1984) and the efficiency of the capital allocation process in particular (Williamson, 1975, 1985), may enhance corporate-level influences on firm performance, i.e., the corporate contribution. Thus, inefficiencies in the latter process can be expected to decrease the corporate contribution. In addition, the process of firm performance variance decomposition where corporate-level influences (such as the efficiency of the capital allocation process) are assessed separately from business segment and industry influences may also lead us to expect a negative relationship between capital allocation inefficiencies and the corporate effect.

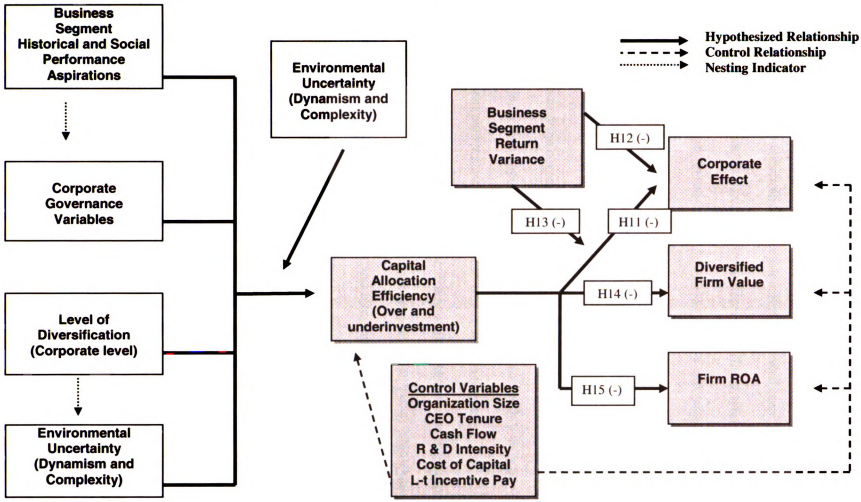
On the other hand, the corporate contribution as measured within the firm performance decomposition research stream, i.e., the corporate effect, may be systematically biased (e.g., Bowman & Helfat, 2001) leading one to, under some

PERFORMANCE IMPLICATIONS OF CAPITAL ALLOCATION EFFICIENCY

FIGURE 2

FIGURE 2

PERFORMANCE IMPLICATIONS OF CAPITAL ALLOCATION EFFICIENCY



circumstances, expect a null or a positive relationship between capital allocation inefficiencies and the corporate effect. Thus, to reflect and account for divergent theoretical arguments and arguments pointing to systematically biased empirical measures of the corporate contribution, multiple hypotheses are offered where the relationship between inefficiencies in the capital allocation process and empirical estimates of the corporate contribution is modeled both as a direct negative relationship (H11) and a relationship that is moderated by the variance of business segment returns within firms (H13). In addition, a direct negative relationship between the variance of business segment returns and the corporate effect is also hypothesized (H12).

The firm performance decomposition framework described earlier is a way to disentangle sources of firm performance into variance from business segment, corporation and industry. Thus, the logic behind that framework suggests that corporate-level factors, actions and resources such as scope of the firm (Rumelt, 1974) where firms choose to operate in more profitable industries, vertical integration and M-form structures where firms adopt more efficient integrated structures as well as internal capital markets (Williamson, 1975, 1985), core competencies where valuable competencies span many business segments (Chandler, 1962), better organizational climates (Hansen & Wernerfelt, 1989), and better and more able corporate management (e.g., Andrews, 1987: Hambrick & Mason, 1984) should enhance the corporate contribution to total firm performance. Thus, firms sharing these corporate-level factors should logically have a higher corporate contribution as measured by the corporate effect relative to firms that do not share them to the same extent. Bowman and Helfat (2001) and Adner and Helfat (2003) support this logic by suggesting a clear effect of "factors internal to the firm at the

corporate level" (Adner & Helfat, 2003: 1011) on firm profitability as they find that "dynamic managerial capabilities" reflected in corporate strategic decisions add a statistically significant increment of variance in firm profitability.

Applying this logic to the association between efficient capital allocation and the corporate contribution is straightforward. First, since the capital allocation decision clearly resides at the corporate-level with a final say in the allocation decision being retained by headquarters (e.g., Stein, 1997), the association between the capital allocation process and the corporate contribution is just as clear as any other action or process emanating from the corporate office. Second, and as described earlier, Williamson (1975) suggests that the capital allocation decision may be one of the most important determinants of firm performance. Thus, based on the fact that the capital allocation decision clearly resides at the corporate-level, in addition to its theoretical importance pointing towards it being a major determinant of firm performance, it should logically also be an important corporate-level determinant of firm performance and thus be closely associated with the corporate contribution.

An example illustrating how firm performance is decomposed to measure corporate-level influence on business segments may clarify this direct theoretical association between the efficiency of the capital allocation process and the corporate contribution (e.g., Williamson, 1975). That is, the common use of firm ROA to proxy for the corporate effect by regressing business segment performance on firm ROA[20] (see for example Bromiley, Brush & Hendrickx, 1999) suggests a direct positive association between (the efficiency of) the capital allocation process and the corporate contribution

[20] In later studies using multilevel models, corporate effects are estimated in a similar way as business segment performance is regressed on firm ROA leaving the residual to represent business segment effects.

as measured by the corporate effect. Suppose, for example, that a firm has three equal sized business segments, two that perform well with correspondingly high ROA (15 and 10 %), and a third segment that is not quite as successful showing a substantially lower return on assets (5 %). An equal allocation between these three segments would account for an overall firm ROA of 10 %. If, however, the corporate office exercises its right to allocate investment capital away from the poorly performing segment in favor of the two seemingly better performing ones, overall firm ROA is likely to increase. For example, allocating a more reasonable 50/50/0 split between the three segments, respectively, implies an overall firm ROA of 12.5 %[21]. This would also increase the corporate effect as business segment returns are regressed on the higher level of overall firm ROA. That is, overall firm ROA would explain more business segment return variance resulting in a higher corporate effect. Thus, based on theoretical insights and the way those insights have shaped the methods used to decompose firm performance, it follows that a more efficient allocation of capital should increase the corporate effect. Therefore, I expect a negative association between inefficiencies in the capital allocation process and the corporate effect. Formally stated:

> *Hypothesis 11: Inefficiencies in the capital allocation process will be negatively associated with the corporate effect.*

[21] Note that this example would also apply to two firms with similar performing business segments (15, 10 and 5 %). After reorganization, one of the firms divests the poorly performing segment (5 %), thus will be credited with a higher corporate effect as a direct result of more efficient capital allocation. Indeed, there is some evidence that business segments performing below some hurdle rate of return are divested (See Bromiley (1986) or Bower (1986) for a discussion and empirical evidence on hurdle rates and divestitures). Since these divestitures represent a natural decrease in investment funds (to zero) and a reallocation of freed-up funds to other business segments, they are and should be reflected in overall firm ROA and need not be controlled for.

Building on Bowman and Helfat's (2001: 5) conclusion that "empirical estimates of corporate effects may not fully and accurately capture the influence of corporate strategy on the variance of profitability", I suggest that statistical artifacts inherent in the way business segment performance variance is decomposed in most firm performance decomposition studies systematically biases empirical estimates of the corporate contribution. Subsequently, this complicates the association between capital allocation efficiency and those estimates. Specifically, it is the treatment (or lack of treatment) of the within firm variance of business segment performance that distorts the corporate effect. Since individual business segment returns are regressed on overall firm ROA regardless of decomposition method (e.g., variance decomposition, ANOVA, HLM), more variance is explained if business segment returns are homogenous, thus resulting in a higher corporate effect. That is, the corporate contribution as measured may not only derive "from differences between multiple-business firms in the average of returns to individual businesses within each corporation" (Bowman & Helfat, 2001: 3) as intended, but also from differences in the level of variance of business segment performance within firms where relatively more "homogenous firms" have higher corporate effects and relatively less homogenous firms have lower corporate effects. Thus, ceteris paribus, lower levels of business segment return variance may directly raise the corporate effect.

As one example illustrating this direct effect, consider two different firms operating in the same industry/business segments, with similar overall firm ROA (10 %), but with differences in the patterns of returns within each firm. The first firm has a large amount of dispersion (low homogeneity) in its business segment returns (5, 10 and 15 %, respectively), while the second firm has a more homogenous pattern of returns where the

three segments have ROAs of 9, 10 and 11 %, respectively. Since less dispersed business segment returns of the latter firm are regressed on same firm ROA, the latter firm would be credited with a much higher corporate effect. Thus, the second firm's more homogeneous return distribution raises the corporate effect relative to the first firm.

To more clearly see how this analytical artifact inherent in the measurement of corporate contributions increases the corporate effect, consider that only the "lowest average improvement"[22] across business segments is reflected in corporate effects. That is, although the corporate office may contribute just as much to profitability in each of my two example firms (more dispersed versus less dispersed business segment profitability), the contribution is much more uneven for the former firm, resulting in a lower corporate effect. That may be because the former firm (but not the latter) has access to some very powerful corporate-level resource (such as Apple's ability to design exceptionally sleek MP3 players, computers, and now also phones) that the firm is able to apply to the products sold by the third business segment (15 % ROA), but not necessarily to the products sold by the other two lower performing segments. This particular corporate-level resource may therefore greatly improve the performance of the third business segment compared to competitor segments, but may only slightly (or not at all) improve the other two segments. Thus, because empirical estimates of the corporate contribution represent the lowest average improvement across business segments, the strong but uneven effect from the design advantage will not be fully represented by corporate effects. In other words, the firm with less dispersed business segment returns

[22] Bowman and Helfat (2001) refer to this as the "average improvement" meaning that it is the lowest common denominator improvement across business segments. This interpretation of "average improvement" becomes clear as they subsequently suggest that the business effect soaks up the remaining variance that should have been attributed to corporate strategy in firms with more dispersion in business segment returns.

will end up with a larger corporate effect just because it may have a corporate-level resource with a low to moderate impact on the performance of each of its three business segments.

In sum, therefore, I expect increasing levels of business segment return variance to have a negative effect on the corporate effect. Stated formally:

> *Hypothesis 12: Business segment return variance will have a negative association with the corporate effect.*

The level of business segment return variance within firms may also moderate the relationship between capital allocation efficiency and estimates of the corporate contribution on firm performance. As suggested by Bowman and Helfat (2001: 3), corporate effects may not only reflect the "true" corporate contribution as characterized by "differences between multiple-business firms in the average of returns to individual businesses with each corporation", but may also reflect the level of dispersion of business segment performance within firms, i.e., relatively more "homogenous" firms have higher corporate effects. If that is true, business segment return variance as a previously unmeasured artifact of how corporate contributions are measured may influence the relationship between capital allocation inefficiencies and the corporate effect (H11). In other words, the relationship between capital allocation inefficiencies and the corporate effect may change depending on the level of business segment return variance, suggesting a joint effect on the criterion variable. Thus, a moderating effect would take place where the negative association would stay the same at higher levels of variance, but may weaken at relatively lower levels of segment return variance.

In sum, based on the moderating influence of business segment return variance on the relationship between capital allocation efficiency and the corporate effect, I expect the following:

> *Hypothesis 13: Business segment return variance within firms will moderate the association between capital allocation inefficiencies and the corporate effect such that at high levels of segment return variance a negative association may be expected, while a null or a positive association may be expected at low levels of return variance.*

Empirically, the association between inefficiencies in the capital allocation process and diversified firm value is not hard to defend. As mentioned earlier, a number of researchers have found evidence that inefficient capital allocation at the corporate-level contributes to differences in valuation between freestanding business segments and those under the corporate umbrella, i.e., they have linked inefficient capital allocation with diversified firm value (e.g., Berger & Ofek, 1995: Shin & Stulz, 1998: Maksimovic & Phillips, 2002: Comment & Jarrell, 1995).

A main difference, however, between those studies and mine is how capital allocation inefficiencies are treated and measured. In line with Jensen (1986, 1989, 1991, 1993), most of the above studies emphasize overinvestment, but spend little or no time investigating instances of underinvestment in business segments with relatively better prospects. Although one could argue that with a binding capital constraint, overinvestment in one segment would automatically result in underinvestment in another, this is not likely to hold in modern corporations where available investment capital instead can, and often is, allocated to buy-backs, dividends and other uses at the discretion of corporate managers (Dow & Gorton, 1997).

To address this limitation of past research, this dissertation uses a more complete measure of inefficient capital allocation where over and underinvestment are measured separately, offering the possibility that they may be fairly independent. That is, the presence or absence of overinvestment does not automatically preclude either the presence or absence of underinvestment. In addition, although the influence of over and underinvestment on firm performance outcomes are measured separately, I suggest that they have similar symmetrical negative effects on firm performance outcomes including the corporate effect, diversified firm value, and firm ROA.

Theoretically, the association between inefficient capital allocation and diversified firm value can be viewed as an outgrowth of the emphasis that Transaction Cost Economics (Williamson, 1975, 1985) traditionally has put on the capital allocation function. Williamson (1975: 148) points to this function being "the most fundamental attribute of the M-form enterprise", indicating its powerful effect on firm performance. In particular, and noting that Williamson assumes that the choice between organizational form always is made in an effortless and optimal manner, his conclusion is that the internal capital allocation mechanism reduces transaction costs by replacing the less efficient external mechanism that single-segment firms rely on, thereby resulting in better firm performance.

This is not likely to hold true, however, if clear inefficiencies are observed within the internal mechanism. At the very least, as inefficiencies in the form of over and underinvestment increase, performance implications for the diversified firm are likely to become increasingly negative, leading to an increased discrepancy in valuation between diversified and single-segment firms. In other words, inefficient capital allocation in

diversified firms is likely to lead to a lower diversified firm value where business segments under the corporate umbrella are valued lower than similar freestanding segments. Thus, based loosely on transaction cost economics and its emphasis on the capital allocation function, I expect that:

> *Hypothesis 14a: Overinvestment will be negatively associated with diversified firm value.*
>
> *Hypothesis 14b: Underinvestment will be negatively associated with diversified firm value.*

Inefficiencies in the capital allocation process will also affect a firm's return on assets (ROA). As argued earlier, inefficiencies will lower overall firm ROA as investment capital is not allocated to business segments with the highest prospects and ROA. That is, overinvestment where "too much" capital is allocated to business segments with relatively lower prospects and ROA, and underinvestment where "not enough" capital is allocated to business segments with relatively better prospects and ROA, will lower overall firm ROA as weighted segment ROAs are aggregated to the firm level. Based on that, I expect that both under and overinvestment will lead to lower firm ROA. Formally stated:

> *Hypothesis 15a: Underinvestment will be negatively associated with firm ROA.*
>
> *Hypothesis 15b: Overinvestment will be negatively associated with firm ROA.*

CHAPTER 3: METHODS

SAMPLE

The model requires data at business segment, firm and at industry levels. At the business segment level and following a number of studies (e.g., McGahan & Porter, 1997: Roquebert, Phillips & Westfall, 1996: Hough, 2006), annual segment level data on profitability was collected from COMPUSTAT business segment database. This database reports up to 10 business segments because the SEC requires the identification of any business segment comprising 10 % or more of consolidated firm sales. For each business segment, COMPUSTAT provides a 4-digit SIC code (for identification of corporation as well as primary and secondary industries) as well as each segment's operating income, sales and identifiable assets. Annual business segment performance (ROA, hereafter) was calculated as operating income[23] represented by COMPUSTAT item "OPS" divided by identifiable assets (e.g., McGahan & Porter, 1997, 2002: Misangyi *et al.*, 2006).

My initial sample of yearly business segment performance covers the years 1998 through 2006. The start date coincides with Financial Accounting Standards (FAS) 131 superseding FAS 14 by becoming effective for fiscal years after December 15, 1997. This change in accounting standards represents a major change in how public firms account for and report their activities by making their segment reporting more in line with how firms actually operate their business segments. Referred to as a "management approach" (FASB, 1997: #4) for determining reportable segments, this new standard specifies that

[23] Note that there are similar measures of operating income available in the COMPUSTAT data base. Although highly correlated (0.87), I rejected operating income before depreciation (OIBD) in favor of OPS because the latter variable offers substantially more useable observations.

firms further split up broader "industry" or "line of business" reporting (required by the old standard FAS 14) into more narrow operating segments. That is, conditions for aggregating business segments were tightened by only allowing aggregation if segments are similar in terms of a number of characteristics including the type and nature of products and services, type of production processes, type of customers, and, if applicable, also the nature of the regulatory environment (FASB, 1997: #17). Thus, public firms often end up reporting more segments under the new standard. Wal-Mart, for example, now reports four segments (Wal-Mart Stores, Sam's Club, International, and Other) versus only one segment previously.

Although the new segment reporting rules require firms to restate prior years' information, the wording in FASB 131 paragraph 34 is vague: "information....shall be restated unless it is impracticable to do so", thus giving considerable freedom to individual firms to determine what burden should be placed on them to furnish the additional information. In addition, the following paragraph (35) provides firms with the option to only restate segment information for the current period "in which the change occurs" if "both the old basis and the new basis of segmentation" is provided for that particular year. Thus, I cannot be sure that firms actually went back and restated segment information based on the new reporting standard, which implies that the same unchanged firm may have very different reported segment structures before and after the new accounting standard took effect. Furthermore, firms that ceased to exist (mergers, bankruptcy, dissolution) before the new rules took effect will not have restated their information, resulting in another possible bias to data sets incorporating observations from both before and after the reporting change in 1998. Therefore, and because the time

period starting in 1998 provides an ample number of observations, my data set only includes observations from after the change of reporting standards.

The data are screened in line with criteria and steps used by McGahan and Porter (1997) and followed by other studies (e.g., Misangyi *et al.*, 2006). To exclude business segments that lack direct competitors (such as for example government entities) or economic significance in their respective industries, and thereby avoid biases leading to understated industry and overstated business segment effects (e.g., McGahan & Porter, 2002), I exclude all business segments not containing a primary SIC designation, all business segments that lack competitors in their primary SIC classifications in a specific year (i.e., monopolies), as well as all segments classified as "not elsewhere classified," "nonclassifiable establishments," or "government excluding finance" (SIC codes in the 9000s). I also exclude all financial business segments designated as "depository institutions" (SIC codes in the 6000s) because returns of financial institutions cannot be compared to those of other industries as explained in McGahan and Porter (1997). In addition, since "single-year appearances and small segments often are anomalous because they are created for the disposition of assets prior to exit" (McGahan & Porter, 1997: 51), business segments with only one observation across the sample as well as segments with sales and/or assets below $10 million are excluded.

Observations at the business segment level were then matched with firm level financial data including Organizational size, Cash flow, R&D intensity, Cost of capital and Firm ROA from the COMPUSTAT firm level (Industrial Annual) database, as well as with CEO compensation, CEO tenure, and stock ownership data from the COMPUSTAT Executive Compensation database. In addition, data on block holder and

institutional ownership were calculated based on underlying data from Thomson Financial and their CDA/Spectrum database S34. Furthermore, Level of diversification and Diversified firm values were calculated using COMPUSTAT business segment and firm level databases. Finally, at the industry level, measures of environmental uncertainty were also collected and calculated using COMPUSTAT business segment and firm level databases.

This resulted in 65,713 observations at the business segment level, 25,037 firm-years of observations, and a total of 5,802 firms represented in my sample (see Table 1 for an overview of the sample including a breakdown of selected variables for illustration purposes). Diversified as well as single-business firms, defined as firms that have business segment(s) in only one unique 4-digit SIC code, are represented in my sample: a total of 34,114 segments belong to single-business firms, while the remaining 31,599 segments belong to diversified firms with segments in more than one unique 4-digit SIC code. Of the segments belonging to diversified firms, the vast majority of segments (28,790) belong to firms with two unique 4-digit SIC codes, while only 14,735 segments belong to firms with segments in at least three unique 4-digit SIC codes. Thus, a large percentage of my business segments (77.6 %) belong to firms that are either not diversified or have segments belonging to only two unique 4-digit SIC codes.

To incorporate divergent arguments that the inclusion of single-business firms "masks the corporate effect" (Bowman & Helfat, 2001: 14), but that their exclusion would artificially inflate corporate effects "because diversified firms tend to perform close to the overall mean" (McGahan & Porter, 2005: 879), segments belonging to both

types of firms are included in the analysis where appropriate according to both applicable theory and methods used.

Table 1. Observations by Segment and Firm levels

	Segment level		*Firm year*		*Firm level*	
Variable name	**N**	**% missing**	**N**	**% missing**	**N**	**% missing**
Full sample	**65,713**		**25,037**		**5,802**	
Organization size	65,621	0.14%	24,974	0.25%	5,761	0.71%
R & D intensity	36,634	44.17%	14,117	43.47%	3,150	45.32%
Cost of capital	56,656	13.78%	19,431	22.39%	4,611	20.53%
Component: total interest expense: L-t and s-t debt	61,617	6.23%	22,608	9.70%	5,219	10.05%
Component: L-t debt	65,514	0.30%	24,986	0.20%	5,782	0.34%
Component: Debt out of s-t liabilities	65,633	0.12%	25,005	0.13%	5,785	0.29%
Block holder ownership	15,460	76.47%	4,711	81.18%	942	83.76%
Institutional shareholder Ownership	20,662	68.56%	6,449	74.24%	1,395	75.96%
Contingent compensation	22,185	66.24%	4,881	80.50%	891	84.64%
Component: Restricted stock grants	22,347	65.99%	4,917	80.36%	896	84.56%
Component: Options granted	22,185	66.24%	4,881	80.50%	891	84.64%
Level of Diversification	65,713					
Environmental dynamism	65,580					
Environmental complexity	65,713					

Finally, the resulting data set extracted from and calculated with data from COMPUSTAT and Thomson Financial, although large, should be viewed as a sample of firms and industries having the following characteristics. First, it covers only public firms traded on domestic exchanges, thereby excluding many foreign firms and all private firms. In addition, the screening procedures discussed above exclude a large number of the original observations. According to McGahan and Porter (2002: 840), about 15 % of observations may be excluded because their "four-digit categories do not correspond to

economically meaningful industries (i.e., 'not elsewhere classified')" alone. Thus, statistical analysis can be used to make inferences to the population based on the sample.

MEASURES

Dependent Variables

Capital Allocation Efficiency: Over and underinvestment.

The measures of capital allocation efficiency are based on business segment prospects which, in turn, are estimated using Tobin's q. Following prior research (e.g., Berger & Ofek, 1995: Lang & Stulz, 1994: Maksimovic & Phillips, 2002: Rajan *et al.*, 2000: David *et al.*, 2006), business segment Tobin's q offers, in contrast to stock returns or accounting performance measures, the advantage that "no risk adjustment or normalization is required to compare q across firms" (Lang & Stulz, 1994: 1249). In other words, since Tobin's q is the market value divided by the replacement cost of the firm, q implicitly incorporates the correct risk-adjusted discount rate as well as minimizes other "distortions due to tax laws and accounting conventions" (Montgomery & Wernerfelt, 1988: 627). Thus, no additional adjustments are necessary to compare business segments with different individual risk levels. In addition, since a business segment q cannot be observed directly, it is estimated by looking at the q of the particular industry that the business segment belongs to. Thus, in line with LeBaron and Speidell's (1987) approach and the empirical study by Rajan *et al.* (2000), business segment q's are approximated by the mean q of single-business firms in the same industry at the lowest possible SIC level. Specifically, a step wise technique following prior research (e.g., Berger & Ofek, 1995: Villalonga, 1999: Campa & Kedia, 2002) is used to estimate the mean Tobin's q of at least five single-business firms by taking the ratio of firm value

(defined as the value of equity plus the book value of total assets minus the book value of equity) to total assets for the specified number of single-business firms at the lowest possible SIC code. That is, I check if an estimate is available at the 4-digit level. If one is available, I use that estimate. If not, I check if an estimate is available at the 3-digit level and instead use that estimate. If neither 4-digit nor 3-digit estimates are available, I check to see if an estimate is available at the 2-digit SIC level. Thus, an estimate of segment Tobin's q is calculated for the focal segment as long as at least 5 single-business firms are available at any SIC level.

Two additional methods of estimating business segment prospects were considered but ultimately rejected due to their inability to represent the forward-looking element of segment prospects. That is, neither firm ROA nor environmental munificence (the latter measured as the average industry sales over the last five years) contains a prediction (or estimate) of future performance, thus neither satisfies the basic requirement for a measure of future performance and success.

Using this method (Tobin's q) to calculate business segment prospects, overinvestment is the allocation of relatively more investment funds measured as scaled (based on segment assets and sales) capital expenditures to business segments with less favorable prospects, while underinvestment is the allocation of relative fewer investment funds to higher prospect segments. Thus, tests determine whether segments with favorable prospects underinvest and whether segments with less favorable prospects overinvest.

Specifically, with the exception of the Berger and Ofek (1995) overinvestment measure described separately, four steps are required to measure over and

underinvestment at the business segment level. As a first step, a segment's growth prospect is calculated using the described Tobin's q methodology, the stepwise technique, and data from that segment's industry. Second, the prospect of a particular segment is compared to two reference points, one external to the firm and one internal to the firm. Following prior research on capital allocation, the external reference point is the median prospect of all business segments (e.g., Shin & Stulz, 1998: Berger & Ofek, 1995), while the internal reference point is firm level Tobin's q (e.g., Rajan, Servaes, & Zingales, 2000). For external calculations of reference points, the focal segment is excluded. For internal calculations, however, the focal segment is not excluded because I assume that managers use firm level Tobin's q as their reference point and are unlikely to go through the additional work of partialling out the focal segment from their calculations. This approach to estimating internal reference points is also consistent with prior research (e.g., Rajan *et al.*, 2000). Therefore, the internal reference point is set as firm level Tobin's q without adjusting for the focal segment.

The described comparison to external and internal reference points determines if the business segment is a high or low prospect business segment which, in turn, determines whether the test is for underinvestment or overinvestment, respectively.

In the third step, the information gained in the previous steps is used to check for over and underinvestment by comparing segment capital expenditures scaled by both segment assets and segment sales to both internal or external reference points of capital allocation. The internal reference point is the level of scaled allocations to business segments within the firm, while the external reference point is measured as the average

investment of the segments in either the bottom half or top half (as divided by the median[24]) of the rank-ordered distribution of all segments.

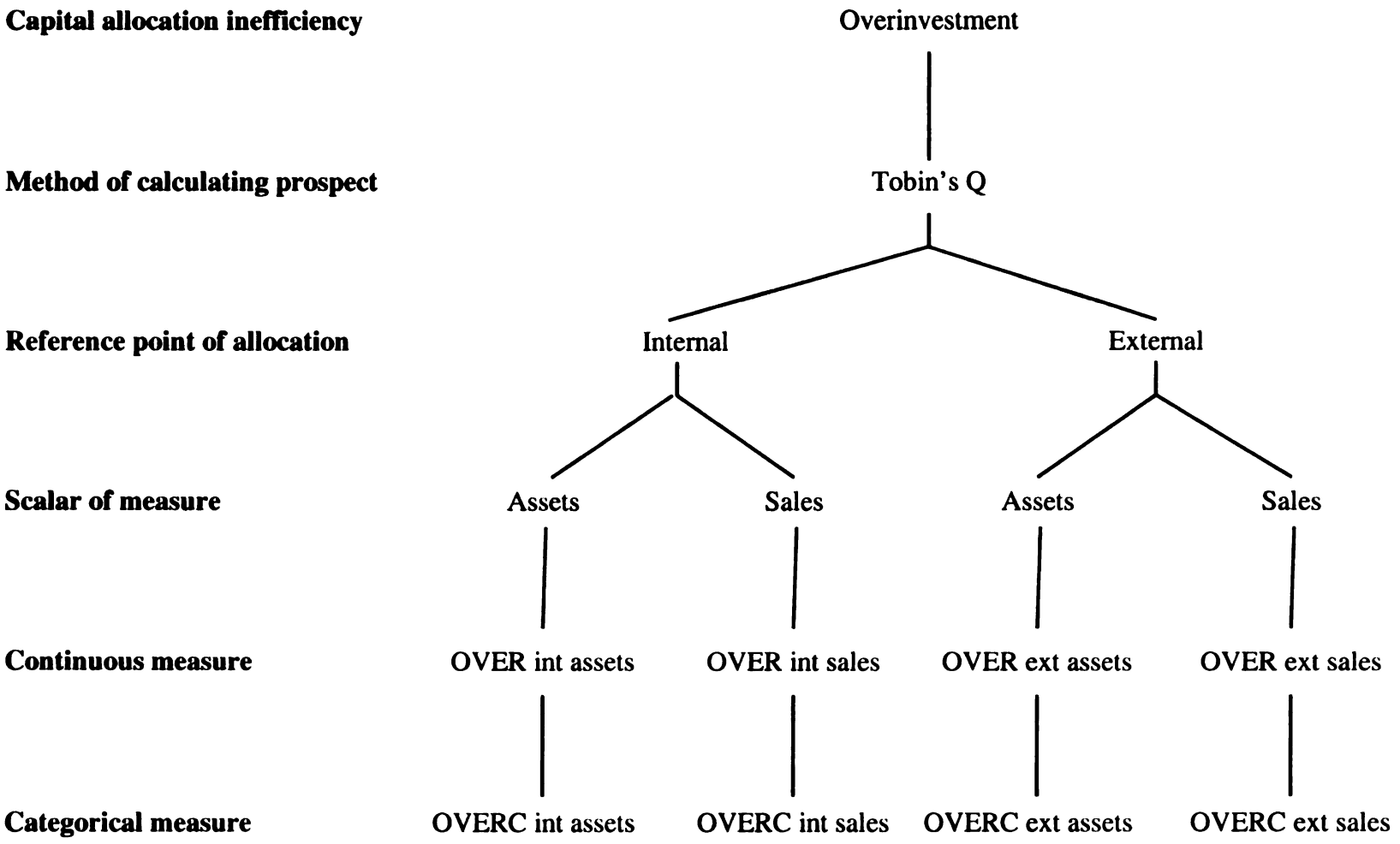
The final and fourth step for calculating capital allocation efficiency creates both continuous and categorical measures from the comparison between actual allocations and internal and external reference levels of allocation. Thus, based on the logic underlying the four steps, overinvestment is measured as scaled capital expenditures allocated to low prospect business segments that are each allocated more investment capital than internal or external reference allocations. This generates two continuous measures based on the internal reference point, one for each scalar (OVER_int_asset and OVER_int_sales), as well as two measures based on the external reference point (OVER_ext_asset and OVER_ext_sales), again distinguished by the scalar used to control for size effects. Similarly, 4 categorical variables are constructed based on similar logic (OVERC_ext_asset, etc.). See Figure 3 for overinvestment measures.

In addition, I include Berger and Ofek's (1995) measure of overinvestment in order to compare the results of my study to their examination of overinvestment. Since they did not examine underinvestment, no comparison of those results can be made. They measured overinvestment as the depreciation-adjusted scaled capital expenditures allocated to a business segment with very low prospect (Tobin's q below 0.25) based on the rank-ordering of all segment prospects. This generates a final continuous measure of overinvestment (OVER_Berger&Ofek).

Four things should be noted at this point. First, the external reference point for capital allocation uses a more restrictive investment hurdle to test for over and

[24] Dividing business segments by median prospects instead of by mean prospects may also help to protect against non-normal data and the undue influence of outliers. In addition, I also looked at distributions and identified outliers as much as possible.

Figure 3
Illustration of Overinvestment Measures



underinvestment. That is, the actual allocation to a business segment is not compared to the average investment of the entire distribution, but instead to the average investment in either the top (testing for overinvestment) or bottom half (testing for underinvestment) of the distribution. Thus, this procedure effectively cuts my initial sample into two separate non-overlapping sub-samples, one sub-sample used to test for overinvestment and the other used to test for underinvestment, as it provides for a more stringent test. The reason behind that stringency is that segment prospects vary around their respective industry means, thus cannot be known. That is, segments could have either better or worse prospects than their respective industries implying the existence of random variation. Therefore, to minimize the impact of that random variation and the possibility that some segments may be incorrectly classified as either over or underinvesting, the stricter investment hurdle is used.

Second, although more restrictive, the construction of measures using the external reference point allows for the inclusion of single-business firms. Since the inclusion of single-business firms increases the likelihood that a reference point can be calculated, it also increases the chance that misallocation can be recognized when external measures are used. This is clearly reflected in the number of instances of over and underinvestment reported between models differentiated only by the way reference points are calculated.

For example, over and underinvestment scaled by assets account for a total of 51,197 observations when external reference points are used, but only 21,777 observations when measures are constructed with internal reference points. Thus, I lose almost 30,000 observations by excluding single-business firms where an internal reference point cannot be meaningfully calculated. As also discussed later in this section,

the inclusion of single-business segments in external measures provides a way to differentiate between effects of capital allocation efficiency for diversified versus for firms that are not diversified. Note that the external measure had to be adapted to exclude single-business firms in models (e.g., diversified firm value) where the inclusion of such firms clearly would be contradictory to underlying theory.

Third, the various individual measures of over and underinvestment (described next) make this measure fairly comprehensive in that it targets several different potential contingencies that managers may consider when allocating capital. For example, the distinction between an external and internal reference point suggests that managers may view a particular segment's prospect or allocation against either an internal or external reference point. Since we cannot be sure which reference point, if any, is most likely to be used, both reference points are included.

Fourth, based on the comprehensiveness of the described measures of capital allocation efficiency, I argue that existing measures to some extent "substitute" for a proximal measure of optimal investment. That is, the absence of inefficiencies even after the application of all individual measures could be taken to mean that the capital allocation process for a particular firm indeed is efficient. Furthermore, the underlying logic behind such a measure also conflicts with the assumption of bounded rationality at the individual decision-making level, i.e., decision-makers could never achieve the level of optimal investment that the proxy is intended to measure. Therefore, measuring inefficiencies in a process that is assumed to be biased and contain error may seem more reasonable than to measure optimality where none can be had.

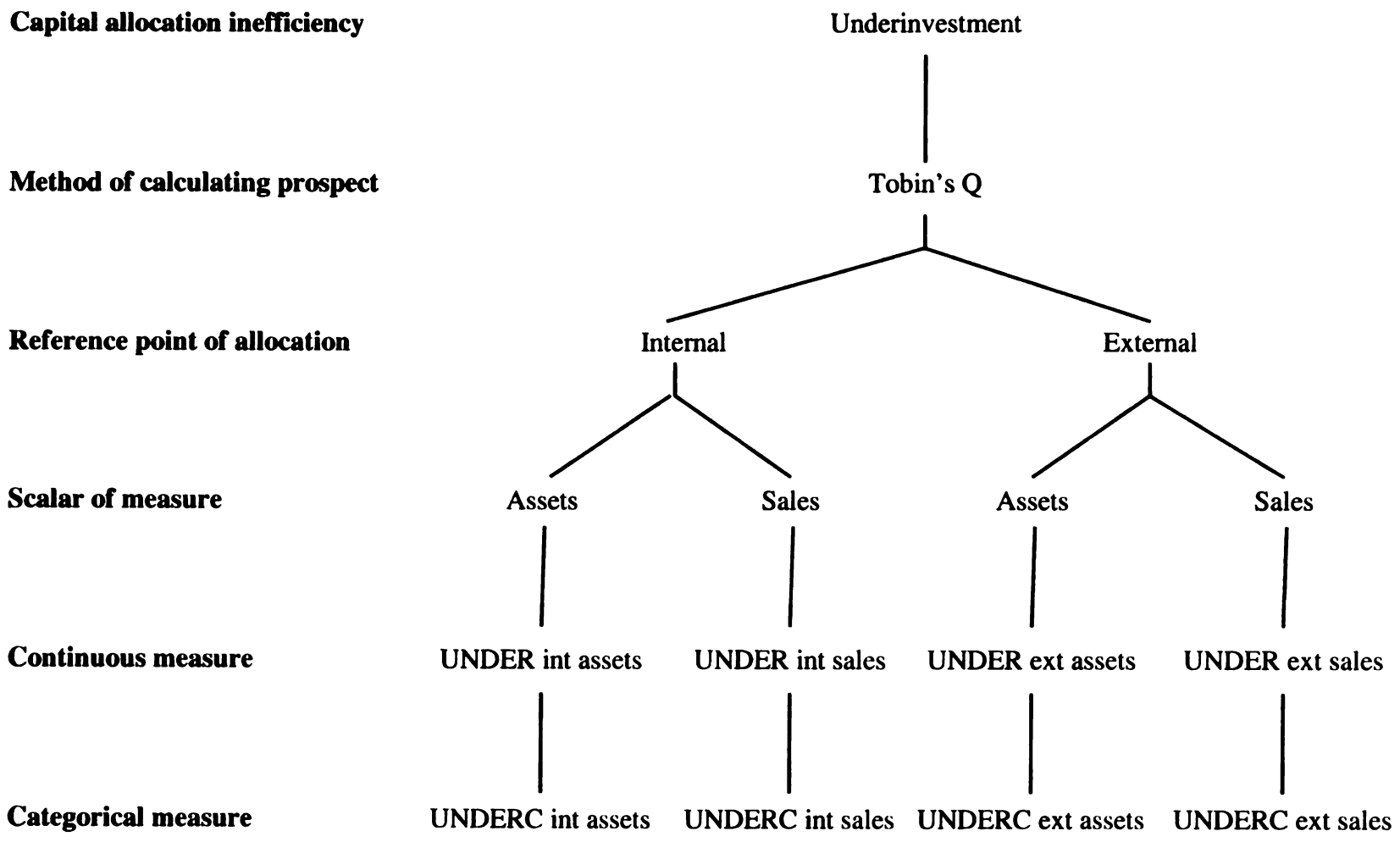
Underinvestment at the business segment level is based on the same logic with the exception that the asymmetry of over and underinvestment does not allow for the depreciation-adjusted measure. That is, the measure that Berger and Ofek (1995) used was not meant to be applied to underinvestment since the logic behind it – that capital expenditures in excess of depreciation to very low prospect business segments represents overinvestment – cannot easily be applied to underinvestment. Thus, underinvestment is measured as scaled capital expenditures allocated to high prospect business segments that are each allocated less investment capital than reference allocations. Note that the average of the lower half of the distribution of segment capital investment is now used as the external allocation reference, while the internal reference stays the same. This generates two continuous measures with internal reference points scaled by assets and by revenue (UNDER_int_asset and UNDER_int_sales) and two measures with external reference points, one scaled by assets (UNDER_ext_asset) and one scaled by revenue (UNDER_ext_sales). In addition, four categorical measures are created (Figure 4).

Diversified firm value (*DIVERSIFIED VALUE*). Diversified firm value measures the degree of discount (or premium) of diversified firms by comparing current firm market value with an estimated value based on a scenario where the firm's business segments are freestanding entities. To estimate this potential "stand-alone" value and enable a comparison with current firm value, researchers (e.g., Berger & Ofek, 1995: Lang & Stulz, 1994: Comment & Jarrell, 1995) use a multiplier method where single-segment firms in the same industry are employed to calculate a potential imputed value for each business segment. Specifically, the median ratio of total capital (market value of common equity plus book value of debt) divided by two accounting items (assets and

Figure 4
Illustration of Underinvestment Measures



Figure 4
Illustration of Underinvestment Measures



sales) for at least five single-segment firms in the same industry is estimated by using the previously described stepwise technique. That is, I check if estimates are available starting at lower SIC levels to construct a proxy at the lowest possible SIC level. The estimated median ratio of capital to accounting item is then multiplied by the business segment's level of the same accounting item as illustrated in equation 1 below. Thus, single-segment firms in the same industry as the focal business segment are used to provide an estimate of a firm's potential value if all of its segment were operated as stand-alone businesses. The current firm value is then compared to the sum of the imputed values for all firm business segments and excess value is calculated as the natural log of firm value to imputed value (e.g., Berger & Ofek, 1995). A positive excess value indicates that diversification enhances firm value while a negative excess value indicates the opposite (Equation 2). Because this measure is constructed to identify excess values for diversified firms, excess values are only calculated for firms with segments in at least two unique 4-digit SIC codes, i.e., single-business firms are excluded.

$$Imputed\ Value_k = \Sigma\,(V_M/AI_M)*AI_i \qquad (1)$$

$$Excess\ value_k = \ln\,(V_k/Imputed\ Value_k) \qquad (2)$$

AI_i *Value of accounting item (sales and assets) for segment i*

AI_M *Value of accounting item for median single-segment firm*

V_M *Total capital for median single-segment firm (market value of common equity + book value of debt)*

V_k *Total capital of firm k*

Thus, based on the accounting item used, this results in two measures of diversified firm value: DIVERSIFIED VALUE_asset and DIVERSIFIED VALUE_sales.

Because of the endogeneity of the diversification decision, I acknowledge the possibility that observed diversified firm values (e.g., Lang & Stulz, 1994: Berger & Ofek, 1995: Servaes, 1996) may not necessarily mean that diversification destroys value. In other words and as argued by Campa and Kedia (2002: 1731), firms choose to diversify in response to firm characteristics that may "make the benefits of diversification greater than the costs of diversification". Poorly performing firms, or firms that believe they will benefit from an internal allocation process, may therefore be more likely to diversify or diversify to a larger extent because their opportunity costs for doing so tend to be much less. Villalonga (1999) and Campa and Kedia (2002) support this reasoning by finding that diversified firms tended to trade at a discount also prior to diversifying.

I argue, however, that firms diversifying in response to particular firm characteristics may not affect the direction and validity of my results for a number of reasons. First, I am not interested in the absolute level of the diversified firm value per se. Instead, I am interested in the relative change of this variable in response to a more or less efficient capital allocation process. Thus, I am actually incorporating the efficiency of the capital allocation process as an antecedent to diversified firm value, thereby acknowledging that a firm's belief that it can implement a highly efficient capital allocation process may contribute to that firm's decision to diversify. This is in line with suggestions by Campa and Kedia (2002: 1733), who argue that important "firm characteristics that affect the diversification decision" should be included or controlled for in the analysis. Second, if poorly performing firms and/or firms who believe they will have an advantage over other firms in implementing an internal capital allocation function indeed diversify to a larger extent, this would, if anything, weaken the

relationship between inefficiencies and diversified firm value. That is, fewer instances of inefficiencies will be associated with smaller diversified firm values, which should weaken the hypothesized relationship between the constructs.

Corporate effect (*EFFECT*). Conceptually, the corporate effect is defined as "differences between multiple-business firms in the average of returns to individual businesses within each corporation" (Bowman & Helfat, 2001: 3). Thus, the larger those differences are, the larger the corporate effect is, implying an increasing potency of the corporate office to affect the overall returns of their business segments. The corporate effect is, in turn, operationalized by decomposing business segment ROA, calculated as the ratio of operating income to segment assets (e.g., Misangyi *et al.*, 2006: McGahan & Porter, 1997: 2002), into effects stemming from industry, corporation, and the business segments themselves following the majority of firm performance decomposition research (see Bowman & Helfat, 2001, for an overview).

As discussed earlier, a number of single-level methods (e.g., analysis of variance and variance components analysis) have been used to decompose business segment ROA with the main drawback that they assume independence between effects, which not only fits poorly with the nested structure of the underlying data, but also makes it impossible to advance theory by investigating relationships between effects as well as antecedents to such effects. Therefore, I have elected to use a more suitable multilevel modeling technique where effects are represented at different levels starting with time (Level 1), followed by business-segment (Level 2), and corporation (Level 3). Due to the cross-nesting of industry effects, they are introduced at the business-segment level. Thus, corresponding to the definition given earlier where corporate effects are defined as

differences between firms in their mean business-segment returns, the corporate effect can be calculated by adjusting the variance of the residual at the corporate level for the cross-nesting of industry effects. This process of classical hypothesis testing is described in detail in the section on model specification and estimation (page 102).

Firm ROA (*FIRMROA*). Firm ROA is a more traditional measure of firm performance in strategic management. It is defined as operating income divided by total assets and is used as an additional and complementary measure of firm performance.

Independent variables

Business segment historical and social performance comparisons (*HISTPERF, SOCPERF*).

Based on March and Simon's (1958) argument that both past performance and the performance of competitors will influence aspiration levels, historical segment performance (measured as the prior year's segment ROA) and the performance of competitors (measured as the current average ROA performance of at least 5 segment competitors) are used to assess aspiration driven influences on the capital allocation process. The stepwise methodology previously discussed to search for reference levels is applied here as well. That is, I first search for five competitors at the 4-digit SIC level. If they cannot be found at that level, I renew my search at the next higher level, and finally at the 2-digit level. This way of gathering reference levels of social performance assumes that firms are looking for segment competitors in single-business as well as diversified firms, i.e., across organizational structure. Evidence from the business press supports this assumption – large firms, such as for example GE, benchmark their divisions against the

best competitors in their respective market segments or industries regardless of parent company structure. Alternatively, well-performing segments of single-business firms may use segments in large well-performing conglomerates (such as GE) as benchmarks. In GE's case, this may be particularly true since they often are at the forefront of their industries due to the much talked about constraint that divisions within GE need to be either first or second in their respective industries or face threats to their existence. Thus, because I cannot *ex ante* exclude firms looking at segments belonging to firms with different organizational structures than their own, I decided to include both types of segments as likely competitors and not further differentiate between them.

A single measure replacing separate historical and social influences on aspirations by combining them (Bromiley, 1991) was initially incorporated, but later rejected for the final analysis because of inconsistencies when used in conjunction with measures of capital allocation efficiency. This measure is based on logic from the Behavioral Theory of the Firm (Cyert & March, 1963) where firms with business segments performing above average segment performance are unlikely to aspire to average performance, instead aspiring to somewhat increased future performance above previous performance levels (e.g., Eliasson, 1976), while firms performing below average may aspire to raise their performance to just that average level. Thus, firms are assumed to have different aspiration levels depending on whether current business segment performance is above or below current average ROA of its segment competitors. It is these dual aspiration levels that create problems when used in conjunction with efficiency measures. When used with overinvestment measures, the likelihood that current business segment performance is below either social or historical aspiration level is high because only segments with

below median (below average) prospects are assumed to overinvest. When used with underinvestment, however, the likelihood that current business segment performance is above the combined aspiration level is low for two reasons. First, current business segment performance needs to be above aspirations, thereby taking the social aspiration level out of play. In addition, the historical aspiration level is now more restrictive since it is set at 5 per cent higher than actual performance last year. Thus, the asymmetry between over and underinvestment due to the construction of capital allocation efficiency measures makes the Bromiley measure unsuited for use in this dissertation.

Corporate Governance

Block holder ownership (*BLOCKOWNER*). Ownership by block holders is a common measure of the ability of shareholders to monitor and control executives (Davis, 1991). I measured this proxy for monitoring and control as the total proportion of ownership held by institutional external shareholders controlling more than a standard 5 % of total outstanding equity.

Institutional shareholder ownership (*INSTITOWNER*). As an alternative measure to block holder ownership (Sanders & Carpenter, 2003), the percentage of total outstanding equity owned by institutional shareholders such as pension funds, mutual funds, and hedge funds may also correspond to shareholder involvement in monitoring. Due to potential overlap in ownership between the two measures (i.e., institutional ownership includes positions by block owners), I test shareholder monitoring with each variable separately.

Contingent compensation (*COMPENSATION*). I focus on CEO compensation for two reasons. First, this ensures that my results not only are comparable to findings of

previous corporate governance research (e.g., Devers *et al.*, 2008), but also comparable to studies modeling the capital allocation process including its efficiency (e.g., Scharfstein & Stein, 2000). Second, prior research has suggested strong relationships between both structure and level of CEO and TMT pay due to influential CEOs being able to affect the compensation of their top management teams (e.g., Carpenter & Sanders, 2002: Gomez-Mejia & Wiseman, 1997). That is, CEOs may act as "gate keepers with respect to TMT member pay" (Carpenter & Sanders, 2002: 378) which would also be consistent with literatures concerned with CEO power (Finkelstein & Hambrick, 1996: Hayward & Hambrick, 1997). Thus, CEO compensation may be a reasonable proxy for incentive alignment effects not only for the CEO, but also for the remainder of the top management team. Therefore, CEO compensation contingent on the performance of the firm's share price was measured by adding the following COMPUSTAT Executive Compensation categories representing contingent compensation: restricted stock representing value of stock-related awards (e.g., restricted stock and restricted stock units) that do not have option like features, and *options granted ($ Compustat Black Scholes value)* representing the aggregate value of stock options granted to the CEO during the year as valued using S & P's Black Scholes methodology. The aggregate value of granted options and restricted stock was used to represent contingent compensation because traditional theory (e.g., Jensen & Meckling, 1976) is not clear on differences between them, if any, in regards to their effects on corporate decision-making and risk taking. In addition, the use and size of restricted stock grants has traditionally been quite modest until FASB amended their rules in 2004 (to take effect in 2005) requiring companies to treat all forms of share-

based payments to employees in a similar fashion by recognizing their expense on the income statement.

Environment

Building on work by Aldrich (1979), Duncan (1972) and Child (1972), Dess and Beard's (1984) influential multidimensional characterization of organizational environments is used to model environmental influences on the capital allocation process. Their model has been supported by a confirmatory factor analysis (Rasheed & Prescott, 1992) where 94 % of environmental variance was explained by environmental dynamism, complexity and munificence. Additionally, a large number of empirical studies have used all or some of the dimensions in studies of corporate strategy (e.g., Boyd, 1990, 1995: Li & Simerly, 1998: Simerly & Li, 2000: Henderson, Miller & Hambrick, 2006). As noted earlier, environmental dynamism and complexity are modeled as independent variables.

Environmental dynamism (*DYNAMISM*). Following the popular characterization of dynamism as the variance of munificence (e.g., Boyd, 1990, 1995: Goll & Rasheed, 1997: Li & Simerly, 1998: Palmer & Wiseman, 1999: Keats & Hitt, 1988: Misangyi *et al.*, 2006), environmental dynamism is operationalized as the variance of industry sales growth over a 5-year period. Specifically, following common practice for the calculation of munificence and dynamism (e.g., Boyd, 1990, 1995: Li & Simerly, 1998: Simerly & Li, 2000: Palmer & Wiseman, 1999: Keats & Hitt, 1988: Misangyi *et al.*, 2006), I am regressing time against industry sales based on the five preceding years. The standard error of the regression slope divided by mean sales over the period is my estimate of environmental dynamism.

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With regards to the measurement of environmental dynamism, I note that Folta and O'Brien (2004) use a very complicated generalized autoregressive conditional heteroscedasticity (GARCH) model (Bollerslev, 1986) that is seldom used in strategic management but often in finance and economics. They argue that more conventional calculations of industry-specific uncertainty involving "the variance of some output or indicator (e.g., stock price, GDP, sales)" (Folta & O'Brien, 2004: 127) may produce biased estimates for two reasons: conventional methods do not account for trends in the data, nor do they allow for variance that is not constant over time, i.e., heteroscedastic variance.

Although they are correct that more conventional methods (such as for example the method of estimating industry dynamism described earlier) do not take trend and heteroscedasticity into consideration, I provide three counterarguments suggesting that more complex models may also provide biased estimates. First, their assumption that trends are predictable, and that "they may not constitute an element of uncertainty if they are predictable" (Folta & O'Brien, 2004: 127) begs the question of how predictable are trends? Trends can, and often do, reverse at any time since their continuation is dependent on the continuation of all necessary conditions promoting those trends. Clearly, even very complex models are not able to control for random events that could reverse such conditions and derail current trends. Thus, the assumption that trends are predictable relies on the assumption that models somehow can control the randomness of the environment – an enormous assumption as evidenced by the generally poor track record of forecasting in predicting future trends.

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In addition, because of strong behavioral instincts and tendencies, people often perceive trends as over long before they actually are, even though their models may predict their continuation[25]. Thus, people often take active steps to benefit from their reverse. For example, people reacting to gain contexts (e.g., Kahneman & Tversky, 1979) by "taking profit", i.e., protecting their gains, after a period of strong market performance are acting contrary to the implied logic of Folta and O'Brien that trends are predictable. Instead, profit takers would seem to be acting as if trends are unpredictable, thus as if they are uncertain about how long the trend will continue. In addition, following S-shaped Prospect theory predictions (Kahneman & Tversky, 1979), the behaviors people exhibit that "double down" and otherwise accept more risk to reverse failing performance are also not in agreement with the authors' logic that trends equal certainty. After all, if trends implied certainty about the future and were certain to continue, why do the majority of people in loss contexts try so hard to reverse them? In sum, therefore, if trends are not predictable and/or if people, because of cognitive limitations, do not follow such predictions, models that nevertheless try to predict such trends would be more, not less, likely to bias estimates of environmental dynamism

Second, since the purpose of measures of environmental dynamism is to represent beliefs about the future, it may be more likely that those beliefs are based on simple as opposed to complex heuristics given our cognitive limitations. That is, the simpler the model, the more accurately it may reflect the heuristics we use when making decisions. Thus, complex models such as the one suggested by Folta and O'Brien, may not

[25] A special case of not just prematurely perceiving trends as coming to an end, but also actively ignoring prior trends is described by Kahneman and Lovallo (1993). This leads to 'bold forecasts' as each new project is viewed as unique and not evaluated against similar projects implemented in the past. Thus, even if the firm has been unsuccessful with similar projects in the past, they may still view the current project as likely to succeed.

correspond very well with heuristics actually used to make decisions. Thus, more complex models, because they do not reflect actual decision making, may actually be more, not less likely to bias estimates.

Third, although GARCH models that account for heteroscedasticity may be necessary to capture long economic time series (Campa, 1993), the same argument cannot be applied to this study since my data structure is not that of an extended economic time series. It covers the years of 1998 through 2006 only, and contains just a few estimates of environmental dynamism since a new estimate is calculated for each 5-year period. In sum, therefore, I have argued that measurement issues involving trend and heteroscedasticity, if at all applicable to my measures and sample, are likely to have rather benign effects on the calculation of environmental dynamism. Therefore, I am electing to follow existing research practice within management and measure dynamism as the variance of sales over preceding 5-year periods.

Environmental complexity (*COMPLEX*). Following Aldrich's characterization of the organizational environment as exuding different degrees of complexity based on the homogeneity and concentration of firms in that particular environment or industry, I operationalize environmental complexity using the Herfindahl index (Herfindahl, 1950: Kelly, 1951). That is, in line with suggestions by Porter (1980) and Scherer (1980), the Herfindahl index takes into account both the number of firms in an industry, as well as inequalities in market shares among those firms by being measured as the sum of the squared market shares for all firms in a particular industry. Thus, the Herfindahl index adds a dimension to other measures of complexity, such as the four firm concentration ratio (Hay & Morris, 1979) and simple count measures of industry competitors, by also

considering inequalities in market shares among industry competitors in addition to industry concentration.

Note that since complexity is the least studied of Dess and Beard's (1984) dimensions of environmental uncertainty, no consensus or "standard" measure of complexity has yet emerged from the literature. At the same time, because the Herfindahl index has been used at least as many times as other measures (e.g., Boyd, 1990, 1995), and because it is more inclusive of, or accommodating to, underlying theoretical arguments (e.g., Aldrich, 1979: Porter, 1980: Scherer, 1980), I have elected to use it in this dissertation. Therefore, following Boyd (1990, 1995), the Herfindahl index (H) is calculated as:

$$H_j = 1 - \sum_{j=1}^{n} (market\ share_j)^2 \qquad (3)$$

where $j = 1, 2, \ldots n$, number of firms in the industry and $market\ share_j$ is the market share for that particular firm.

Herfindahl index scores are confined to a range of between 0 and 1 where a value close to 1 implies many competitors and no firms with dominant market shares (i.e., no monopolistic or oligopolistic industry structure). In effect, therefore, industries with a Herfindahl score approaching 1 are considered more complex, while industries with scores approaching 0 are considered relatively less complex.

Level of diversification (*DIVERSIFICATION, DIVERSIFICATIONdummy*). To measure differences in diversification strategies, the entropy measure of diversification (Jacquemin & Berry, 1979) is used. This is an objective measure of diversification that has shown strong construct validity (Hoskisson, Hitt, Johnson & Moesel, 1993) and has

been used in a number of recent studies (Sanders & Carpenter, 2003: Bowen & Wiersema, 2005: Boyd, Gove & Hitt, 2005: Birkinshaw, Braunerhjelm, Holm & Terjesen, 2006).

In addition, Robins and Wiersema (2003) show that of the two most widely used measures of diversification in contemporary research (Barker & Duhaime, 1997: Bergh, 1997), the entropy measure and the concentric measure of diversification, only the former is affected in the appropriate direction by two simulated changes in firm portfolios. To show how these measures differ, Robins and Wiersema perform several tests. First, the authors add three (related) new business segments with distinct 3-digit SIC codes, but within the same 2-digit SIC area of business to the existing firm portfolio. The result is that the original segments now each account for a smaller piece of total corporate activity because of the addition of the new segments. In response to this increase in related diversification, the entropy measure shows an increase in its related component (DR), while the concentric measure actually shows a decrease in related diversification.

Next, Robins and Wiersema reduce the business segments down to the original four, but make one of the segments far more dominating than in the original configuration. That is, the number of business segments are reduced and their concentration is increased which should decrease related diversification. Here, the authors find that the entropy measure shows a decrease in related diversification while the concentric measure, again, shows the opposite. Based on those findings, they conclude that related entropy (but not the concentric measure) is positively related to the number of business segments in the corporate portfolio, while negatively related to the size of the dominant business segment in the corporate portfolio. In sum, because related

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entropy seem to measure what it should, because it has shown strong construct validity, and because it has been used extensively in strategic management, I elect to use the entropy measure of diversification in this dissertation.

The entropy measure has two components - related diversification (DR) and unrelated diversification (DU) - that together add up to total diversification (DT). Following Hoskisson *et al.*, (1993), related diversification is defined as four-digit SIC segments within a two-digit SIC group, while unrelated diversification is defined as firms operating across two-digit groups and total diversification is calculated based on its relative share of sales according to the following formula:

$$Total\ entropy = \sum_{i=1}^{N} Pi \ln(1/Pi) \qquad (4)$$

where *Pi* is defined as the firm's share of sales in segment *i* and *ln (1/P)* is the weight of each segment. Thus, this measure is a combination of the number of segments a firm is active in as well as their relative sales importance.

In addition, a categorical variable (*DIVERSIFICATIONdummy*) that distinguishes corporations operating two or more business segments (dummy = 1) from those operating only a single segment (dummy = 0) is used to investigate the impact that multi-segment corporations may have on performance.

Business segment return variance (*SRV*). To account for homogeneity in business segment returns within firms, this measure of dispersion was calculated as the variance of business segment returns (ROA) for firms with at least 2 segments.

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Table 2. Measures

Full Name	Short Name
Dependent Variables	
External measure of overinvestment (asset)	OVER_ext_asset
External measure of overinvestment (sales)	OVER_ext_sales
Internal measure of overinvestment (asset)	OVER_int_asset
Internal measure of overinvestment (sales)	OVER_int_sales
Berger & Ofek measure of overinvestment	OVER_Berger & Ofek
External measure of undernvestment (asset)	UNDER_ext_asset
External measure of underinvestment (sales)	UNDER_ext_sales
Internal measure of underinvestment (asset)	UNDER_int_asset
Internal measure of underinvestment (sales)	UNDER_int_sales
Diversified firm value (asset)	DIVERSIFIED VALUE_asset
Diversified firm value (sales)	DIVERSIFIED VALUE_sales
Corporate effect	EFFECT
Firm ROA	FIRMROA
Note: Categorical measures of above exist, but not shown here	
Independent Variables	
Business segment historical performance comparisons	HISTPERF
Business segment social performance comparisons	SOCPERF
Block holder ownership	BLOCKOWNER
Institutional shareholder ownership	INSTITOWNER
Contingent compensation	COMPENSATION
Environmental dynamism	DYNAMISM
Environmental complexity	COMPLEX
Level of diversification	DIVERSIFICATION
Level of diversification (categorical measure)	DIVERSIFICATIONdummy
Business segment return variance	SRV
Controls	
Organization size	SIZE
CEO tenure	TENURE
Cash flow	CASHFLOW
R & D intensity	R&DINT
Cost of capital	COST
Long-term incentive plans	LTIP

Controls

Organization size (*SIZE*). The log of firm revenue is used as a measure of organization size and was included because it may affect firm resource allocations (Haveman, 1993).

CEO tenure (*TENURE*). To control for the possibility that CEOs feel varying levels of "ownership" of business segments depending on if they acquired a particular segment or built it "from the ground up", CEO tenure proxies for the tendency of CEOs to more strongly defend and be more inclined to fix, rather than divest, poorly performing segments they feel ownership in.

In addition, CEO tenure may also control for a possible interaction between the length of time a CEO has held office and the trend in capital allocation, i.e., controlling for consistent over or underinvestment over long time periods.

Cash flow (*CASHFLOW*). Cash flow may also affect resource allocations within the firm (Jensen, 1986) by representing capital available for investment. Following Gibbs (1993), I measure firm cash flow as earnings before interest, taxes, depreciation, and amortization divided by total assets. Using assets instead of market value reduces unnecessary correlation with Tobin's q as a measure of investment opportunity.

R&D intensity (*R&DINT*). Research intensity (R & D expenditures/sales) was included as a control because higher research intensity has been shown to increase information asymmetries in organizations (Aboody & Lev, 2000). If this association holds true also in the context of this study, capital allocation decisions may become more complicated as the level of research intensity increases thus potentially leading to additional capital allocation inefficiencies. Thus, because I am restricting my study to

investigate effects of environmental uncertainty on capital allocation efficiency without investigating additional antecedents to that uncertainty, I control for R&D intensity at the corporate level. Naturally, that would allow me to include firms in my sample with different levels of research intensity without the possibility of biasing my results.

Cost of debt capital (*COST*). The weighted average cost of debt is included to control for the possibility that firms with a lower funding cost may pursue more inefficient capital allocation strategies because of their presumably larger pools of investment capital to draw from. This control was calculated using COMPUSTAT data as total interest rate expense of short and long term debt (data item 15) divided by long-term debt (data item 9) and the part of short term liabilities constituting debt (data item 34).

Long-term Incentive Plans (*LTIP*). The payouts of long-term incentive plans are contingent on accounting returns and measure performance over a period of more than one year. Although this control variable represents the actual amount paid out to the executive and does not reflect an award that may grow over time, the existence and size of long-term incentive plans may still have an effect on managerial decisions including the decision to allocate capital. Thus, I control for such cash payments made to the CEO.

Model Specification And Estimation

Introduced to the strategic management literature by McNamara, Deephouse and Luce (2003), multilevel modeling (Bruk & Raudenbush, 1992: Raudenbush, Bruk, Cheong & Congdon, 2000) is appropriate for the analysis of my model for three reasons. First, the design of my study involves variables at three different levels – at the business segment level (business segment historical and social performance comparisons, over- and underinvestment, business segment return homogeneity), at the firm level

(governance variables, level of diversification, corporate effects and diversified firm value) as well as at the industry level (environmental uncertainty). As such, my study naturally lends itself to a multilevel modeling technique since each lower level is nested within each higher level as well as within the hierarchy itself. That is, business segments are nested within firms and firms are nested within industries, which implies a lack of independence between observations since both business segments from the same firm as well as firms from the same industry may be more similar than segments from different firms and industries, respectively. This lack of independence, or alternatively, the likely existence of higher level constructs affecting lower level constructs would have resulted in biased standard errors of regression coefficients (Snijders & Bosker, 1999) had a single-level approach such as regular OLS regression been used.

Second, modeling the decomposition of firm performance and the corporate effect also requires a multilevel approach. Not only does a multilevel modeling technique avoid a number of documented problems with alternative methods such as nested ANOVA, variance components analysis (VCA), and the continuous variable model used by Brush, Bromiley and Hendrickx (1999)[26], but it also takes into account a number of dependencies between industries, corporations, and business segments. Specifically, business segments are not independent of industries as industry environments and conditions affect firm conduct (Bain, 1956: Porter, 1980). At a higher level, corporations and industries may also enjoy reciprocal influences as suggested by McGahan and Porter

[26] A main problem with nested ANOVA is that the fixed dummy coding consumes a large amount of degrees of freedom while VCA has been shown to be insensitive to small effect sizes (Brush & Bromiley, 1997). In addition, the more advanced continuous variable method also has drawbacks because it divides firms into a limited number of groups based on the number of segments and then models each with separate equations. This requires that firms with either more or less segments be discarded which restricts generalization to a larger and more inclusive population of firms.

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(2002: 838) "the covariance between industry and corporate-parent effects is potentially important because, for example, a diversified firm may be more likely to expand into particular types of industries". Taken together, this means that business segment performance is cross-nested or dependent on both the corporation as well as on the industry, implying that industry, corporate, and business segment effects are not independent of each other. Thus, to properly model the described dependencies, a multilevel specification (such as STATA Multilevel mixed-effects linear regression, STATA XT Mixed hereafter) is necessary to adjust for dependencies so as to avoid biasing regression coefficients.

Finally, antecedents to the corporate effect cannot be investigated using either of the more popular single-level methods, because neither VCA nor ANOVA estimates of industry, corporate, and business segment effects enable inferences about the importance of strategy (Misangyi *et al.*, 2006). Instead, by using dummy variables and often including shared variance due to order of entry effects, they tend to represent "upper bounds of each class of effects" (Misangyi *et al.*, 2006), offering little information about specific industry, corporate, and business segment factors associated with superior firm performance. Thus, translated to the context of this study, single-level techniques would not have allowed me to investigate the efficiency of the capital allocation process as an antecedent to the corporate effect.

In sum, STATA XT Mixed allows me to pursue an alternative approach to modeling the inherently multilevel capital allocation process in multidivisional firms. As such, it addresses and avoids specific problems with prior methodologies as well as correctly accounting for the lack of independence of observations. In contrast with

methods used by previous scholars not allowing the investigation of antecedents, STATA XT Mixed allows me to investigate both the efficiency of the capital allocation process as an important antecedent to the size of the corporate effect, as well as to investigate multilevel antecedents to the capital allocation process itself.

In addition, STATA XT Mixed allows me to treat my longitudinal or panel data set as multilevel in structure by assigning time to the first level. That is, the time-series dimension of my data set is represented at the first level, while stable business segment, corporate, and industry influences get represented at higher levels. This enables the separation of cross-sectional information from information varying over time and the use of different predictors at each level.

For those reasons, I used STATA XT Mixed[27] to analyze the effects of multilevel antecedents at business segment, corporate, and industry levels on the capital allocation process (Figure 1), as well as to analyze performance implications of degrees of capital allocation efficiency on the corporate effect (Figure 2). Additional effects of capital allocation efficiency on diversified firm value and firm ROA were modeled using a single-level panel data technique (STATA XT reg). Temporal aspects (time lags) of the different variables are specified and discussed for both the antecedent model as well as for models analyzing performance implications of capital allocation efficiency.

[27] Note that HLM (Raudenbush *et al*, 2000) is another popular statistical program for fitting multilevel models. HLM and STATA XT Mixed are, however, very similar when it comes to what models can be specified as well as underlying estimation theory and computational algorithm to fit such models. That is, they both offer the choice of modeling effects on the dependent variable separated into a number of levels, the choice between full maximum likelihood as well as restricted maximum likelihood (estimation theories), as well the popular "expected-maximization" (EM) algorithm (Dempster, Laird, & Rubin, 1977) as the computational algorithm of choice.

Antecedents to Capital Allocation Efficiency

Theory suggests that transient effects (i.e., varying over time) should be distinguished from stable effects (Rumelt, 1991: Misangyi *et al.*, 2006) and most studies have tried to capture "variance over time effects" (McGahan & Porter, 2002: McGahan & Porter, 1997: Roquebert *et al.*, 1996: Rumelt, 1991) in explaining business segment performance. However, due to the lack of theory guiding the characterization of strategic factors as either transient or stable, the characterization is based on empirical assessment of type of variance. Therefore, the initial step before examining associations between multilevel antecedents and capital allocation efficiency is to determine whether each antecedent should be treated as a transient or as a stable strategic factor. The difference is that a transient strategic factor explains variance over time and should be entered individually for each year, while a stable factor only explains cross-sectional variance between corporations or business segments and should therefore be entered as the average of observations over time. To determine if each strategic factor should enter as a transient or as a stable factor, I used intra-class correlation (ICC_1) analysis to examine how much variance of each strategic factor occurs across time as opposed to in a cross-sectional manner. Strategic factors where most variance occurs across time should be entered as transient factors as opposed to those where most variance is cross-sectional in nature allowing aggregation and stable effects (James, 1982: Bliese, 2000). Although no absolute standard value for aggregation based on ICC_1 has been established (Avolio, Zhu, Koh & Bhatia, 2004), I used a conservative value of 0.60 to allow for aggregation. This cut-off value is above conventional recommended values for aggregation and multilevel analysis, thus fulfills required statistical support for aggregation to a higher level (Chan,

1998: Bliese, 2000). In addition, following Misangyi *et al.*, (2006), I performed an ICC_2 analysis to determine the reliability of each aggregated measure. Based on those analyses (Table 2), I aggregated INSTITOWNER (institutional shareholder ownership), DIVERSIFICATION (level of diversification) and SOCPERF (social performance comparisons) because a majority of its variance (81%, 86%, 65%, respectively) occurred between organizations, while HISTPERF (historical performance comparisons), COMPENSATION (contingent compensation), DYNAMISM (environmental dynamism), and COMPLEX (environmental complexity) all had the majority of their variance within unit and, thus, were left as transient effects. High levels of reliability (ICC_2) support the use of the aggregated measures. For the SRV (segment return variance) and BLOCKOWNER (block holder ownership) measures, the variance is relatively equally shared between the aggregate unit (business segment and corporation) and across time, thus their ICC_1 values are very close to my designated cut-off. However, because a sizable part of their variance occurs across time, and because I was hesitant to set that variance to zero thereby reducing their power to explain variance over time to zero as well, I elected to follow my rule and treat them as transient effects. Among control variables, SIZE (firm size), TENURE (CEO tenure), and R&DINT (R&D intensity) required aggregation. In addition, since a multilevel specification requires a dependent variable at the lowest level, I examined measures of capital allocation efficiency for levels of transient versus cross-sectional variance. I found that all measures of capital allocation efficiency vary substantially over time, none requiring aggregation, which supports the use of a multilevel specification.

Table 3. Intra-class Correlations (ICC) of Relevant Variables

Variable	ICC(1)	ICC(2)	Enter as
1. External Overinvestment (assets)	0.14		transient
2. External Overinvestment (sales)	0.08		transient
3. Internal Overinvestment (assets)	0.06		transient
4. Internal Overinvestment (sales)	0.02		transient
5. External Underinvestment (assets)	0.22		transient
6. External Underinvestment (sales)	0.04		transient
7. Internal Underinvestment (assets)	0.01		transient
8. Internal Underinvestment (sales)	0.03		transient
9. Organization size	0.92	0.99	stable
10. CEO tenure	0.89	0.99	stable
11. Cash flow	0.58		transient
12. R & D intensity	0.70	0.95	stable
13. Cost of capital	0.22		transient
14. Long-term incentive plans	0.31		transient
15. Social Performance Comparisons	0.65	0.98	stable
16. Historical/social Performance Comp.	0.30		transient
17. Block holder ownership	0.57		transient
18. Institutional shareholder ownership	0.81	0.98	stable
19. Contingent compensation	0.27		transient
20. Environmental dynamism	0.08		transient
21. Environmental complexity	0.28		transient
22. Level of diversification	0.86	0.98	stable
23. Business Segment Return Variance	0.58		transient

After performing the initial ICC analysis, I used STATA XT Mixed to regress measures of capital allocation efficiency on level 1 (*Time level*) strategic factor antecedents including HISTPERF, COMPLEXPROXY, BLOCKOWNER, COMPENSATION, DYNAMISM, and COMPLEX. Subsequently, level 2 (*Business-segment level*) stable strategic factors (SOCPERF) were used to explain between-business segment variance in level 1 parameters (intercepts), while level 3 (*Corporate level*) stable strategic factors (INSTITOWNER, DIVERSIFICATION) in turn were used to explain between-corporation variance in level 2 parameters. In addition, a number of interaction

variables were used to analyze interactions between environmental uncertainty (Dynamism and Complex) and some of the antecedent relationships. Below is the full model including control variables where equation 7 models stable organizational effects for each firm *j*. The predicted values from this equation are included as the intercept in the next equation (equation 6) which models stable business segment effects on each segment *i*. Finally, the predicted values from that model are included as the intercept in equation 5 which models transient effects on allocation efficiency across time t.

$$(5)\ \textbf{\textit{Allocation Inefficiencies}}_{tij} = \pi_{0ij} + \pi_{1ij}(\text{Cost})_{tij} + \pi_{2ij}(\text{LTIP})_{tij} + \pi_{3ij}(\text{Cashflow})_{tij} +$$
$$\pi_{4ij}(\text{Histperf})_{tij} + \pi_{5ij}(\text{Complexproxy})_{tij} +$$
$$\pi_{6ij}(\text{Blockowner})_{tij} + \pi_{7ij}(\text{Compensation})_{tij} +$$
$$\pi_{8ij}(\text{Dynamism})_{tij} + \pi_{9ij}(\text{Complex})_{tij} +$$
$$\pi_{10ij}(\text{Dynamism*Blockowner})_{tij} +$$
$$\pi_{11ij}(\text{Dynamism*Institowner})_{tij} +$$
$$\pi_{12ij}(\text{Dynamism*Compensation})_{tij} +$$
$$\pi_{13ij}(\text{Dynamism*Diversification})_{tij} +$$
$$\pi_{14ij}(\text{Complex*Blockowner})_{tij} +$$
$$\pi_{15ij}(\text{Complex*Institowner})_{tij} +$$
$$\pi_{16ij}(\text{Complex*Compensation})_{tij} +$$
$$\pi_{17ij}(\text{Complex*Diversification})_{tij} + e_{tij}$$

$$(6)\ \boldsymbol{\pi_{0ij}} = \beta_{00j} + \beta_{01j}(\text{Socperf})_{ij} + r_{ij}$$

$$(7)\ \beta_{00j} = \gamma_{000} + \gamma_{001}(\text{Size})_j + \gamma_{002}(\text{Tenure})_j + \gamma_{003}(\text{R\&DINT})_j + \gamma_{004}(\text{Institowner})_j + \gamma_{005}(\text{Diversification})_j + \mu_j$$

Properly specifying temporal aspects of a model are important because it integrates theory, design, and analysis, i.e., it increases the power and precision of theories as well as strengthens and lends credibility to subsequent empirical results (e.g., Mitchell & James, 2001). With respect to the antecedent model, I can specify when each strategic factor antecedent should enter the model in relation to the dependent variable (capital allocation efficiency). That is, each strategic factor can enter the model either at the same time or before the dependent variable, depending on if the effect is likely to be instantaneous or working with a lag. However, because most firms plan ahead and decide on budgets in the year prior to the actual allocation of funds, a one-year lag structure is appropriate to reflect how antecedents affect the actual decision-making process underlying a subsequent allocation. That is, since I measure the outcome of a capital allocation process varying in efficiency, variables affecting the efficiency of that process need to be entered as that process is taking place, not after it is completed. This indicates that a one-year lag structure is appropriate.

Another consideration is whether segments belonging to single-business firms should be included in the antecedent analysis together with segments belonging to diversified firms. As explained, segments belonging to single-business firms allocate capital between potential uses within the firm, and since they do, the efficiency of the allocation process is likely to be affected by the same multilevel antecedents that affect the allocation efficiency in diversified firms. For example, agency theoretical control variables such as compensation and share holder concentration, are likely to be just as

effective in situations where firms only have one segment. Segments in single-business firms are also just as likely to view both historical and social aspirations as appropriate reference levels for performance. Thus, because single-business firms are not excluded from making allocation errors and because the underlying mechanism with which my multilevel antecedents work are unchanged when applied to (segments belonging to) single-business firms, I have elected to include segments belonging to single-business firms in the analysis of antecedents to capital allocation efficiency. Note, however, that segments belonging to single-business firms only are included when external measures of capital allocation errors are used. Because of the construction of internal measures of allocation errors, they remain excluded.

Performance Implications: Corporate Effect

The first step in investigating how capital allocation efficiency is related to the corporate effect is to run an unconditional (null) STATA XT Mixed model without predictors. In other words, measures of capital allocation efficiency are purposely left out of the model, which allows for the partitioning of the dispersion in business segment ROA across time, between business segments, and between corporations. Therefore, estimates of how much variance is due to variation across time, between business segments, as well as between corporations can be obtained from the unconditional model[28]. In addition, by introducing industry effects at the business-segment level and thereby accounting for their cross-nesting, individual effects (business-segment, corporate, industry, and year effects) can also be calculated.

[28] Note that these estimates also are incorporated in the full model as predictors at each level of analysis explain both between-business segment and between-corporation variance.

Therefore, at *Time level*, business segment ROA at time t for business segment i within firm j is a function of average business segment ROA over time (π_{0ij}) as well as a random error (e_{tij}):

$$SegmentROA_{tij} = \pi_{0ij} + e_{tij} \qquad (8)$$

Usual assumptions of normality for the error term applies such that e_{tij} is assumed to have a mean of zero and uniform variance of σ^2 within each of the i business segments. Thus, total business segment ROA variance across time is σ^2.

At the *Business-segment level*, the level 1 intercept (π_{0ij}) representing mean ROA performance of business segment i over time is regressed on average ROA of all business segments in corporation j (β_{00j}) with a between-business residual (r_{ij}) accounting for unexplained variance:

$$\pi_{0ij} = \beta_{00j} + r_{ij} \qquad (9)$$

r_{ij} is assumed to be normally distributed with a mean of zero and with uniform business segment variance within each firm of τ_π.

At the *Corporate level* of analysis, the intercept of the business segment level model (β_{00j}), representing mean ROA of business segments in corporation j, is now

modeled as an outcome varying randomly around a grand mean representing the mean of all business segments in the sample (γ_{000}):

$$\beta_{00j} = \gamma_{000} + \mu_j \qquad (10)$$

Thus, this level investigates between-corporation variance with its own residual that is also assumed to have a mean of zero and a between-corporation variance of τ_β.

As mentioned earlier, the unconditional model (Equations 8 through 10) can now be used to calculate the amount of variance in business segment ROA over time, between-business segments, and between-corporations as a proportion of total variance. That is, by using the variance of the residuals at each level, I can determine the proportion of total variance that can be attributed to each level. Thus, the amount of variance across time is $\sigma^2 / (\sigma^2 + \tau_\pi + \tau_\beta)$, the amount of variance between segments is $\tau_\pi / (\sigma^2 + \tau_\pi + \tau_\beta)$, while the amount of variance between corporations is $\tau_\beta / (\sigma^2 + \tau_\pi + \tau_\beta)$.

In addition, by adding year effects to the first level (reduced model=R) and industry effects to the second level (complete model=C), I can in conjunction with the unconditional models also estimate individual business segment, corporate, industry as well as year effects[29].

[29] When estimating individual effects, the cross nesting of industry effects on business segment performance needs to be accounted for by introducing industry effects at the second level (business-segment level) of analysis.

Time level: $SegmentROA_{tij} = \pi_{0ij} + \pi_{1ij}(\text{Year})_{tij} + e_{tij}$ (R) *(11)*

Business-segment level: $\pi_{0ij} = \beta_{00j} + r_{ij}$ *(12)*

Corporate level: $\beta_{00j} = \gamma_{000} + \mu_j$ *(13)*

Time level: $SegmentROA_{tij} = \pi_{0ij} + \pi_{1ij}(\text{Year})_{tij} + e_{tij}$ (C) *(14)*

Business-segment level: $\pi_{0ij} = \beta_{00j} + \beta_{01j}(\text{Industry})_{ij} + r_{ij}$ *(15)*

Corporate level: $\beta_{00j} = \gamma_{000} + \mu_j$ *(16)*

That is, the year effect is calculated by using the proportional difference in residual variance across time between unconditional and reduced models (R): $(\sigma^2_U - \sigma^2_R)/((\sigma^2 + \tau_\pi + \tau_\beta)_U$. Following the logic of entering industry effects at the business segment level and allowing for cross-nesting of industry effects at both business-segment and corporate levels, industry effects are calculated by measuring the reduction of variance as the industry dummies are entered into the model. Thus, industry effects are calculated as the proportional reduction of variance of the business segment residual as we go from the reduced to the complete model: $(\tau_{\pi R} - \tau_{\pi C})/((\sigma^2 + \tau_\pi + \tau_\beta)_R$.

Following similar logic of cross-nesting between levels, business-segment and corporate effects are calculated by accounting for the possibility that some between business-segment and between corporations variance may be due to industry and year effects. Therefore, each needs to be adjusted for industry and year effects using the unconditional, reduced, and complete equations above. Hence, business-segment effects are calculated as $(\tau_{\pi U} + \tau_{\pi C} - \tau_{\pi R})/((\sigma^2 + \tau_\pi + \tau_\beta)_R$, while the corporate effect is

calculated as $(\tau_{\beta U} + \tau_{\beta C} - \tau_{\beta R}) / ((\sigma^2 + \tau_\pi + \tau_\beta)_R$. Finally, to adjust variance across time for year effects, the following formula is appropriate: $(\sigma^2_U + \tau_{\pi C} - \tau_{\pi R}) / ((\sigma^2 + \tau_\pi + \tau_\beta)_R$.

At this point, the unconditional model can be extended to include measures of capital allocation efficiency as predictors. Thus, I am now able to investigate the impact of capital allocation efficiency on the corporate effect by introducing measures of capital allocation efficiency at the appropriate level of the unconditional model. Before doing so, however, I determine if each measure of capital allocation efficiency as well as control variables should enter the model as transient or stable effects, i.e., how much variance of each measure occurs across time versus in a cross-sectional manner. This was done previously using intra-class correlation (ICC_1) analysis to estimate transient and stable variance for each individual measure (see Table 2). All measures of capital allocation efficiency and all but three control variables (firm size, CEO tenure, and R&D intensity) varied significantly over time and will therefore be introduced at the first level (*Time level*) since they are more likely to explain business-segment ROA over time. Conversely, firm size, CEO tenure, and R&D intensity, showing relatively more variation across firms will be aggregated and introduced as stable effects at the *Corporate* level. Thus, control variables (with the exception of firm size, CEO tenure and R&D intensity), measures of capital allocation efficiency, and the business segment ROA dispersion variable (SRV) enter at time level. Firm size, CEO tenure, and R&D intensity, finally, enter at the corporate level forming the following model:

$$SegmentROA_{tij} = \pi_{0ij} + \pi_{1ij}(\text{Cost})_{tij} + \pi_{2ij}(\text{LTIP})_{tij} + \pi_{3ij}(\text{Cashflow})_{tij} + \quad (17)$$

$$\pi_{4ij}(\text{Measures of capital allocation efficiency})_{tij} + \pi_{5ij}(\text{SRV})_{tij} +$$

$$\pi_{6ij}(\text{Measures of capital allocation efficiency*SRV})_{tij} + e_{tij}$$

$$\pi_{0ij} = \beta_{00j} + r_{ij} \quad (18)$$

$$\beta_{00j} = \gamma_{000} + \gamma_{100}(\text{Size})_j + \gamma_{200}(\text{Tenure})_j + \gamma_{300}(\text{R\&DINT})_j \quad (19)$$

Using this model, I can determine whether each strategic factor (measures of capital allocation efficiency and business segment return homogeneity) has a statistically significant effect on business segment ROA. In addition, because STATA XT Mixed incorporates the calculation of variance components, the amount of variance explained by strategic factors at each level as well as the portion of total variance captured by each effect can be determined. That is, similar to the variance partitioning of the unconditional model previously described, unconditional, complete, and reduced models are compared to estimate the amount of variance each factor explains. Thus, the association between inefficiencies and the corporate effect (H11) is analyzed in two steps. First, the significance of the parameter estimate for each measure of capital allocation efficiency is established. Second, the amount of variance explained is calculated based on applicable variance components for each statistically significant ($p<0.05$ or better) measure of capital allocation efficiency as it is introduced in the model. For example, models including only control variables are compared to extended models also including measures of capital allocation i.e., a comparison of the level 1 residuals between the models. Associations between business segment return variance and corporate effects

(H12) and moderation effects of segment return variance (H13) are established in a similar manner of classical hypothesis testing.

Furthermore, time lags are specified using the same underlying logic as in the antecedent model (*Antecedents to Capital Allocation Efficiency*): causal inferences require predictors to be lagged relative to dependent variables unless the effect is instantaneous. It is likely that misallocations of capital have lagged effects on performance outcomes. That is, effects of "too much" capital invested in low prospect segments and "not enough" capital invested in high prospect segments will gradually feed through to corporate effects, diversified firm value, and firm ROA from the time the allocations are made and until new allocations are implemented in the next time period. Thus, because a new budget is decided on each year to be implemented the following year, a one-year lag is a reasonable length of time for the temporal interplay between these variables. Therefore, measures of capital allocation efficiency, business segment return homogeneity, as well as control variables enter the model in the year prior to the outcome variables.

Finally, the fact that segments belonging to single-business firms are excluded from models using measures of allocation errors with internal reference points, but not excluded in models with external reference points, provides a natural way to distinguish between effects of diversified and single-business firms. In addition, it also provides a compromise between those that believe that the corporate contribution is more appropriately represented when segments belonging to both diversified and single-segment firms are included (e.g., McGahan & Porter, 1997), and those that believe that only segments belonging to diversified firms should be represented in corporate effects

models (e.g., Bowman & Helfat, 2001: Adner & Helfat, 2003: Brush, Bromiley & Hendrickx, 1999).

Performance implications: Diversified Firm Value and Firm ROA

The other two firm performance outcome dependent variables, diversified firm value and firm ROA, are not measured at the lowest level of analysis, making a multilevel specification inappropriate for analysis. Therefore, I chose to aggregate measures of capital allocation efficiency to the corporate level to match their higher levels of analysis, which would enable me to use a single-level technique (such as OLS) to analyze the data.

Regular OLS, however, is seldom appropriate to analyze panel data sets because of the potential for correlation between the error structures across panels. That is, since panel data sets include cross-sections of data each containing a time series, the error term is two-dimensional, inviting opportunities for bias both across time as well as within cross-sectional unit.

In my data set, I have both a temporal (year) and a cross-sectional unit of observation (ticker), which subsequently requires a more robust approach than regular OLS can provide. Therefore, I am using STATA's panel data approach (XT reg), which uses a more flexible generalized least squares (GLS) technique that more appropriately deals with common panel data problems, including cross-panel heteroscedasticity and serial correlation of errors within panels (STATA Longitudinal /Panel-Data Reference Manual). Further, as an extra precaution against potentially biased (lower) standard errors, I am using robust errors (option *vce robust* in STATA XT reg) based on the White/Huber/sandwich formula to further correct for heteroscedasticity and serial

correlation of errors. In addition, because serial correlation of errors within panels are accounted for and STATA does not offer any post-estimation commands to test for first-order autocorrelation (e.g. Durbin-Watson) within this particular panel data approach, I ran the affected models with a panel data approach that specifically corrects for first-order autocorrelation. In other words, this model corrects for autocorrelation by adjusting coefficients for the potential bias. Comparing results from the two models, I found no substantial differences in coefficients and thus concluded that autocorrelation is not a problem in the affected models.

To determine whether tests of performance implications on diversified firm values and firm ROA should be run with random or fixed effects estimators, a Hausman test (Hausman, 1971) was performed. For performance implications on Firm ROA, this test was conclusive and non-significant meaning that the more efficient random effects estimator is the best choice as it is not likely to bias estimates. Thus, the random estimator was used in regressions with Firm ROA as the dependent variable. In regressions with diversified firm value as the dependent variable, however, test were inconclusive as the Hausman test was significant in some regressions, but not in others. Thus, I decided to run all regressions with diversified firm values as the dependent variable with fixed effects to guard against possible biases from using the more efficient, but more bias prone random estimator.

Although measures of capital allocation errors with external reference points allow for the inclusion of segments belonging to single-business firms, regressions with diversified firm values were constrained to only include segments belonging to diversified firms because the measure is constructed to compare diversified firm values

with potential freestanding segment values. Thus, for single-business firms, the comparison would be compromised as it would entail a comparison with itself resulting in potential bias. Therefore, segments tied to single-business firms are excluded.

CHAPTER 4: RESULTS

In this chapter, I present results from both the antecedent part of my full model as well as from the part describing performance implications of capital allocation efficiency, thus results are delineated into four sections: *Antecedents to Capital Allocation Efficiency* describes how multilevel antecedents affect capital allocation efficiency, *Performance Implications: Corporate Effect* describes performance implications of capital allocation efficiency on the corporate effect, *Performance Implications: Diversified firm value* describes similar effects on diversified firm values, and *Performance Implications: Firm ROA*, finally, describes effects of capital allocation efficiency on firm ROA. As described earlier, both single-business and diversified firms (and their segments) are included in models using measures of capital allocation errors with external reference points, but excluded from similar measures using internal reference points. Single-business firms are, however, excluded from models describing performance implications on diversified firm values. Table 4 presents means and variance as well as correlations among variables.

Antecedents to Capital Allocation Efficiency

In this model, the dependent variable (capital allocation efficiency) is measured using both internal and external reference points, but only regressions with external reference points are shown because sample sizes were insufficiently small with internal reference points. Low sample sizes can be explained by the exclusion of segments belonging to single-business firms in internal, but not in external measures. Therefore, since low sample size effectively made it impossible to use measures based on internal

Table 4. Descriptive Statistics and Correlations

Variable	Mean	s.d.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. External Overinvestment (assets)	0.02	0.11	1.00													
2. External Overinvestment (sales)	0.07	0.47	0.38	1.00												
3. Internal Overinvestment (assets)	0.02	0.07	0.94	0.60	1.00											
4. Internal Overinvestment (sales)	0.05	0.34	0.62	0.98	0.53	1.00										
5. External Underinvestment (assets)	0.05	0.03	n/a	n/a	-0.42	-0.11	1.00									
6. External Underinvestment (sales)	0.12	0.06	n/a	n/a	-0.47	-0.23	0.69	1.00								
7. Internal Underinvestment (assets)	0.01	0.03	-0.05	-0.04	n/a	n/a	0.25	0.13	1.00							
8. Internal Underinvestment (sales)	0.02	0.13	-0.01	-0.03	n/a	n/a	0.03	0.01	0.54	1.00						
9. Diversified Firm Value (assets)	0.15	0.72	0.05	0.00	0.08	-0.01	-0.15	-0.07	-0.01	0.05	1.00					
10. Diversified Firm Value (sales)	-0.04	0.92	0.04	0.06	0.04	0.05	-0.05	-0.22	0.05	0.13	0.71	1.00				
11. Firm ROA	0.10	0.16	0.02	-0.04	0.00	-0.05	-0.11	0.04	0.09	-0.05	0.16	0.06	1.00			
12. Segment ROA	0.06	0.41	0.02	-0.05	-0.08	-0.06	-0.04	0.08	-0.01	0.00	0.13	0.04	0.45	1.00		
13. Organization size (logged)	6.40	2.03	-0.05	-0.02	0.00	-0.01	-0.16	0.01	-0.04	-0.03	0.11	0.00	0.29	0.15	1.00	
14. CEO tenure	3.50	3.96	0.01	0.02	-0.02	0.04	0.02	-0.01	0.03	0.02	0.04	0.05	0.05	0.03	0.00	1.00
15. Cash flow	0.10	0.16	0.01	-0.04	0.00	-0.05	-0.12	0.04	0.09	-0.05	0.15	0.06	0.68	0.45	0.29	0.05
16. R & D intensity	0.10	0.34	-0.02	0.01	0.15	0.27	0.07	-0.25	0.02	0.41	0.01	0.16	-0.33	-0.14	-0.23	-0.04
17. Cost of capital	0.28	7.24	0.00	0.00	0.00	-0.01	0.02	0.01	-0.01	-0.01	-0.03	-0.03	-0.02	-0.01	-0.02	-0.02
18. Long-term incentive plans	248	1259	-0.01	0.00	0.01	-0.01	-0.03	0.00	0.00	0.05	0.08	0.01	0.02	0.02	0.23	0.02
19. Historical Performance Comparisons	0.07	0.33	0.00	-0.03	0.02	-0.03	-0.13	0.02	-0.04	-0.02	0.14	0.04	0.29	0.31	0.16	0.03
20. Social Performance Comparisons	0.06	0.11	-0.05	-0.06	-0.05	-0.06	-0.03	0.12	-0.04	-0.07	0.01	-0.03	0.24	0.17	0.17	-0.02
21. Block holder ownership	0.20	0.15	-0.01	-0.01	-0.04	0.00	0.00	-0.06	-0.01	-0.01	-0.07	-0.05	-0.01	-0.03	0.01	-0.02
22. Institutional shareholder ownership	0.51	0.30	-0.03	-0.02	-0.05	-0.04	-0.01	-0.01	-0.01	-0.03	0.15	0.11	0.17	0.12	0.33	-0.05
23. Contingent compensation	3460	11569	-0.01	0.00	0.02	0.00	0.01	-0.03	-0.01	0.04	0.10	0.11	0.02	0.01	0.19	0.01
24. Environmental dynamism	0.06	0.06	-0.01	0.00	0.03	0.02	-0.05	-0.06	0.08	0.06	0.03	0.03	0.01	-0.01	-0.03	-0.02
25. Environmental complexity	0.25	0.23	-0.07	-0.07	-0.06	-0.07	0.05	0.15	-0.01	-0.02	0.04	0.03	0.07	0.06	0.03	-0.03
26. Level of diversification	0.37	0.73	-0.02	-0.03	0.00	0.00	-0.07	0.02	-0.04	-0.01	0.08	0.02	0.08	0.05	0.31	0.03
27. Business Segment Return Variance	0.15	0.41	0.11	0.00	0.06	0.01	-0.04	-0.02	0.00	0.01	0.09	-0.02	-0.02	0.01	-0.01	-0.04

Table 4. **Descriptive Statistics and Correlations (continued)**

Mean	SD	15	16	17	18	19	20	21	22	23	24	25	26	27

Table 4. Descriptive Statistics and Correlations (continued)

Variable	Mean	s.d.	15	16	17	18	19	20	21	22	23	24	25	26	27
15. Cash flow	0.10	0.16	1.00												
16. R & D intensity	0.10	0.34	-0.33	1.00											
17. Cost of capital	0.28	7.24	-0.03	0.01	1.00										
18. Long-term incentive plans	248	1259	0.02	-0.04	-0.01	1.00									
19. Historical Performance Comparisons	0.07	0.33	0.29	-0.14	-0.04	0.03	1.00								
20. Social Performance Comparisons	0.06	0.11	0.24	-0.18	-0.01	0.06	0.15	1.00							
21. Block holder ownership	0.20	0.15	-0.01	0.01	0.00	-0.04	-0.03	0.01	1.00						
22. Institutional shareholder ownership	0.51	0.30	0.17	0.00	0.00	0.00	0.10	0.09	0.56	1.00					
23. Contingent compensation	3460	11569	0.02	0.03	0.00	0.05	0.01	-0.08	-0.03	0.02	1.00				
24. Environmental dynamism	0.06	0.06	0.00	-0.06	-0.01	-0.02	0.00	-0.03	-0.02	-0.08	-0.02	1.00			
25. Environmental complexity	0.25	0.23	0.07	-0.12	-0.01	0.00	0.07	0.18	-0.01	-0.01	-0.03	0.32	1.00		
26. Level of diversification	0.37	0.73	0.08	-0.14	-0.01	0.09	0.09	0.08	-0.02	0.09	0.04	0.05	0.08	1.00	
27. Business Segment Return Variance	0.15	0.41	-0.02	0.13	0.00	-0.02	0.02	-0.05	0.00	0.00	-0.01	0.00	-0.03	-0.02	1.00

reference points, I elected to focus on external measures of over and underinvestment for the purpose of testing this model.

Using external measures of over and underinvestment, low sample sizes also turned out to be a problem, although much less severe than for internal measures. Low sample sizes were mainly due to the inclusion of CEO tenure because this variable had substantially fewer usable observations than other variables. Thus, after running similar regressions both with and without CEO tenure to make sure that this control variable did not have any material impact on my results, I eliminated CEO tenure in all regressions. In addition, I also eliminated another control variable, firm cash flow (Cash flow), because it exhibited strong collinearity with the existing group of variables. It is possible that the collinearity may be due to a common denominator (assets) of some of my measures as described in Wiseman (working paper). However, the underlying mechanism causing this problem may be more complex, considering that cash flow causes no apparent problem in other models with similar common denominators. For example, the cash flow variable is not collinear in models analyzing relationships between inefficiencies in the capital allocation process and diversified firm value, even though those are also scaled by assets (see Table 15B). That is, if the common denominator was the only culprit causing the collinearity, this would most likely be reflected in all regressions having assets as the common denominator.

With the exclusion of CEO tenure and cash flow, sample sizes range from 9,055 to 10,234 in models with control variables only. From those levels, further reductions occur in two steps as historical and social performance aspirations are added followed by governance variables. In the first step, observations available for analysis are reduced

because historical and social aspiration levels are available for only part of the sample. In addition, only segments with historical and social performance below (above) current performance are eligible for inclusion when testing for overinvestment (underinvestment). For example, out of a total sample of 65,713 segments, 25,059 total historical reference levels (38.1%) are available with only 12,283 (18.7%) of those representing instances where historical performance is below current performance. Thus, this decrease in the full sample corresponds to a decrease to roughly 2,500 observations as historical performance aspirations are added to models with control variables.

In the second step, governance variables[30] are added, which further reduces the sample because block holder ownership, institutional shareholder ownership, and contingent compensation are missing anywhere from 66.24% to 76.47% of the time (Table 1). Thus, with the inclusion of governance variables, sample sizes are further reduced to between 451 and 914 in final models.

Antecedents to overinvestment

Tables 5A and 5B provide results of tests for overinvestment. Control variables exhibited few relationships with overinvestment in models where overinvestment is scaled by assets, but both organizational size and R & D intensity exhibited expected positive relationships in models where overinvestment is scaled by sales (Model 1B). This indicates that the added complexity of both larger and more R & D focused organizations may make it more difficult for such organizations to allocate capital, thus increasing the likelihood of overinvestment errors.

[30] Note that variables measuring diversification and environmental uncertainty enter as well, but that they only have a very marginal effect on sample sizes (Table 1)

Table 5A. Antecedents to Capital Allocation Efficiency (DV = External Overinvestment scaled by assets)

Model	1A	2A	3A	4A	5A	6A	7A
Organization size	0.79	-0.10	-0.02	-0.08	1.01	0.99	1.13
R & D intensity	-0.90	-0.56	-0.61	-0.60	-0.42	-0.42	-0.49
Cost of capital	-0.10	-0.43	-0.36	-0.45	-0.37	-0.37	-0.47
Historical Performance Comparisons		8.06***	8.12***	8.06***			
Social Performance Comparisons					4.31***	4.26***	4.18***
Block holder ownership					-2.12*	-2.06*	-2.31*
Institutional shareholder ownership		-0.37	-0.49	-0.27			
Contingent compensation		-0.14	-0.02	-0.13	0.02	0.27	-0.10
Level of Diversification		-1.72^	-1.80^	-1.81^	-1.54	-1.54	-1.59
Environmental dynamism			-1.56		-1.23	-0.74	
Environmental complexity		1.22		0.62			0.42
Env. Dynamism * Block holder ownership						0.54	
Env. Dynamism * Institutional Ownership			0.61				
Env. Dynamism * Contingent Compensation			0.33			0.44	
Env. Dynamism * Level of Diversification			1.16			0.36	
Env. Complexity * Block holder ownership							1.01
Env. Complexity * Institutional Ownership				-0.61			
Env. Complexity * Contingent Compensation				0.05			0.29
Env. Complexity * Level of Diversification				0.79			0.42
Intercept	7.75	1.54	2.78	1.27	2.85	2.65	1.64
Wald Chi 2	1.44	72.21	74.64	73.14	25.42	26.26	24.76
Prob >Chi2	0.69	0.00	0.00	0.00	0.00	0.00	0.01
N	9055	660	660	660	481	481	481

^p<.10, * p< .05, **p<.01, ***p<.001

Table 5B. Antecedents to Capital Allocation Efficiency (DV = External Overinvestment scaled by sales)

Model	1B	2B	3B	4B	5B	6B	7B*
Organization size	3.42**	-0.01	0.14	-0.05	-0.55	-0.54	-0.34
R & D intensity	4.22***	2.46*	2.43*	2.50*	-0.34	-0.31	0.26
Cost of capital	-0.08	-0.76	-0.74	-0.73	0.16	0.14	0.12
Historical Performance Comparisons		2.78**	2.77**	2.76**			
Social Performance Comparisons					4.53***	4.34***	4.22***
Block holder ownership					-0.79	-0.75	
Institutional shareholder ownership		0.36	0.40	0.35			0.47
Contingent compensation		-0.05	0.05	-0.03	-0.07	0.31	0.78
Level of Diversification		0.27	0.18	0.43	0.67	0.70	0.76
Environmental dynamism			0.49		-1.10	0.03	0.45
Environmental complexity		0.50		0.01			
Env. Dynamism * Block holder ownership						0.47	
Env. Dynamism * Institutional Ownership			-0.04				-0.19
Env. Dynamism * Contingent Compensation			0.32			0.72	1.37
Env. Dynamism * Level of Diversification			-0.06			-0.56	-0.73
Env. Complexity * Block holder ownership							
Env. Complexity * Institutional Ownership				0.17			
Env. Complexity * Contingent Compensation				-0.21			
Env. Complexity * Level of Diversification				-0.67			
Intercept	1.38	-0.57	-0.53	-0.32	0.19	-0.20	-1.00
Wald Chi 2	29.52	15.86	16.02	16.39	21.35	22.16	22.47
Prob >Chi2	0.00	0.04	0.14	0.12	0.00	0.02	0.02
N	9419	660	660	660	482	482	587

^p<.10, * p< .05, **p<.01, ***p<.001

Hypothesis 1a predicts that business segment performance below aspirations for such performance leads to overinvestment. Consistent with prediction, measures based on both historical and social aspirations were significant in models scaled by assets (Model 2A-7A, $p<0.001$), as well as by sales[31] (Models 2B, $p<0.01$: Model 5B-7B, $p<0.001$). Thus, Hypothesis 1a is supported.

Hypotheses 3a and 3b offer the prediction that higher levels of shareholder concentration reduce instances and magnitudes of overinvestment. Consistent with prediction, block holder ownership was found to decrease overinvestment in models where overinvestment is scaled by assets (Model 5A-7A, $p<0.05$), while institutional ownership had no effect on overinvestment. The association between block holders and overinvestment, however, is not consistent across scalars and only significant when measures of social aspirations are used. Thus, Hypothesis 3a, suggesting a negative association between block holder ownership and overinvestment is partially supported, while Hypothesis 3b is not supported.

Hypothesis 4a suggests that higher levels of compensation contingent on firm performance may be able to reduce overinvestment. This hypothesis is not supported as I find no significance in associations between contingent compensation and overinvestment in my sample.

Hypothesis 5a offers the prediction that higher levels of firm diversification increases overinvestment. This hypothesis is also not supported as parameter estimates fail to achieve significance in all models except Model 2A-4A where a non-hypothesized negative association is weakly supported ($p<0.10$).

[31] Note that coefficients in Models 3B and 4B could not be interpreted due to model non-significance.

Hypothesis 6a and Hypothesis 7a predicting positive association between environmental uncertainty and overinvestment are also not supported in any of my models with the current data.

Finally, the next three sets of hypotheses (H8a-b, H9a-b and H10a-b) offer predictions about effects where environmental uncertainty moderates previously described relationships between level of diversification, shareholder concentration, and contingent compensation, on the one hand, and inefficiencies in the capital allocation process on the other. Following previous logic, I have separated inefficiencies into over and underinvestment to make possible separate predictions for each. Neither Hypothesis 8a-b, 9a-b, nor 10a-b is, however, supported indicating no evidence that environmental uncertainty moderates any of the described associations. Thus, overall, my data does not support any moderating effects of environmental uncertainty.

Antecedents to underinvestment

Tables 6A and 6B provide results of tests for underinvestment. Control variables exhibited different relationships with underinvestment depending on scaling. In the model scaled by assets, R & D intensity exhibits an expected positive association, indicating that the added complexity of more research focused organizations may contribute to additional underinvestment errors. In models scaled by sales, however, the association between R & D intensity and underinvestment is negative, indicating a decreasing tendency of more research focused firms to commit underinvestment errors. Furthermore, organization size exhibits an unexpected negative association with underinvestment with both scalars, indicating that larger firms may commit fewer underinvestment errors. Finally, cost of capital exhibits positive associations indicating

that firms with higher funding costs may be more likely to commit underinvestment errors.

The caveat that a common denominator may influence associations between R & D intensity and underinvestment (when both are scaled by sales) applies, but is unlikely because the association is negative. In addition, associations between overinvestment scaled by sales and R & D intensity are positive, which conflicts with the previous finding. Thus, associations involving R & D intensity may more likely be driven by statistical chance than by a systematic bias due to a common scalar.

Hypothesis 1b predicts that business segment performance above aspirations leads to underinvestment. Parameter estimates are non-significant in models with historical aspirations, but actually decreases underinvestment in models with social aspirations and underinvestment scaled by assets (Model 5A-7A). Thus, Hypothesis 1B is not supported.

Hypothesis 2a and Hypothesis 2b predict associations between shareholder concentration and underinvestment. Although parameter estimates are significant for block holder ownership (Model 2B-4B), they are in the opposite of the hypothesized direction. Note that parameter estimates in Models 2A-4A cannot be interpreted due to model non-significance. Thus, Hypothesis 2a and 2b are not supported.

Hypothesis 4b suggests a negative association between contingent compensation and underinvestment. In contrast with prediction, this hypothesis is not supported.

Hypothesis 5b predicts a positive relationship between level of diversification and underinvestment. This hypothesis is partially supported as the relationship is significant in models where underinvestment is scaled by sales (Model 2B-3B, $p<0.05$: Model 4B,

Table 6A. Antecedents to Capital Allocation Efficiency (DV = External Underinvestment scaled by assets)

Model	1A	2A	3A	4A	5A	6A	7A
Organization size	-6.85***	1.07	0.95	0.85	0.06	0.04	0.18
R & D intensity	3.61***	1.32	1.51	1.15	-0.06	0.02	0.01
Cost of capital	2.17*	0.60	0.42	0.59	0.76	0.79	0.77
Historical Performance Comparisons		-0.83	-0.96	-0.84			
Social Performance Comparisons					-3.40**	-3.38**	-3.42**
Block holder ownership		1.70^	2.04*	1.83^			
Institutional shareholder ownership					1.13	1.03	1.28
Contingent compensation		0.14	0.93	0.28	-0.96	-1.35	-1.14
Level of Diversification		-0.01	0.06	-0.07	0.80	0.59	0.44
Environmental dynamism		-0.48	0.26		-1.31	0.04	
Environmental complexity				0.32			0.08
Env. Dynamism * Block holder ownership			1.16				
Env. Dynamism * Institutional Ownership						-0.28	
Env. Dynamism * Contingent Compensation			-0.97			-0.99	
Env. Dynamism * Level of Diversification			-0.58			-1.71^	
Env. Complexity * Block holder ownership				0.86			
Env. Complexity * Institutional Ownership							0.86
Env. Complexity * Contingent Compensation				0.27			-0.69
Env. Complexity * Level of Diversification				1.33			0.42
Intercept	89.03	12.47	10.42	5.15	6.02	5.91	3.57
Wald Chi 2	67.20	6.30	10.24	8.67	18.06	22.29	19.25
Prob >Chi2	0.00	0.61	0.50	0.65	0.02	0.02	0.05
N	9890	465	465	465	909	909	909

^p<.10, * p< .05, **p<.01, ***p<.001

Table 6B. Antecedents to Capital Allocation Efficiency (DV = External Underinvestment scaled by sales)

Model	1B	2B	3B	4B	5B	6B	7B
Organization size	-4.31***	1.11	1.03	1.03	-0.41	-0.45	-0.37
R & D intensity	-11.30***	-9.49***	-9.07***	-9.29***	-5.72***	-5.63***	-5.59***
Cost of capital	2.55*	0.65	0.52	0.70	0.59	0.66	0.62
Historical Performance Comparisons		1.22	1.25	0.20			
Social Performance Comparisons					1.07	1.13	1.07
Block holder ownership		1.79^	2.57*	1.73^			
Institutional shareholder ownership					1.38	1.16	1.56
Contingent compensation		0.19	0.73	0.22	-1.74^	-1.70^	-0.49
Level of Diversification		2.08*	2.21*	1.66^	3.07**	2.75**	2.40*
Environmental dynamism		-1.65^	-0.26		0.02	1.24	
Environmental complexity				-0.78			-2.02*
Env. Dynamism * Block holder ownership			1.98*				
Env. Dynamism * Institutional Ownership						-0.71	
Env. Dynamism * Contingent Compensation			-0.69			-0.1	
Env. Dynamism * Level of Diversification			-0.8			-2.34*	
Env. Complexity * Block holder ownership				-0.16			
Env. Complexity * Institutional Ownership							0.44
Env. Complexity * Contingent Compensation				0.17			0.57
Env. Complexity * Level of Diversification				0.15			-2.01*
Intercept	136.98	34.42	29.64	15.83	12.31	12.16	9.32
Wald Chi 2	149.23	125.56	132.66	123.96	55.23	61.20	66.79
Prob >Chi2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	10234	451	451	451	914	914	914

^p<.10, * p< .05, **p<.01, ***p<.001

$p<0.10$: Model 5B-6B, $p<0.01$: Model 7B, $p<0.05$). Thus, Hypothesis 5b is also only partially supported as associations are not consistent across my two scalars.

Hypothesis 6b suggesting a positive association between environmental dynamism and underinvestment is not supported in either models scaled by assets or sales.

Hypothesis 7b predicts a positive association between environmental complexity and underinvestment. Although environmental complexity explains variance in underinvestment scaled by sales (Model 7B), the direction of the association is opposite of the hypothesized direction. Thus, Hypothesis 7b is not supported.

Hypotheses 8a-b, 9a-b, and 10a-b predicting moderating effects of environmental uncertainty on associations between antecedents and underinvestment are not supported in any of my models. Although interactions explain variance in a few models, associations are in the opposite of the hypothesized directions. That is, any evidence of an interaction effect where higher levels of environmental uncertainty exacerbates the effect of diversification as well as reduces the effectiveness of both monitoring and contingent compensation is not present in the current analysis. Thus, Hypotheses 8a-b, 9a-b, and 10a-b are not supported.

Performance Implications: Corporate Effect

I will present results from this model in two steps. First, I will show results of the variance partitioning of segment ROA into components using the unconditional model and reduced models with time and industry effects added. Second, I will show results as the unconditional model is extended to include predictors (measures of capital allocation efficiency and business segment return variance), which allows me to obtain estimates of

variance components as well as parameter estimates. All extended models are run with the same limited number of control variables described in the previous section (CEO tenure and firm cash flow are eliminated) after I determined that their exclusion had no discernible impact on significance and size of parameter estimates. To further increase usable sample sizes in regressions, over and underinvestment were combined into an overall measure of capital allocation errors (Table 9 and Table 10), although separate effects of over and underinvestment were also investigated in Tables 11 through 14. While acknowledging that prior variance decomposition studies (e.g., McGahan & Porter, 1997: Brush, Bromiley & Hendrickx, 1999: Misangyi *et al.*, 2006: Hough, 2006), have not used control variables in modeling corporate effects to, for example, partial out effects from firm characteristics that may be beyond the control of managers, I chose to include control variables to be able to differentiate between effects of capital allocation efficiency on business segment ROA and potential alternative explanations. Doing so, however, suggests that my estimates of explained variance may not be exactly comparable to prior studies - my estimates are likely to be lower due to the included controls accounting for some of the variance in business segment performance. In addition, segments belonging to diversified and single-business firms are included in the analysis when measures of capital allocation errors with external reference points are used, while only diversified firms are included as measures with internal reference points are used.

Unconditional variance partitioning

Table 7 presents results of my estimation of variance components and individual effects (year, industry, corporate, business-segment, and time) for models without

predictor variables. Calculated variance components, although not directly used to test hypotheses, are used to measure the variance explained by significant predictors.

Using this unconditional model, the largest part of total business segment variance is across time (61.2%) followed by variance between business segments (25.0%) and variance between corporations (13.8%). Those three components are further narrowed down by comparing unconditional, reduced, and complete models as described in the section on model specification and estimation. Results can be found at the bottom of Table 7: year effects account for 0.1 %, industry effects for 1.3 %, corporate effects for 12.5%, business-segment effects for 25.0%, while the proportion of variance explained by time makes up 61.1% of total variance. All variances are highly significant ($p<0.001$).

Effect sizes differ from previous studies with similar multilevel methods (e.g, Misangyi *et al.* 2006: Hough, 2006) and from earlier studies using VCA or ANOVA variance decomposition techniques (e.g., McGahan & Porter, 1997: Rumelt, 1991). In particular, I find lower industry effects (1.3%) compared to industry effects in past research, ranging from 4 percent (Rumelt, 1991) to 9.4 percent (McGahan & Porter, 1997). In addition, my corporate effect is generally higher (12.5 %), while my business segment effect (25 %) is generally lower than comparable effects in past research (Table 8). This discrepancy can be explained by my sample covering a later time period (1998 through 2006) as opposed to previous sample periods ending in 1999 or earlier. Thus, my sample includes effects of FAS 131, requiring firms to further split up broader "industry" or "line of business" segments into more narrow operating segments. Thus, firms on average are likely to report more segments in this study as opposed to previous studies ending in 1999 or earlier. The higher number of business segments tend to increase

Table 7. Performance Implications: Corporate Effects Variance Partitioning

	Variance Estimate	d.f.	*p*-value
Unconditional model			
Level 1 variance (across time), e_{tij}	0.37688	35409	0.000
Level 2 variance (between business-segments), r_{ij}	0.15412	7882	0.000
Level 3 variance (between corporations), μ_j	0.08471	5395	0.000
Variance across time as a % of total variance	61.2%		
Variance between business segments as a % of total variance	25.0%		
Variance between corporations as a % of total variance	13.8%		
Model inclusive of year effects at Level 1			
Level 1 variance (across time), e_{tij}	0.37625	35409	0.000
Level 2 variance (between business-segments), r_{ij}	0.15338	7882	0.000
Level 3 variance (between corporations), μ_j	0.08321	5395	0.000
Model inclusive of year (Level 1) and industry effects (Level 2)			
Level 1 variance (across time), e_{tij}	0.37592	35409	0.000
Level 2 variance (between business-segments), r_{ij}	0.15328	7882	0.000
Level 3 variance (between corporations), μ_j	0.07526	5395	0.000
Total variance explained by year effects	0.1%		
Total variance explained by industry effects	1.3%		
Total variance explained by corporate effects	12.5%		
Total variance explained by business-segment effects	25.0%		
Total variance explained by time	61.1%		

corporate effects and decrease business segment effects by directly transferring variance between the two effects (Bowman & Helfat, 2001). This is easy to see when considering a single-segment firm (under FAS 14) that is now required to split up a larger "industry-like" segment into two or more smaller 'operating-like' segments to conform to FAS 131. Thus, because single-segment firms by definition have no corporate effects, the change in

reporting regulations will result in larger corporate effects and smaller business segment effects.

To test the sensitivity of effects to the number of business segments firms are reporting, I also decomposed business segment performance of diversified firms only. That is, I excluded all single-business firms from the analysis, which should increase corporate effects and decrease business segment effects based on the above argument. In that analysis, corporate effects indeed increased to 13.8 %, while business segment effects decreased to 18.9 % (Table 8). Thus, the increase in business segments had the forecasted effect in my sample.

The described transfer of variance from business segment to corporate effects as the number of reported segments increase also affects the variance allocated to industry effects. This is because industry effects in this study and other studies (e.g., Misangyi *et al.*, 2006) are represented by industry dummies entered at the business segment level of the multilevel specification. Thus, since my reported business segment effects (25.0 %) are substantially lower than previous studies (Table 8), it follows that my industry effects logically also could have a tendency to be lower. In sum, my more current sample period impacts variance estimates of corporate and business segment effects which, in turn, affects estimates of industry effects by lowering such effects compared to previous studies.

The relative size of reported corporate and business segment effects also corresponds with those reported by Hough (2007). That is, the ratio of corporate to business segment effects using proportional Rs (Brush et al., 1999) is exactly the same as that reported by her indicating that corporate effects are smaller than business segment

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effects by 0.71 to 1[32]. This is significant because she uses information on "operating segments while datasets covering earlier time periods contain line of business or industry information" (page 52). Thus, although her sample covers a shorter time period (1995 through 1999) than mine, her sample is similar to mine in that it reports less aggregated operating segments which could result in relatively larger corporate and smaller business segment effects compared to earlier studies using more aggregated "industry" or "line of business" reporting. Furthermore, absolute differences in effects between our two studies can be attributed to the substantially smaller proportion of transient variance (described as error variance) in her study. Thus, because most of her business segment variance is between segments (65.5 %), it is not surprising that her absolute estimates of corporate (20.2 %), business segment (40.2 %), and also industry effects (5.3 %) are substantially higher than my corresponding estimates (Table 8). Reasons for the smaller proportion of transient variance in her study may include a shorter sample period as well as a different multilevel model where she characterizes transient variance as error variance and thus captures that portion as whatever variance is left over after all effects have been entered.

In addition, effects are often not directly comparable between variance decomposition studies because samples differ also in a number of other ways. With respect to my study, my sample includes all firms (manufacturing and service firms), while some studies (e.g., Rumelt, 1991: Roquebert *et al.,* 1996) limit theirs to manufacturing firms. My sample also includes both diversified and single-business firms with up to 10 segments, while Brush, Bromiley, and Hendrickx (1999), for example, limited theirs to only diversified firms with either 3 or 4 segments. Finally, some studies

[32] Ratio = square root (variance of corporate effects/variance of segment effects). My reported ratio = sqrt (12.5/25) = 0.71. Hough (2007) reported ratio = sqrt (20.2/40.1) = 0.71

TABLE 8. Comparison of Effects With Selected Previous Studies*

	Arrfelt	Arrfelt (diversified firms only)	Misangyi *et al.* (2006)	Hough (2006)	McGahan & Porter (1997)	Rumelt (1991)
Method	Multilevel	Multilevel	HLM	Multilevel	ANOVA	VCA
Source of data	Compustat	Compustat	Compustat	Compustat	Compustat	FTC
Years covered	1998-06	1998-06	1984-99	1995-99	1981-94	1974-77
Sectoral coverage	All	All	All	All	All	Manuf.
No. of observations	35,409	15,147	10,633	19,405	58,132	10,866
% of total variance						
Year	0.1	0.1	0.8	<1.0	0.3	0.1
Industry	1.3	0.2	7.6	5.3	9.4	4.0
Corporation	12.5	13.8	7.2	20.2	9.1	1.6
Business segment	25.0	18.9	36.6	40.1	35.1	44.2
Time	61.1	67.0	47.8	N/A	N/A	N/A
Error	N/A	N/A	N/A	34.5	46.1	44.8

*Note that the Brush, Bromiley, and Hendrickx (1999) study is excluded because their method (2SLS) limits their sample to firms with either 3 or 4 segments. Thus, their sample is very different from other studies (including those selected for comparison) and also substantially smaller (1,605 segment years in the three-segment set, 692 segment-years in the four-segment set).

have used stratified sampling techniques (e.g., Misangyi *et al.* 2006) in effect limiting their samples to only a portion of available firms and segments. Thus, not only are sample periods different, but a myriad of other differences between samples may also contribute to the difficulty of comparing effect sizes across studies.

Hypotheses testing

Hypothesis 11 predicts a negative association between capital allocation errors and the corporate effect. This prediction is tested, as described earlier, in two steps by looking at both parameter estimates as well as at variance components. Parameter estimates are given for all models, while estimates of variance components are emphasized when parameter estimates are significant ($p<0.05$ and better). Effects of

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capital allocation efficiency are tested with measures based on both internal and external reference points. In addition, to differentiate between effects of overinvestment and underinvestment, individual effects of overinvestment and underinvestment are also presented.

Table 9 provides results from testing the effect of allocation efficiency on the corporate effect using internal reference points. Hypothesis 11, predicting a negative

Table 9. Performance Implications: Corporate Effects

Allocation Errors: Internal	1	2	3	4	5	7	8	9
Time level								
Cost of capital	-1.90^	-0.25	0.18	-0.24	-0.23	-0.26	-0.24	-0.23
Allocation Errors (assets)		-0.60		-0.68	-0.26			
Allocation Errors (sales)						-2.03*	-2.00*	-0.89
Segment return variance (SRV)			0.80	-1.80^	-1.76^		-1.80^	-2.20*
Allocation Errors (assets) *SRV					-2.16*			
Allocation Errors (sales) *SRV								-2.23*
*Corporate level***								
Organization size								
R & D intensity								
Intercept	17.78	20.44	16.10	19.78	19.74	21.32	20.36	20.43
Wald Chi2	3.63	0.42	0.67	3.83	8.32	4.20	7.30	12.23
Prob >Chi2	0.05	0.81	0.71	0.28	0.08	0.12	0.05	0.02
N	30584	11729	16321	11399	11399	11820	11399	11399
Variance components								
Level 1 variance, e_{tij}							0.4733	0.4733
Level 2 variance, r_{ij}							0.0703	0.0699
Level 3 variance, μ_j							0.0461	0.0458
Level 1 variance Explained					*	*		0.00%
Total variance explained					*	*		0.10%

*Not calculated due to model partial or non-significance

**Models with corporate level controls are not shown due to lack of convergence

influence of capital allocation errors on the size of the corporate effect, is supported when capital allocation errors are scaled by sales in Model 8 ($p<0.05$), but not in Model 7 because model non-significance suggests that the significant coefficient cannot be interpreted. In addition, when capital allocation errors are scaled by assets, the association is not significant and neither is the model (Model 2). Thus, with respect to measures of allocation errors using internal reference points, Hypothesis 11 is only partially supported.

Table 10 provides results from testing the effect of allocation efficiency on the corporate effect using external reference points. Direct effects of allocation errors are supported in regressions with assets as scalar (Model 2, $p<0.001$) and explains approximately 11.80 % of time level variance and 7.42 % of total variance. In addition, direct effects are supported also with sales as a scalar (Model 7, $p<0.05$), explaining 11.96 % of time level variance and 7.52 % of total variance. Thus, overall H11 and associations between capital allocation errors and segment performance are supported in models with both types of reference points and scalars with the exception of when internal measures are scaled by assets.

With respect to the two scalars, I acknowledge that the scalar itself may affect how the measure of business segment performance is interpreted. That is, when scaled by assets, business segment performance may be interpreted as a measure of the efficiency with which assets are used, while interpreted as a measure of margins when scaled by sales. Although potential differences in interpretation are not directly supported by Table 9 and 10 since external measures are significant regardless of scalar, further investigation

Table 10. Performance Implications: Corporate Effects

Allocation Errors: External	*1*	2	*3*	4	5	*6*	*7*	8	9	10
Time level										
Cost of capital	-1.90^	-2.80**	0.18	0.18	0.18	0.41	-2.75*	0.18	0.18	0.40
Allocation Errors (assets)		-3.74***		-1.45	-0.92	-0.40				
Allocation Errors (sales)							-2.25*	-1.47	-1.53	0.58
Segment return variance SRV			0.80	-1.85^	-1.57	-2.93**		-1.89^	-1.94*	-2.54*
Allocation Errors (assets) *SRV					-3.88***	-3.54***				
Allocation Errors (sales) *SRV									-0.41	0.77
Corporate level										
Organization size						0.44				0.47
R & D intensity						0.67				0.56
Intercept	17.78	22.07	16.10	22.26	22.13	12.14	22.48	23.08	22.99	12.16
Wald Chi2	3.63	21.93	0.67	5.71	20.52	22.08	12.61	5.76	5.96	9.18
Prob > Chi2	0.05	0.00	0.71	0.12	0.00	0.00	0.00	0.12	0.20	0.16
N	30584	27330	16321	14211	14211	7671	27473	14212	14212	7672
Variance components										
Level 1 variance, e_{tij}	0.3956	0.3489		0.4360	0.4359		0.3483			
Level 2 variance, r_{ij}	0.1444	0.1024		0.0770	0.0770		0.1029			
Level 3 variance, μ_j	0.0892	0.0496		0.0513	0.0492		0.0515			
Level 1 variance explained		11.80%			0.00%		11.96%			
Total variance explained		7.42%			0.37%*		7.52%			

*Level 3 variance out of total variance

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of such differences could be an interesting avenue for future extensions of this dissertation.

To allow for a more precise test of H11, capital allocation errors are, once more, separated into over and underinvestment to allow for separate predictions and tests. Associations between overinvestment and business segment performance support Hypothesis 11. External overinvestment is significant in models using both scalars (Table 11), although only weakly significant ($p<0.10$) in Model 4 where overinvestment is scaled by sales and controls at the corporate level are used. Associations between internal overinvestment and segment performance (Table 12) are, however, only significant in models without control variables at the corporate level (Model 1, $p<0.05$: Model 3, $p<0.01$). Thus, with respect to overinvestment and measures using both external and internal reference points, H11 is only partially supported.

Table 11. Performance Implications: Corporate Effects

Overinvestment: External	1	2	3	4
Time level				
Cost of capital	0.44	-0.27	0.46	-0.03
External Overinvestment (assets)	-6.83***	-6.37***		
External Overinvestment (sales)			-6.14***	-1.65^
Corporate level				
Organization size		1.73^		1.76^
R & D intensity		-8.28***		-8.10***
Intercept	29.66	23.01	29.58	22.49
Wald Chi2	46.91	110.4	37.94	72.39
Prob > Chi2	0.00	0.00	0.00	0.00
N	15431	6824	15514	6889

^p<.10, * p< .05, **p<.01, ***p<.001

Table 12. Performance Implications: Corporate Effects

Overinvestment: Internal	1	2	3	4
Time level				
Cost of capital	-0.20	-0.66	-0.22	0.69
Internal Overinvestment (assets)	-2.12*	-0.11		
Internal Overinvestment (sales)			-3.42**	-1.02
Corporate level				
Organization size		-0.65		-0.65
R & D intensity		5.45***		6.44***
Intercept	19.59	8.30	19.21	7.64
Wald Chi2	6.35	30.68	11.73	43.8
Prob > Chi2	0.02	0.00	0.00	0.00
N	4169	2319	4203	2346

^p<.10, * p< .05, **p<.01, ***p<.001

Associations between underinvestment and business segment performance offer more ambiguous support for H11. As presented in Table 13, internal measures[33] representing effects of segments belonging to diversified firms only are not related to business segment performance, while measures of underinvestment calculated with external reference point scaled by sales (Table 14: Model 3 and 4) exhibits a non-hypothesized positive association with the dependent variable. Thus, with respect to underinvestment, Hypothesis 11, suggesting a negative relationship between underinvestment and the corporate effect is not supported.

Hypothesis 12 predicts a negative relationship between the variance of business segment ROA within firms and the corporate effect. This hypothesis is partially supported as parameter estimates for segment return variance are significant in some models where allocation errors are included as well (Table 9: Model 8 and 9, Table 10:

[33] Note that Model 2 and Model 3 did not converge due to a number of potential reasons including (but not limited to) a lack of variance to allow the calculation of variance components.

Model 6). Thus, overall, a negative association between segment return variance and the corporate effect is partially supported.

Table 13. Performance Implications: Corporate Effects

Underinvestment: Internal	1	2*	3*	4
Time level				
Cost of capital	-0.32			-0.09
Internal Underinvestment (assets)	-0.63			
Internal Underinvestment (sales)				0.58
Corporate level				
Organization size				0.2
R & D intensity				1.63^
Intercept	5.00			3.21
Wald Chi2	0.49			3.32
Prob > Chi2	0.78			0.5
N	7462			5363

**Models did not converge*

Table 14. Performance Implications: Corporate Effects

Underinvestment: External	1	2	3	4
Time level				
Cost of capital	-2.16*	-1.41	-2.22	-1.40
External Underinvestment (assets)	-0.55	-0.54		
External Underinvestment (sales)			9.36***	7.43***
Corporate level				
Organization size		3.90***		4.56***
R & D intensity		-9.99***		-7.75***
Intercept	6.07	4.64	-3.80	-3.93
Wald Chi2	5.01	124.59	92.26	180.6
Prob > Chi2	0.08	0.00	0.00	0.00
N	11899	7663	11959	7712

^p<.10, * p< .05, **p<.01, ***p<.001

Hypothesis 13, finally, suggesting a moderating effect of segment return variance on the association between allocation errors and business segment performance is supported in models with allocation errors constructed with both internal (Table 9) and external (Table 10) reference points. The associations, however, are not consistently supported across models with both scalars and corporate level control variables. That is, the association is supported in Model 9 ($p<0.05$) where internal reference points are used, while only supported with assets as a scalar when external reference points are used (Model 5, $p<0.001$: Model 6, $p<0.001$). Thus, Hypothesis 13 is partially supported.

Performance Implications: Diversified firm value

Table 15A-B presents results from my estimation of relationships between capital allocation efficiency and diversified firm values. In particular, Table 15A presents results where both independent and dependent variables are scaled by sales, while Table 15B presents results from regressions scaled by assets. In contrast with previous models estimating effects of antecedents on capital allocation efficiency and of capital allocation efficiency on the corporate effect, sample size and collinearity considerations did not interfere with my analysis thus the full range of control variables (including CEO tenure and cash flow) were included in regressions. Also in contrast with previous models, regressions involving external measures were constrained to only include diversified firms.

Diversified firm value scaled by sales (Table 15A)

Control variables exhibited relationships with diversified firm value in expected as well as unexpected directions. Organization size exhibited a negative association with

my measure of diversified firm value[34], indicating higher discounts for larger firms, while CEO tenure exhibited a generally expected (positive) relationship, indicating lower discounts (or higher firm values) when firms are run with more experienced CEOs. Cash flow and cost of capital, on the other hand, exhibited somewhat surprising associations with the dependent variable given Jensen's work on how cash rich organizations invest (e.g., Jensen, 1886: 1991: 1993). That is, according to Jensen, firms with access to ample and cheap investment capital tend to invest in ways that could lower firm values, not increase them as I find evidence of. Finally, R&D intensity exhibited a positive association with diversified firm values, while long-term incentive plans was unrelated to observed discounts in diversified firms.

Models 2A-6A assesses associations between overinvestment and diversified firm value (Hypothesis 14a) as well as between underinvestment and diversified firm value (Hypothesis 14b) using sales to scale relevant measures. Thus, the hypotheses assess the relationship between capital allocation errors and the degree of discount (or premium) exhibited by diversified firms as compared to their potential value if their business segment were stand-alone entities. Hypothesis 14a predicts a negative relationship between overinvestment and diversified firm value. This hypothesis was assessed in Models 2A and 3A. Contrary to prediction, however, both internal and external measures of overinvestment exhibited positive relationships with my measures of diversified firm value ($p<0.001$), indicating that, although overinvestment explains variance in diversified firm value, it is in the opposite of the hypothesized direction as overinvestment tend to increase firm values. In addition, Model 6A uses the Berger and Ofek measure of

[34] The diversified firm value construct is measured as actual firm value over imputed firm value if all business segments instead were freestanding.

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overinvestment to assess effects on diversified firm values with only very marginal significance in the expected direction ($p<0.10$). The difference between my measures of overinvestment and the measure used by Berger and Ofek may account for the divergent results in associations between overinvestment and diversified firm value. That is, the threshold level set for overinvestment is much more severe in their measure only capturing firms with very poor future prospects (Tobin's q below 0.25 as opposed to below 0.5), thus they likely capture segments with little or no chance to reverse poor performance. With my less strict threshold, however, it is likely that some segments allocated extra investment may be able to turn their performance around, thereby potentially accounting for the positive association between my measures of overinvestment and diversified firm value.

Table 15A. Performance Implications: Diversified Firm Value

Fixed effects model: Scaled by sales	1A	2A	3A	4A	5A	6A
Organization size	-9.49***	-9.45***	-9.26***	-9.54***	-9.41***	-2.08*
CEO tenure	2.09*	2.08*	1.86^	1.86^	2.09*	1.43
Cash flow	10.68***	10.73***	10.32***	10.81***	10.73***	2.01*
R & D intensity	4.65***	4.66***	4.51***	4.70***	4.66***	0.42
Cost of capital	-2.62**	-2.64**	-2.61**	-2.65**	-2.63**	-2.28*
Long-term incentive plans	0.02	0.01	0.03	-0.05	-0.06	-1.15
External Overinvestment (sales)		3.82***				
Internal Overinvestment (sales)			2.92**			
External Underinvestment (sales)				2.33*		
Internal Underinvestment (sales)					0.32	
Over_berger & Ofek						-1.67^
Intercept	7.63	7.66	7.53	7.67	7.63	0.57
F (number of variables, DF)	33.23	29.16	28.36	30.59	28.69	4.13
Prob > F	0.00	0.00	0.00	0.00	0.00	0.00
N	3179	3179	3179	3179	3179	277

^p<.10, * p< .05, **p<.01, ***p<.001

Hypothesis 14b predicts a negative association between underinvestment and diversified firm value. This hypothesis was assessed in Models 4A and 5A. Contrary to prediction, the external measure exhibited a positive association with diversified firm values, while the internal measure exhibited a non-significant relationship.

In sum, therefore, although both overinvestment and underinvestment explain variance in diversified firm value, it is contrary to the predicted direction. Thus, neither Hypothesis 14a nor 14b are supported.

Diversified firm value scaled by assets (Table 15B)

Control variables exhibit slightly different relationships than in the prior model. Although organization size, CEO tenure, cost of capital, and cash flow have similar effects on the dependent variable as in the previous model (15A), R&D intensity, and

Table 15B. Performance Implications: Diversified Firm Value

Fixed effects model: Scaled by assets	1B	2B	3B	4B	5B	6B
Organization size	-9.29***	-9.30***	-9.26***	-9.34***	-9.22***	-2.70**
CEO tenure	2.32*	2.23*	2.28*	2.30*	2.32*	1.64^
Cash flow	8.59***	8.58***	8.48***	8.55***	8.58***	3.77***
R & D intensity	-1.55	-1.54	-1.59	-1.54	-1.54	-2.22*
Cost of capital	-4.38***	-4.36***	-4.40***	-4.37***	-4.37***	-2.02*
Long-term incentive plans	2.59**	2.59*	2.69**	2.59*	2.60**	-0.61
External Overinvestment (assets)		1.87^				
Internal Overinvestment (assets)			1.80^			
External Underinvestment (assets)				0.76		
Internal Underinvestment (assets)					-0.44	
Over_berger & Ofek						-1.96*
Intercept	9.40	9.41	9.36	9.42	9.34	2.80
F (number of variables, DF)	32.23	28.20	27.81	27.77	27.66	6.30
Prob > F	0.00	0.00	0.00	0.00	0.00	0.00
N	2825	2825	2825	2825	2825	268

^p<.10, * p< .05, **p<.01, ***p<.001

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Results from Models 2B-6B differ from those reported for previous Models 2A-6A in two respects. First, direct effects of overinvestment are now only weakly significant (Model 2B, $p<0.10$: Model 3B, $p<0.10$), but still in a direction contrary to prediction. Second, underinvestment is not related to diversified firm value in any of my models. Therefore, with the exception of the Berger & Ofek measure of overinvestment that exhibited an expected negative association with diversified firm value, neither Hypothesis 14a nor 14b is supported.

Performance Implications: Firm ROA

Tables 16A and 16B present result of the test of allocation efficiency on Firm ROA. In these models, control variables (with the exception of cash flow that was excluded because it is measured in essentially the same way as the dependent variable) generally exhibited strong relationships with firm ROA. Only firm size was unrelated to the rate of return on assets, while cost of capital had a negative effect on Firm ROA, indicating a plausible negative relationship between cost of funding and firm returns. Furthermore, CEO tenure and long-term incentive plans exhibited an equally plausible, but positive relationship implying that more experienced and better compensated CEOs may be able to raise asset returns. Surprisingly, observed R&D intensity had a negative association with Firm ROA, indicating that more research and development focused firms may have lower returns on assets.

In order to assess performance implications of capital allocation efficiency on Firm ROA, Hypothesis 15a predicts a negative association between underinvestment and

Firm ROA, while Hypothesis 15b predicts a negative association between overinvestment and Firm ROA. Consistent with prediction, Model 4A and Model 5A show that internal measures of underinvestment were negatively related to Firm ROA for both scalars ($p<0.01$). In addition, one of the external measures of underinvestment was significant (Model 2A, $p<0.01$) offering additional support for hypothesis 15a, predicting a negative association between underinvestment and Firm ROA.

Hypothesis 15b predicts a negative relationship between overinvestment and Firm ROA. This prediction is partially supported as Model 2B is significant in the predicted direction ($p<0.001$), while remaining models returned non-significant parameter estimates. Overall, therefore, Hypothesis 15a, predicting a negative relationship between underinvestment and Firm ROA is relatively well-supported as three out of four possible measures are significant in the predicted direction. Hypothesis 15b, however, is only partially supported as only 1 out of 5 models are significant in the predicted direction. Specifically, only external overinvestment scaled by assets was significant.

Table 16A. Performance Implications: Firm ROA

Underinvestment	1A	2A	3A	4A	5A
Organization size	-1.55	-0.53	-0.40	-2.21*	-1.43
CEO tenure	2.46**	2.92**	3.09**	0.63	1.72^
R & D intensity	-4.12***	-4.53***	-2.95**	-1.62^	-2.19*
Cost of capital	-4.07***	-6.16***	-7.23***	-3.29**	-2.22*
Long-term incentive plans	4.82***	4.20***	3.75***	5.17***	4.14***
External Underinvestment (assets)		-2.97**			
External Underinvestment (sales)			0.04		
Internal Underinvestment (assets)				-2.87**	
Internal Underinvestment (sales)					-3.20**
Intercept	16.14***	13.24***	16.16***	18.27***	19.09***
Wald Chi 2	67.25	84.42	81.23	64.41	31.54
Prob > Chi2	0.00	0.00	0.00	0.00	0.00
N	4634	1912	2207	1051	1358

^p<.10, * p< .05, **p<.01, ***p<.001

TABLE 16B. Performance Implications: Firm ROA

Overinvestment	1B	2B	3B	4B	5B	6B
Organization size	-1.55	-1.82^	-2.07*	-1.93^	-1.70^	-0.71
CEO tenure	2.46*	1.45	1.75^	2.96**	2.91**	0.48
R & D intensity	-4.12***	-1.28	-3.69***	-5.03***	-3.39**	-1.73^
Cost of capital	-4.07***	0.43	-1.75^	-3.26**	-3.66***	-3.54***
Long-term incentive plans	4.82***	0.67	2.77**	3.42**	0.86	0.97
External Overinvestment (assets)		-3.50***				
External Overinvestment (sales)			0.15			
Internal Overinvestment (assets)				-0.59		
Internal Overinvestment (sales)					0.41	
Over_berger & Ofek						0.86
Intercept	16.14***	12.60***	9.56***	19.91***	20.00***	13.72***
Wald Chi 2	67.25	18.05	25.02	54.08	31.88	17.34
Prob > Chi2	0.00	0.00	0.00	0.00	0.00	0.00
N	4634	649	716	1068	871	354

^p<.10, * p< .05, **p<.01, ***p<.001

Summarizing the described findings of my two models investigating antecedents and performance implications, antecedents primarily affects allocation efficiency through the effect of performance aspirations. Performance shortfalls in relation to aspirations for such performance generally increase overinvestment as predicted, while instances when current performance is above aspirations do not, as predicted, lead to increased underinvestment. Instead, my results indicate that current performance below aspirations tends to decrease underinvestment. Further, governance variables affect allocation efficiency through the effect of block holders generally acting to reduce allocation to business segments. That is, my results indicate that block holders tend to both decrease overinvestment and increase underinvestment for firms in my sample. Environmental uncertainty, finally, did not materially affect allocation efficiency in my study.

Effects of allocation efficiency on performance outcomes differ across the three measures of firm performance. Both over and underinvestment reduce firm ROA as

predicted, while only overinvestment reduces corporate effects. Diversified firm value, however, is affected in the opposite direction by overinvestment – excessive allocation of capital to segments with relatively poor prospects tends to increase firm values. Finally, business segment variance affects corporate effects as both direct and moderated effects are supported.

CHAPTER 5: DISCUSSION, LIMITATIONS, AND EXTENSIONS

Discussion

Introduction

In this dissertation, I have argued that the capital allocation process is an important, albeit by management researchers, a fairly overlooked corporate level process that may have strong implications for firm performance. The central argument is that a number of multilevel antecedents affect the efficiency of this process which, by extension, also affects the level of performance of diversified as well as the single-business firm. This is in contrast with much of the prior literature on capital allocation that has been more concerned with building elegant models of capital allocation based on ad-hoc assumptions (e.g., Scharfstein & Stein, 2000: Stein, 1997) than with empirical investigations of performance implications of capital allocation efficiency in firms. Prior research has also shown virtually no interest in antecedents to the efficiency of the capital allocation process.

This dissertation, therefore, may be viewed as an initial step in building knowledge about the capital allocation process, including knowledge about drivers tied to the efficiency of the process, as well as performance implications of allocation efficiency within the boundaries of the firm. Specifically, my results show that the level of efficiency of the capital allocation process is an important factor in the performance of diversified as well as single-business firms. In addition, my results, although somewhat mixed, also show how a number of antecedents determine, as well as offer opportunities for stakeholders to exercise control over the capital allocation process thereby affecting its efficiency. Below, I will discuss implications of my findings in four sections,

including performance implications of capital allocation efficiency on diversified firm value, firm ROA, and on the corporate effect, in that order. Following that, I will describe implications of my results examining antecedents to capital allocation efficiency.

Performance Implications on Diversified firm value

More fine-grained findings of this study also support the above interpretation that the capital allocation process has important implications for firm performance. Namely, inefficiencies in the capital allocation process explain significant variance in diversified firm value. More specifically, I find evidence of a positive association between overinvestment and diversified firm value, indicating that overinvestment instead of decreasing firm value, actually increases such value in relation to potential stand-alone firm value if all business segments were freestanding. A number of explanations subject to future verification emerge for this surprising, counterintuitive, and interesting finding. First, overinvestment, although predicted to be a main driver of inefficient capital allocation resulting in worse firm performance for the diversified firm may, after all, not reduce firm performance. Instead, there may be processes at work whereby firms use private knowledge not shared by capital markets about segments likely to show significant and quick improvement if properly fertilized with extra capital allocations. That is, there may be opportunities for overinvestment in select business segments potentially resulting in quick improvements of segment performance. Thus, firms may use this knowledge to their advantage by improving performance in ways initially overlooked by capital markets, but eventually acknowledged in the form of higher stock prices for firms successful in picking segments worthy of extra investment capital. By extension, since the reference level used to delineate business segments with relatively

better prospects from those with relatively worse prospects is the median (or average) such prospect, the implication is that the average firm may be skilled at picking improvement targets that, although technically on the low side of the reference point, may be very close to the reference point and therefore offer potentially quick and easy fixes resulting in higher firm values.

With respect to improving segments close to the reference point, it is interesting to note how the Berger & Ofek measure of overinvestment suggests a limit to the value-increasing effect of overinvestment. That is, selective overinvestment leading to higher firm values may not apply to firms with prospects that are much below the median of such prospects. Thus, segments with very low prospects (such as those below the 25th percentile) may be poor candidates for overinvestment since their segment performance will not likely increase as a result of additional allocations.

A second explanation relies on the reasonable assumption that investors use heuristics or short-cuts (e.g., Kahneman, Slovic & Tversky, 1982), to deal with the complexities inherent in judging the performance of business segments and firms. Prior research has suggested a publicity effect with legitimacy benefits (e.g., Zuckerman, 1999: Pollack & Rindova, 2003) if the firms managers and their actions are visible enough to be reported in the business press. That is, since investors may be unable to perfectly judge the efficiency and effectiveness of each decision (including decisions to allocate capital) made by the firm, the visibility of each action or decision may be interpreted as a signal containing information on how well the firm is doing. Thus, since firms betting heavily on certain business segments may be more visible (and more likely subjects to press coverage) than those with more conservative investment strategies, investors may

anticipate higher performance from the former group of firms. Because distinctive actions such as heavy overinvestment are often attributed to the CEO by business press journalists (Hayward, Rindova & Pollock, 2004), CEO celebrity effects may also add to the visibility of the firm and its managers. In some sense, therefore, overinvestment may signal to shareholders that managers are taking prompt and strong action in the hope of raising overall firm performance. Hence, if investors believe that signal, they may bid up stock prices of overinvesting firms potentially creating and reinforcing this positive association between overinvestment and firm value. However, against the background that overinvestment tends to reduce firm performance as measured by both the corporate effect and firm ROA, this signal may be less than rational as overinvestment may be more likely to reduce firm performance. Thus, investors relying on this heuristic to make decisions may inadvertently bid up share prices of firms that are making decisions more likely to hurt, than to increase their firm performance.

Finally, a third post hoc explanation for the divergent effects of over and underinvestment on firm value is that both internal and external reference levels of investment may be too low, potentially biasing measures of overinvestment. That is, the hurdle for overinvestment (average level of investment) may be set too low, resulting in many segments being deemed to overinvest, although they may in reality receive just the optimal amount of investment. This implies that average levels of capital investment in diversified firms may be lower than optimal. Investors seem to strongly support this contention by rewarding firms overinvesting with significantly higher firm values compared to those that do not. That is, the positive association between overinvestment

and firm value could be interpreted as investors viewing the average level of firm investment as too low, and signaling for it to be raised.

Implications of the finding that overinvestment increases firm values depend on which explanation(s) are deemed most feasible. Still, clear overall implications can be delineated for managers of diversified firms and for academic scholars, respectively. For firms, the positive association between overinvestment and firm values implies that managers may want to look over their current allocations – those allocations may be insufficiently low to allow for maximization of existing profit and growth opportunities. Firms in cash intensive industries, firms in early stages (e.g., start-up firms), and those actively involved in M&A activities, may be particularly vulnerable with respect to insufficient rates of investment. Further, suggested visibility effects imply that investors, often hindered from objective insights into the internal workings of firms, use heuristics to substitute for such insights. Thus, firm managers should acknowledge that investor may use heuristics to form judgments of complex processes (such as the capital allocation process) that may drive firms share prices.

For scholars, the main implication may be to avoid assuming that overinvestment (as defined by existing measures) has negative implication for diversified firm performance. Instead, selective overinvestment based on private information not shared by markets may, at least temporarily, be supportive of firm performance and lead to higher share prices. Ultimately, however, incongruence between theories suggesting negative performance implications of overinvestment and opposite empirical results needs to be reconciled with a better measure of capital allocation errors. That is, a measure based not on the distance between actual allocations and average levels of

investment, but between actual allocations and optimal levels is needed. Thus, scholars may want to focus on constructing models for calculating firm specific optimal levels of capital allocation that could subsequently become a starting point for estimating capital allocation errors. Further, scholars may also want to acknowledge and incorporate into models predicting performance that heuristics, often used to interpret, predict, and judge overall firm performance, may also be used by investors to judge the performance and rationality of more fine-grained corporate level process in the diversified firm. That is, investors may use heuristics to judge the efficiency of the capital allocation process. Thus, to obtain a more thorough understanding of how the capital allocation process affects firm performance, scholars may be well advised to study how investors not only use heuristics to judge the effectiveness of the capital allocation process, but also how those heuristics affect share prices, the latter to get a more complete picture of how capital allocation errors (or the absence of such errors) affect firm value.

With regards to underinvestment, I find some evidence that underinvestment in relatively better performing business segments is positively associated with diversified firm value, meaning that underinvestment tends to increase actual firm value in relation to a firm's hypothetical value if no underinvestment existed. Although I am hesitant to draw conclusions based on this finding because it was not consistently supported in my analysis, the value-increasing effect of underinvestment still supports my theoretical argument that over and underinvestment should be treated as two separate capital allocation errors with independent effects on firm performance. That is, since

overinvestment clearly is a different construct from underinvestment[35], researchers should no longer continue to assume that they are dependent, or that underinvestment automatically follows overinvestment as has been common practice in the literature on capital allocation (e.g., Berger & Ofek, 1995). Instead, each can exist on its own with independent effects on diversified firm value.

Performance Implications on Firm ROA

Inefficiencies in the capital allocation process also explain significant variance in firm ROA. In fact, compared to associations between capital allocation efficiency and diversified firm value, associations with firm ROA are more in line with predicted results. That is, underinvestment has consistently negative performance implications by reducing firm return on assets, while overinvestment also reduces firm ROA, just not as consistently across all measures and scalars. This inconsistency in results between overinvestment and firm ROA may be due to, as previously suggested, the hurdle rate for overinvestment set too low, allowing instances of optimal allocation to be characterized as overinvestment which, if true, could potentially account for the inconsistency of overinvestment findings.

Performance Implications on Corporate Effects

Finally, capital allocation efficiency also explains significant variance in business segment ROA and the corporate effect. Inefficiencies (over and underinvestment

[35] The difference between the two constructs becomes evident when considering that well-performing segments cannot overinvest while under-performing segments cannot underinvest. Therefore, a firm may have only well-performing (underperforming) segments in its portfolio which makes overinvestment (underinvestment) impossible. In addition, there are additional uses of capital (e.g., buy-backs of company shares, mergers & acquisition activity) that cash-rich firms can pursue instead of automatically allocating excess capital to business segments.

combined into one measure) based on external reference points explain between 11.80% and 11.96% of level 1 (time-level) variance and between 7.42% and 7.52% of total variance depending on scalar. Thus, capital allocation errors explain significant variance in business segment performance.

This variance, however, is not stable across time and may therefore not be recognized as variance related to the corporate effect. That is, corporate effects have traditionally been viewed as stable effects (e.g., McGahan & Porter, 1997), or performance differences between firms that are invariant over longer periods of time. A more contemporary way of viewing corporate effects, however, may be to recognize that corporate level influences may also be dynamic, something first suggested by Adner and Helfat (2003). Thus, according to that more contemporary view and logic, inefficiencies in the capital allocation process, accounting for substantial variance in year-to-year variations of business segment ROA should be viewed as a "dynamic" type of corporate effect.

Considering the evidence of associations between capital allocation errors and business segment performance, individual effects of over and underinvestment can be used to differentiate between over and underinvestment, and to determine exactly what drives the overall effect of allocation errors on business segment performance. Interestingly, only overinvestment corresponds with the previous finding, i.e., exhibiting a negative association with business segment performance. Underinvestment, on the other hand, seems to have a positive effect on business segment performance as evidenced by a positive association in a few models. The discrepancy in effects between over and underinvestment poses an interesting question for future extension of this dissertation –

why does overinvestment, but not underinvestment affect business segment performance and the corporate effect in the hypothesized direction? One possible reason subject to future verification may be that the level of business segment variance is different between firms in the two categories – overinvesting firms may have segments with higher variance in their segment returns as compared to firms that underinvest. This will be elaborated on in the next section.

Associations involving segment return variance also warrant further attention. The question of whether the level of segment return variance biases the variance decomposition process has been much debated in the literature (e.g., Bowman & Helfat, 2001: Adner & Helfat, 2003), with as of yet, no agreement or even a single empirical test of this potential bias. I, however, find evidence that the level of segment return variance has the potential to bias estimates of corporate effects. That is, significant direct effects of allocation errors suddenly become nonsignificant as segment return variance is added to the model. In addition, I find evidence of an interaction effect between capital allocation errors and segment return variance as the interaction explains variance up and above the explanatory power of each component. Thus, this supports researchers questioning the variance decomposition methodology (e.g., Bowman & Helfat, 2001: Adner & Helfat, 2003: Brush, Bromiley & Hendrickx, 1999), and suggests that future variance decomposition research may need to control for the variance of segment returns within firms as to not bias regression coefficients and results.

As mentioned earlier, it is possible that this bias could help explain the discrepancy between over and underinvestment and their individual effects on business segment performance. Suppose segments with poor prospects that overinvest tend to

belong to firms with relatively high variance of their segment returns, while segments with relatively better prospects that underinvest tend to belong to firms with relatively lower variance of their segment returns. In that case, the discrepancy in effects of over and underinvestment may be partly driven by the variance of underlying segment returns – they strengthen the association between overinvestment and business segment performance, while weakening the association between underinvestment and business segment performance. This explanation will be investigated in future extensions of this dissertation.

Antecedents to Capital Allocation Efficiency

The analysis of antecedents to capital allocation efficiency offers several findings that contribute to our understanding of what drives and determines the efficiency of the capital allocation process. From those findings, several implications emerge.

First, managers in charge of allocating capital are not only affected by considerations tied directly to the decision at hand, but also by their aspirations for business segment performance in combination with current performance. Consistent with predictions, aspirations for such performance have powerful effects on the capital allocation decision. Shortfalls in relation to aspirations for segment performance tend to increase investment levels leading to overinvestment in poorly performing business segments. This result holds true for performance shortfalls in relation to both relative and to historical performance, which suggests that managers actively monitor and reacts to, not only segment performance relative to industry competitors, but also to prior performance of the particular focal segment.

Instances when current segment performance exceeds aspirations for such performance do not as hypothesized, however, lead to increased levels of underinvestment. Instead, my results suggest that managers exceeding their aspirations for segment performance may act in a more rational manner by reducing instances and magnitudes of underinvestment. At first glance, this may seem to contradict the referent-dependent logic underlying aspiration driven predictions of choice behavior. However, there may be other forces at work to partially, or fully, offset these aspiration driven influences. As previously discussed, organizations may have established routines (Nelson & Winter, 1982) in the form of strong norms or rules governing the allocation of capital (e.g., Bower, 1986: Shin & Stulz, 1998). That is, organizations may, for example, automatically raise allocations each year based on increases in cash flows or profits of the firm. Alternatively, as also suggested by previous research (e.g., Scharfstein & Stein, 2000), allocations may be tied to the cash flow of each individual business segment thus may increase when business segments generate more cash, and decrease when the generate less. Based on described norms and rules of allocation, allocations to well-performing business segments may increase each year accounting for this empirical result.

Second, although effects of agency-theoretical variables on the efficiency of the capital allocation process are somewhat disappointing, my results nonetheless demonstrate that large shareholders (block holders) may have the power and interest to affect allocations, and thereby the efficiency of the allocation process. The effect of block holders, however, is only partly in line with predictions and is therefore not consistently beneficial to owners by aligning interests, including reducing the risk differential (Coffee,

1988) between owners and protection-minded managers in charge of allocating capital. That is, I find evidence that block holders reduce levels and magnitudes of overinvestment, but that they seem to increase underinvestment at the same time. Thus, they are effective in loss contexts by reversing underlying managerial tendencies to allocate excess capital to relatively less well-performing segments, but not in gain contexts where they exacerbate protection-minded managerial tendencies to allocate insufficient amounts of capital to better performing segments by limiting investment in promising business segments. In effect, therefore, block holder's combined influence on the capital allocation process may be a general tendency to lower allocations – both when firms are overinvesting as well as when they are underinvesting in their respective segments.

The response of block holders to overinvestment, although consistent with predictions, is interesting because it can be viewed as contradicting the previously discussed positive association between overinvestment and diversified firm values. That is, block holders as an important share holder in most firms have a tendency to bid up share prices of diversified firms that are overinvesting, while at the same time working to lower allocations of the same firms. Notwithstanding that effects on diversified firm values are stronger and more consistent as compared to direct effects of block holders in antecedent models, this is an interesting contradiction in results that could be due to a number of reasons subject to future verification. First, the difference could be because of important differences between firms in the two models – diversified as well as non-diversified (single-segment and single-business) firms are allowed in antecedent models, but only diversified firms are allowed in diversified firm value models. Thus, it could be

that block holders favor overinvestment only in diversified firms, but not in less diversified firms. Results from the antecedent model supports this explanation as block holders only have an allocation-reducing effect in models where both diversified as well as non-diversified firms are included (e.g., models with external reference points). In fact, when only diversified firms are included (models with internal reference points), block holders have no effect on overinvestment. Second, the difference in block holder effect may also stem from the presumably two different functions being performed by block holders in the two models – investing in models investigating diversified firm value, but monitoring in antecedent models. In fact, it corresponds to the anomaly pointed out by a number of authors (e.g., Coffee, 1988) - agency theory presumes that share holders as investors are risk neutral, but that that they have less of a risk appetite (risk averse) as managers. Although monitoring is not necessarily the same as managing, there are important similarities in that large share holders are presumed to monitor managerial activity and intervene when managers act without their best interest in mind. Thus, my finding corresponds to agency-theory and predictions of how managers act in their dual roles as both investors and managers.

Limitations and Extensions

Limitations of this study are mainly related to my measures. In particular, measures of inefficiencies in the capital allocation process have limitations. Although the complexity of measuring the efficiency of a process (particularly one as complex as the capital allocation process) in an objective manner, the relative lack of prior work and guidance within capital allocation research, as well as the lack of studies using closer performance measures (as evidenced in many calls to study the performance of closer

processes, e.g., Adner & Helfat, 2003: Misangyi *et al.* 2006) may have contributed, there are specific limitations including the methodology underlying measures used that warrant further attention. Below, I will outline some of those limitations.

The common structure of capital allocation efficiency measures relying on reference points creates a number of problems related to empirical analyses. First, the reference point structure limits the number of instances of over and underinvestment that may be identified in any given sample. That is, firms are deemed to overinvest (underinvest) in a particular business segment only if two conditions are fulfilled: (1), that the business segment has below (above) median prospect as measured by a reference point, and (2), that the particular business segment receives more (less) capital as compared to the average investment of relatively higher (above median) and (lower) prospect segments[36]. In addition, measures are not sensitive to excessive investment in segments deemed to be above median prospects, nor are measures sensitive to excessive underinvestment in segments deemed to be below median prospect, which leaves out possible instances of capital allocation errors. Thus, measures of capital allocation efficiency may be too stringent in defining which business segments are committing capital allocation errors and which ones are not. Many firms, therefore, may be overinvesting as well as underinvesting in their different business segments, but may not be categorized that way potentially leading to overlooked instances of capital allocation errors. In fact, this probably contributed to insufficient sample sizes when modeling antecedents with internal measures of capital allocation errors. Although this limiting

[36] The logic underlying these measures dictates that some cut-off is used to differentiate between segments with high and low prospects. Because of the symmetry of over and underinvestment, this cut-off has to be at the 50th percentile or less. Thus, the current cut-off is the least restrictive that it could be while still retaining the logic of the measures. In fact, Berger and Ofek (1995) use a much more severe 25th percentile cut-off to differentiate between segments with high and low prospects.

influence on sample sizes may not bias results, it contributes to the difficulty of finding consistent evidence of associations between both antecedents and capital allocation errors as well between capital allocation errors and performance outcomes.

Another problem with the reference point construction of allocation measures is that internal measures are more restrictive than external measures. That is, internal measures only allow the inclusion of diversified firms, while external measures allow for the inclusion of both diversified and single-business firms. Although this difference between measures allows a comparison between effects of diversified versus single-business firms, it also strongly limits the number of useable observations in models with internal measures of allocation efficiency. In fact, this is the underlying reason why the number of observations was insufficient in antecedent models with internal allocation errors.

A third problem with the reference point construction is the inclusion of a high level of noise into the resulting measures. In particular, external measures of allocation errors assume that all segments in a particular industry have similar prospects. Although this is motivated by the difficulty of applying a measure of future prospects (e.g., Tobin's q) to business segments, this likely adds noise to my measures as within-industry differences between segment prospects are not reflected. This symmetrical assignment of prospects within industries may also contribute to lower variance of the measure itself. Thus, the additional noise and the lower variance, together, reduces useful variance and thereby further adds to the difficulty of achieving significant results when using measures of capital allocation efficiency in empirical analysis.

Finally, reference centric capital allocation measures are at risk of bias because they use the average level of capital allocation to determine whether a firm is allocating capital in an optimal manner, allocating too much, or not enough capital to its respective business segments. Thus, as previously described, this introduces the potential for bias since the rational or optimal level of capital allocation may not correlate with the average level used as a reference level in my measures of capital allocation efficiency. Therefore, if the reference level is not optimal, neither predictions involving antecedents and their effect on capital allocation efficiency, nor performance implications of such efficiency can be completely trusted. Thus, although my current measures of capital allocation errors are a worthwhile evolution from measures used by previous scholars (e.g., Berger & Ofek, 1995), they may still overlook many instances of firms committing capital allocation errors due to stringent threshold levels. In addition, they may also include much noise, be biased by the use of non-optimal reference points, and thereby also offer lower levels of useful variance to model.

My measures and their impact on the number of observations may also affect the ability to generalize my findings over a larger population of firms and segments. In particular, antecedent models may be susceptible to this issue because they include allocation (allocation errors) as well as aspiration measures – both of which create sharp losses of observations as the original sample is divided into appropriate groups for the purpose of hypotheses testing. That is, my sample is first divided into two groups of segments based on segment prospects – below median prospect segments are in one group to enable a test of overinvestment, while above median prospect segments are divided into a different group to enable a test of underinvestment. Within those groups,

segments are further divided into groups based on if current operating performance is above or below aspirations for such performance. Thus, two distinct groups of observations are formed depending on whether the test is for overinvestment (below median prospect and below performance aspirations), or for underinvestment (above median prospect and above performance aspirations). Observations not fitting either group are discarded. Therefore, allocation and aspiration measures necessitate a drastic reduction in observations as segments are divided into appropriate dissimilar groups to enable hypotheses testing. These groups are further reduced by the inclusion of other independent as well as control variables.

To assess a potential sample bias due to differences between firms and segments in my antecedent models versus the overall population of firms and segments, I performed three different t-tests comparing means of four firm and segment characteristics. In the first test, I compared means of variables in individual models of over and underinvestment (N=451-914) with means of the same variables in the population sample (N=30,039-53,465). In the second test, I compared means of variables in individual models of over and underinvestment (N=451-914) with observations specifically tied to only over or underinvestment (N=9,842-26,843). This was done to avoid comparing segments operating below (or above) median prospects with a population of segments operating both below and above median prospects. In the third test, I compared means of segments making allocation errors with the population means. This last test can be viewed as an alternative way of avoiding to compare segments operating below (or above) median prospects with a population of segments operating both below and above median prospects.

Results of the three tests (Table 17-19) suggest that means are not similar between my models of antecedents to capital efficiency and population derived comparison samples. That is, the alternative hypothesis (Ha) stating that means compared are significantly different from each other is supported in most cases. Implications of these tests with regards to the existence of a possible sample bias may, however, still be unclear for at least two reasons. First, in all three tests I compare distinct groups of segments with a largely ungrouped population of segments. When looking at underinvestment in the first test, for example, I compare segments with both better prospects and better performance (relative to the median segment and to competitor and/or historical performance, respectively), to all segments regardless of prospects and performance. When looking at underinvestment in the second test, I still compare a distinct group of segments with current performance above aspirations to a sample of segments performing both below as well as above performance aspirations. The third test looks at allocation errors (over and underinvestment together), and compares means to the full population of segments. This may be the most attractive test because it contains observations from both over and underinvestment together, but it still compares those two distinct groups to an ungrouped population. Thus, segments not being either below or above both reference levels are excluded from the comparison. In sum, all three tests have limitations because distinct groupings of segments are compared to a largely ungrouped population of segments. Therefore, since the division of segments is based on the dissimilarity of segments between groups, and because those groups are distinct from each other, it may be unrealistic to expect segments to be similar in other respects including those tested for.

Second, it is also unclear what level this test should be conducted at. On the one hand, the antecedent investigation is at the business segment level as the dependent variable is measured at the lowest level. On the other hand, antecedents are at all three levels (industry, firm, and segment) – thus, should the burden of the test rest on the similarity of segments, or the firms that those segments belong to? Put differently, similarity between firms may not matter when looking at segment-level influences, while similarity between segments may not matter when looking at firm-level influences. Closely related to this is the added caveat that segment prospects are assigned based on industry prospects, which could increase segment similarity within, but not between industries.

Furthermore, the first problem of comparing distinct groups to a largely ungrouped population may indeed be difficult to solve as the population of segments cannot be made to replicate model groupings without actually replicating the models themselves. Thus, even after performing the described tests, the possibility remains that a sample bias exists and that I therefore may not be able to generalize my findings to a larger population of firms and segments[37].

What I can do, however, is to generalize my theoretical conclusions (Mook, 1983), which may further our understanding of the capital allocation process. That is, I have argued theoretically and shown empirically that behavioral antecedents affect allocation efficiency, and I can generalize those conclusions to the capital allocation

[37] The ability to generalize my findings over a larger population of segments and firms may also be affected by the limited number of observations available for R & D intensity. That is, firms, and by extension segments, report corporate level R & D spending only around 55 % of the time (Table 1). Although this caveat would affect all studies using R & D spending or similar variables, it suggests that my results may not generalize to select industries where R & D may be an unlikely expense such as for example retailing.

Table 17A. Independent sample T-tests (Antecedents to Overinvestment, population)

T-test/Model	Table 5A: Model 2A-4A	Table 5A: Model 5A-7A	Table 5B: Model 2B-4B	Table 5B: Model 5B-6B	Table 5B: Model 7B
	N=660	N=481	N=660	N=482	N=587
Segment ROA					
$Mean_{model}$, $Mean_{N=50,230}$	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00
Organization size					
$Mean_{model}$, $Mean_{N=53,465}$	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00
R & D intensity					
$Mean_{model}$, $Mean_{N=30,039}$	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.01	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.01	Ha: Diff !=0, p<0.00
Cost of capital					
$Mean_{model}$, $Mean_{N=46,135}$	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00

Table 17B. Independent sample T-tests (Antecedents to Underinvestment, population)

T-test/Model	Table 6A: Model 2A-4A	Table 6A: Model 5A-7A	Table 6B: Model 2B-4B	Table 6B: Model 5B-7B
	N=465	N=909	N=451	N=914
Segment ROA				
$Mean_{model}$, $Mean_{N=50,230}$	Ha:Diff !=0, p<0.00	Ha:Diff !=0, p<0.00	Ha:Diff !=0, p<0.00	Ha:Diff !=0, p<0.00
Organization size				
$Mean_{model}$, $Mean_{N=53,465}$	Ha:Diff !=0, p<0.41	Ha:Diff !=0, p<0.00	Ha:Diff !=0, p<0.36	Ha:Diff !=0, p<0.00
R & D intensity				
$Mean_{model}$, $Mean_{N=30,039}$	Ha:Diff !=0, p<0.86	Ha:Diff !=0, p<0.01	Ha:Diff !=0, p<0.67	Ha:Diff !=0, p<0.01
Cost of capital				
$Mean_{model}$, $Mean_{N=46,135}$	Ha:Diff !=0, p<0.36	Ha:Diff !=0, p<0.43	Ha:Diff !=0, p<0.35	Ha:Diff !=0, p<0.42

Table 18A. Independent sample T-tests (Antecedents to Overinvestment, limited population)

T-test/Model	Table 5A: Model 2A-4A	Table 5A: Model 5A-7A	Table 5B: Model 2B-4B	Table 5B: Model 5B-6B	Table 5B: Model 7B
	N=660	N=481	N=660	N=482	N=587
Segment ROA					
$Mean_{model}$, $Mean_{N=23,820}$	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.01	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.01	Ha: Diff !=0, p<0.00
Organization size					
$Mean_{model}$, $Mean_{N=26,519}$	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00
R & D intensity					
$Mean_{model}$, $Mean_{N=9,842}$	Ha: Diff !=0, p<0.06	Ha: Diff !=0, p<0.89	Ha: Diff !=0, p<0.06	Ha: Diff !=0, p<0.89	Ha: Diff !=0, p<0.00
Cost of capital					
$Mean_{model}$, $Mean_{N=20,859}$	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00

Table 18B. Independent sample T-tests (Antecedents to Underinvestment, limited population)

T-test/Model	Table 6A: Model 2A-4A	Table 6A: Model 5A-7A	Table 6B: Model 2B-4B	Table 6B: Model 5B-7B
	N=465	N=909	N=451	N=914
Segment ROA				
$Mean_{model}$, $Mean_{N=25,200}$	Ha:Diff !=0, p<0.00	Ha:Diff !=0, p<0.00	Ha:Diff !=0, p<0.00	Ha:Diff !=0, p<0.00
Organization size				
$Mean_{model}$, $Mean_{N=22,772}$	Ha:Diff !=0, p<0.83	Ha:Diff !=0, p<0.00	Ha:Diff !=0, p<0.25	Ha:Diff !=0, p<0.00
R & D intensity				
$Mean_{model}$, $Mean_{N=12,754}$	Ha:Dif f !=0, p<0.00	Ha:Diff !=0, p<0.00	Ha:Diff !=0, p<0.00	Ha:Diff !=0, p<0.01
Cost of capital				
$Mean_{model}$, $Mean_{N=15,209}$	Ha:Diff !=0, p<0.31	Ha:Diff !=0, p<0.35	Ha:Diff !=0, p<0.35	Ha:Diff !=0, p<0.41

Table 19. Independent sample T-tests (Antecedents to Allocation errors, population)

T-test/Model	Table 5A and 6A: Model 2A-4A	Table 5A and 6A: Model 5A-7A	Table 5B and 6B: Model 2B-4B	Table 5B and 6B: Model 5B-6B	Table 5B and 6B: Model 7B
	N=1125	N=1390	N=1111	N=1396	N=1501
Segment ROA					
$Mean_{model}$, $Mean_{N=50,230}$	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00
Organization size					
$Mean_{model}$, $Mean_{N=53,465}$	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00
R & D intensity					
$Mean_{model}$, $Mean_{N=30,039}$	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00	Ha: Diff !=0, p<0.00
Cost of capital					
$Mean_{model}$, $Mean_{N=46,135}$	Ha: Diff !=0, p<0.51	Ha: Diff !=0, p<0.56	Ha: Diff !=0, p<0.51	Ha: Diff !=0, p<0.56	Ha: Diff !=0, p<0.59

process. In particular, current performance in relation to performance aspirations may have distinct effects on the level of efficiency of the capital allocation process. Thus, although I cannot say exactly under what circumstances and contexts this may happen, it could happen, which may make it necessary for future research to include behavioral antecedents when studying capital allocation efficiency in firms. In addition, my conclusions may also add to our understanding of how the allocation process may impact a number of well-defined performance outcomes for firms. For example, based on my theoretical arguments and empirical findings tying capital allocation efficiency with both corporate effects and diversification discounts, researchers working in those areas may need to consider the impact of capital allocation efficiency not to "underspecify" their theoretical as well as empirical models.

To overcome many of the measure-related limitations and to assure continued theoretical and empirical progress within capital allocation research, a new approach to measuring capital allocation efficiency may be necessary. Such approach should be centered on a theory-driven optimal level of investment instead of being centered, as is currently the case, on empirically observed average levels of actual allocated capital. Within such a framework, a baseline optimal level of capital investment could be calculated for each firm that would be congruent with each firms' idiosyncratic environment. That optimal level of capital investment could subsequently be broken down into individual allocations to business segments. Thus, deviations from that optimal allocation could be measured and translated into a more continuous measure of capital allocation errors. This approach would likely generate additional instances of capital allocation errors since previously unaccounted for instances will now be accounted for.

For example, overinvestment in relatively better performing segments, as well as underinvestment in relatively worse performing segments could now be accounted for. In addition, since these new theory-driven measures of capital allocation efficiency are based on optimal levels of capital allocation, they may be both more precise and less likely to be afflicted with biases compared to existing measures.

This new framework for measuring allocation errors would enable a number of important extensions of the capital allocation literature. First, it allows an investigation into optimal levels of capital allocation. That is, I have presented some evidence that average levels of allocated capital in my sample may be too low as additional allocations often lead to increased firm values. Thus, this opens up an interesting avenue for future investigation assuming optimal levels can be established. Second, with more precise measures of capital allocation efficiency, offering additional power in empirical analysis, additional antecedents and more complicated structures of antecedents could be investigated with increased precision. In particular, future scholars could investigate interesting interactions not only between corporate and environmental factors following this dissertation, but also between the corporate level factors themselves. For example, in line with Devers *et al.*, (2008), scholars could investigate how individual parts of CEO pay packages (e.g., cash pay, stock options, and restricted stock) may interact in complex ways to affect managerial risk preferences, thereby also potentially affecting the efficiency of the capital allocation process.

Third, more precise and efficient measures of capital allocation efficiency would also increase the power and reach of investigations into performance outcomes of capital allocation efficiency. In particular, closer performance outcomes (other than diversified

firm value and the corporate effect) that are derivatives of more traditional accounting and market based measures may become possible, or at least easier, to model with better measures of allocation efficiency. In addition, it may also become possible to estimate relationships between the capital allocation process and other processes, allowing for a more fine-grained insight into the internal workings of the firm.

A final benefit of this new framework would be a stronger link between applicable theory and empirical results. That is, less noisy, more bias-free and efficient measures closely linked with an optimal capital allocation process may be more likely to produce results corresponding with applicable theory. Thus, empirical studies of capital allocation errors will be more likely to show consistent and unambiguous results across different samples, types of error (over and underinvestment), and scalars used. In addition, the increased empirical power stemming from more efficient measures could be used to test more advanced theoretical models looking at possible relationships between antecedents and performance outcomes of capital allocation efficiency not only across industries, but also within individual industries.

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