Corporate Diversification, Investment Flexibility and Internal Capital Markets

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Abstract

The objective of this thesis is to understand the effect of corporate diversification on the selection of growth options with relevant implications for firm value. This is achieved by undertaking a theoretically grounded empirical analysis in three separate empirical studies, namely the "investment flexibility" of diversified firms in the selection of growth options, the impact of "financial constraints" that arise from the efficiency of internal capital markets, and finally, the implications of both investment flexibility and the efficiency of internal capital markets for firm value in the context of global diversification.

The first study examines the "investment flexibility" of diversified firms in the selection of growth options versus focused firms. Investment flexibility points to the ability of a firm to manage its systematic risk by optimally selecting and exercising growth options available to it. In a portfolio context, the scope of growth options accessible to a firm is constrained to the business segments in which it participates. Firms participating in a larger number of business segments can opportunistically select growth options to optimize the systematic risk of its cash flows from capital investments. Consistent with this interpretation, empirical results show that diversified firms have more investment flexibility than focused firms to select growth options with lower systematic risk. However, the benefits of investment flexibility are limited to states when both diversified and focused firms have few growth options available.

The second study discusses the implications for firm value due to financial constraints attributable to the efficiency of an internal capital market (ICM) within a diversified firm. ICMs offer the advantage of relaxing financial constraints for capital investment through the avoidance of costly external capital markets. ICM are also criticized for funding inefficient investment due to the insulation of management from the discipline of external financial

markets. Recent studies show that financial constraints are a source of risk that is priced in stock returns. This suggests a positive constraints-return relation between the efficiency of a diversified firm's ICM and stock returns. Empirical results confirm this relation and show that ICM efficiencies are priced in asset markets. In addition, firm characteristics such as total asset growth and asset tangibility are documented to have a positive and significant relation with ICM efficiency. In contrast, a significantly negative relation between ICM efficiency and intangible assets is documented.

Finally, the third study examines the implications that both investment flexibility and financial constraints arising from ICM efficiency have for firm value within the context of global diversification. Hypothetically, global diversification potentially enhances investment flexibility as firms can select growth options from both a variety of industries and geographic markets. A lower correlation of internal funds due to the diversification benefit of cash flows from different countries could also potentially increase ICM efficiency. However, the results suggest otherwise. In comparison with firms that operate in only one geographic market, globally diversified firms do not have greater investment flexibility to select growth options with lower systematic risk nor do they have ICMs that are more efficient in reducing financial constraints. Consistent with observation that the global economy is economically and financially integrated, the evidence suggests that industry effects dominate country effects for both investment flexibility and ICM efficiency.

Statement by candidate

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other institution and affirms that to the best of the candidate's knowledge the thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

Wang Hung Yip Davin

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All errors in this thesis are my sole responsibility.

Dedication

This dissertation is dedicated to my wife, Daphne, and our two lovely children, Daniel and Dana. This journey would not have been possible without your loving support and encouragement. Thank you for your faith in me.

Chapter 1:
Introduction

1.1 Corporate diversification – a continued reality in the marketplace

The literature on firm diversification is voluminous and contains puzzling shifts over time. Overall, the effect of firm diversification on shareholder value is unclear. Since many of the arguments in the literature reflect to some degree changing managerial motivations for or against corporate diversification, it is useful to compare the evolution of the diversification debate with observations of marketplace trends over time.

The 1950s and '60s were characterised by massive corporate diversification programs soon to be followed by a "merger wave" in the late 1960s. Many theoretical arguments advocating corporate diversification stem from studies that examined the merger wave during this time. Diversified corporate empires were built primarily through acquisition and merger activities with an emphasis on the value adding benefits of diversification. For example, Matsusaka (1993) examines takeover motives during the conglomerate merger wave and reports that acquisitions were not driven by managerial private benefit but by managerial synergies which increased firm value. Hubbard and Palia (1999) argue that corporate diversification was a viable corporate strategy in the 1960s as internal capital markets that were formed mitigated the information costs associated with the less-well-developed external capital market of the time.

Similarly, Weston (1970), Lewellen (1971) and Chandler (1977) suggest that diversified firms provide more efficient operations and more profitable lines of business than stand-alone firms because they have the ability to leverage economies of scale. Examples of such scale economies include (i) managerial economies of scale, (ii) economies of scope in production and marketing, and (iii) financial synergies such as earnings smoothing and the efficiencies that arise with an internal capital market. Overall, these studies suggest that companies realized value enhancing benefits from diversification strategies.

However, by the 1980s, a change in both academic and corporate opinion suggested that the post-war movement toward increased corporate diversification had ended and a new trend towards corporate focus had begun. The 1980s saw a wave of consolidating mergers aimed at undoing the conglomeration of the previous two decades (see Shleifer and Vishny (1989)). In the marketplace, managerial ambitions to focus businesses were declared. It was not uncommon for assets of diversified target companies to be sold off to management or firms in related industries (see Bhagat, Shleifer, Vishny, Jarrel and Summers (1990)). Separately, many firms embarked on corporate programs which divested unrelated assets that were not core to company's operations (see Kaplan and Weisbach (1992)).

Correspondingly, the literature saw an increased emphasis on explaining why the costs of firm diversification outweighed any potential benefits. For example, Comment and Jarrell (1995) suggest that the trend towards corporate focus confirmed the failure of diversified firms to exploit financial economies of scope such as the coinsurance of debt (see Lewellen (1971)) or the substitution of internal capital markets for costly external capital markets.[1] Likewise, John and Ofek (1995) report that firms that increased focus through the divestment of assets saw an improvement in the operating performance of remaining assets.

Since then, much of the conventional wisdom among finance scholars suggests that corporate diversification destroys value. For example, Lang and Stulz (1994) and Berger and Ofek (1995) compare business segments in diversified firms with industry medians of focused firms and report that the shares of the typical diversified firm sell at a discount relative to those of single-segment (focused) firms. The authors decompose diversified conglomerate firms into their constituent industry segments and value these segments separately in comparison with corresponding single-segment industry peers. A

[1] Lewellen (1971) suggests that corporate diversification reduces the variability of earnings which leads to increases in debt capacity by reducing expected default rates. The use of more debt by diversified firms due to a reduction in default rates is known as the "coinsurance of corporate debt."

"diversification discount" is reported when the comparative valuation of the diversified firm is less than an equivalent portfolio of single-segment firms operating in the same industries.[2]

However, there are reasons to believe that the diversification debate is yet ripe for another twist back towards a bias for corporate diversification. Recent studies in the literature contradict earlier findings of a diversification discount by documenting evidence of measurement error, data sample bias and even a "diversification premium" (Campa and Kedia (2002);Villalonga (2004a); Villalonga (2004b); Jandik and Makhija (2005), among others). In contrast to agency explanations that depend on empire building to explain a diversification discount, there is also recent evidence that the investment policies of diversified firms are optimal (Maksimovic and Phillips (2002); Jandik and Makhija (2005)).

Perhaps the most important evidence that suggests that potential benefits of corporate diversification for firm value are likely to outweigh potential costs is found in the marketplace. The last three decades have witnessed burgeoning global commerce and financial exchange with the majority of U.S. firms remaining highly diversified. Montgomery (1994) reports, as late as 1992, that about two-thirds of Fortune 500 firms had at least five distinct lines of business.[3] The significance of this finding by Montgomery (1994) is underscored by her observation that the 500 largest U.S. public companies sold $3.7 trillion worth of goods and services, or approximately 75 percent of the output of all U.S. public companies.

Echoing this observation, Martin and Sayrak (2003) document that, between 1990 to 1996, diversified firms accounted for nearly 50% of all U.S. employment and owned about 60% of total assets of all firms that were publicly traded on the stock exchanges. Hatfield,

[2] Conversely, a "diversification premium" is reported when diversified firms have a higher comparative valuation than an equivalent portfolio of focused firms.

[3] In addition, while Lichtenberg (1992) reported that the level of diversification declined between 1985 and 1989, Montgomery (1994) showed that diversification actually increased during this period for the 500 largest firms in the US.

Liebeskind and Opler (1996) record that even the diversified "conglomerate bust-up" wave of the 1980s resulted in lower rather than higher overall aggregate industry focus. Martin and Sayrak (2003) describe the end of the 20th century as a period with "record-breaking levels of mergers and acquisitions", and more importantly, a return to more diversified firms.

Clearly, the diversification debate remains an active and important one in both academia and the corporate boardroom. Diversified firms appear to be here to stay and will likely remain a dominant feature in the economic landscape. More importantly, academic findings and conclusions cannot be divorced from the reality that corporate diversification as a strategy continues to be embraced by managers. The task at hand then for finance scholars is to identify the reasons why.

1.2 Why do firms diversify?

Montgomery (1994) identifies three main theoretical perspectives that explain why a manager may select a corporate diversification strategy: agency theory, the resource based view, and market power. First, agency theory relies on the underlying assumption that managers have incentives to pursue corporate diversification strategies as long as their private benefits from diversification exceed their private costs. Private benefits include the power and prestige associated with managing a larger firm (e.g. Jensen (1988)), increased managerial compensation because compensation is directly related to firm size (e.g. Jensen and Murphy (1990)), "managerial self-preservation" (i.e. entrenchment) by making investments that require their particular skills via manager-specific investments (e.g. Shleifer and Vishny (1989)), or to reduce the risk of their personal investment portfolio by reducing firm risk since the managers cannot reduce their own risk by diversifying their portfolios (Amihud and Lev (1981)).

Second, the resource-based perspective supports the notion that firms embrace diversification so as to exploit excess capacities in resources and capabilities that are imperfectly tradable outside of the firm but are yet able to be used productively across different business segments within the firm.[4] This points to economies of scope whereby the diversified firm is an efficient form for organizing economic activities (see Penrose (1959)). For example, the firm may use the same marketing channel to market goods or services from a variety of business segments, or alternatively, use a common logistics and distribution network to deliver finished goods. Similarly, the firm may be able to utilize its corporate legal and financial staff to support a variety of different industries. In other words, firms are composed of organizational capabilities that can be profitably used in multiple businesses (see Matsusaka (2001) and Wernerfelt and Montgomery (1988)).

Finally, the third managerial motivation for corporate diversification is market power. Montgomery (1994) suggests that there are three ways in which conglomerates may yield power in an anti-competitive way: cross-subsidization, wherein a firm uses profits from one business segment to support predatory pricing activities in another; mutual forbearance, where firms competing simultaneously in multiple markets recognize their interdependence and collude to compete less vigorously; and reciprocal buying, where the interrelationships among large diversified firms foreclose markets to smaller competitors.

1.3 Research objectives of this thesis

The aim of this thesis is to study the impact of corporate diversification on the selection of growth options with relevant implications for firm value. This is done by undertaking three separate themes of study, namely the "investment flexibility" of diversified firms in the selection of growth options with varying systematic risk, the impact of "financial

[4] Teece (1980) points out that in order for a firm's resources or economies of scope to justify diversification, it has to be the case that those resources cannot be exchanged through a market mechanism.

constraints” due to the efficiency of internal capital markets, and finally, the implications of both investment flexibility and the efficiency of internal capital markets in the context of global diversification.[5]

Chapter 2 of this thesis examines the theme of “investment flexibility” in the selection of growth options in relation to firm value. Investment flexibility points to the ability of a firm to manage its systematic risk by optimally selecting and exercising growth options available to it. All things being equal, each firm is inherently endowed with some measure of investment flexibility limited only by the growth options uniquely available to it. In a portfolio context, the scope of growth options accessible to a firm is constrained to the business segments that it participates in. As such, the investment flexibility of diversified firms to select growth options from a cross-section of business segments allows it to optimize the systematic risk of its cash flows from its investments better than focused firms.

This line of reasoning is plausible for two reasons. First, subsequent to capital investment, the average systematic risk of a firm’s cash flow generated by assets created from capital investment depends on the underlying risk of the growth option exercised. In other words, the exercise of growth options with low (high) systematic risk results in less (more) risky cash flows with implication for firm value. Second, growth options are well documented in the literature to be an integral part of firm value (see Myers (1977), Myers and Turnbull (1977) and Majd and Pindyck (1987), among others).

Results from Chapter 2 show that, on average, focused firms earn economically and significantly higher future returns than diversified firms when few growth options are available, with no statistical difference in return spreads when both focused and diversified firms have many growth options. The findings are robust to a variety of growth option

[5] Global diversification refers to corporate diversification across different national markets, while industrial diversification refers to diversification across multiple business segments.

proxies, diversification measures and portfolio variations. Overall, the findings support the suggestion that managers of diversified firms have the investment flexibility to optimally choose growth options with lower systematic risk. However, the benefits of investment flexibility are limited to states when both diversified and focused firms have few growth options available.

Chapter 3 discusses implications that financial constraints arising from the efficiency of an internal capital market (ICM) have for firm value. The focus of the extant corporate finance literature has been primarily on the debate about whether the relaxation of financial constraints by ICMs is efficient (value-creating) or inefficient (value-destroying). Recent works in the asset pricing literature such as Whited and Wu (2006) and Livdan, Sapriza and Zhang (2009) show that financial constraints present a source of risk that is priced in stock returns. This is described by a positive relationship between financial constraints and stock returns. The question remains whether ICM efficiencies are priced in asset markets. In other words, do ICM efficiencies affect stock returns, and if so, what are the potential drivers for the availability of internal funds that are reallocated in an internal capital market?

The findings from the study show that diversified firms with inefficient ICMs have positive and significantly larger returns than firms with efficient ICMs. The findings suggest that cross-sectional differences in corporate investment behaviour due to financial constraints arising from internal capital market efficiencies are reflected in the stock returns of diversified firms. In addition, firm characteristics such as total asset growth and asset tangibility are documented to be persistent and significant drivers of ICM efficiency. These findings are interpreted as evidence that ICM efficiencies are sensitive to changes in the collateral value of a firm’s existing and new assets which can be used to generate funds through collateralized financing.

Finally, Chapter 4 looks at the implications of both investment flexibility and financial constraints in the context of global diversification. There is reason to believe that global diversification improves the investment flexibility of industrial firms by enabling them to select growth options from not only a variety of industries but also across country markets. In addition, the correlation of funds available in an internal capital market is reduced due to the diversification benefit of having cash flows from different countries.

The results show that globally diversified firms do not have any incremental benefit over industrial firms that have operations concentrated in one country. The evidence is also supportive of findings in the literature that suggest industry specific factors, as opposed to country specific effects, are drivers of any benefit for corporate diversification.

1.4 Motivation for the research

The literature on corporate diversification is voluminous, diverse and quite old. Despite this, contradictions in reported studies on the value effect of corporate diversification suggest that new approaches to the diversification debate are required. One motivation for this research is to examine the link between corporate diversification and growth options as an alternative approach. Little research has been done specifically in this area.[6] To the best of my knowledge, this thesis is believed to be the first extensive study on the relation between corporate diversification, growth options and the unique properties of diversified firms.

More importantly, a constant challenge facing academic research is the reconciliation of scholarly findings with marketplace realities. In other words, the diversification literature cannot ignore the possibility that existing explanations have been inadequate in addressing

[6] Bernardo and Chowdhry (2002) and Stowe and Xing (2006) are examples of two attempts to relate the corporate diversification to growth options. There is otherwise limited work specific to this area.

the persistence and continued success of diversified firms in the economic landscape. This challenge serves as another motivation for this thesis.

If the relationship between corporate diversification and growth options is understood, then more can be done to inform the debate on reasons why diversified firms continue to thrive and increase in number. As such, research that has empirical results based on established theory and which is broadly consistent with the literature offers valuable contributions to the diversification debate. This serves as another source of motivation which is achieved by considering aspects of both the corporate finance and asset pricing literature.

The choice to embrace a strategy of corporate focus or diversification has also become a matter of increasing importance to managers. Improved logistical connectivity, reduced political and trade barriers as well as increased domestic competition have altered the relative costs and benefits of corporate diversification. In addition, access to limited growth opportunities within a domestic market coupled with an influx of foreign competitors have increased the urgency for managers to seek new avenues for value adding capital investment.

Consequently, managers are increasingly forced to decide between being focused in one business segment, or diversified, regardless of whether the decision is to diversify across industry segments (industrial diversification) or national markets (global diversification). Therefore, a practical motivation for this research is to facilitate decision making by managers by informing them on potential implications that a corporate diversification strategy may have for the firm, and ultimately shareholder value.

1.5 Thesis structure

The thesis is structured as follows: Chapter 2 investigates the investment flexibility of diversified firms versus focused firms. Chapter 3 examines the implications for firm value due to financial constraints arising from the efficiency of an internal capital market (ICM). Chapter 4 analyses the implications of both investment flexibility and the efficiency of internal capital markets in the context of global diversification. Chapter 5 concludes.

Chapter 2:

Corporate Diversification, Investment Flexibility and Growth Options

2.1 Introduction

Conventional wisdom among finance scholars suggests that corporate diversification destroys shareholder wealth such that the shares of diversified firms sell with an associated "diversification discount". For example, the seminal papers of Lang and Stulz (1994) and Berger and Ofek (1995) report that the shares of the typical diversified firm sell at a discount relative to those of single-segment (focused) firms by comparing business segments in diversified firms with the corresponding single-segment industry median.[7] Since then, a number of studies have replicated findings of a diversification discount with much emphasis placed on potential explanations for the anomaly. However, recent work contradicts earlier findings by documenting evidence of measurement error, data sample bias and even a diversification premium (Campa and Kedia (2002);Villalonga (2004a); Villalonga (2004b); Jandik and Makhija (2005), among others). Overall, the validity of a diversification discount and reasons for its presence remains actively debated in the corporate finance literature.

Perhaps the most glaring contradiction against the notion that corporate diversification destroys firm value is the fact that many successful companies continue to embrace a diversification strategy in the marketplace. This observation, coupled with conflicting findings of measurement error and a diversification premium, suggests that a new approach towards understanding the relation between corporate diversification and firm value is necessary. For example, Stowe and Xing (2006) are among the first to suggest that the diversification discount could be a manifestation of differing growth options between diversified and focused firms. The rationale is that if available growth options are different, then the methodology of comparing business segments in diversified firms to the industry

[7] The authors decompose diversified conglomerate firms into their constituent industry segments and value these segments separately in comparison with corresponding single-segment industry peers. A "diversification discount" is reported when the comparative valuation of the diversified firm is less than an equivalent portfolio of single-segment firms operating in the same industries. In the case where diversified firms have a higher comparative valuation, a "diversification premium" is then found.

medians of focused firms is flawed. Using a sample of diversifying firms, they find evidence that focused and diversified firms have differing growth options but argue that its contribution to the diversification discount, if any at all, is at best trivial.

This study investigates the effect of corporate diversification by relating the "investment flexibility" of a firm in the selection of growth options to implications for its market value. Investment flexibility points to the ability of a firm to manage its systematic risk by optimally selecting and exercising growth options available to it. Investment flexibility has implications for firm value because the average systematic risk of a firm's cash flow from its assets subsequent to capital investment intrinsically depends on the associated growth option exercised.

All things being equal, each firm is inherently endowed with some measure of investment flexibility limited only by the growth options uniquely available to it. In a portfolio context, the scope of growth options accessible to a firm is constrained to the business segments that it participates in. Growth options within a specific business segment are highly correlated given the common dependence on the fortunes of a single business segment. As such, the investment flexibility of diversified firms to select growth options from a cross-section of business segments allows it to optimize the systematic risk of its cash flows from its investments better than focused firms. Assuming that growth options with low systematic risk are attractive, this leads to the testable prediction that diversified firms have lower future returns than focused firms because they can select growth options with the lowest systematic risk from all the business segments that they operate in.

This line of reasoning is viable because growth options are well documented in the literature to be an integral part of firm value (see Myers (1977), Myers and Turnbull (1977) and Majd and Pindyck (1987), among others). In addition, recent evidence from Danbolt, Hirst and Jones (2002) suggests that the present value of growth options account for more than 50% of company market value.

Using a data sample of 96,169 firm-year observations from the CRSP/Compustat Merged Database (CCM) over the sample period beginning in 1979 and ending in 2010, this study provides new evidence that diversified firms have more investment flexibility than focused firms to select growth options with lower systematic risk. On average, focused firms earn economically and significantly higher future returns than diversified firms when few growth options are available, with no statistical difference in return spreads between focused and diversified firms when both types of firms have many growth options. The findings are robust to variety of growth option proxies, diversification measures and portfolio variations. Overall, the findings support the notion that managers of diversified firms have more investment flexibility to optimally choose growth options with lower systematic risk. However, another important finding is that the benefits of investment flexibility are limited to states when both diversified and focused firms have few growth options available.

Another noteworthy aspect of this study is that the results are broadly consistent with findings in both the corporate finance and asset pricing literature. These include a link between growth options and the firm value (see Myers (1977)), a significantly negative and persistent relation between asset growth and stock returns (see Cooper, Gulen and Schill (2008); Gray and Johnson (2010); Li, Becker and Rosenfeld (2010), among others), a link between systematic risk and total asset growth (see Cooper and Priestley (2011) and the explanatory role that the turnover in firm assets has for firm value (see Berk, Green and Naik (1999)) to name a few.

Several key contributions are made as well. In their study, Stowe and Xing (2006) report that the diversification discount cannot be explained by differing growth options between diversified and focused firms. Similarly, this study examines the link between corporate diversification and growth options. However, a new perspective is the rationale for why the participation in differing business segments contributes to the differing growth options with varying levels of systematic risk. More importantly, this study suggests that the investment flexibility of diversified firms to select growth options with lower systematic risk might account for the difference in firm value when compared to focused firms.

Contributions are also made to the asset pricing literature. There is an argument that the asset growth effect is a result of mispricing. For example, Cooper, et al. (2008) show that standard models of risk, such as the three-factor model of Fama and French (1993) and four-factor model of Carhart (1997), have difficulty in explaining the variation in returns associated with asset growth portfolios. In a recent paper, Gray and Johnson (2010) test the asset growth effect in Australian stock returns and document its presence. Using a two-stage cross-sectional regression methodology to test if asset growth is a risk factor, they find no evidence to support a risk-based explanation. Overall, both Cooper, et al. (2008) and Gray and Johnson (2010) suggest that the asset growth effect is attributable to mispricing.

More recently, work by Cooper and Priestley (2011) contradicts these findings by showing that the negative relation between asset growth and average stock returns is driven by risk. Central findings from their study are summarized as follows. First, by using the Chen, Roll and Ross (1986) factors as common risk factors driving the pricing kernel, empirical results show that the average return spread between low and high asset growth and investment portfolios is accounted for by their spread in systematic risk. Second, as predicted by q-theory and real options models, systematic risk falls during periods of high investment (high asset growth). Third, the asset growth factor can predict real economic activity. Specifically, asset growth is positively related to future real industrial production growth, real GDP growth, real earnings growth, and the growth rate of real aggregate investment.

Although Cooper and Priestley (2011) show convincingly that the negative relation between asset growth and returns is driven by changes in systematic risk, the authors do not give an explanation for why this occurs. This study extends their work in two ways. First, based on findings from past theoretical and empirical work, the use of asset growth as a growth option proxy explains the changes in systematic risk proposed by studies such as Berk, et al. (1999), Gomes, Kogan and Lu (2003) and Carlson, Fisher and Giammarino (2004). Second, this study provides a novel platform to test this interpretation. The investment flexibility of a firm, as determined by its diversification across different business segments, is shown to have significant influence on the ability of a firm in being able to manage the average systematic risk of its assets-in-place.

The chapter is organized as follows. Section 2 discusses the linkages between corporate diversification, growth options and firm value. Section 3 describes the sample selection criteria and introduces the measures of diversification and asset growth. Section 4 presents the empirical results. Section 5 concludes.

2.2 Related literature

2.2.1 The diversification debate – diversification discount or premium?

How does corporate diversification affect firm value? The impact of corporate diversification on stock returns has been the subject of an active debate in the corporate finance literature. At the heart of the debate is evidence of a "diversification discount" that suggests diversified firms trade at a discount in comparison to their focused peers. The seminal studies of Lang and Stulz (1994) and Berger and Ofek (1995) decompose diversified firms into constituent industry segments and value these segments by comparing them with the median valuation of focused firms in the same industry. Empirical evidence from both studies suggests that the typical diversified conglomerate is undervalued and selling at a discount compared to a collection of comparable single-segment firms. More importantly, evidence of a diversification discount suggests that corporate diversification has value destroying consequences for firm value.

Subsequent to the findings of Lang and Stulz (1994) and Berger and Ofek (1995), the emphasis of much research has been on explaining the diversification discount. The main thrust of most arguments suggests that diversified firms are subject to greater agency problems than focused firms. The underlying assumption is that managers have incentives to pursue corporate diversification strategies as long as their private benefits from diversification exceed their private costs. Private benefits include the power and prestige associated with managing a larger firm (e.g. Jensen (1988)), increased managerial compensation because compensation is directly related to firm size (e.g. Jensen and Murphy

(1990)), or "managerial self-preservation" because diversification makes the manager indispensable to the firm (e.g. Shleifer and Vishny (1989)).[8]

More recently, a growing body of research suggests that the diversification discount is not due to diversification at all but is rather an artefact of either measurement error or sample bias. In contrast to earlier findings, some studies even report evidence of a "diversification premium". For example, Whited (2001) suggests that prior work establishing a link between the diversification discount and inefficient allocation of capital expenditures suffers from measurement error due to the use of Tobin's q as a proxy for growth options. By accounting for measurement error in q, Whited (2001) refutes work linking inefficient allocation of investment and the diversification discount.

Villalonga (2004a) suggests that the diversification discount is due to a data bias in segment data. The author suggests that the Business Information Tracking Series (BITS), a census database which covers the U.S. economy at the establishment level, allows for the construction of business units that are more consistently and objectively defined than segment data. More importantly, the author claims that using the BITS database allows for a better comparison of both focused and diversified firms in establishing if a diversification discount does indeed exist. Contrary to earlier studies, Villalonga (2004a) reports a diversification premium that is robust to variations in the sample, business unit definition, and measures of excess value and diversification.

Separately, there is also reason to believe that prior evidence documenting a diversification discount by examining changes in corporate diversification through time are likely to have a sample selection bias. The rationale is that the typical diversifying firm was

[8] For example, in the case of "managerial self-preservation" as described by Shleifer and Vishny (1989), managers entrench themselves by making investments specific to their own talents that make it costly for shareholders to replace them. In doing so, managers reduce the probability of being replaced, extract higher wages, demand larger perquisites from shareholders, and obtain more latitude in determining corporate strategy.

already selling at a discount prior to the event of firm diversification (see Lang and Stulz (1994), Campa and Kedia (2002) and Villalonga (2004b)). Graham, Lemmon and Wolf (2002) show that half or more of the diversification discount appears because the segments acquired by diversifying firms were discounted prior to their acquisition, and not because diversifying destroys value. In addition, Campa and Kedia (2002) and Villalonga (2004b) show that the diversification discount either disappears or turns into a premium after correcting for the selection bias.

In contrast to agency explanations that depend on empire building to explain a diversification discount, there is also evidence that the investment policies of diversified firms are optimal. Using plant-level data, Maksimovic and Phillips (2002) find that corporate growth and investment is related to fundamental industry factors and segment-level productivity, and that the majority of diversified conglomerate firms exhibit growth that is consistent with optimal behaviour. Similarly, by examining the investment policies of firms in the utility industry, Jandik and Makhija (2005) report that focused firms over-invest compared to diversified firms. The study suggests that this explains the findings of a diversification premium in their study which implies that diversification can create value by opening up new investment opportunities.

The preceding studies suggest that corporate diversification does not destroy firm value. Indeed, a walk down the proverbial “Main Street” confirms that diversified conglomerates continue to increase in number and thrive. Echoing this observation, Martin and Sayrak (2003) describe the end of the 20th century as a period with record-breaking levels of mergers and acquisitions and more importantly, a return to more diversified firms.

2.2.2 The link between corporate diversification and growth options

A recent approach to examining the diversification discount is to investigate the link between corporate diversification and growth options. This line of reasoning is viable because growth options are an important component of firm value. For example, work by Myers (1977) establishes the economic principle that firm value is composed of the value of assets-in-place and the value of future growth options. Empirical evidence from Danbolt, et al. (2002) further underscores the role of growth options to firm value by reporting that the present value of growth options on average accounts for more than 50% of company market values.

The distinction that growth options are an integral part of firm value is also well established in many areas of financial research. These include the valuation of corporate equity (e.g. Merton and Modigliani (1961); Kester (1986)), corporate financial structure (e.g. Myers (1977)), corporate cost of capital and capital budgeting decisions (e.g. Myers and Turnbull (1977); Majd and Pindyck (1987)), corporate debt policy (e.g. Goyal, Lehn and Racic (2002)), optimal investment by the firm (Berk, et al. (1999); Anderson and Garcia-Feijoo (2006)) and the risk of the firm (e.g. Chung and Charoenwong (1991) ;Cao, Simin and Zhao (2008); Bernardo, Chowdhry and Goyal (2007); Jacquier, Titman and YalçIn (2010)).

In related work, Bernardo and Chowdhry (2002) suggest that the decision to be focused or diversified is linked to the learning lifecycle in which firms learn about the potential economic rents that available resources can generate through new investment.[9] "Young" firms in the learning lifecycle are typically focused firms that learn about the match between their resources and growth options by undertaking investments and observing their

[9] In the study, resources differ in their degree of specificity and can be classified as a general or specific resource. For example, R&D expertise is most likely valuable only to a specific business segment and is considered a "specific" resource. On the other hand, resources such as an efficient distribution system can be leveraged in many different business segments and are considered "general" resources.

outcomes.[10] By learning about how firm resources contribute to the success or failure of these investments, young firms then choose to specialize by remaining focused in one business segment and scaling up operations, or after multiple lifecycles, eventually become “older” diversified firms by experimenting and finding new matches between their resources and growth options in other business segments.[11]

In other words, the authors argue that the learning implications from the investment of resources dictate corporate strategies of whether to be focused or diversified.[12] More importantly, Bernardo and Chowdhry (2002) suggest that young (focused) firms are more valuable than older (diversified) firms with the same expected level of resources because they have more to learn about their resources and therefore have more valuable real options. The authors posit that the difference in valuable real options explains the diversification discount.

Separately, Stowe and Xing (2006) suggests that the practice of comparing business segments of diversified firms and industry medians of focused firms (see Lang and Stulz (1994) and Berger and Ofek (1995)) would lead to an inaccurate conclusion of a diversification discount in the presence of differing growth options. Along this line of reasoning, the authors examine a diversifying sample of firms and find a significant diversification discount even after controlling for a difference in growth options between diversified and focused firms. More specifically, Stowe and Xing (2006) argue that the difference in growth options occurs not due to the act of diversification itself shrinking the firms’ growth opportunities, but because diversifying firms have poor growth opportunities even before they diversify.

[10] Bernardo and Chowdhry (2002) indicate that focused (young) firms have learning limitations constrained to the potential of general and specific resources in only one business segment. Likewise, diversified (older) firms also learn about the specific resources in each business segment. However, diversified firms have the added advantage of comparing what it learns about its general resources across multiple business segments.

[11] There is also some evidence that suggests corporate diversification is related to firm age (see Montgomery (1994) and Matsusaka (2001)).

[12] Matsusaka (2001) also argues that diversification is a process by which corporations search for good matches with their organizational capabilities.

2.2.3 Corporate diversification, investment flexibility and the selection of growth options

A new approach to examining the link between diversification and growth options is from the perspective that diversified firms inherently have more "investment flexibility" than focused firms in the selection of growth options. In this case, "investment flexibility" points to the unique ability of a diversified firm to optimally select and exercise risky growth options with differing levels of systematic risk in a manner that cannot be replicated by a focused firm.

All things equal, all firms are endowed with a measure of investment flexibility that is limited only by the growth options available to it. In a larger context, the scope of growth options accessible to a firm is constrained to the business segments and/or industries that it participates in. Specifically, each business segment avails a unique set of growth options with different levels of systematic risk specific to that product category or industry. Following this line of reasoning, diversified firms which participate in more than one business segment naturally have more investment flexibility to compare and select growth options than focused firms which have a unique business footprint.

In addition, diversified firms not only have a larger group of growth options compared to focused firms, but can optimally select growth options from a wider range of systematic risk due to lower correlation of cash flows from diverse product segments and/or industries. Conversely, focused firms select from a smaller group of growth options with a narrow band of systematic risk as all cash flows are derived from business operations concentrated in one product segment or industry.

To illustrate, consider two famous automotive brands such as Aston Martin, a focused British automaker, and Honda Motor Company, a diversified Japanese conglomerate that operates in multiple business segments including the automobile, motorcycle, marine, aerospace and even garden equipment, to name a few.[13] Aston Martin is limited to growth options within the automobile industry. In contrast, Honda has much more investment flexibility to comparatively select growth options from among the different business segments/industries that it operates in. Furthermore, the commercial and economic drivers in each of the business segments that Honda operates in are very diverse. Thus, it is reasonable to expect that growth options of the Honda's business segments have systematic risks that are largely uncorrelated. Conversely, Aston Martin's growth options have a high degree of correlation in systematic risk as they are all dependent on the fortunes of a single business segment.

Of course, the concept of investment flexibility should extend beyond a simple operational presence in multiple business segments. For instance, one may argue that access to a larger number of growth options with uncorrelated systematic risks does not naturally equate to superior operational abilities that facilitate the selection and financing of ideal investment opportunities. Without the ability to identify and exercise the most attractive growth options, any advantage of investment flexibility is arguably limited, if existent at all. The literature, however, provides evidence of such advantages unique to diversified firms.

Chandler (1977) suggests that diversified firms with multiple business divisions create a level of management concerned with coordination of specialized divisions. Specialist managers within divisions are likely to be more efficient as they possess higher levels of expertise, experience and qualifications in their core competencies. These specialist managers are complemented by the extra layer of management which is dedicated to optimizing the coordination of resources, information and capacity within the firm. With both division specialists and coordinating management acting in concert, diversified firms are more efficient and profitable than their lines of business would be separately. In contrast, managers

[13] Sources include www.astonmartin.com and www.world.honda.com.

of focused firms are likely required to fulfil a variety of roles concurrently. This setting calls for greater managerial effort and limits the mastery and application of specialized skills, resulting in comparatively lower operational efficiency. More importantly, this suggests that diversified firms have superior operational advantages over focused firms for the comparative selection of growth options.

In contrast to focused firms, diversified firms also have internal capital markets (ICMs) which allows for the internal reallocation of cash flows generated by one business segment (division) for new investment in another. ICMs increase the investment flexibility of diversified firms in at least three ways (see Weston (1970); Gertner, Scharfstein and Stein (1994) and Stein (1997), among others). First, internally raised capital is less costly than funds raised in an external capital market. Second, the firm avoids transaction costs associated with the sale of securities to the public, as well as the costs of overcoming information asymmetry problems encountered when selling securities in the capital market. Third, with an internal source of financing, managers are able to exercise superior decision control over the selection of investment projects, rather than leaving the firm's investment decisions to less well-informed arbitrators in the external capital market. This suggests that diversified firms also have superior financing advantages in comparison to focused firms.

The investment flexibility afforded to diversified firms, coupled with organizational advantages of superior managerial coordination in the selection and internal funding of growth options, mean that diversified firms are better able to optimally select growth options with lower systematic risk than focused firms.

2.2.4 Corporate diversification, investment flexibility and stock returns

What are the implications for stock returns given greater investment flexibility in the selection of growth options? Prior work provides guidance. Berk, et al. (1999) establish a dynamic model where firm value is composed of the value of "growth options" and the value of "assets-in-place". The exercise of growth options is described by new investment that changes a firm's asset portfolios. Growth options with low systematic risk are attractive to the firm and consequently when exercised, the average systematic risk of the firm's cash flows in subsequent periods is reduced, leading to lower returns. Overall, the authors suggest that the optimal exercise of growth options through new investment results in lower systematic risk of the firm and lower future stock returns.

The presence of a negative investment-return relation that is driven by changing levels of systematic risk has also been substantiated by other recent papers. For example, Berk, Green and Naik (2004) present a model of a multi stage investment project in which uncertainty is resolved with investment, implying that the risk of the firm declines with investment. Cooper (2006) constructs a model with non-convex adjustment costs of investment in which low investment firms have excess capital capacity and are thus able to fully benefit from positive aggregate shocks without undertaking costly investment. This implies that firms with low investment are riskier than high investment firms which operate near full capacity.

More recently, Cooper and Priestley (2008) find that systematic risk falls during investment periods and rises in disinvestment periods. The authors argue that the negative investment-return relation is consistent with both risk-based and behavioural explanations. Similarly, real option models (see McDonald and Siegel (1986); Majd and Pindyck (1987); Pindyck (1988); and Carlson, Fisher and Ron (2006)) also predict that firms that exercise growth options experience a fall in their systematic risk because undertaking real investment exercises a risky real option.

Berk, et al. (1999) suggest that growth options with low systematic risk are more attractive to the firm but do not offer reasons for this preference. Fortunately, the corporate finance literature provides insights on potential motivations behind the investment decision. From the agency perspective, Amihud and Lev (1981) suggest that risk associated with a manager's income is intrinsically closely linked to the firm's risk. This is because shareholders actively incentivise managers to achieve predetermined performance targets through profit-sharing schemes, bonuses, and the value of stock options. By the same token, shareholders also actively punish managers for poor performance by reducing bonuses and, in many cases, even dismissal.

Since managers cannot hold a portfolio of employers through which they can diversify away such "employment risk", risk-adverse managers diversify employment risk by choosing investments with the lowest systematic risk. Investments with low systematic risk have low variations in cash flow and help to stabilize the firm's income stream. This strategy of predictable cash flows introduces predictability in employment income and allows the manager to avoid wild swings in employment compensation due to market shocks. Consequently, the risk-averse manager is able to avoid heavy income penalties at least, even if private benefits are not fully optimized.

In related work that highlights the importance of stable cash flows from investment with low systematic risk, Hahn and Lee (2009) show that variations in the availability of internal funds reduces the efficiency of an ICM. This leads to a reduced supply of internal funds and constrains the exercise of growth options. As existing assets are exhausted, the overall implication is that the firm suffers a reduction in collateral debt capacity and increased financial constraints, thereby raising the overall risk of the firm. Consequently, in order to maximise the relaxation of financial constraints through efficient ICMs, managers prefer investments with low systematic risk to ensure that cash flows generated by new investment have less variation.

Conversely, Peyer (2002) suggests that an efficient ICM which reduces financial constraints is an important determinant of a diversified firm's ability to capture new growth opportunities. Peyer (2002) suggests that diversified firms with efficient ICMs are both able to raise more external capital and reduce the impact of information asymmetry problems when raising external capital. Consequently, the additional benefit is that diversified firms with efficient ICMs have a lower cost for external capital.

Overall, the surveyed literature suggests that diversified firms have greater investment flexibility than focused firms in the comparative selection of growth options that lower the systematic risk of the firm's overall assets. This suggests that, after controlling the same level of growth options, diversified firms should have on average lower future returns than focused firms.

2.3 Sample selection and variable measures

2.3.1 Sample selection

Collated business segment and price data on all firms used in this study is from the CRSP/Compustat Merged Database (CCM). CCM data draws from two separate sources: monthly price data for firms listed on the NYSE, AMEX or NASDAQ exchanges from the Centre for Research in Security Prices (CRSP) database and business segment data from the Compustat Industry Segment (CIS) database. Financial Accounting Standards Board (FASB) regulation No. 14 and SEC Regulation S-K require firms to report audited footnote information for segments where sales, assets, or profits exceed 10% of consolidated totals for fiscal years ending after December 15, 1977. The number of segments in a firm is also reported. The initial data sample period before applying any data filters is from 1978 to 2012.

Segment data for a given fiscal year may have multiple records due to reporting adjustments made in subsequent years. Compustat does not eliminate these duplicate entries which can be identified by their source year. In the case of multiple adjustments, the most recent update is denoted by the latest source year. As such, only segment data for the latest source year of each segment-year observation is considered. Following Berger and Ofek (1995) and Lamont and Polk (2002), firm-year observations that do not have an allocated SIC code are eliminated. Consistent with Duchin (2010), while financial firms with SIC code '6' at the one-digit level are excluded, industrial firms with financial segments are included because excluding these would eliminate from the sample many large conglomerates that maintain a finance division.[14] Firms with segments that do not have any operations as noted by SIC code '9' are omitted from the sample. Firms are also required to have total sales of at

[14] Similarly, Duchin (2010) adopts a similar data filter in his study that finds an efficient link between corporate liquidity and diversification that corresponds to efficient fund transfers from low- to high-productivity divisions.

least $10 million without any missing or negative segment information on sales, assets or capital expenditures.

Finally, the sample is restricted to firm-years that have information required to calculate the relevant measures of growth opportunities (total asset growth (AG) and market to book (MB)), diversification measures (Herfindahl index measures for segment asset (H_ASSETS) and segment sales (H_SALES), as well as the number of business segments (BUSSEG)). Inverse values of the Herfindahl index measures of segment assets and segment sales are used in the analysis. Firm-years without any of the required imputed values for the analyses are eliminated from the sample. In effect, this limits the sample to firms that survive any consecutive three-year period with complete data in all three years.

The final filtered data set used in the analysis of this chapter, comprising of both diversified and focused firms, consists of 96,169 firm-year observations on 11,992 unique firms over the sample period beginning in 1979 and ending in 2010. More specifically, the data consists of 27,789 firm-year observations on 4,413 unique diversified firms, and 68,290 firm-year observations on 10,047 unique focused firms.[15]

2.3.2 Measures of growth options

Growth options are by nature unobservable and a suitable proxy is required to represent them. However, Cao, et al. (2008) and Adam and Goyal (2008) note that every proxy is prone to criticism. In order to overcome this shortcoming, two different proxies for growth options are used to investigate and confirm empirical findings.

A comprehensive measure of firm growth, total asset growth (AG), or the year-on-year percentage change in firm total assets, is employed as one proxy. There are reasons to

[15] The sum of unique diversified firms and unique focused firms do not equal to the unique count of actual firms because some firms undergo changes in their level of diversification, from focused to diversified or vice versa, over the long sample period.

believe that AG is a suitable proxy for growth options. While Cooper, et al. (2008) suggest that the negative relation between AG and stock returns is due to mispricing, Chen, Novy-Marx and Zhang (2011) argue that that AG is potentially consistent with optimal investment as it is the most comprehensive measure of investment-to-assets.

In their study on optimal firm investment, Berk, et al. (1999) show that the turnover of assets-in-place, or the change in total assets of the firm, alters the relative importance of growth options versus existing assets. In other words, the turnover of assets-in-place results in changes in the systematic risk of the firm and leads to its explanatory role for firm value.[16] Consistent with the theoretical model of Berk, et al. (1999), Cooper and Priestley (2011) show that the return spreads from low and high AG investment portfolios are accounted for by the spread in systematic risk.

In addition, AG is a relevant proxy for growth options for another three reasons. First, Cooper, et al. (2008) demonstrate that the ability of total asset growth to predict returns dominates other traditional growth measures such as capital investment (see Titman, Wei and Xie (2004)), accruals (see Sloan (1996)) and sales growth rates (see Lakonishok, Shleifer and Vishny (1994)). The authors suggest that because total asset growth is the sum of the subcomponents of growth from both the left-hand or right-hand side of the balance sheet, it synergistically benefits from the predictability of all sub-components of growth, allowing total asset growth to better predict the cross-section of returns relative to any single component of growth.

Second, total asset growth reflects the availability of assets from new investments that can serve as collateral for borrowing to finance future investment, thus effectively capturing

[16] In their study, Berk, et al. (1999) focus on the book-to-market variable and do not use total asset growth as a proxy for growth options. Total asset growth is used in this study as a proxy for growth options because it is based on the rationale by the authors that the turnover of assets-in-place alters the relative importance of growth options versus existing assets, has an explanatory role for firm value.

the financial constraints imposed on a firm when debt has to be secured by collateral (see Hahn and Lee (2009)). In this perspective, firms with high total asset growth have more assets that can serve as collateral for new debt, have higher debt capacity and are less financially constrained from making new investments. In this sense, changes in AG are correlated with both the exercise of existing options to create new assets-in-place and the generation of new growth options.

Third, Cooper, et al. (2008) document that the asset growth effect is persistent both in the cross-section of returns and over time. This consideration is important to the analysis since firms do not change firm structure, from industrially focused to industrially diversified or vice versa, frequently.

The base methodology for calculating the asset growth variable is adapted from Cooper, et al. (2008).[17] The annual firm total asset growth rate (AG) is calculated using the year-on-year percentage change in total assets. A firm must have non-zero total assets in both year's (t) and (t−1) in order to compute this measure. The firm's asset growth rate for year (t) is estimated as the percentage change in total assets from fiscal year ending in calendar year (t−1) to fiscal year ending in calendar year (t), depicted as:

$$Asset\ growth(t) = \frac{(Total\ Assets_{(t)} - Total\ Assets_{(t-1)})}{Total\ Assets_{(t-1)}} \qquad (1)$$

Asset growth is calculated for stocks that have at least two years of consecutive data for total assets. Since regulations FASB No. 14 and SEC Regulation S-K were enforced for firms only after December 15, 1977, and at least two years of consecutive data are required to

[17] Cooper, et al. (2008) employ both positive and negative asset growth values in their study. In contrast, Gray and Johnson (2010) differentiate between positive and negative asset growth values through separation into two different portfolios. While negative asset growth rates may signal firm distress or underperformance, there is no evidence linking it to firm structure in the corporate finance literature. Accordingly, both positive and negative total asset growth values are included for analysis.

calculate total asset growth, the first portfolio formation year is 1979. This portfolio formation procedure is repeated annually through to December 2010.

Despite the important role of growth options in the corporate finance literature, there is no consensus on a single proxy for a firm's investment opportunity set. However, an alternative proxy for growth options is required in order to confirm empirical findings based on the AG proxy. Adam and Goyal (2008) provide insight on this issue by evaluating the performance of existing growth option proxies that are popular in the literature. These include the market-to-book assets ratio (MBA), the market-to-book equity ratio (MBE), the earning-price ratio (EP) and the ratio of capital expenditures over the net book value of plant, property and equipment (CAPX/PPE). A ranking of the proxies in terms of their information content about a firm's growth options show that the MBA proxy (or Tobin's *q*) has the highest relative information content, followed by MBE, EP and CAPX/PPE. The authors argue that MBE and EP ratios also have information content related to growth options but do not contain information that is not already contained in the MBA ratio. Finally, results from the study show that the CAPX/PPE ratio is the poorest proxy for growth options.[18]

Despite the finding by Adam and Goyal (2008) that MBA has the highest relative information content about a firm's growth options, there are several reasons documented within their study that discourage its use. First, the market value of assets requires an estimation of the market value of debt. However, this is difficult since corporate debt is not often publicly traded. Second, the book value of assets does not necessarily equal the replacement value of assets. Third, in relation to the prior two points, the empirical advantage

[18] Stowe and Xing (2006) use the ratio of capital expenditures to total assets in their study which investigates if the diversification discount is due to differing growth options between diversified and focused firms. Adam and Goyal (2008) show that the CAPX/PPE ratio is the worst proxy among the four growth options employed in their study. This casts doubt on the empirical findings of Stowe and Xing (2006) who suggest that growth differences do not account for the diversification discount.

of the MBE ratio over the MBA ratio is that its construction does not require information on the market value of debt, nor does it require the estimation of replacement values.

For the purpose of this study, the market-to-book value of equity ratio (MB) is used as the second proxy for growth options.[19] MB is constructed as the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity. The market value of equity measures the present value of all future cash flows to equity holders from both assets-in-place and future investment opportunities, whereas the book value of equity represents the accumulated value generated from existing assets only. Therefore, the MB ratio measures the mix of cash flows from assets-in-place and future investment opportunities.

2.3.3 Measures of diversification

Three diversification measures used by Comment and Jarrell (1995) are employed to calculate firm diversification: (1) a count of the number of business segments (BUSSEG) reported by management, (2) the inverse of a sales based Herfindahl index (1/H_SALE), and (3) the inverse of an asset based Herfindahl index (1/H_ASSETS).

The diversification measure of the number of business segments (BUSSEG) is a direct count of the number of segments declared by the managers of the firm. Focused firms have only one business segment while diversified firms have more than one business segment. For the diversification measure of BUSSEG, firms are more diversified as the number of firm segments increases.

The Herfindahl index value for segment sales (assets) is calculated across Nj, segments for the j^{th} firm in fiscal year t as the sum of the squares of each segment i's revenue

[19] To avoid confusion, the acronym for market-to-book value of equity ratio used in this study is "MB" instead of MBE as used in Adam and Goyal (2008).

(assets) as a proportion of total revenue, where X_{ijt} is the revenue (assets) attributable to a corporate segment:

$$\textit{Herfindahl Index(t)} = \sum_{i=1}^{Njt} \left(\frac{X_{ijt}}{\sum_{i=1}^{Njt} X_{ijt}} \right)^2 \qquad (2)$$

An illustration: a focused firm with only one business segment will have a Herfindahl index value of 1; a firm with 10 business segments where each segment contributes 10 percent of total sales will have a Herfindahl sales index value of 0.1. In other words, the Herfindahl index value decreases as firm diversification increases.

A large Herfindahl index value describes a focused firm that has a greater concentration of activities in one segment and/or industry, whereas a small Herfindahl index value corresponds to a relatively more diversified firm with activities across multiple industry segments and/or industries. As the inverse of the Herfindahl index value is used in the analysis for scaling purposes, a larger value for 1/H_SALES indicates greater firm diversification.

2.4 Results

2.4.1 Summary statistics for all firms

Table 1 presents summary statistics for the pooled sample over the period of 1979 to 2010. The pooled sample of all firms has a total of 96,169 firm-years on 11,992 unique firms. Summary statistics for focused firms comprises of 68,290 firms-years on 10,047 unique focused firms, while summary statistics for diversified firms is made up of 27,879 firms-years on 4,413 unique diversified firms.

Of particular interest are the various measures of diversification used in this study. This is because the median diversification measure for all three variables of segment assets (1/H_ASSETS), segment sales (1/H_SALES) and number of firm segments (BUSSEG) in the full sample have the value of unity. This suggests a dominance of single-segment focused firms over multi-segment diversified firms in the sample population.

Total asset growth rates (AG) for the full sample have a positive median of 7.72%, with focused and diversified firms reporting AG medians of 8.19% and 6.93%, respectively. Diversified firms are, on average, much larger than focused firms. This inference is supported by SIZE statistics where focused firms have a median market capitalization (US$81 million) that is approximately half of the median diversified firm (US$166 million).

Table 2 reports the Spearman's correlation matrix for the main variables of interest. It is no surprise that the measures of diversification are highly correlated with each other since they each effectively perform the same function. The correlation coefficient is positive between the three diversification measures and size. This confirms the earlier findings that diversified firms typically have larger market capitalizations than focused firms. Especially notable is that all measures of diversification are not correlated with asset growth, firm size or

Table 1
Summary statistics

This table reports summary statistics for the full sample of both diversified and focused firms consisting of 96,169 nonfinancial firm-years from 1979 to 2010. Summary statistics for the subsample of diversified and focused firms are also reported. This consists of 27,789 firm-year observations on 4,413 unique diversified firms, and 68,290 firm-year observations on 10,047 unique focused firms. Asset growth (AG) is the year-on-year percentage change in total assets for the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). Market-to-book (MB) is the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity in calendar year (t−1). Business segments (BUSSEG) is the number of business segments reported by management. The Herfindahl index value of segment sales (H_SALES) and segment assets (H_ASSETS) is calculated as the sum of the squares of each segment's sales (assets) as a proportion of the firm's total sales (assets) for that fiscal year. The inverse of the Herfindahl index values is used in this analysis. Size (SIZE) is the market value of a firm calculated using the price and the number of shares outstanding at the end of year (t), in millions of dollars. Book-to-market (BM) is common equity divided by the product of the share price and common shares outstanding at the end of the fiscal year. Annual stock return (RET12) is the buy-and-hold return for one year from July (t) to June (t+1), where t is the portfolio formation year. All variables are calculated using data from the CRSP-Compustat Merged (CCM) database.

	All Firms			Focused			Diversified		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
Asset growth (AG)	0.2972	0.0772	26.2321	0.2266	0.0819	1.3101	0.4701	0.0693	48.6775
Market-to-book (MB)	2.8249	1.0743	70.4602	2.900	1.8376	77.1387	2.6410	1.4751	50.4991
Number of Business Segments (BUSSEG)	1.5731	1	1.1048	1	1	0	2.977	3	1.1977
Segment Sales Herfindahl Index (1/H_SALE)	1.2960	1	0.6475	1	1	0	2.0208	1.8433	0.8403
Segment Assets Herfindahl Index (1/H_ASSETS)	1.3108	1	0.6728	1	1	0	2.0722	1.8830	0.8632
Size (US$ millions)	1,345	97	7,495	1,052	81	6,371	2,062	166	9,676
Book-to-market (BM)	0.6416	0.5493	3.8162	0.6205	0.5021	2.2235	0.6932	0.6518	6.1744
Annual Stock Return (RET12)	0.2003	-0.0070	2.3600	0.2287	-0.0192	2.7286	0.1309	0.0111	0.9831
Number of firm-year observations		96,169			68,290			27,879	

Table 2
Spearman's Rank Correlation Matrix

This table reports Spearman's rank correlations for the full sample of both diversified and focused firms consisting of 96,169 nonfinancial firm-years from 1979 to 2010. Asset growth (AG) is the year-on-year percentage change in total assets for the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). Market-to-book (MB) is the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity in calendar year (t−1). Business segments (BUSSEG) is the number of business segments reported by management. The Herfindahl index value of segment sales (H_SALES) and segment assets (H_ASSETS) is calculated as the sum of the squares of each segment's sales (assets) as a proportion of the firm's total sales (assets) for that fiscal year. The inverse of the Herfindahl index values is used in this analysis. Size (SIZE) is the market value of a firm calculated using the price and the number of shares outstanding at the end of year (t), in millions of dollars. Book-to-market (BM) is common equity divided by the product of the share price and common shares outstanding at the end of the fiscal year. Annual stock return (RET12) is the buy-and-hold return for one year from July (t) to June (t+1), where t is the portfolio formation year. All variables are calculated using data from the CRSP-Compustat Merged (CCM) database.

	AG	MB	BUSSEG	1/H_SALE	1/H_ASSETS	SIZE	BM	RET12
Asset growth (AG)	1							
Market-to-book (MB)	0.2705	1						
Number of Business Segments (BUSSEG)	-0.0236	-0.1187	1					
Segment Sales Herfindahl Index (1/H_SALE)	-0.0263	-0.1197	0.9874	1				
Segment Assets Herfindahl Index (1/H_ASSETS)	-0.0258	-0.1165	0.9893	0.9921	1			
Size (US$ millions)	0.1941	0.3497	0.1615	0.1484	0.1498	1		
Book-to-market (BM)	-0.2054	-0.8101	0.1411	0.1408	0.1376	-0.3046	1	
Annual Stock Return (RET12)	-0.0883	-0.1311	0.0292	-0.0290	0.0287	-0.0307	0.1289	1

stock returns. Similarly, there is no correlation between asset growth and firm returns. The correlation between the growth option proxy, market-to-book (MB) and book-to-market (BM) is 81.01% as both variables are basically the inverse of each other. More importantly, due to the high correlation, regression analysis that use MB as a growth option proxy will not employ BM as a control variable to avoid issues due to multicollinearity.

2.4.2 Fama and MacBeth regressions

To test if investment flexibility is a determinant for stock returns, we estimate the following cross-sectional regression:

$$RET12_{i,t} = b_0 + b_{1}(BUSSEG)_{i,t} + b_{2}(1/H\_SALES)_{i,t} + b_{3}(1/H\_ASSETS)_{i,t} + b_{4}(AG)_{i,t} + b_{5}(BM)_{i,t} + b_{6}(SIZE)_{i,t} + \varepsilon_{i,t} \quad (3)$$

where RET12 is the is the buy-and-hold return for one year from July (t) to June (t+1), where t is the portfolio formation year. BUSSEG is a direct count of the number of business segments reported by management. The Herfindahl index value of segment sales (H_SALES) and segment assets (H_ASSETS) is calculated as the sum of the squares of each segment's sales (assets) as a proportion of the firm's total sales (assets) for that fiscal year. SIZE is the log of the market value of a firm in millions of dollars calculated as the product of the price and the number of shares outstanding at the end of year (t).

Following Cooper, et al. (2008), Fama and French (2008) and Gray and Johnson (2010), the Fama and MacBeth (1973) regression procedure is used to estimate the above regression model. Separate cross-sectional regressions in each sample year are first estimated then, second, the average of the coefficients and standard errors across years are reported with corresponding t-statistics in brackets. Table 3 tabulates the results using AG

Table 3

Fama–MacBeth regressions of annual stock returns on key characteristics with asset growth (AG) as a growth option proxy

This table presents Fama and MacBeth (1973) regressions with annual stock returns as the dependent variable over the period of 1979 to 2010. First, separate cross-sectional regressions in each sample year are estimated then, second, the average of the coefficients and standard errors across years are reported. Independent variables are composed as follows. Market-to-book (MB) is the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity in calendar year (t−1). MB is used as the proxy for growth options. BUSSEG is a direct count of the number of business segments reported by management. The Herfindahl index value of segment sales (H_SALES) and segment assets (H_ASSETS) is calculated as the sum of the squares of each segment's sales (assets) as a proportion of the firm's total sales (assets) for that fiscal year. The inverse of the Herfindahl index values is used in this analysis. Size (SIZE) is the log of the market value of a firm in millions of dollars calculated as the product of the price and the number of shares outstanding at the end of year (t). Annual stock return (RET12) is the buy-and-hold return for one year from July (t) to June (t+1), where t is the portfolio formation year. All variables are calculated using data from the CRSP-Compustat merged database. t-statistics are in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

Model	1	2	3	4	5	6	7	8	9	10
Number of Business Segments (BUSSEG)	-0.0330***				-0.0338***			-0.0264**		
	(-3.03)				(-3.09)			(-2.47)		
1/Sales Herfindahl Index (1/H_SALES)		-0.0502***				-0.0515***			-0.0395**	
		(-2.87)				(-2.94)			(-2.29)	
1/Asset Herfindahl Index (1/H_ASSETS)			-0.0489***				-0.0505***			-0.0387**
			(-2.97)				(-3.05)			(-2.39)
Asset Growth (AG)				-0. 0528***	-0.0535***	-0.0535***	-0.0536***	-0.0527***	-0.0528***	-0.0528***
				(-3.65)	(-3.66)	(-3.67)	(-3.67)	(-3.63)	(-3.64)	(-3.64)
Book-to-Market (BM)								-0.0309*	-0.0311*	-0.0309*
								(-1.73)	(-1.73)	(-1.72)
Size								-7.42E-6***	-8.02E-6***	-7.86E-6***
								(-3.47)	(-3.49)	(-3.47)

Table 4

Fama–MacBeth regressions of annual stock returns on key characteristics with market-to-book (MB) as a growth option proxy

This table presents Fama and MacBeth (1973) regressions with annual stock returns as the dependent variable over the period of 1979 to 2010. First, separate cross-sectional regressions in each sample year are estimated then, second, the average of the coefficients and standard errors across years are reported. Independent variables are composed as follows. Market-to-book (MB) is the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity in calendar year (t−1). MB is used as the proxy for growth options. BUSSEG is a direct count of the number of business segments reported by management. The Herfindahl index value of segment sales (H_SALES) and segment assets (H_ASSETS) is calculated as the sum of the squares of each segment's sales (assets) as a proportion of the firm's total sales (assets) for that fiscal year. The inverse of the Herfindahl index values is used in this analysis. Size (SIZE) is the log of the market value of a firm in millions of dollars calculated as the product of the price and the number of shares outstanding at the end of year (t). Annual stock return (RET12) is the buy-and-hold return for one year from July (t) to June (t+1), where t is the portfolio formation year. All variables are calculated using data from the CRSP-Compustat merged database. t-statistics are in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

Model	1	2	3	4	5	6	7	8	9	10
Number of Business Segments (BUSSEG)	-0.0330***				-0.0332***			-0.0272**		
	(-3.03)				(-3.05)			(-2.57)		
1/Sales Herfindahl Index (1/H_SALES)		-0.0502***				-0.0504***			-0.0405**	
		(-2.87)				(-2.89)			(-2.37)	
1/Asset Herfindahl Index (1/H_ASSETS)			-0.0489***				-0.0491***			-0.0392**
			(-2.97)				(-2.99)			(-2.46)
Market-to-book (MB)				-0. 0010**	-0.0010**	-0.0010**	-0.0025**	-0.0025**	-0.0010**	-0.0009**
				(-2.28)	(-2.29)	(-2.30)	(-2.29)	(-2.27)	(-2.27)	(-2.27)
Size								-7.383-6***	-7.93E-6***	-7.78E-6***
								(-3.44)	(-3.46)	(-3.44)

as a growth option proxy while Table 4 uses the alternative growth option proxy, the MB ratio. Since there is no consensus of a standard proxy for growth options in the literature, this analysis employs more than one growth option proxy for the same analysis in order to confirm empirical findings. The three different measures of firm diversification, namely the number of business segments (BUSSEG) as well as the inverse of the Herfindahl index value of segment sales and segment assets are used in both tables.

One purpose of this section of the analysis is to determine if investment flexibility as revealed by a diversification measure is a determinant for stock returns. Recall that diversified firms are predicted to have more investment flexibility than focused firms as they are able to opportunistically select growth options with the lowest systematic risk from among multiple business segments. This line of reasoning is viable as the task of opportunistically selecting growth options with the lowest systematic risk logically becomes easier when managers have a larger number of business segments for comparison. Focused firms do not have investment flexibility as all growth options are limited to one business segment. In additions, the growth options available to focused firms are also likely to have a high correlation in investment outcomes due to the common dependence on the fortunes of a single business segment. In other words, the investment flexibility of a firm increases as it becomes more diversified. Therefore the testable prediction is that if firms that are more diversified have more investment flexibility to select growth options with lower systematic risk than firms that are less diversified, regression analysis should reveal a negative relation between firm diversification and returns.

Consistent with this interpretation, the diversification measure BUSSEG in model 1 for both Table 3 and Table 4 is negative and significant (at the 1% level) with stock returns. The negative significance (at the 1% level) of the BUSSEG measure continues even after growth option proxies are included in regression model 5 of both tables. After including control variables book-to-market (BM) and size (SIZE) in regression model 8 of Table 3, the negative explanatory power persists albeit at a weaker 5% level of significance. The test is repeated in regression model 8 of Table 4 without the BM variable to avoid multicollinearity issues due to the high correlation between MB and BM. Likewise, the results show that BUSSEG is negative and significant at the 5% level.

For robustness, I repeat the analysis using two additional diversification measures which are the Herfindahl index value for segment sales (H_SALES) and segment assets (H_ASSETS) for Table 3 (AG as growth option proxy) and Table 4 (MB as growth option proxy). The inverse of the Herfindahl index values are used in the analysis. Regression models using AG as the proxy for growth option are in Table 3. As before, for robustness and to confirm findings, the tests are repeated using the alternative growth option proxy of MB in Table 4. The empirical results are qualitatively the same as the diversification measure of BUSSEG. Both Herfindahl index measures of segment sales and segment assets have negative and significant coefficients in all the regression models. The results are interpreted as evidence that the investment flexibility of a firm to select growth options with lower systematic risk increases as a firm becomes more diversified.

Regression models 3 to 10 in Table 3 and Table 4 employ both proxies for growth options in various combinations. Empirical results show that both proxies have a negative and significant relation with firm returns, at the 1% level for AG and at the 5% level for MB, for all regression models where it is employed as an independent variable. The significant relation between the growth option proxies and stock returns is consistent with the interpretation that growth options are an integral part of firm value, where firm value is made up of the value of assets-in-place and the value of risky growth options (see Myers (1977).

The negative coefficients of both growth option proxies agree with the theoretical basis that the exercise of growth options results in less risky assets-in-place thus leading to lower returns (see Berk, et al. (1999), Carlson, et al. (2004) and Jacquier, et al. (2010)). In this perspective, growth options with low systematic risk are attractive to the firm. Exercising these options through capital investment reduces the average systematic risk of the firm's cash flows in subsequent periods, leading to lower returns.

The results do not, however, show whether diversified firms have more investment flexibility than focused firms. To do this, portfolio analysis is done in the following sections for further insight.

2.4.3 Univariate portfolio sort on proxies for growth options

Earlier studies on asset growth report a negative relation with stock returns that is strongly robust across the cross-section of stocks and in international markets (see Cooper, et al. (2008); Gray and Johnson (2010); Yao, Yu, Zhang and Chen (2011), among others).[20] First, to verify the existence of the asset growth effect in the sample, I construct univariate portfolios based on asset growth deciles. Panel A of Table 5 reports returns for all firms sorted into decile stock portfolios according to their asset growth rates for the full sample.

At the end of June of each year t over the sample period of July 1979 to June of 2010, stocks are allocated into decile portfolios based on AG and MB. The portfolios are held for 1 year, from July of year (t) to June of year (t+1), and then rebalanced. Portfolio returns are calculated for each decile every year around the portfolio formation year (t) over the period.

[20] Examples of studies that report international evidence of an asset growth effect include Gray and Johnson (2010) for the Australian market and Yao, et al. (2011) for the Asian financial markets.

Firm return statistics for each decile are then reported for the time-series average of yearly returns.

The results are consistent with findings from the above cited asset pricing studies. Firms with low asset growth earn higher returns than firms with high asset growth. The univariate portfolio sorts on asset growth support these findings. Conditioning on asset growth rates creates a large and economically significant dispersion in average returns across the ten portfolios in the year after portfolio formation. Over this period, firms with the lowest growth rates in decile 1 generate the largest significant returns of 26.46% per annum on average, with a corresponding t-statistic of 4.08. Conversely, firms with the highest growth in decile 10 report the lowest return at 1.8% per annum on average.

Table 5
Univariate portfolio returns sorted on growth option proxies

This table presents average equal-weighted annual returns from univariate sorts on key characteristics over the period 1979 to 2010. At the end of June of each year (t), stocks are allocated into portfolios based on key characteristics. The portfolios are held for 1 year, from July of year (t) to June of year (t+1), and then rebalanced. Portfolio return statistics are reported every year around the portfolio formation year (t) over the sample period. Panel A reports returns from stock portfolios sorted into deciles according to their asset growth (AG) rates. AG is defined as the percentage change in total assets from the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). Panel B reports returns from stock portfolios sorted into deciles according to market-to-book (MB) ratio. MB is the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity in calendar year (t−1). All variables are calculated using data from the CRSP-Compustat merged database.

Panel A: Asset growth (AG)												
Portfolio		1 (Low AG)	2	3	4	5	6	7	8	9	10 (High AG)	Spread (1-10)
AG	RET12	0.2646	0.2192	0.1789	0.1362	0.1295	0.1012	0.0837	0.0786	0.0615	0.0180	0.2466
	t-stat	(4.08)	(4.56)	(4.05)	(3.59)	(3.52)	(3.08)	(2.41)	(2.01)	(1.54)	(0.47)	(6.95)

Panel B: Market-to-book (MB)												
Portfolio		1 (Low MB)	2	3	4	5	6	7	8	9	10 (High MB)	Spread (1-10)
MB	RET12	0.3067	0.2144	0.1547	0.1348	0.1109	0.1082	0.0819	0.0685	0.0432	0.0481	0.2586
	t-stat	(5.21)	(4.55)	(3.94)	(3.47)	(2.90)	(2.84)	(2.20)	(1.75)	(1.09)	(1.10)	(6.66)

As in Cooper, et al. (2008), the negative relation between growth and returns is monotonic across the ten deciles. Especially notable is the spread in returns for low-minus-high (decile 1 minus decile 10) AG portfolios of 24.66% with t-statistic of 6.95. These results confirm that the negative relation between firm asset growth and returns is robust and pervasive in the sample period.

More importantly, total asset growth is used as proxy for growth options because it is hypothesized that the turnover in assets describes the changing systematic risk of the firm. This is linked to both theoretical and empirical evidence that suggests firm value is described by the value of unobservable growth options and the value of assets-in-place (see Myers (1977); Berk, et al. (1999); Carlson, et al. (2004), among others). Separately, in their study of existing growth option proxies widely used in the literature, Adam and Goyal (2008) document that MB has significant information content with respect to growth options. For robustness, univariate portfolios sorted on the proxy of MB is constructed in Panel B of Table 5. This test is appropriate to verify the negative relation between growth options and stock returns as inferred from AG.

Consistent with an interpretation that MB is a proxy for growth options, univariate sorts on the MB ratio reveals a significant and negative trend in portfolio returns. Returns monotonically decline from portfolio 1 (low MB) to portfolio 10 (high MB). The spread in returns for low-minus-high (decile 1 minus decile 10) MB portfolios generates a return of 25.86% with t-statistic of 6.66. This is similar to the return spread of 24.66% for the low-minus-high AG portfolios earlier in Panel A.

2.4.4 *Univariate portfolio sort on segment asset diversification measure*

Similarly, univariate portfolios based on the three diversification measures are likewise constructed to discern if any patterns in returns exist. The portfolio formation methodology is the same as that used for earlier univariate sorts on the growth option proxies. Panel A and B of Table 6 report returns from stock portfolios sorted into deciles on the inverse Herfindahl index value for a firm's segment assets and segment sales, respectively. A Herfindahl index value for a firm's total assets (H_ASSETS) is calculated across its business segments as the sum of the squares of each segment's assets as a proportion of total assets for the firm. The inverse value of the ratio is used in the analysis for scaling purposes. Stocks with an inverse Herfindahl index value of unity are focused firms (decile 1). As a firm becomes more diversified, the inverse Herfindahl index value increases. Therefore, decile 10 is the portfolio that has the most diversified firms in the full sample. Likewise, this approach is adopted for portfolio sorts on the number of business segments in Panel C of Table 6. Decile 1 is a portfolio of single-segment (focused) firms, while decile 10 contains diversified firms with the highest number of ten business segments.[21]

Unlike portfolios sorted on the growth options proxies of AG and MB, there are no patterns in returns across the deciles for any of the diversification measures. To illustrate, consider Panel A that examines univariate portfolio sorted on the inverse of the Herfindahl index value of segment assets (1/H_ASSETS). Stocks in decile 3 have a return of 8.95%. This is similar to the return generated by decile 7 (8.78%). Returns across the deciles also do not exhibit any form monotonic of monotonic behaviour (increasing or decreasing) across the

[21] Financial Accounting Standards Board (FASB) regulation No. 14 and SEC Regulation S-K require firms to report audited footnote information for segments where sales, assets, or profits exceed 10% of consolidated totals. Accordingly, the highest number of business segments that can be reported by a manager is ten segments.

Table 6
Univariate portfolio returns sorted on measures of diversification

This table presents average equal-weighted annual returns from univariate sorts on measures of diversification over the period 1979 to 2010. At the end of June of each year (t), stocks are allocated into portfolios based on key characteristics. The portfolios are held for 1 year, from July of year (t) to June of year (t+1), and then rebalanced. Portfolio return statistics are reported every year around the portfolio formation year (t) over the sample period. Panel A and Panel B reports returns from stock portfolios sorted into deciles according to the inverse of the Herfindahl index value of segment sales (1/H_SALES) and segment assets (1/H_ASSETS), respectively. The Herfindahl index value of segment sales (H_SALES) and segment assets (H_ASSETS) is calculated as the sum of the squares of each segment's sales (assets) as a proportion of the firm's total sales (assets) for that fiscal year. Panel C reports returns from stock portfolios sorted into deciles according to the number of business segments (BUSSEG). BUSSEG is the number of business segments reported by management. All variables are calculated using data from the CRSP-Compustat merged database.

Panel A: Inverse of Herfindahl index value of segment assets (1/H_ASSETS)

Portfolio		1 (Focused)	2	3	4	5	6	7	8	9	10 (Diversified)	Spread (1-10)
1/H_ASSETS	RET12	0.2219	0.1138	0.0895	0.1318	0.1111	0.1205	0.0878	0.1034	0.0976	0.0931	0.1287
	t-stat	(4.45)	(2.98)	(2.55)	(3.25)	(2.61)	(2.78)	(2.18)	(2.64)	(2.51)	(2.50)	(3.66)

Panel B: Inverse of Herfindahl index value of segment sales (1/H_SALES)

Portfolio		1 (Focused)	2	3	4	5	6	7	8	9	10 (Diversified)	Spread (1-10)
1/H_SALES	RET12	0.2219	0.1140	0.0976	0.1119	0.1167	0.0931	0.1055	0.1102	0.1088	0.0905	0.1314
	t-stat	(4.45)	(2.96)	(2.61)	(2.54)	(2.85)	(2.52)	(2.61)	(2.84)	(2.55)	(2.38)	(3.85)

Panel C: Number of business segments (BUSSEG)

Portfolio		1 (Focused)	2	3	4	5	6	7	8	9	10 (Diversified)	Spread (1-10)
BUSSEG	RET12	0.1356	0.1130	0.1023	0.1038	0.0919	0.0570	0.1102	0.1227	0.1809	0.0878	0.0581
	t-stat	(3.20)	(2.86)	(2.74)	(2.59)	(2.23)	(1.51)	(2.52)	(1.22)	(1.22)	(1.16)	(0.86)

deciles. Unlike earlier trends in returns for the growth options proxies, univariate portfolios sorted on diversification measures produce random patterns in returns.

2.4.5 Portfolio sorts on growth option proxies and diversification measures

Recall that growth options with low systematic risk are attractive to the firm. Consequently when exercised, the average systematic risk of the firm in subsequent periods is reduced, leading to lower returns. Diversified firms are also hypothesized to have greater investment flexibility than focused firms for the comparative selection of growth options due to operations in more than one business segment. Taken together, this suggests that diversified firms are able to optimally select and exercise growth options with lower systematic risk than focused firms. As such, after controlling for growth options, diversified firms are hypothesized to have lower returns than focused firms. More specifically, since the investment flexibility of a firm to choose growth options with lower systematic risk increases as diversification increases, future returns are also predicted to trend lower with greater diversification.

This section of the analysis tests these predictions by examining the effect of changing levels of diversification (investment flexibility) on stock returns after controlling for the level of growth options available.[22] This is done by constructing both independent and dependent portfolio sorts on growth option proxies and diversification measures.

The following describes the independent portfolio sorting process used in the analysis. At the end of June of each year (t) over the sample period of 1979 to 2010, stocks are allocated by a two-by-three sorting process into six independently sorted portfolios based on

[22] Firms with low (high) asset growth have few (many) growth options. This is consistent with Adam and Goyal (2008) who document that a low (high) MB ratio indicates that a firm has few (many) investment opportunities relative to its assets-in-place.

the respective growth options proxies and diversification measures. For each year of the sample period, all firms are ranked by the median value for the growth option proxy used in the portfolio sort into two horizontal rows – low and high growth. Likewise, for each year of the sample period, all firms are also ranked by the relevant diversification measure used in the analysis. Focused firms have an inverse Herfindahl index value of unity and are exclusively allocated to one portfolio column. In contrast, diversified firms have inverse Herfindahl index values ranging from zero to less than unity. As such, diversified firms are sorted into two different portfolio columns based on the median diversification measure of the sample. Therefore, portfolios constructed consist exclusively of either focused or diversified firms which are distinguished by their level of low or high growth.

The combined ranking in growth options and diversification measures allows for the construction of a two-by-three matrix of six independent portfolios. This consists namely of two groupings of low and high growth options, versus three groupings based on diversification measures described by a trend of focused firms, less diversified firms, and finally, highly diversified firms.[23] The portfolios are held for 1 year, from July of year (t) to June of year (t+1), and then rebalanced. The time-series of portfolio returns around the portfolio formation year (t) over the sample period are then averaged and reported with t-statistics in brackets.

Rather than base ensuing conclusions on outcomes from independent portfolio sorts, dependent sorts are also constructed to examine if return patterns (if any) are robust across portfolio variations. This step allows for an assessment of whether investment flexibility is

[23] To avoid confusion, only the extremes of the portfolio sort (that is, focused and highly diversified) are referenced in the analysis. The middle portfolios of less diversified firms are not referenced in the discussion of results.

indeed important in the selection of growth options and also provides an indication of the attainability of reported returns for spread portfolios.

As before, stocks are allocated into six portfolios for each year of the sample period. However, the next step of the sorting process varies depending on the dependent variable used. If the dependent variable is a growth option proxy, stocks are first sorted into two groups of low and high growth options by the median value of the proxy. As before, the two groupings of low and high growth options are then sorted three ways by the measure of diversification into focused firms, less diversified firms, and finally, highly diversified firms. This results in a two-by-three matrix of six dependent portfolio sorts.

The opposite process applies if the dependent variable used is a diversification measure. Stocks in each year are first sorted three ways by the measure of diversification into focused firms, less diversified firms, and finally, highly diversified firms. The three groupings are then ranked by the median value of the growth option proxy into another two portfolios. This again effectively produces a two-by-three matrix of six independently sorted portfolios again. The method of calculation for portfolio returns remains the same.[24]

Lastly, there is a notable difference in the portfolio sorting method when using the diversification measure of the number of business segments (BUSSEG). In contrast to portfolio variations using the Herfindahl index as a measure for diversification, portfolio sorts of firms based on BUSSEG are grouped according to a predetermined range of business segments. Focused firms have only one business segment. Diversified firms are grouped

[24] The use of diversification measures in dependent portfolio sorts allows for variation in returns across diversified firms in the sample due to a range of Herfindahl index values and the number of business segments. In contrast, focused firms only have the diversification measure of unity. Consequently, tabulated returns for focused firms do not change across independent and dependent portfolio sorts.

according to the median number of business segments (two segments) into two groups – diversified firms with either low or high diversification.

Firms with low diversification have two business segments while firms with high diversification have three segments and above. Another important difference is that dependent portfolio sorts using BUSSEG essentially predetermines the allocation of firms to portfolios and is independent of whether BUSSEG is the dependent variable. Consequently, there is only one portfolio variation for the dependent sort of a growth option proxy and BUSSEG instead of two portfolio variations for dependent sorts if one employs the Herfindahl index as a diversification measure.

2.4.6 Returns to portfolio sorts on asset growth and the diversification measure of segment assets

Panel A of Table 7 tabulates returns from an independent sort of AG against the diversification measures of segment assets (1/H_ASSETS). Stocks with low AG (row 1) have larger returns than stocks with high AG (row 2). Return spreads for low minus high AG portfolios are also significantly positive. Both trends are also robust for both focused and diversified firms. This finding serves as no surprise as a strong and robust negative relation between AG and stock returns is documented by prior work in the literature as well as the univariate portfolio sorts of this study.

Of specific interest is whether increasing diversification is related to increased investment flexibility to choose growth options with lower systematic risk. Focused firms have much higher returns (19.97%) than highly diversified firms (12.29%) for the same portfolio sort of low AG (few growth options). The difference in returns for both portfolios

Table 7
Portfolio returns sorted on Asset Growth and Segment Asset Diversification

This table presents average equal-weighted returns from independent and dependent portfolio sorts on asset growth (AG) and the inverse of the Herfindahl index value of segment assets (1/H_ASSETS) over the period 1979 to 2010. Firms are ranked by the median value for AG into low and high AG stocks. Focused firms have an inverse Herfindahl index value of unity (left column). Diversified firms have inverse Herfindahl index values that are greater than unity and are likewise ranked into less diversified (middle column) and more diversified stocks (right column) based on the median diversification measure of the sample for the fiscal year ending in calendar year (t-1). At the end of June of each year (t), stocks are allocated by a two-by-three sorting process into six portfolios. The portfolios are held for 1 year, from July of year (t) to June of year (t+1), and then rebalanced. Portfolio returns around the portfolio formation year (t) over the sample period are then averaged with return statistics reported. Panel A presents average returns from independent portfolio sorts on AG and 1/H_ASSETS. Panel B (C) presents average returns from dependent portfolio sorts by the dependent variable AG (1/H_ASSETS) and then by 1/H_ASSETS (AG). Low-minus-high AG portfolios represent the return differential between low and high AG states. Focused-minus-diversified portfolios represent the return differential between portfolios of focused and the more diversified firms. The bottom right corner of each matrix represents the average return differential between the extreme portfolio sorts for each characteristic (e.g. Low AG-Focused minus High AG-Diversified in Panel A). AG is defined as the percentage change in total assets from the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). The Herfindahl index value of segment assets (H_ASSETS) is calculated as the sum of the squares of each segment's assets as a proportion of the firm's total assets for that fiscal year. t-statistics are in parentheses. All variables are calculated using data from the CRSP-Compustat merged database.

Panel A: Independent portfolio sort on Asset Growth (AG) and Diversification in Segment Assets (1/H_ASSETS)

Variable	Focused		Diversified	Focused minus Diversified
Low AG	0.1997	0.1644	0.1229	0.0769
	(4.20)	(3.84)	(2.97)	(3.29)
High AG	0.0716	0.0588	0.0775	-0.0059
	(1.86)	(1.71)	(2.17)	(-0.40)
Low Minus High AG	0.1281		0.0453	0.1222
	(7.42)		(3.33)	(4.94)

Panel B: Dependent Sort on Asset Growth (AG) by Diversification in Segment Assets (1/H_ASSETS)

Variable	Focused		Diversified	Focused minus Diversified
Low AG	0.1997	0.1634	0.1220	0.0778
	(4.20)	(3.84)	(2.93)	(3.26)
High AG	0.0716	0.0590	0.0777	-0.0056
	(1.86)	(1.69)	(2.18)	(-0.38)
Low Minus High AG	0.1281		0.0447	0.1225
	(7.42)		(3.18)	(4.84)

Panel C: Dependent Sort on Diversification in Segment Assets (1/H_ASSETS) by Asset Growth (AG)

Variable	Focused		Diversified	Focused minus Diversified
Low AG	0.1997	0.1633	0.1235	0.0762
	(4.20)	(3.85)	(3.02)	(3.24)
High AG	0.0716	0.0582	0.0767	-0.0051
	(1.86)	(1.67)	(2.14)	(-0.35)
Low Minus High AG	0.1281		0.0468	0.1230
	(7.42)		(3.68)	(5.04)

(focused minus diversified) at 7.69% is also significant. In contrast, for firms sorted on high AG (more growth options), focused firms and diversified firms have similar returns (7.17% and 7.75%, respectively). The return spread for focused minus diversified firms sorted on high AG is also not statistically different from zero.

Dependent portfolio sorts on AG and 1/H_ASSETS are constructed to verify if the pattern of returns is robust to portfolio variations. Panel B of Table 7 reports returns with AG as the dependent variable. The dependent sorting process is again repeated in Panel C with 1/H_ASSETS as the dependent variable. Results from both panels show a trend in returns consistent with findings in Panel A. A negative relation between AG and stock returns is observed with low-minus-high AG return spreads for both focused and diversified firms being significantly positive.

More importantly, similar to findings for independent portfolio sorts on AG and 1/H_ASSETS, focused firms have higher returns than diversified firms for portfolios of low asset growth (few growth options) in both Panels B and C. The return spreads between focused and diversified firms are again positive and statistically significant. As before, there is little difference in returns between focused and diversified firms for portfolios of high asset growth (many growth options), for both dependent sorts. This is again confirmed by return spreads that are not significantly different from zero.

The findings support the conjecture that focused firms have less investment flexibility than diversified firms to choose growth options with lower systematic risk. However, this seems to be true for firms that have few growth options. In contrast, there is no evidence that suggests investment flexibility is important to the selection of growth options when firms have many growth options.

2.4.7 Returns to portfolio sorts on the market-to-book value of equity ratio and the diversification measure of segment assets

To test the validity of the prior findings, independent and dependent portfolio sorts are repeated with the same diversification measure of segment assets but the alternative proxy for growth options, the market-to-book value of equity ratio (MB). Results from the portfolio sorts are tabulated in Table 8. Panel A reports results for independent portfolio sorts. Returns from dependent portfolio sorts are shown in Panels B and C.

Overall, results for the portfolio sorts that use MB as an alternative proxy for growth options are qualitatively identical to findings for portfolio variations using AG as the growth option proxy. Focused firms yield higher returns than diversified firms only during periods of low MB when both firms have few growth options. There is also little difference in returns between focused and diversified firms when firms have many growth options (high MB).

Overall, the findings based in Tables 7 and 8 suggest that the greater investment flexibility of diversified firms compared to focused firms to select growth options with lower systematic risk is important only when few investment opportunities are available.

2.4.8 Robustness tests: Returns to portfolio sorts on growth option proxies and alternative diversification measures

It is possible that measurement or classification error specific to the accounting information of segment assets systematically biases the results. Therefore, a valid consideration is whether the results from portfolio variations will hold if other measures of corporate diversification are employed. To explore this possibility, robustness tests are conducted to investigate the sensitivity of the results to alternative measures of firm

Table 8
Portfolio returns sorted on Market-to-book and Segment Asset Diversification

This table presents average equal-weighted returns from independent and dependent portfolio sorts on the market-to-book (MB) ratio and the inverse of the Herfindahl index value of segment assets (1/H_ASSETS) over the period 1979 to 2010. Firms are ranked by the median value for MB into low and high MB stocks. Focused firms have an inverse Herfindahl index value of unity (left column). Diversified firms have inverse Herfindahl index values that are greater than unity and are likewise ranked into less diversified (middle column) and more diversified stocks (right column) based on the median diversification measure of the sample for the fiscal year ending in calendar year (t-1). At the end of June of each year (t), stocks are allocated by a two-by-three sorting process into six portfolios. The portfolios are held for 1 year, from July of year (t) to June of year (t+1), and then rebalanced. Portfolio returns around the portfolio formation year (t) over the sample period are then averaged with return statistics reported. Panel A presents average returns from independent portfolio sorts on MB and 1/H_ASSETS. Panel B (C) presents average returns from dependent portfolio sorts by the dependent variable MB (1/H_ASSETS) and then by 1/H_ASSETS (MB). Low-minus-high asset growth portfolios represent the return differential between low and high MB states. Focused-minus-diversified portfolios represent the return differential between portfolios of focused and the more diversified firms. The bottom right corner of each matrix represents the average return differential between the extreme portfolio sorts for each characteristic (e.g. Low MB-Focused minus High MB-Diversified in Panel A). MB is the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity in calendar year (t−1). The Herfindahl index value of segment assets (H_ASSETS) is calculated as the sum of the squares of each segment's assets as a proportion of the firm's total assets for that fiscal year. t-statistics are in parentheses. All variables are calculated using data from the CRSP-Compustat merged database.

Panel A: Independent portfolio sort on Market-to-book (MB) and Diversification in Segment Assets (1/H_ASSETS)

Variable	Focused		Diversified	Focused minus Diversified
Low MB	0.1950	0.1773	0.1448	0.0502
	(4.31)	(4.05)	(3.41)	(2.78)
High MB	0.0764	0.0401	0.0584	0.0179
	(1.84)	(1.20)	(1.66)	(0.89)
Low Minus High MB	0.1187		0.0863	0.1366
	(6.09)		(5.42)	(6.43)

Panel B: Dependent Sort on Market-to-book (MB) by Diversification in Segment Assets (1/H_ASSETS)

Variable	Focused		Diversified	Focused minus Diversified
Low MB	0.1950	0.1744	0.1483	0.0467
	(4.31)	(4.03)	(3.47)	(2.57)
High MB	0.0764	0.0391	0.0598	0.0166
	(1.84)	(1.16)	(1.71)	(0.81)
Low Minus High MB	0.1187		0.0886	0.1353
	(6.09)		(5.51)	(6.33)

Panel C: Dependent Sort on Diversification in Segment Assets (1/H_ASSETS) by Market-to-book (MB)

Variable	Focused		Diversified	Focused minus Diversified
Low MB	0.1950	0.1798	0.1443	0.0507
	(4.31)	(4.10)	(3.43)	(2.83)
High MB	0.0764	0.0418	0.0560	0.0204
	(1.84)	(1.24)	(1.59)	(1.02)
Low Minus High MB	0.1187		0.0884	0.1390
	(6.09)		(5.54)	(6.52)

diversification established in the literature. These include the Herfindahl index measure of segment sales and the number of firm segments (see Berger and Ofek (1995); Comment and Jarrell (1995); Graham, et al. (2002), among others). As before, both proxies for growth options, AG and MB, are also used in all tests to confirm findings.

Tables 9 and 10 reports the results for portfolio sorts on the diversification measure of segment sales (1/H_SALES) and the growth option proxies of AG and MB, respectively. Panels A, B and C of Table 9 all document a positive and significant return spread between focused and diversified firms when firms have low asset growth. The return spread is similar in magnitude for both independent and dependent portfolio sorts, with the lowest spread generated by the dependent portfolio sort of 1/H_SALES by AG (6.59% per annum) and the largest spread produced by the dependent portfolio sort of AG by 1/H_SALES (7.12% per annum). An independent portfolio sort on AG and 1/H_SALES gives a return of 6.84% per annum. There is no statistical difference in returns for focused and diversified firms when firms have many growth options (high asset growth). In other words, portfolio variations using the alternative diversification measure of segment assets confirm earlier findings.

Table 10 replicates the portfolio sorts by using MB as a growth option proxy instead. The pattern of returns generated confirms earlier findings. Similar to portfolio sorts on MB and 1/H_ASSETS earlier, return spreads for focused and diversified firms in all panels during periods of low asset growth (few growth options) are smaller than when the AG proxy is employed. There is no deviation from earlier findings that there is a negligible return spread (2.23% per annum with a t-statistic of 1.16 for the dependent sort of 1/H_SALES by MB)) between focused and diversified firms during periods of high asset growth (many growth options).

Table 9
Portfolio returns sorted on Asset Growth and Segment Sales Diversification

This table presents average equal-weighted returns from independent and dependent portfolio sorts on asset growth (AG) and the inverse of the Herfindahl index value of segment sales (1/H_ SALES) over the period 1979 to 2010. Firms are ranked by the median value for AG into low and high AG stocks. Focused firms have an inverse Herfindahl index value of unity (left column). Diversified firms have inverse Herfindahl index values that are greater than unity and are likewise ranked into less diversified (middle column) and more diversified stocks (right column) based on the median diversification measure of the sample for the fiscal year ending in calendar year (t-1). At the end of June of each year (t), stocks are allocated by a two-by-three sorting process into six portfolios. The portfolios are held for 1 year, from July of year (t) to June of year (t+1), and then rebalanced. Portfolio returns around the portfolio formation year (t) over the sample period are then averaged with return statistics reported. Panel A presents average returns from independent portfolio sorts on AG and 1/H_ SALES. Panel B (C) presents average returns from dependent portfolio sorts by the dependent variable AG (1/H_ SALES) and then by 1/H_ SALES (AG). Low-minus-high AG portfolios represent the return differential between low and high AG states. Focused-minus-diversified portfolios represent the return differential between portfolios of focused and the more diversified firms. The bottom right corner of each matrix represents the average return differential between the extreme portfolio sorts for each characteristic (e.g. Low AG-Focused minus High AG-Diversified in Panel A). AG is defined as the percentage change in total assets from the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). The Herfindahl index value of segment assets (H_ SALES) is calculated as the sum of the squares of each segment's assets as a proportion of the firm's total assets for that fiscal year. t-statistics are in parentheses. All variables are calculated using data from the CRSP-Compustat merged database.

Panel A: Independent portfolio sort on Asset Growth (AG) and Sales Diversification (1/H_SALES)

Variable	Focused		Diversified	Focused minus Diversified
Low AG	0.1997	0.1551	0.1313	0.0684
	(4.20)	(3.71)	(3.14)	(3.19)
High AG	0.0716	0.0604	0.0729	-0.0013
	(1.86)	(1.81)	(2.10)	(-0.09)
Low Minus High AG	0.1281		0.0584	0.1268
	(7.42)		(4.03)	(5.06)

Panel B: Dependent Sort on Asset Growth (AG) by Sales Diversification (1/H_ SALES)

Variable	Focused		Diversified	Focused minus Diversified
Low AG	0.1997	0.1569	0.1285	0.0712
	(4.20)	(3.72)	(3.10)	(3.24)
High AG	0.0716	0.0670	0.0692	0.0025
	(1.86)	(1.91)	(1.92)	(0.17)
Low Minus High AG	0.1281		0.0594	0.1306
	(7.42)		(4.34)	(5.25)

Panel C: Dependent Sort on Sales Diversification (1/H_ SALES) by Asset Growth (AG)

Variable	Focused		Diversified	Focused minus Diversified
Low AG	0.1997	0.1533	0.1338	0.0659
	(4.20)	(3.70)	(3.19)	(3.02)
High AG	0.0716	0.0635	0.0713	0.0004
	(1.86)	(1.77)	(2.05)	(0.03)
Low Minus High AG	0.1281		0.0626	0.1285
	(7.42)		(4.26)	(5.17)

Table 10

Portfolio returns sorted on Market-to-book and Segment Sales Diversification

This table presents average equal-weighted returns from independent and dependent portfolio sorts on the market-to-book (MB) ratio and the inverse of the Herfindahl index value of segment sales (1/H_ SALES) over the period 1979 to 2010. Firms are ranked by the median value for MB into low and high MB stocks. Focused firms have an inverse Herfindahl index value of unity (left column). Diversified firms have inverse Herfindahl index values that are greater than unity and are likewise ranked into less diversified (middle column) and more diversified stocks (right column) based on the median diversification measure of the sample for the fiscal year ending in calendar year (t-1). At the end of June of each year (t), stocks are allocated by a two-by-three sorting process into six portfolios. The portfolios are held for 1 year, from July of year (t) to June of year (t+1), and then rebalanced. Portfolio returns around the portfolio formation year (t) over the sample period are then averaged with return statistics reported. Panel A presents average returns from independent portfolio sorts on MB and 1/H_ SALES. Panel B (C) presents average returns from dependent portfolio sorts by the dependent variable MB (1/H_ SALES) and then by 1/H_ SALES (MB). Low-minus-high MB portfolios represent the return differential between low and high MB states. Focused-minus-diversified portfolios represent the return differential between portfolios of focused and the more diversified firms. The bottom right corner of each matrix represents the average return differential between the extreme portfolio sorts for each characteristic (e.g. Low MB-Focused minus High MB-Diversified in Panel A). MB is the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity in calendar year (t−1). The Herfindahl index value of segment assets (H_ SALES) is calculated as the sum of the squares of each segment's assets as a proportion of the firm's total assets for that fiscal year. t-statistics are in parentheses. All variables are calculated using data from the CRSP-Compustat merged database.

Panel A: Independent portfolio sort on Market-to-book (MB) and Sales Diversification (1/H_ SALES)

Variable	Focused		Diversified	Focused minus Diversified
Low MB	0.1950	0.1700	0.1530	0.0421
	(4.31)	(3.90)	(3.62)	(2.42)
High MB	0.0764	0.0472	0.0523	0.0241
	(1.84)	(1.38)	(1.52)	(1.23)
Low Minus High MB	0.1187		0.1007	0.1427
	(6.09)		(6.59)	(6.90)

Panel B: Dependent Sort on Market-to-book (MB) by Sales Diversification (1/H_ SALES)

Variable	Focused		Diversified	Focused minus Diversified
Low MB	0.1950	0.1704	0.1523	0.0427
	(4.31)	(3.91)	(3.60)	(2.45)
High MB	0.0764	0.0479	0.0510	0.0253
	(1.84)	(1.41)	(1.48)	(1.29)
Low Minus High MB	0.1187		0.1013	0.1440
	(6.09)		(6.64)	(6.95)

Panel C: Dependent Sort on Sales Diversification (1/H_ SALES) by Market-to-book (MB)

Variable	Focused		Diversified	Focused minus Diversified
Low MB	0.1950	0.1681	0.1511	0.0439
	(4.31)	(3.87)	(3.60)	(2.50)
High MB	0.0764	0.0487	0.0540	0.0223
	(1.84)	(1.42)	(1.54)	(1.16)
Low Minus High MB	0.1187		0. 0971	0.1410
	(6.09)		(5.96)	(6.79)

Lastly, the robustness check is repeated for portfolio variations on growth option proxies versus the diversification measure of the number of business segments (BUSSEG). Tables 11 and 12 document the results for portfolio variations based on either of the two growth option proxies, AG and MB, respectively. Focused firms have only one business segment. Diversified firms are grouped according to the median for the number of business segments (two segments) into two groups of firms with either low (two business segments) or high diversification (three business segments and above).[25]

The tabulated results are consistent with prior tests employing different diversification measures based on the Herfindahl index. Focused and diversified firms are documented to have an economically meaningful and positive return spread (7.18% per annum with a t-statistic of 2.98 for the independent sort of AG and BUSSEG) when they have few growth options (low AG) with no difference in returns (0.44% per annum with a t-statistic of 0.28 for the independent sort of AG and BUSSEG) when they have many growth options (high AG). Results remain qualitatively the same in Table 12 when the MB growth option proxy is applied instead.

Overall, results from both the use of a variety of diversification measures and growth option proxies suggest that investment flexibility in the selection of growth options with lower systematic risk account for an economically significant spread in returns for focused and diversified firms. This supports the interpretation that because diversified firms have operations in more than one business segment, managers of diversified firms are able to

[25] Dependent portfolio sorts of the number of business segments (BUSSEG) predetermines the allocation of firms to portfolios regardless whether BUSSEG is the dependent variable. Consequently, there is only one variation for dependently sorted portfolios on a growth option proxy and BUSSEG, as compared to two variations for dependent sorts employing the Herfindahl index as a diversification measure.

Table 11

Portfolio returns sorted on Asset Growth and Number of Business Segments

This table presents average equal-weighted returns from independent and dependent portfolio sorts on asset growth (AG) and the number of business segments (BUSSEG) over the period 1979 to 2010. Firms are ranked by the median value for AG into low and high AG stocks. Focused firms have one business segment. Diversified firms are ranked into less diversified (two segments) and more diversified stocks (three or more segments) based on the median number of business segments of the sample for the fiscal year ending in calendar year (t-1). At the end of June of each year (t), stocks are then allocated by a two-by-three sorting process into six portfolios. The portfolios are held for 1 year, from July of year (t) to June of year (t+1), and then rebalanced. Portfolio returns around the portfolio formation year (t) over the sample period are then averaged with return statistics reported. Panel A presents average returns from independent portfolio sorts on AG and BUSSEG. Panel B presents average returns from dependent portfolio sorts by the dependent variable AG and then by BUSSEG. Low-minus-high AG portfolios represent the return differential between low and high AG states. Focused-minus-diversified portfolios represent the return differential between portfolios of focused and the more diversified firms. The bottom right corner of each matrix represents the average return differential between the extreme portfolio sorts for each characteristic (e.g. Low AG-Focused minus High AG-Diversified>=3 in Panel A). AG is defined as the percentage change in total assets from the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). BUSSEG is the number of business segments reported by management. Dependent portfolio sorts employing BUSSEG predetermines the allocation of firms to portfolios. Consequently, there is only one portfolio variation for the dependent sort of a growth option proxy and BUSSEG. t-statistics are in parentheses. All variables are calculated using data from the CRSP-Compustat merged database.

Panel A: Independent portfolio sort on Asset Growth (AG) and Number of Business Segments (BUSSEG)

	No. of Business Segments			
	(1)	(2)	(>=3)	
Variable	Focused		Diversified	Focused minus Diversified
Low AG	0.2027	0.1638	0.1309	0.0718
	(4.21)	(3.71)	(3.16)	(2.98)
High AG	0.0719	0.0599	0.0676	0.0044
	(1.89)	(1.67)	(1.92)	(0.28)
Low Minus High AG	0.1308		0.0633	0.1351
	(7.44)		(4.53)	(5.09)

Panel B: Dependent Sort on Asset Growth (AG) by Number of Business Segments (BUSSEG)

	No. of Business Segments			
	(1)	(2)	(>=3)	
Variable	Focused		Diversified	Focused minus Diversified
Low AG	0.1997	0.1614	0.1290	0.0708
	(4.20)	(3.40)	(3.19)	(2.99)
High AG	0.0716	0.0648	0.0701	0.0015
	(1.86)	(1.84)	(1.99)	(0.10)
Low Minus High AG	0.1281		0.0589	0.1296
	(7.42)		(5.05)	(5.00)

Table 12

Portfolio returns sorted on Market-to-book and Number of Business Segments

This table presents average equal-weighted returns from independent and dependent portfolio sorts on the market-to-book (MB) ratio and the number of business segments (BUSSEG) over the period 1979 to 2010. Firms are ranked by the median value for MB into low and high MB stocks. Focused firms have one business segment. Diversified firms are ranked into less diversified (two segments) and more diversified stocks (three or more segments) based on the median number of business segments of the sample for the fiscal year ending in calendar year (t-1). At the end of June of each year (t), stocks are then allocated by a two-by-three sorting process into six portfolios. The portfolios are held for 1 year, from July of year (t) to June of year (t+1), and then rebalanced. Portfolio returns around the portfolio formation year (t) over the sample period are then averaged with return statistics reported. Panel A presents average returns from independent portfolio sorts on MB and BUSSEG. Panel B presents average returns from dependent portfolio sorts by the dependent variable MB and then by BUSSEG. Low-minus-high AG portfolios represent the return differential between low and high MB states. Focused-minus-diversified portfolios represent the return differential between portfolios of focused and the more diversified firms. . The bottom right corner of each matrix represents the average return differential between the extreme portfolio sorts for each characteristic (e.g. Low MB-Focused minus High MB-Diversified>=3 in Panel A). MB is the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity in calendar year (t−1). BUSSEG is the number of business segments reported by management. Dependent portfolio sorts employing BUSSEG predetermines the allocation of firms to portfolios. Consequently, there is only one portfolio variation for the dependent sort of a growth option proxy and BUSSEG. t-statistics are in parentheses. All variables are calculated using data from the CRSP-Compustat merged database.

Panel A: Independent portfolio sort on Market-to-book (MB) and Number of Business Segments (BUSSEG)

	No. of Business Segments			
	(1)	(2)	(>=3)	
Variable	Focused		Diversified	Focused minus Diversified
Low MB	0.1976	0.1644	0.1422	0.0554
	(4.38)	(3.65)	(3.40)	(2.91)
High MB	0.0791	0.0476	0.0470	0.0321
	(1.90)	(1.39)	(1.38)	(1.66)
Low Minus High MB	0.1184		0.0952	0.1506
	(6.06)		(5.58)	(6.98)

Panel B: Dependent Sort on Market-to-book (MB) by Number of Business Segments (BUSSEG)

	No. of Business Segments			
	(1)	(2)	(>=3)	
Variable	Focused		Diversified	Focused minus Diversified
Low MB	0.1950	0.1790	0.1490	0.0460
	(4.31)	(3.91)	(3.54)	(2.32)
High MB	0.0764	0.0474	0.0501	0.0262
	(1.84)	(1.37)	(1.47)	(1.29)
Low Minus High MB	0.1187		0.0989	0.1449
	(6.09)		(6.12)	(6.84)

comparatively select available growth options from all the business segments and "cherry pick" the most attractive ones.

Another important observation is that the advantage of diversified firms having investment flexibility in the selection of growth options is limited to states when both focused and diversified firms have few growth options available. When firms have many growth options available, the return spread between focused and diversified firms disappears and is not statistically different from zero. This finding does not necessarily contradict the suggestion that diversified firms have more investment flexibility. However, it does suggest that investment flexibility may be of significant importance only in the presence of constraints that inhibit the selection of investment opportunities.

For example, in the presence of financial constraints imposed by the external capital market, diversified firms can resort to substituting internal capital markets for costly external markets (see Yan, Yang and Jiao (2010)). Alternatively, diversified firms also have the investment flexibility to select growth options in alternative business segments that require less upfront capital. In both cases, investment flexibility allows the diversified firm to make undertake value increasing projects that might otherwise be bypassed (see Denis and Sibilkov (2010)). In contrast, focused firms do not have internal capital markets due to operations in only one business segment. As such they are unable to relax constraints imposed on them by costly external capital markets. Focused firms also do not have the investment flexibility to choose alternative growth options in unrelated business segments.

2.5 Summary and conclusion

This chapter presents new evidence that diversified have more investment flexibility than focused firms to select growth options with lower systematic risk. Tests including Fama and MacBeth (1973) and portfolio variations compare future returns of diversified and focused firms after controlling for the level of growth options available. Two proxies for growth options are used: total asset growth which captures the turnover of assets for a firm and the ratio of market-to-book value of equity (see Adam and Goyal (2008)). Similar to Comment and Jarrell (1995), three different measures of diversification are used: the Herfindahl index value for segment assets and segment sales as well as the count of the number of business segments reported by management.

On average, focused firms earn economically and significantly higher future returns than diversified firms when few growth options are available, with no statistical difference in return spreads when both focused and diversified firms have many growth options. The findings are robust to a variety of growth option proxies, diversification measures and portfolio variations. Overall, the findings support the notion that managers of diversified firms have the investment flexibility to optimally choose growth options with lower systematic risk. However, the benefits of investment flexibility are limited to states when both diversified and focused firms have few growth options available.

The results of this study bring important insights to both the corporate finance and asset-pricing literature. A unique contribution to the corporate finance literature is the idea that the investment flexibility of a firm to optimally select growth options with low systematic risk has important implications for firm value. Growth options limited to a specific business segment are likely to have highly correlated systematic risk. In contrast, investment flexibility to select growth options from a variety of business segments allows a firm to manage the systematic risk of its investments and consequently, the risk of resulting cash flows. In this sense, this study offers a novel interpretation why corporate diversification is not value destroying and a potential explanation for the diversification discount.

This chapter also makes a contribution to the asset pricing literature. Prior work documents the persistent and significantly negative relation between total asset growth and stock returns (see Cooper, et al. (2008); Gray and Johnson (2010); Li, et al. (2010), among others). Cooper and Priestley (2011) subsequently show that the return spread between low and high asset growth portfolios are largely accounted for by their spread in systematic risk. The authors also argue that total asset growth forecasts aggregate economic activities and show that the negative investment-return relation is driven by risk. This study extends the findings of prior studies by suggesting that total asset growth is an effective proxy for growth options because it captures the relative importance of growth options versus existing assets in explaining firm value. The evidence provides support for risk based explanations in contrast to earlier mispricing arguments.

Results from this study offer practical insight as to why managers continue to pursue diversification strategies in the marketplace. A limitation of this study that requires more research is why the benefits of investment flexibility are limited to states when firms have few growth options. This is left for future work.

Chapter 3:

Corporate Diversification, Internal Capital Markets and Financial Constraints

3.1 Introduction

The process by which capital is allocated for new capital investment is a key area of research in corporate finance. Much of the emphasis of past studies has been on the allocation of capital to the firm by external providers. Typical sources of external capital include banks, finance companies, stock markets and corporate bond markets. Yet, perhaps the most significant capital allocation process takes place within the internal capital markets (ICMs) of diversified firms that have operations in multiple business segments.

The importance of an ICM is underscored by the significant proportion of investment activity that it funds. For example, Lamont (1997) documents that more than three quarters of all capital outlays for U.S. non-financial corporations between 1981 and 1991 are funded by ICMs. It is thus no surprise that ICMs in diversified firms have been the subject of recent theoretical and empirical research in the corporate finance literature.

How do ICMs work? In the presence of credit-constraints, not all positive net present value investment opportunities (growth options) can be financed. The headquarters of a diversified firm creates value by actively reallocating scarce internal funds generated by its business units to the most attractive growth options.[1] For example, cash flows generated by one business segment may be taken and used for investment in another business segment that has better investment prospects. Alternatively, Stein (1997) suggests that another source of internal funds for ICMs is the use of one business unit's assets as collateral to raise financing from external capital markets. Funds generated through such collateralized loans are then diverted to another unit for investment use.

[1] Similarly, Williamson (1975) suggests that cash flows generated within a firm are not automatically returned to their sources but are instead exposed to internal competition.

ICMs are unique to diversified firms. Single-segment (focused) firms do not have ICMs because all cash flows are completely sourced from and allocated to investments within the same business segment. Thus, focused firms are not able to access the incremental benefits that can be gained from the reallocation process between different business segments in an ICM. In addition, diversified firms have growth options from multiple business segments that may have low correlation in investment outcomes. As such, managers of diversified firms are able to opportunistically compare and select growth options from among the different business segments. ICMs are then used to divert internal funds to business units with the most favourable growth options for new capital investment. In contrast, the available growth options within a single business segment are likely to have highly correlated investment outcomes. This effectively mitigates any value that focused firms potentially gain from internal comparisons of investment opportunities.

Despite the obvious benefits of an ICM, there is reason to believe that the reallocation process within an ICM may not always relax financial constraints on the firm. In other words, ICMs may be "inefficient" in the reallocation of internal funds thereby imposing greater financial constraints on the firm. The key distortion of ICM efficiency is that the real option from internal cash flows is exercised at the discretion of managers with minimal fiscal accountability. Under these conditions, managers may seek their own private benefit by using free cash flows from ICMs to indulge in inefficient investment. As such, inefficient ICMs exacerbate financial constraints for new firm investment.

The literature gives evidence of both efficient and inefficient ICMs. Theoretical models that suggest that ICMs relax financial constraints are Weston (1970), Williamson (1986), Gertner, et al. (1994) and Stein (1997). Alternative theoretical arguments which emphasize the value destroying behaviour of internal allocation models based on agency conflicts include Rajan, Servaes and Zingales (2000), Scharfstein and Stein (2000) and Motta (2003). Empirical tests of these models which suggest that capital reallocation by ICMs are, on average, inefficient include Lamont (1997), Shin and Stulz (1998) and Rajan, et al. (2000). On the other hand, recent empirical evidence from Khanna and Tice (2001), Yan, et al. (2010) and Gayané (2011) suggest that internal capital markets work efficiently by reallocating capital away from low productivity to high productivity business segments.

This chapter of the thesis examines whether financial constraints arising from ICM efficiency are priced into stock returns. Motivation for this inquiry starts with a recent and growing body of asset pricing literature that provides evidence of a positive relation between financial constraints and the risk of the firm. For example, Lamont, Polk and Saa'-Requejo (2001) and Gomes, Yaron and Zhang (2006) report that financing frictions serve as a significant common factor for the pricing of cross-sectional returns. Whited and Wu (2006) extend the work of these studies and find evidence of a positive relation between financial constraints and stock returns that dominates the size effect. More importantly, the authors argue that financial constraints represent a source of risk that is priced in stock returns that cannot be explained by the Fama-French and momentum factors. Livdan, et al. (2009) study the effect of financial constraints on risk and expected returns. The authors show empirically that the assets of more financially constrained firms are riskier and have higher expected stock returns than less financially constrained firms.

The preceding findings suggest that financial constraints arising from ICM efficiency are potentially priced into stock returns. In other words, diversified firms with low ICM efficiency should have more financial constraints and higher stock returns. Diversified firms with high ICM efficiency should have less financial constraints and lower stock returns. To test this conjecture, a pooled sample of 14,709 firm-years comprising 2,683 diversified firms from the CRSP/Compustat Merged Database (CCM) during the period of 1979 to 2010 is examined. Absolute value added (AVA), a measure of ICM efficiency as defined by Rajan, et al. (2000), is used to account for the extent to which an ICM relaxes financial constraints by efficiently reallocating internal funds to business segments with superior investment opportunities. Firms with inefficient ICMs have low AVA values and vice versa. Therefore, the testable prediction is that diversified firms with inefficient ICMs (low AVA values) have greater financial constraints and earn significantly higher returns than firms with efficient ICMs (high AVA values).

Consistent with the perspective that ICM efficiency is priced into stock returns, Fama and MacBeth (1973) regressions with annual stock returns as the dependent variable show that ICM efficiency has a negative and statistically significant relation with stock returns. The findings are consistent with the interpretation that firms with inefficient ICMs (low AVA values) are more financially constrained and earn higher returns than firms with efficient ICMs (high AVA). More importantly, the statistical significance of the negative relation is robust to alternative growth option proxies and measures of firm diversification.

This study is also related to recent work by Almeida and Campello (2007), Chang and Dasgupta (2007), Livdan, et al. (2009) and Hahn and Lee (2009). These studies likewise report that more financially constrained firms are riskier and earn higher future returns than less financially constrained firms. The cited studies suggest that a “credit multiplier” effect that is based on collateral constraints explains the positive relation between financial constraints and stock returns.

These explanations are built on the argument by Kiyotaki and Moore (1997) who show that the interaction of collateral constraints and asset prices acts as a powerful transmission mechanism to amplify and propagate the effects of economic shocks. Kiyotaki and Moore (1997) construct a model of a dynamic economy where lenders cannot force borrowers to repay debts unless debts are secured by collateral. Consequently, firm assets play a dual role, both as factors of production and collateral for loans. When debts have to be secured by collateral, firms with higher debt capacity in the form of tangible assets that can be collateralized are able to borrow more. This in turn allows more investment in assets that can serve as collateral for further borrowing. The interdependence of borrower debt capacity and prices of collateralized assets thus act as a transmission mechanism, also known as the "credit multiplier effect", by which the effects of economic shocks persist, amplify, and spread out into the economy.

Similarly, collateral constraints can act as a transmission channel through which ICM efficiencies are enhanced or decreased. As the collateral debt capacity of a firm increases with the creation of new assets from the exercise of growth options, the ability of ICMs to relax financial constraints are also enhanced. In line with prior studies that rely on a credit multiplier effect based on collateral constraints to explain the positive relation between financial constraints and stock returns, this predicts that ICM efficiency has a positive relation with an increase in total assets that results from the exercise of growth options. Consistent with this perspective, Fama and MacBeth (1973) regressions with ICM efficiency as the dependent variable show that the relation between ICM efficiency and proxies for growth options is positive and significant. The evidence is consistent with the interpretation that a reduction in collateral constraints due to new assets from capital investment has a credit multiplier effect on ICM efficiency in relaxing financial constraints on the firm.

In addition, Almeida and Campello (2007) argue that financing constraints affect investment decisions by showing investment-cash flow sensitivities are increasing in the tangibility of a firm's assets. Firms with tangible assets are able to satisfy external capital market conditions for collateral financing because tangible assets have values that can be contractually captured by creditors should the firm enter into default. In contrast, intangible assets such as brand value or intellectual property are prone to subjective valuations. Claims on intangible assets in the event of default are not easily enforced. As such, intangible assets cannot be pledged as collateral for loans. In this sense, asset tangibility affects the credit status of the firm whereby firms with tangible assets have less financial constraints as they are able to get collateralized financing more easily than firms with intangible assets.

This study provides new evidence supporting the claim by Almeida and Campello (2007) by extending the effect of asset tangibility in relation to collateral constraints to ICM efficiency. The testable prediction is that ICM efficiency should be increasing in the tangibility of a firm's assets. In support of this prediction, a significantly positive relation between ICM efficiency and asset tangibility is documented. In addition, a negative and significant relation between ICM efficiency and asset intangibility is also observed.

Building on the credit multiplier argument of Kiyotaki and Moore (1997), the link between asset tangibility and ICM efficiency also provides an explanation for the finding by Peyer (2002) who suggests that firms with efficient ICMs are able to borrow more external capital. This is because ICMs which are efficient are able to relax financial constraints for new capital investment. New tangible assets that are created can be pledged as collateral thereby increasing the capacity of the firm for external debt.

Lastly, the findings are also consistent with theoretical models of firm value as being composed of assets-in-place and growth options such as Myers (1977), Berk, et al. (1999) and Anderson and Garcia-Feijoo (2006). This chapter complements and extends their findings by providing evidence that links growth options and the collateral value of asset-in-place with the ICM efficiency of diversified firms.

The remainder of this chapter is organized as follows. Section 2 examines the literature on ICMs. Section 3 describes the sample selection criteria and methodology. Section 4 presents the results. Section 5 concludes.

3.2 Related literature

3.2.1 The bright side of internal capital markets

The benefit of an ICM is that the firm has a real option to avoid external capital markets and the associated deadweight transaction costs. Weston (1970) cites three distinct advantages of an internal market in comparison to an external capital market: (I) raising equity capital is less costly internally than externally; (II) transaction costs associated with sales of public securities can be avoided; (III) firm managers have better capability in selecting superior projects than external capital arbitrators.[2]

In this situation, the role of headquarters within a firm is to pick the winners and losers in the competition for capital. Stein (1997) formalizes this "winner-picking" argument by examining the role of headquarters in allocating scarce resources to competing projects in an internal capital market. He assumes that headquarters, unlike funding institutions in external financial markets, has control rights that enable it to actively shift funds from one project to another.[3] In addition, headquarters is assumed to have superior information about the prospects of projects. This enables it to engage in winner-picking by comparing projects throughout the firm in search of the highest yield.

In line with these findings, Matsusaka and Nanda (2002) document that in the presence of significant external financing costs, a multi-divisional firm owns a valuable real option in allocating capital across divisions because it allows the firm to avoid costly external

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[2] In addition, the firm also avoids the costs of overcoming information asymmetry problems encountered when selling securities in the capital market.

[3] Gertner, et al. (1994) likewise make the distinction on control rights between two modes of financing - corporate headquarters and a bank. A bank does not own the firms to which it lends whereas corporate headquarters own the business units to which it allocates capital. Ownership gives residual control rights over the use of the firm's assets. These control rights reside with the capital supplier, the corporate headquarters, in an internal capital market.

capital markets more frequently. More importantly, the reduction in financial constraints through the reallocation of internal funds facilitates capital investment in growth options and the creation of new assets that would otherwise have been foregone.

Studies in the corporate finance literature have provided much support for the role that ICMs have in reducing financial constraints on the firm and consequently increasing investment. For example, Hubbard and Palia (1999) examine the conglomerate merger wave of the 1960s and demonstrate that the increased availability of internal capital post-acquisition helped to overcome funding constraints imposed by information deficiencies of the less-developed capital markets during that period.

Similarly, Fluck and Lynch (1999) emphasize the advantage of ICMs by showing that positive net present value (NPV) projects are often foregone by firms without ICMs due to costly external financing. Specifically, the study reports bidder returns are higher when financially "unconstrained" buyers acquire "constrained" targets. The authors argue that the higher returns of buyer firms are due to the realisation of positive NPV projects in target firms that were previously capital starved but are now creating shareholder value.

Yan, et al. (2010) investigate how ICMs in diversified firms help to overcome financial constraints and allow funding of new investment by comparing the investment of diversified and focused (single-segment) firms under various capital market conditions. The ability of ICMs to relax financial constraints becomes obvious when aggregate external capital becomes more costly. During periods when external finance is costly, the authors show that the average rate of new investment in diversified firms remains unchanged whereas it declines in focused firms. The authors interpret the investment advantage enjoyed by diversified firms as evidence that diversified firms are able to substitute ICMs for costly external markets. Furthermore, Yan, et al. (2010) show that the investment advantage of diversified firms exists even after controlling for the access to external markets by both focused and diversified firms.

More recently, several studies examine if ICMs are efficient in the reallocation of internal funds for more productive use. Duchin (2010) reports a link between corporate diversification and corporate liquidity by finding evidence of efficient fund transfers from low- to high-productivity divisions within diversified firms due to lower correlations in cross-divisional investment opportunities.

Likewise, Gayané (2011) finds that conglomerates improve the efficiency of internal capital markets by increasing the allocation of funds to high q divisions relative to low q divisions. The authors suggest that financial constraints improve the quality of project selection by reducing free cash flow and pressuring managers to fund the more valuable investment opportunities.

3.2.2 The dark side of internal capital markets

An equally pertinent question related to ICM efficiency is whether ICMs can have sufficient internal funds so as to relax overall firm-wide financial constraints but yet be value-destroying? Researchers who suggest that ICMs subvert efficient investment decisions depend on agency explanations that insulate management from the discipline and constraints of costly external finance. The basis of the argument lies in how ICMs differ from external capital markets in information, incentives, asset specificity, control rights, or transactions costs (see Alchian (1969), Gertner, et al. (1994), and Stein (1997)).

The key distortion highlighted by these studies is that the real option embedded in ICMs is exercised at the discretion of managers with minimal fiscal accountability. In other words, ICMs allow management to be insulated from the discipline and constraints imposed by costly external capital markets. Under these conditions, managers are thus able to seek their own private benefit by using cash flows from ICMs to indulge in inefficient investment.

Scharfstein and Stein (2000) summarize how inefficient ICMs exacerbate investment inefficiencies in two general ways. First, firms with ICMs have more free cash flow. This grants managers access to more resources to engage in managerial entrenchment and empire building efforts through overinvestment. Second, ICMs in conglomerates do a worse job of allocating a given amount of resources than external capital markets due to a lack of disciplinary constraints. That is, managers tend to engage in inefficient cross-subsidization to mask poor operating performance, effectively reallocating resources to poor performing divisions instead of better ones.

For example, Jensen (1988) argues that diversification programs exemplify the theory that managers of firms with large free cash flows from ICMs are more likely to undertake low-benefit or even value-destroying investments. In the study, managers with empire building ambitions actively engage in undisciplined diversification investment programs by deploying internal funds in expansionary mergers and acquisitions.[4] These diversification programs benefit managers because of the power and prestige associated with managing a larger firm (see Stulz (1990)), because managerial compensation is related to firm size (see Jensen and Murphy (1990)), because diversification reduces the risk of managers'

[4] Similarly, Matsusaka and Nanda (2002) argue that a disadvantage of ICMs is that it exacerbates an overinvestment agency problem.

undiversified personal portfolios (see Amihud and Lev (1981)), or because diversification helps make the manager indispensable to the firm (see Shleifer and Vishny (1989)).

ICMs can also be a source of value destroying cross-subsidization for divisions that are performing poorly. Using data from the severe 1986 oil price collapse, the seminal study of Lamont (1997) examines the capital expenditures of subsidiaries in oil companies and finds evidence of ICMs subsidizing weaker operations when firms significantly reduce their non-oil investment in response to a negative shock to their oil division.[5] Specifically, large decreases in cash flow and collateral value in oil related divisions were subsidized by substantial decreases in investment for other non-oil divisions.

Separately, Rajan, et al. (2000) examine a model of internal capital misallocation based on power considerations among managers. The study makes two key assumptions that are contrary to efficient internal capital market reallocation theories such as Weston (1970) and Stein (1997). First, headquarters is assumed to have limited power over its divisions. This effectively allows division managers to have autonomy in choosing investments. Second, surplus internal funds are distributed among divisions through negotiations between managers and headquarters.

Rajan, et al. (2000) argue that division managers with poorer investment opportunities are able to benefit from surpluses generated by other divisions with better investment opportunities through their bargaining power. As such, investment distortions arise when division managers of better performing divisions resort to inefficient transfers to poor

[5] The oil price collapse was caused by a significant increase in petroleum production by Saudi Arabia. The world price of oil, which had peaked in 1980 at over US$35 per barrel, fell from $26.60 in December 1985 to below $12.67 a barrel in April 1986. See Lamont (1997) for details.

performing divisions in order to minimize such events.[6] In this way, a greater difference in investment opportunities between divisions serves to exacerbate investment distortions within the firm even more. Consistent with their interpretation, the authors report that an increase in the diversity of investment opportunities results in the inefficient allocations of internal funds.

3.2.3 Internal capital markets, financial constraints and stock returns

The corporate finance literature offers a clear understanding of the potential investment advantages and disadvantages that ICMs offer through the relaxation of financial constraints. Efficient ICMs help to reduce financial constraints and allocate internal funds to superior investment activities that benefit shareholders. Inefficient ICMs increase financial constraints for new investment through inefficient cross-subsidization to mask poor operating performance or undisciplined investment that benefits managerial self-interests and destroys shareholder value. There is however little evidence in the corporate finance literature that connects ICM efficiency to the risk of the firm and stock returns.

There is reason to believe that financial constraints have implications for the risk of a firm and consequently stock returns. For example, Lamont, et al. (2001) document that stock returns for financially constrained firms move together over time, suggesting that constrained firms are subject to common shocks. The study examines a limited sample of growing manufacturing firms spanning the period of 1968-1997 and finds that financially constrained firms have low average stock returns. Consistent with Lamont, et al. (2001), Gomes, et al.

[6] In their model, Rajan, et al. (2000) suggest that each division manager starts with an endowment of resources that can be invested in one of two project: an "efficient" investment and a "defensive" investment. The former is the optimal investment for the firm, but surpluses that are generated have to be shared with the poor performing division. The latter offers lower returns, but protects the investing division against poaching by the other division that has poor investment opportunities.

(2006) use a production-based asset pricing model and report that financing frictions provide a common factor that improves the pricing of cross-sectional returns.

In this perspective, a recent body of research in the asset pricing literature offers new evidence for a positive relation between financial constraints and stock returns. Whited and Wu (2006) extend the work of both Lamont, et al. (2001) and Gomes, et al. (2006).[7] They report that financial constraints present a source of risk that is priced in stock returns and that cannot be explained by the Fama-French and momentum factors. In their study, more financially constrained firms earn higher returns than less financially constrained firms.

Almeida and Campello (2007) develop a theoretical argument that identifies the impact of financing frictions based on a credit multiplier effect of tangible assets that can be pledged (collateralized) for borrowing. Firms with tangible assets are able to satisfy external capital market conditions for collateral financing because tangible assets have higher values that can be captured by creditors in default states.

Building on this point, the authors suggest that assets which can be collateralized support more borrowing, which in turn allows for further investment in new assets with collateral value. When firms experience financial constraints such as imperfect access to credit, tangible assets allow a firm to increase investment due to greater access to external financing. Through this relation, Almeida and Campello (2007) argue that financing frictions affect investment decisions by showing investment-cash flow sensitivities are increasing in the tangibility of constrained firms' assets.

[7] Like Lamont, et al. (2001), the authors use an index of financial constraints to sort firms into financially constrained and unconstrained groups. Further, like Gomes, et al. (2006), the authors use a structural model to construct the index for financial constraints instead of traditional tests based on regressions of investment on Tobin's q and cash flow as in Fazzari, Hubbard, Petersen, Blinder and Poterba (1988).

Livdan, et al. (2009) study the effect of financial constraints on risk and expected returns by extending the neoclassical investment-based asset pricing framework to incorporate retained earnings, debt, costly equity, and collateral constraints on debt capacity. In their model, firms must pay off existing debt before financing new investments. As such, firms that are more financially constrained have less flexibility in adjusting new capital investment to mitigate the impact of aggregate shocks on dividend streams. In addition, by preventing firms from financing all desired investments, collateral constraints work against the dividend smoothing mechanism. Consequently, the more inflexible firms are in adjusting investments to smooth dividends due to financial constraints, the more dividends will covary with business cycles, and the higher their risk and expected returns. In support of their model, the authors show empirically that the assets of more financially constrained firms are riskier and earn higher expected stock returns than less financially constrained firms.

Another important point made in the study is that financial constraints and financial distress are different albeit related concepts. Livdan, et al. (2009) give two reasons for this. First, one significant difference between financial constraints and financial distress is seen from their respective relations with average stock returns. More financially distressed firms earn lower average returns than less financially distressed firms. In contrast, firms with more financial constraints earn higher returns than firms with less financial constraints. Second, the authors argue that the use of collateral constraints in their study captures the effect of financial constraints and not financial distress.[8] In their model, firms face collateral constraints which require that the liquidation value of capital (net of depreciation) is greater

[8]In addition, Livdan, et al. (2009) argue that their model of financial constraints in the form of collateral constraints is more realistic than dividend non-negativity constraints used in the prior literature (for example, Gomes, et al. (2006) and Whited and Wu (2006)) earlier. A constraint of dividend non-negativity refers to the situation where distributions to shareholders are suspended should a firm have negative cash flow such as when an operational loss is incurred.

than or equal to the promised debt payment. In this way, the use of collateral constraints avoids potential interpretations of financial distress by guaranteeing that lenders always get repaid in full.

Hahn and Lee (2009) further extend prior work demonstrating a positive link between financial constraints and stock returns by developing a model of corporate investment under collateral constraints that is sensitive to changes in the availability of both internal and external funds. Marginal increases in internal funds support more borrowing and investment for firms to invest in assets with high collateral value. This in turn increases the debt capacity of firms by serving as new collateral for further borrowing of external funds, effectively reducing financial constraints on the firm. To the extent that the net present value of investment is reflected in stock prices, the authors show that risk associated with variations in the availability of internal funds is priced into stock returns.

Overall, these asset pricing studies provide strong evidence that firms with greater financial constraints have higher risk and earn higher returns. However, none of these studies connects financial constraints explicitly to the efficiency of ICMs and stock returns. Taken together with studies in the corporate finance literature, the preceding evidence suggests a positive constraints-return prediction for the relation between the efficiency of a diversified firm's ICM and stock returns. Diversified firms with inefficient ICMs are predicted to be more financially constrained, have higher risk and earn higher returns than firms with efficient ICMs.

3.2.4 ICM Efficiency, growth options and the multiplier effect in collateral credit

Corporate finance studies such as Stein (1997) suggest that ICMs relax financial constraints in two ways. First, ICMs reallocate cash flows generated by one division to another division within the firm to fund new investment. Second, the assets of one division can be used to raise collateralized financing from external capital markets that is then diverted to another division.

The key distinction in relation to financial constraints is that firm assets play a dual role in which they are not only factors of production but also serve as collateral for new loans. Investment by one business segment depends not only on the cash flows that are generated within an ICM but also the asset values of other segments. When debts have to be secured by collateral, firms with higher debt capacity in the form of a larger asset base or assets with higher collateral value will be able to borrow more, which in turn allows more investment in assets that can serve as collateral for further borrowing.

This dynamic interaction between credit limits, investment, and the value of firm assets and liabilities form the basis of the "credit multiplier" effect identified by Kiyotaki and Moore (1997).[9] Specifically, Kiyotaki and Moore (1997) develop a theoretical model whereby a negative temporary shock which reduces the collateral value of a financially constrained firm can produce effects that persist and amplify via this “collateral channel”.

Recent empirical work by Chang and Dasgupta (2007) provides supporting evidence for the operation of an external finance collateral channel as identified by Kiyotaki and Moore (1997). The authors study how negative aggregate shocks to specific business segments of a firm affect investment in the same firm's non-shock segments on the basis that collateral is important in raising financing in the presence of incentive problems and asymmetric information between the firm and capital markets. The study finds that segment shocks are propagated to non-shock business segments within the firm through the decreasing

[9] In their study, Kiyotaki and Moore (1997) show how credit constraints as described by the collateral value of a firm’s assets play an important role in propagating and amplifying business cycle fluctuations.

value of collateral assets. As a result of the lower collateral value of a firm's assets, financial constraints on the firm are increased due to a reduction in the availability of collateralized external financing.

Likewise, recent asset pricing studies such as Almeida and Campello (2007), and Hahn and Lee (2009) present arguments suggesting that a credit multiplier effect exists in the reallocation of internal funds that help to reduce financial constraints on the firm. Almeida and Campello (2007) suggest that assets which can be collateralized support more borrowing, which in turn allows for further investment in new assets with collateral value. Hahn and Lee (2009) demonstrate that firms which are unable to make new collateralized investment suffer greater financial constraints due to reduced debt capacity.[10]

The credit multiplier effect of a firm's assets on raising collateralized financing has important implications for the dynamic interaction of ICM efficiency and the exercise of existing growth options. New assets are created as growth options are exercised through capital expenditure. The collateral value of these assets reduces financial constraints on the firm and increases the availability of internal funds through a firm's ICM. In other words, there is a corresponding increase in debt capacity (collateral value of new assets) as the total assets of a firm increase through new investment. This predicts a positive relation between total asset growth and ICM efficiency. A related perspective is that firms with more growth options are also more likely to make more new investments that increase the total base of new assets that can serve as collateral for external financing. As before, this increases the ability

[10] The study also distinguishes between the potential debt capacities offered by new assets. Firms with few or no financial constraints selectively invest in assets that provide the highest collateral value. In contrast, financially constrained firms have greater variation in internal funds and are limited to investments with lower collateral value. In both cases, a multiplier credit effect exists where the financial constraints increase (decrease) due to new assets with lower (higher) collateral value.

of an ICM to reduce financial constraints imposed on a firm for new investment. This predicts a positive relation between growth options and ICM efficiency.

3.3 Sample selection and variable measures

3.3.1 Sample selection

Collated business segment and price data on all firms used in this study are from the CRSP/Compustat Merged Database (CCM). CCM data draws from two separate sources: monthly price data for firms listed on the NYSE, AMEX or NASDAQ exchanges from the Centre for Research in Security Prices (CRSP) database and business segment data from the Compustat Industry Segment (CIS) database. Financial Accounting Standards Board (FASB) regulation No. 14 and SEC Regulation S-K require firms to report audited footnote information for segments where sales, assets, or profits exceed 10% of consolidated totals for fiscal years ending after December 15, 1977. The number of segments in a firm is also reported. The initial data sample period before applying any data filters is from 1978 to 2012.

Segment data for a given fiscal year may have multiple records due to reporting adjustments made in subsequent years. Compustat does not eliminate these duplicate entries which can be identified by their source year. In the case of multiple adjustments, the most recent update is denoted by the latest source year. As such, only segment data for the latest source year of each segment-year observation is considered. Following Berger and Ofek (1995) and Lamont and Polk (2002), firm-year observations that do not have an allocated SIC code are eliminated. Consistent with Duchin (2010), while financial firms with SIC code '6' at the one-digit level are excluded, industrial firms with financial segments are included because excluding these would eliminate from the sample many large conglomerates that maintain a finance division.[11] Firms with segments that are allocated a SIC code '9' do not have any operations and are omitted from the sample. Firms are also required to have total

[11] Similarly, Duchin (2010) adopts a similar data filter in his study that finds an efficient link between corporate liquidity and diversification that corresponds to efficient fund transfers from low- to high-productivity divisions.

sales of at least \$10 million without any missing or negative segment information on sales, assets or capital expenditures.

Finally, the sample is restricted to firm-years that have information required to calculate the relevant measures of ICM efficiency (absolute value added), growth opportunities (total asset growth (AG) and market to book (MB)) and diversification measures (Herfindahl index value for segment sales (H_SALES) and segment assets (H_ASSETS)). Inverse values of the Herfindahl index measures of segment assets and segment sales are used in the analysis. Firm-years without any of the required imputed values for the analyses are also eliminated from the sample. In effect, this limits the sample to firms that survive any consecutive three-year period with complete data in all three years.

The final data sample consists of 12,425 firm-year observations on 2,431 diversified firms over the sample period beginning in 1979 and ending in 2010. As this chapter focuses on examining the effects of ICM efficiency in diversified firms, there are no focused firms used in sample selection (as compared to Chapter 2 where both focused and diversified firms are included in the sample selection).

3.3.2 Measure of ICM efficiency, absolute-value-added (AVA)

To measure allocation efficiency of a firm's ICM, this study uses the measure of "absolute value added by allocation" (AVA) as defined by Rajan, et al. (2000):

$$AVA = \frac{\sum_{j=1}^{n} BA_j(q_j - 1)\left(\frac{Capex_j}{BA_j} - \frac{Capex_j^{SS}}{BA_j^{SS}}\right)}{BA} \quad (1)$$

where BA is the book value of firm assets, BA_j is the book value of firm assets in segment j, $Capex_j$ is the firm's capital expenditures of segment j, $(Capex_j^{ss}/BA_j^{ss})$ is the asset-weighted average capital expenditure to assets ratio for single segment firms in the same industry as the segment j of the diversified firm and q_j is the asset-weighted Tobin's q of single segment firms that operate exclusively in the same three-digit SIC industry as segment j. BA and q_j are values at the beginning of the period. Tobin's q is the market-to-book ratio of a firm, where market value is computed as the market value of common equity plus book value of assets minus book value of common equity minus deferred taxes.

$(Capex_j/BA_j) - (Capex_j^{ss}/BA_j^{ss})$ serves as a proxy for transfers made between segments of a diversified firm. It compares the segment's investment ratio to the asset-weighted average investment ratio of single segment firms in the same industry. The latter serves as a proxy for what a segment's investment ratio would have been if it were a stand-alone entity. Overall, firms with higher values for AVA have ICMs that are more efficient and are predicted to have less financial constraints and lower risk.

3.3.3 Measures of growth options

Growth options are by nature unobservable and suitable proxies are required to represent them. Two proxies are used in the empirical analysis for this chapter. A comprehensive measure of firm growth, total asset growth (AG), or the year-on-year percentage change in firm total assets, is used as one proxy for growth options. The market-to-book value of equity ratio (MB) is used as the second proxy for growth options. MB is constructed as the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity. Please refer to section 2.3.2 of chapter 2 in this thesis for a description of the proxies as well as arguments for their use as a measure of growth options.

3.3.4 Measures of diversification

Three diversification measures used by Comment and Jarrell (1995) are employed to calculate firm diversification: (1) a count of the number of business segments (BUSSEG) reported by management, (2) the inverse of a sales based Herfindahl index (1/H_SALE), and (3) the inverse of an asset based Herfindahl index (1/H_ASSETS). The method used to calculate the measures of diversification are the same as that used in section 2.3.3 of chapter 2 of this thesis. The diversification measure of the number of business segments (BUSSEG) is a direct count of the number of segments declared by the managers of the firm.

A high Herfindahl index value describes a focused firm with a greater concentration of activities in one segment and/or industry whereas a low Herfindahl index value corresponds to a relatively more diversified firm with activities across multiple industry segments and/or industries. As the inverse of the Herfindahl index value is used in the analysis, a larger value for 1/H_SALES indicates greater firm diversification.

3.3.5 Measure of productivity

The measure of productivity used is the return-on-assets (ROA) which measures how profitable a company's assets are in generating revenue. It is measured by the ratio of total revenue over total assets of the firm.

3.4 Results

3.4.1 Summary statistics

Table 1 presents summary statistics for the pooled sample of firms that operate across multiple business segments. The sample consists of a total of 12,425 firm-year observations on 2,431 firms spanning the period of 1979 to 2010. In terms of the number of different business segments, firms in the sample have a median of two business segments per firm while the overall average is three business segments per firm. The diversification into two different business segments on average is also reflected by the similar inverse values for the Herfindahl index values of segment sales (1/H_SALE) and segment assets (1/H_ASSETS). The inverse Herfindahl index value of two indicates an approximate split of business activity across two different business segments. The finding that the majority of diversified firms participate in the range of two to three business segments suggests that smaller firms dominate the sample population. Smaller diversified firms tend to operate in fewer segments as opposed to larger well-known conglomerates such as General Electric (GE). This is confirmed by statistics for firm size, where the median firm size is 194 million and the mean firm size is more than ten times larger at 1,957 million.

Table 2 presents the correlation matrix of the variables used for the analysis. There are high correlation values (0.6568 to 0.8260) among the three diversification measures of the number of business segments (BUSSEG) and the inverse Herfindahl index values for segment sales and segment assets. This is expected as the Herfindahl index values reflect the degree of diversification into different business segments for a firm’s operations. Notably, a firm’s return on assets (ROA) exhibits positive correlation (0.2626) with firm size. This

Table 1
Summary statistics

This table reports summary statistics for the full sample of diversified firms consisting of 12,425 nonfinancial firm-years from 1979 to 2010. Absolute value added by allocation (AVA) is the measure of allocation efficiency of an internal capital market as defined by Rajan, et al. (2000). Asset growth (AG) is the year-on-year percentage change in total assets for the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). Market-to-book (MB) is the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity. Business segments (BUSSEG) is the number of business segments reported by management. The Herfindahl index value of segment sales (H_SALES) and segment assets (H_ASSETS) is calculated as the sum of the squares of each segment's sales (assets) as a proportion of the firm's total sales (assets) for that fiscal year. The inverse of the Herfindahl index values is used in this analysis. Return on assets (ROA) is the ratio of total revenue over total assets of the firm. Annual stock return (RET12) is the buy-and-hold return for one year from July (t) to June (t+1), where t is the portfolio formation year. Size (SIZE) is the market value of a firm calculated using the price and the number of shares outstanding at the end of year (t), in millions of dollars. Tangible assets as a percentage of total assets (TAN) represent common equity minus intangible assets divided by total assets. Intangible assets as a percentage of total assets (INTAN) represent the net value of intangible assets divided by total assets. All variables are calculated using data from the CRSP-Compustat Merged (CCM) database.

Variable	Mean	Median	Standard Deviation
Absolute Value Added by Allocation (AVA)	-0.0001	-0.0010	0.0619
Asset growth (AG)	0.1546	0.0684	0.9436
Market-to-book (MB)	2.3104	1.5284	24.8784
Number of Business Segments (BUSSEG)	2.7860	2	1.0141
Segment Sales Herfindahl Index (1/H_SALE)	1.9954	1.8422	0.7643
Segment Assets Herfindahl Index (1/H_ASSETS)	2.0273	1.8698	0.7776
Return on Assets (ROA)	0.0842	0.0885	0.0964
Tangible Assets / Total Assets (TAN)	0.3761	0.3942	0.3205
Intangible Assets / Total Assets (INTAN)	0.0803	0.0310	0.1199
Annual Stock Return (RET12)	0.1073	0.0131	0.8886
Size (millions)	1,962	190	8,254

Table 2

Spearman's Rank Correlation Matrix

This table reports the Spearman's rank correlations for the full sample of diversified firms consisting of 12,425 nonfinancial firm-years from 1979 to 2010. Absolute value added by allocation (AVA) is the measure of allocation efficiency of an internal capital market as defined by Rajan, et al. (2000). Asset growth (AG) is the year-on-year percentage change in total assets for the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). Market-to-book (MB) is the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity. BUSSEG is a direct count of the number of business segments reported by management. The Herfindahl index value of segment sales (H_SALES) and segment assets (H_ASSETS) is calculated as the sum of the squares of each segment's sales (assets) as a proportion of the firm's total sales (assets) for that fiscal year. The inverse of the Herfindahl index values is used in this analysis. Return on assets (ROA) is the ratio of total revenue over total assets of the firm. Annual stock return (RET12) is the buy-and-hold return for one year from July (t) to June (t+1), where t is the portfolio formation year. Size (SIZE) is the market value of a firm calculated using the price and the number of shares outstanding at the end of year (t), in millions of dollars. Tangible assets as a percentage of total assets (TAN) represent common equity minus intangible assets divided by total assets. Intangible assets as a percentage of total assets (INTAN) represent the net value of intangible assets divided by total assets. All variables are calculated using data from the CRSP-Compustat Merged (CCM) database.

	AVA	AG	MB	BUSSEG	1/H_SALE	1/H_ASSETS	ROA	RET12	SIZE	TAN	INTAN
Absolute Value Added by Allocation (AVA)	1										
Asset growth (AG)	0.1149	1									
Market-to-book (MB)	0.0825	0.2364	1								
Number of Business Segments (BUSSEG)	0.0099	-0.0159	0.0050	1							
Segment Sales Herfindahl Index (1/H_SALE)	-0.0183	-0.0400	-0.0324	0.6568	1						
Segment Assets Herfindahl Index (1/H_ASSETS)	-0.0252	-0.0388	0.0054	0.7035	0.8260	1					
Return on Assets (ROA)	0.0966	0.2386	0.3619	0.0470	0.0481	0.0605	1				
Annual Stock Return (RET12)	0.0071	-0.0771	-0.1234	0.0286	0.0209	0.0252	0.0118	1			
Size	0.1005	0.0633	0.4429	0.2763	0.1209	0.1360	0.2626	-0.0091	1		
Tangible Assets / Total Assets (TAN)	0.0874	0.0057	-0.0992	-0.0791	-0.0300	-0.0495	0.1888	0.0190	-0.1111	1	
Intangible Assets / Total Assets (INTAN)	-0.1219	0.0726	0.2128	0.0808	0.1034	0.1160	0.0564	-0.0004	0.1621	-0.4591	1

suggests that there is a correlation between firm size and the ability of a firm to use its assets to generate earnings. The number of business segments in a firm (BUSSEG) also exhibits positive correlation (0.2763) with firm size. This is no surprise as larger firms are generally more diversified across a number of industries. In contrast, the other variables of interest such as ICM efficiency (AVA), asset growth (AG) and market-to-book (MB) do not exhibit similar correlation with firm size.

3.4.2 Univariate portfolio sorts of key characteristics

The analysis begins with univariate sorts of annual stock returns over the sample period based on a variable of interest. At the end of June of each year *t* over the sample period of July 1979 to June of 2010, stocks are allocated into decile portfolios based on key characteristics. The portfolios are held for 1 year, from July of year (t) to June of year (t+1), and then rebalanced. Portfolio returns are calculated for each decile every year around the portfolio formation year (t) over the sample period. The average return for each decile over the time series is then reported with relevant t-statistics.

Cooper, et al. (2008), Gray and Johnson (2010) and Yao, et al. (2011) document evidence of a significant and negative relation between AG and returns. The studies report that the negative relation is robust in the cross-section of stocks as well as international markets. Panel A of Table 3 begins the analysis by replicating this work. The univariate sort on AG exhibits a similar negative relation between AG and stock returns, with low AG (decile 1) firms earning 15.05% per annum and high AG (decile 10) earning 1.40% per annum. The return spread of low-minus-high AG portfolios (decile 1 minus decile 10 portfolio returns) is significant with a t-statistic of 4.92 and a return differential of 13.66% per annum. However, while there is a clear negative relation between AG and stock returns, the rate of decline in decile returns is not consistent. For example, decile 1 and decile 2

Table 3
Univariate portfolio returns sorted on key characteristics

This table presents annual returns from univariate sorts on key characteristics during the period 1979 to 2010. At the end of June of each year (t), stocks are allocated into portfolios based on key characteristics. The portfolios are held for 1 year, from July of year (t) to June of year (t+1), and then rebalanced. Portfolio return statistics are reported every year around the portfolio formation year (t) over the sample period. Panel A reports returns from stock portfolios sorted into deciles according to their asset growth (AG) rates. AG is defined as the percentage change in total assets from the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). Panel B reports returns from stock portfolios sorted into deciles according to market-to-book (MB) ratio. MB is the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity. Panel C reports returns from stock portfolios sorted into deciles according to their absolute value added by allocation (AVA). AVA is the measure of allocation efficiency of an internal capital market as defined by Rajan, et al. (2000). All variables are calculated using data from the CRSP-Compustat merged database.

Panel A: Asset growth (AG)

Portfolio		1 (Low AG)	2	3	4	5	6	7	8	9	10 (High AG)	Spread (1-10)
AG	RET12	0.1505	0.1321	0.1398	0.0905	0.0778	0.0739	0.0769	0.0845	0.0780	0.0140	0.1366
	t-stat	(3.08)	(3.15)	(2.90)	(2.17)	(2.23)	(2.19)	(1.81)	(2.23)	(2.03)	(0.37)	(4.92)

Panel B: Market-to-book (MB)

Portfolio		1 (Low MB)	2	3	4	5	6	7	8	9	10 (High MB)	Spread (1-10)
MB	RET12	0.2302	0.1814	0.1240	0.1072	0.0753	0.0558	0.0765	0.0465	0.0176	0.0052	0.2250
	t-stat	(3.88)	(3.41)	(2.82)	(2.55)	(1.93)	(1.49)	(2.12)	(1.41)	(0.50)	(0.14)	(5.38)

Panel C: Internal capital market efficiency (AVA)

Portfolio		1 (Low AVA)	2	3	4	5	6	7	8	9	10 (High AVA)	Spread (1-10)
AVA	RET12	0.0953	0.1008	0.1157	0.1075	0.0833	0.0740	0.0971	0.0940	0.1089	0.0429	0.0540
	t-stat	(2.00)	(2.28)	(2.37)	(2.57)	(2.03)	(1.84)	(2.21)	(2.64)	(2.66)	(1.23)	(1.81)

portfolios have a spread of 1.84% while decile 9 and 10 have a spread of 6.40% per annum. This uneven but negative relation between AG and stock returns stands out from the earlier studies mentioned. One plausible explanation for the lack of monotonicity in univariate returns is that the data set used is comprised of only diversified firms since ICMs are a unique feature of corporate diversification.

For robustness, an alternative measure of growth options is employed in subsequent tests to qualitatively confirm findings using AG. The market-to-book value of equity (MB) is a commonly used proxy for growth options in the corporate finance literature (see Chung and Charoenwong (1991), Collins and Kothari (1989) and Graham and Rogers (2002) and Lewellen, Loderer and Martin (1987)). The market value of equity measures the present value of all future cash flows to equity holders from both assets-in-place and growth options, whereas the book value of equity represents the accumulated value generated from existing assets-in-place only. Therefore, the MB ratio measures the mix of cash flows from assets-in-place and growth options.

As before, similar to AG, a univariate sort on MB of the sample in Panel B of Table 3 reveals a negative relation between MB and stock returns. Low MB stocks have higher returns than high MB stocks. The return spread of low-minus-high MB portfolios (decile 1 minus decile 10 portfolio returns) is also significant with t-statistic of 5.38 and a large premium of 22.50% per annum. The results from the univariate sort on MB are similar in trend and direction to the univariate sort on AG. Notably, the rate of decline in decile returns is comparably more consistent. In addition, a univariate sort on AVA and stock returns in Panel C of Table 3 is performed to test for a relation with returns. Unlike the previous results sorted on the characteristics AG or MB, there is no observable pattern in the returns across all deciles for the AVA characteristic.

3.4.3 Fama and MacBeth regressions with stock returns as the dependent variable

Efficient ICMs relax financial constraints for new capital investment. A central motivation of this chapter is to investigate if ICM efficiency is priced into the stock returns of diversified firms. Recent findings in the literature such as Lamont, et al. (2001), Whited and Wu (2006), Almeida and Campello (2007), Hahn and Lee (2009) and Livdan, et al. (2009) all document that financially constrained firms are riskier and earn higher expected stock returns than less financially constrained firms.

According to this line of thought, the efficiency of an ICM is expected to be a source of priced risk in stock returns since it is characterised by its ability to relax financial constraints imposed on the firm by reallocating internal funds to superior investment opportunities. Firms with inefficient ICMs have more financial constraints and have higher risk and are predicted to earn higher returns than firms with efficient ICMs which have fewer financial constraints and lower risk. If the above conjecture is true, there should be a significant and negative relation between ICM efficiency and stock returns.

To test this conjecture, Fama and MacBeth (1973) regressions on key characteristics are conducted with annual stock returns as the dependent variable, as follows:

$$\text{RET12}_{i,t} = b_0 + b_{1}(\text{AVA})_{i,t} + b_{2}(\text{AG})_{i,t} + b_{3}(\text{BUSSEG})_{i,t} + b_{4}(1/\text{H\_SALES})_{i,t} + b_{5}(1/\text{H\_ASSETS})_{i,t} + b_{6}(\text{ROA})_{i,t} + b_{7}(\text{SIZE})_{i,t} + \varepsilon_{i,t} \quad (2)$$

where RET12 is the is the buy-and-hold return for one year from July (t) to June (t+1), where t is the portfolio formation year. Absolute value added by allocation (AVA) is the measure of allocation efficiency of an internal capital market as defined by Rajan, et al. (2000). Asset growth (AG) is the year-on-year percentage change in total assets for the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). BUSSEG is a direct count of the number of business segments reported by management. The Herfindahl index value of segment sales (H_SALES) and segment assets (H_ASSETS) is calculated as the sum of the squares of each segment's sales (assets) as a proportion of the firm's total sales (assets) for that fiscal year. Return on assets (ROA) is the ratio of total revenue over total assets of the firm. SIZE is the log of the market value of a firm in millions of dollars calculated as the product of the price and the number of shares outstanding at the end of year (t).

The methodology for Fama and MacBeth (1973) regressions involves two steps. First, cross-sectional regressions in each sample year are estimated. Then, the average of the coefficients and standard errors across years are reported with corresponding t-statistics in brackets. Table 4 tabulates the results.

Consistent with expectations, the measure of ICM efficiency, AVA, has negative and significant coefficients for all regression models in Table 4. The negative relation persists regardless of the measure of firm diversification used and even after including other control variables such as asset growth, return-on-assets and firm size. The evidence suggests that the risk-reducing effect of a firm's ICM in relation to financial constraints is important to investors. The findings are interpreted as new evidence that is consistent with the financial constraints literature. While prior studies have put more emphasis on financial constraints imposed on the firm by external capital markets, the innovation of this study is to show that internal capital markets are important to firm valuation.

Table 4
Fama–MacBeth regressions of annual stock returns on key characteristics

This table presents Fama and MacBeth (1973) regressions with annual stock returns as the dependent variable during the period 1979 to 2010. First, separate cross-sectional regressions in each sample year are estimated then, second, the average of the coefficients and standard errors across years are reported. Independent variables are composed as follows. Absolute value added by allocation (AVA) is the measure of allocation efficiency of an internal capital market as defined by Rajan, et al. (2000). Asset growth (AG) is the year-on-year percentage change in total assets for the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). AG is used as the proxy for growth options. BUSSEG is a direct count of the number of business segments reported by management. The Herfindahl index value of segment sales (H_SALES) and segment assets (H_ASSETS) is calculated as the sum of the squares of each segment's sales (assets) as a proportion of the firm's total sales (assets) for that fiscal year. The inverse of the Herfindahl index values is used in this analysis. Return on assets (ROA) is the ratio of total revenue over total assets of the firm. Annual stock return (RET12) is the buy-and-hold return for one year from July (t) to June (t+1), where t is the portfolio formation year. Size (SIZE) is the log of the market value of a firm in millions of dollars calculated as the product of the price and the number of shares outstanding at the end of year (t). All variables are calculated using data from the CRSP-Compustat merged database. t-statistics are in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

Model	1	2	3	4	5	6
Absolute Value Added (AVA)	-0.5299**	-0.5331**	-0.5241**	-0.4926*	-0.4923*	-0.4836*
	(-2.09)	(-2.11)	(-2.08)	(-1.98)	(-2.00)	(-1.97)
Asset growth (AG)	-0.0851**	-0.0860**	-0.0856**	-0.0853**	-0.0858**	-0.0856**
	(-2.30)	(-2.35)	(-2.35)	(-2.31)	(-2.36)	(-2.36)
Number of Business Segments (BUSSEG)	0.0140*			0.0112		
	(2.01)			(1.49)		
1/Sales Herfindahl Index (1/H_SALES)		-0.0025			-0.0026	
		(-0.34)			(-0.36)	
1/Asset Herfindahl Index (1/H_ASSETS)			0.0063			0.0060
			(0.97)			(0.97)
Return on Assets (ROA)				-0.2833	-0.2831	-0.2818
				(-1.46)	(-1.49)	(-1.47)
Size	-0.0469***	-0.0438***	-0.0448***	-0.0427***	-0.0401***	-0.0411***
	(-5.31)	(-5.13)	(-5.17)	(-5.65)	(-5.49)	(-5.50)

The proxy for growth options, AG, is also negative and significant in all regressions. This negative relation implies that expected stock returns decrease as the value of growth options increase from low asset growth to high asset growth. All things equal, firms with a larger number of growth options have a greater advantage over firms with a smaller number of growth options in selecting growth options with the lowest systematic risk. Consequently, firms with more growth options are likely to have lower risk.

This reasoning is aligned with the seminal work of Berk, et al. (1999) who study the interaction of optimal investment by firms in relation to growth options and stock returns. The authors suggest that, all things equal, firms optimize the investment decision by choosing growth options with the lowest systematic risk. The exercise of these growth options results in assets that generate cash flows with low systematic risk, leading to lower future returns.[1]

In contrast to AVA and AG, there is no significant relation between stock returns and the segment sales (1/H_SALES) and segment assets (1/H_ASSETS) diversification measures or the ROA variable. The only exception to this finding is that the number of business segments (BUSSEG) shows a positive and weakly significant (at the 10% level) relation with returns in model one, but loses this significance when ROA is included as a control variable in model 4. Firm size shows a significant (at the 1% level) and negative relation to returns, consistent with the well-known size effect that is widely documented in in the literature.

3.4.4 Robustness test for Fama and MacBeth regressions with stock returns as the dependent variable

To test the robustness of the negative relation of AVA with stock returns, an alternative measure of growth options, the market-to-book (MB) ratio, is employed in a separate set of Fama and MacBeth (1973) regressions. MB is widely accepted as proxy for

[1] See chapter one of this thesis for a thorough discussion.

growth options in the corporate finance literature. The book value of assets is a proxy for assets-in-place, whereas the market value of assets is a proxy for both assets-in-place and investment opportunities. Thus, a high MB ratio indicates that a firm has many investment opportunities relative to its assets-in-place. In other words, high MB firms have more growth options than low MB firms.

Table 5 presents the results of the regressions using the MB growth option proxy. The findings show that AVA has a persistently significant and negative relation with returns in regression models one to six, even after controlling for different diversification measures, firm productivity and size. The results are similar to those in Table 4 that employ AG as the growth option proxy, and are interpreted as additional evidence confirming the conjecture that a reduction in financial constraints imposed on a firm due to the presence of internal capital markets are priced into stock returns. In addition, the MB growth option proxy has a negative and significant (1% level) relation with stock returns. This again confirms that growth options have a negative relation with stock returns and reaffirms earlier findings based on the AG growth option proxy.

No significant relation is detected between either of the segment sales (1/H_SALES) and segment assets (1/H_ASSETS) diversification measures and stock returns. As before, a significant (at the 10% level) and positive relation between the number of business segments (BUSSEG) and stock returns is reported in model 1. However, the variable BUSSEG becomes insignificant once ROA is included in model 4. ROA remains insignificant in all regression models while firm size retains a negative effect on returns, significant at the 1% level.

Table 5
Fama–MacBeth regressions of annual stock returns on key characteristics

This table presents Fama and MacBeth (1973) regressions with annual stock returns as the dependent variable during the period 1979 to 2010. First, separate cross-sectional regressions in each sample year are estimated then, second, the average of the coefficients and standard errors across years are reported. Independent variables are composed as follows. Absolute value added by allocation (AVA) is the measure of allocation efficiency of an internal capital market as defined by Rajan, et al. (2000). Market-to-book (MB) is the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity. MB is used as the proxy for growth options. BUSSEG is a direct count of the number of business segments reported by management. The Herfindahl index value of segment sales (H_SALES) and segment assets (H_ASSETS) is calculated as the sum of the squares of each segment's sales (assets) as a proportion of the firm's total sales (assets) for that fiscal year. The inverse of the Herfindahl index values is used in this analysis. Return on assets (ROA) is the ratio of total revenue over total assets of the firm. Annual stock return (RET12) is the buy-and-hold return for one year from July (t) to June (t+1), where t is the portfolio formation year. Size (SIZE) is the log of the market value of a firm in millions of dollars calculated as the product of the price and the number of shares outstanding at the end of year (t). All variables are calculated using data from the CRSP-Compustat merged database. *t*-statistics are in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

Model	1	2	3	4	5	6
Absolute Value Added (AVA)	-0.5083*	-0.5093*	-0.5016*	-0.4741*	-0.4707*	-0.4642*
	(-1.94)	(-1.96)	(-1.94)	(-1.81)	(-1.83)	(-1.80)
Market-to-book (MB)	-0.0110***	-0.0108***	-0.0109***	-0.0104***	-0.0104***	-0.0105***
	(-2.94)	(-2.90)	(-2.92)	(-2.74)	(-2.74)	(-2.77)
Number of Business Segments (BUSSEG)	0.0127*			0.0102		
	(1.95)			(1.44)		
1/Sales Herfindahl Index (1/H_SALE)		-0.0020			-0.0023	
		(-0.28)			(-0.33)	
1/Asset Herfindahl Index (1/H_Assets)			0.0083			0.0079
			(1.32)			(1.28)
Return on Assets (ROA)				-0.2703	-0.2694	-0.2665
				(-1.35)	(-1.37)	(-1.35)
Size	-0.0449***	-0.0421***	-0.0425***	-0.0411***	-0.0388***	-0.0400***
	(-5.11)	(-4.90)	(-4.96)	(-5.39)	(-5.20)	(-5.23)

3.4.5 Fama and MacBeth regressions with ICM efficiency as the dependent variable

The preceding findings suggest that both the positive and negative aspects of ICM efficiency as indicated by financial constraints are priced into stock returns. Inefficient ICMs (low AVA) are more financially constrained and earn higher returns than efficient ICMs that have less financial constraints. An equally pertinent question is what are the potential drivers of ICM efficiency? In order to investigate this, Fama and MacBeth (1973) regressions on key characteristics are conducted with ICM efficiency (AVA) as the dependent variable, as follows:

$$AVA_{i,t} = b_0 + b_1(AG)_{i,t} + b_2(BUSSEG)_{i,t} + b_3(1/H\_SALES)_{i,t} + b_4(1/H\_ASSETS)_{i,t} + b_5(ROA)_{i,t} + b_6(SIZE)_{i,t} + \varepsilon_{i,t} \quad (3)$$

where absolute value added by allocation (AVA) is the measure of allocation efficiency of an internal capital market as defined by Rajan, et al. (2000). Asset growth (AG) is the year-on-year percentage change in total assets for the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). BUSSEG is a direct count of the number of business segments reported by management. The Herfindahl index value of segment sales (H_SALES) and segment assets (H_ASSETS) is calculated as the sum of the squares of each segment's sales (assets) as a proportion of the firm's total sales (assets) for that fiscal year. Return on assets (ROA) is the ratio of total revenue over total assets of the firm. SIZE is the log of the market value of a firm in millions of dollars calculated as the product of the price and the number of shares outstanding at the end of year (t). Tables 6 and 7 perform Fama and MacBeth (1973) regressions using ICM efficiency as the dependent variable with asset growth and the market-to-book characteristics respectively as growth option proxies in each analysis.

Results for both tables indicate that the relation between AVA and growth options is positive and significant (at the 1% level for AG and 5% level for MB) across all regression models one to six. The positive relation persists regardless of the measure of diversification and control variables used. This suggests that diversified firms that have higher asset growth or market-to-book values have a positive influence on the ability of a firm's ICMs to reduce financial constraints. Intuitively, the exercise of growth options results in the creation of new assets-in-place, which in turn acts as collateral for new borrowing and more importantly, results in further relaxation of financial constraints in funding new investment.

This interpretation of the positive link between growth options and AVA is also consistent with other studies in the literature. Stein (1997) suggests that besides reallocating cash flow generated by one division to another for new investment, an alternative way ICMs operate is through using divisional assets as collateral to raise financing that is then diverted to another division. Likewise, Livdan, et al. (2009) suggest that an increase in assets leads to a reduction in collateral constraints. This relaxes financial constraints by increasing the collateralized debt capacity of the firm.

Table 6

Fama–MacBeth regressions of ICM Absolute-Value-Added (AVA) on key characteristics

This table presents Fama and MacBeth (1973) regressions with internal capital market efficiency as measured by absolute value added as the dependent variable during the period 1979 to 2010. First, separate cross-sectional regressions in each sample year are estimated then, second, the average of the coefficients and standard errors across years are reported. Independent variables are composed as follows. Absolute value added by allocation (AVA) is the measure of allocation efficiency of an internal capital market as defined by Rajan, et al. (2000). Asset growth (AG) is the year-on-year percentage change in total assets for the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). AG is used as the proxy for growth options. BUSSEG is a direct count of the number of business segments reported by management. The Herfindahl index value of segment sales (H_SALES) and segment assets (H_ASSETS) is calculated as the sum of the squares of each segment's sales (assets) as a proportion of the firm's total sales (assets) for that fiscal year. The inverse of the Herfindahl index values is used in this analysis. Return on assets (ROA) is the ratio of total revenue over total assets of the firm. Size (SIZE) is the log of the market value of a firm in millions of dollars calculated as the product of the price and the number of shares outstanding at the end of year (t). All variables are calculated using data from the CRSP-Compustat merged database. *t*-statistics are in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

Model	1	2	3	4	5	6
Asset growth (AG)	0.0141***	0.0139***	0.0140***	0.0133***	0.0131***	0.0133***
	(4.10)	(4.12)	(4.08)	(4.03)	(4.03)	(4.03)
Number of Business Segments (BUSSEG)	-0.0013**			-0.0011*		
	(-2.08)			(-1.72)		
1/Sales Herfindahl Index (1/H_SALE)		-0.0028**			-0.0027**	
		(-2.74)			(-2.70)	
1/Asset Herfindahl Index (1/H_Assets)			-0.0031***			-0.0029***
			(-4.65)			(-4.18)
Return on Assets (ROA)				0.0350**	0.0344**	0.0346**
				(3.07)	(3.10)	(3.06)
Size	0.0008**	0.0008**	0.0009**	0.0003	0.0003	0.0003
	(2.53)	(2.66)	(2.79)	(0.66)	(0.68)	(0.77)

Table 7

Fama–MacBeth regressions of ICM Absolute-Value-Added (AVA) on key characteristics

This table presents Fama and MacBeth (1973) regressions with internal capital market efficiency as measured by absolute value added as the dependent variable during the period 1979 to 2010. First, separate cross-sectional regressions in each sample year are estimated then, second, the average of the coefficients and standard errors across years are reported. Independent variables are composed as follows. Absolute value added by allocation (AVA) is the measure of allocation efficiency of an internal capital market as defined by Rajan, et al. (2000). Market-to-book (MB) is the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity. MB is used as the proxy for growth options. BUSSEG is a direct count of the number of business segments reported by management. The Herfindahl index value of segment sales (H_SALES) and segment assets (H_ASSETS) is calculated as the sum of the squares of each segment's sales (assets) as a proportion of the firm's total sales (assets) for that fiscal year. The inverse of the Herfindahl index values is used in this analysis. Return on assets (ROA) is the ratio of total revenue over total assets of the firm. Size (SIZE) is the log of the market value of a firm in millions of dollars calculated as the product of the price and the number of shares outstanding at the end of year (t). All variables are calculated using data from the CRSP-Compustat merged database. *t*-statistics are in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

Model	1	2	3	4	5	6
Market-to-book (MB)	0.0008**	0.0008**	0.0008**	0. 0009**	0.0008**	0.0009**
	(2.51)	(2.48)	(2.53)	(2.43)	(2.41)	(2.47)
Number of Business Segments (BUSSEG)	-0.0013**			-0.0011		
	(-2.07)			(-1.61)		
1/Sales Herfindahl Index (1/H_SALE)		-0.0030**			-0.0028**	
		(-2.73)			(-2.65)	
1/Asset Herfindahl Index (1/H_Assets)			-0.0032***			-0.0030***
			(-5.11)			(-4.56)
Return on Assets (ROA)				0.0377**	0.0367**	0.0368**
				(3.00)	(3.01)	(2.96)
Size	0.0007*	0.0007**	0.0008**	0.0001	0.0001	0.0002
	(2.00)	(2.12)	(2.28)	(0.21)	(0.24)	(0.36)

In addition, other studies report a positive multiplier effect whereby new assets-in-place facilitate collateralized borrowing from external capital markets for new investment. This further increases the collateralized debt capacity of the firm and positively reinforces the cycle of relaxing financial constraints on the firm (see Almeida and Campello (2007), Hahn and Lee (2009) and Yan, et al. (2010), among others). Similarly, Peyer (2002) examines the role of ICMs in relation to external capital and reports that firms with efficient ICMs are able to use more external capital relative to comparable single segment firms. Taken together, the evidence from these studies supports the explanation that capital expenditures to capture existing growth options create new assets-in-place. This in turn acts as collateral for borrowing from external capital markets, thus further reducing financial constraints of the firm.

Another result of particular interest is the negative and significant relation between AVA and measures of firm diversification in both Tables 6 and 7. Notably, the level of significance and absolute magnitude of the coefficients increase from the BUSSEG to 1/H_ASSETS measure of diversification, across all the regression models and in both sets of analysis. The increase in magnitude and consistent direction of the coefficients is important as the Herfindahl index provides greater accuracy in measuring firm diversification than a straight count of the number of business segments.

For example, a firm that operates in two different business segments may be assumed to have evenly split its operations. However, if ninety-nine percent of its operations are concentrated in one of the business segments, then it can be argued that the firm behaves more like a single-segment (focused) firm. Furthermore, it is well known that managers often manipulate sales figures in annual reports. In contrast, there is less incentive and it is more difficult to manipulate the reporting of operating assets within business divisions.

Under this perspective, the Herfindahl index value provides a more discerning measure of a firm's diversified operations and explains the increasing significance of the result. Therefore, the significant and negative coefficients for 1/H_SALE and 1/H_ASSETS are interpreted as stronger evidence that ICM efficiency has a negative relation with firm diversification. Overall, the results suggest that ICMs are less efficient in reducing financial constraints as the number of business segments increases.

There are reasons to believe that firm diversification exerts a negative influence on ICM efficiency. For example, Stein (1997) suggests that ICMs are efficient when headquarters in a diversified firm engage in "winner-picking" through the active monitoring and comparison of different growth options from various business divisions within a firm. However, Stein's study is also careful to emphasize that an increase in the number of divisions decreases the effectiveness of the "winner-picking" process as it becomes more difficult for headquarters to discern the most attractive growth option. This effectively leads to a decline in the efficiency of a firm's ICM and results in the inefficient reallocation of internal funds. Rajan, et al. (2000) present a model in which cross-subsidization is a more severe problem in firms that have greater diversity in resources and investment opportunities across divisions.

Regression models four to six in both Table 6 and Table 7 include the productivity measure, return-on-assets (ROA). ROA is positive and significant at the 5% level in all regression models, regardless of growth option proxy or diversification measure used. This is not surprising since managers who are efficient at using a firm's assets to generate revenue are also more likely to have a positive influence on reallocating resources in a firm, thereby increasing the efficiency of a firm's ICM. Conversely, if internal capital markets suffer from inefficient capital allocation, then a diversified firm would tend to experience a reduction in its overall level of asset productivity as unproductive segments grow disproportionately relative to their optimal size. For example, Scharfstein and Stein (2000) propose a theory in which less productive divisions of a diversified firm are subsidized by more productive divisions because of rent-seeking behaviour on the part of division managers.

3.4.6 Fama and MacBeth regressions examining the relation of ICM efficiency and proportion of intangible/tangible assets

Earlier regression analysis with AVA as the dependent variable shows that growth options have a positive and significant relation to the ability of an ICM to reduce financial constraints. An explanation for this relation is that capital expenditures capturing existing growth options result in new assets-in-place that serve as collateral value for new borrowing from external capital markets. The overall effect of this credit channel is that ICMs now have even more financial resources to reallocate to new superior investment opportunities. However, asset tangibility is of great importance in order for this argument to hold. This is because external financing is based on tangible assets because such assets mitigate contractibility problems. Another important reason is that tangible assets increase the value that can be captured by creditors in default states.

For example, Almeida and Campello (2007) suggest that asset tangibility itself affects the credit status of the firm, as firms with a high level of tangible assets may become unconstrained. The authors develop a new theoretical argument that asset tangibility increases a firm's ability to obtain external financing for new capital investment when firms have imperfect access to credit. Building on a credit multiplier effect identified by Kiyotaki and Moore (1997), the study shows that investment-cash flow sensitivities are increasing in the tangibility of constrained firms' assets.

Evidence from these studies offers the testable prediction of a positive (negative) relation between ICM efficiency and asset tangibility (intangibility). Firms that have a higher proportion of tangible assets as a proportion of total assets are able to raise more collateralized loans and are better able to reduce financial constraints imposed on the firm. In contrast, firms that have more intangible assets as a proportion of total assets are more likely to be less able to raise collateralized loans due to contractibility issues and experience more financial constraints.

To test these predictions, Table 8 and Table 9 tabulate regression results with ICM efficiency as the dependent variable and include independent variables for tangible and intangible assets as a percentage of total assets. As predicted, tangible assets show a positive relation with AVA that is significant at the 1% level and robust to alternative measures of diversification. The relation is also persistent in both statistical significance and direction when an alternative proxy for growth options, the market-to-book ratio, is used.

Conversely, intangible assets have a significantly negative relation with AVA that is likewise robust to alternative measure of diversification and growth options. Overall, the results are interpreted as extra evidence that the capital expenditure in the capture of growth options creates new assets-in-place that can used as collateral which further relaxes financial constraints and increases the efficiency of ICMs.

Table 8

Fama–MacBeth regressions of ICM Absolute-Value-Added (AVA) on key characteristics

This table presents Fama and MacBeth (1973) regressions with internal capital market efficiency as measured by absolute value added (AVA) as the dependent variable during the period 1979 to 2010. First, separate cross-sectional regressions in each sample year are estimated then, second, the average of the coefficients and standard errors across years are reported. Independent variables are composed as follows. Absolute value added by allocation (AVA) is the measure of allocation efficiency of an internal capital market as defined by Rajan, et al. (2000). Asset growth (AG) is the year-on-year percentage change in total assets for the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). AG is used as the proxy for growth options. BUSSEG is a direct count of the number of business segments reported by management. The Herfindahl index value of segment sales (H_SALES) and segment assets (H_ASSETS) is calculated as the sum of the squares of each segment's sales (assets) as a proportion of the firm's total sales (assets) for that fiscal year. The inverse of the Herfindahl index values is used in this analysis. Tangible assets as a percentage of total assets (TAN) represent common equity minus intangible assets divided by total assets. Intangible assets as a percentage of total assets (INTAN) represent the net value of intangible assets divided by total assets. Size (SIZE) is the log of the market value of a firm in millions of dollars calculated as the product of the price and the number of shares outstanding at the end of year (t). All variables are calculated using data from the CRSP-Compustat merged database. *t*-statistics are in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

Model	1	2	3	4	5	6
Asset growth (AG)	0.0129***	0.0127***	0.0129***	0. 0147***	0.0145***	0.0147***
	(4.32)	(4.31)	(4.31)	(4.77)	(4.77)	(4.77)
Number of Business Segments (BUSSEG)	-0.0009			-0.0011*		
	(-1.51)			(-1.74)		
1/Sales Herfindahl Index (1/H_SALE)		-0.0025**			-0.0022**	
		(-2.59)			(-2.23)	
1/Asset Herfindahl Index (1/H_Assets)			-0.0026***			-0.0024***
			(-3.72)			(-3.51)
Tangible Assets / Total Assets (TAN)	0.0168***	0.0169***	0.0166***			
	(3.27)	(3.30)	(3.20)			
Intangible Assets / Total Assets (INTAN)				-0.0555***	-0.0549***	-0.0545***
				(-8.08)	(-7.96)	(-7.84)
Return on Assets (ROA)	0.0284**	0.0278**	0.0281**	0.0332***	0.0329***	0.0330**
	(2.13)	(2.13)	(2.11)	(2.94)	(3.00)	(2.93)
Size	0.0006	0.0006	0.0006	0.0006	0.0005	0.0006
	(0.99)	(1.02)	(1.05)	(1.24)	(1.18)	(1.25)

Table 9

Fama–MacBeth regressions of ICM Absolute-Value-Added (AVA) on key characteristics

This table presents Fama and MacBeth (1973) regressions with internal capital market efficiency as measured by absolute value added (AVA) as the dependent variable during the period 1979 to 2010. First, separate cross-sectional regressions in each sample year are estimated then, second, the average of the coefficients and standard errors across years are reported. Independent variables are composed as follows. Absolute value added by allocation (AVA) is the measure of allocation efficiency of an internal capital market as defined by Rajan, et al. (2000). Market-to-book (MB) is the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity. MB is used as the proxy for growth options. BUSSEG is a direct count of the number of business segments reported by management. The Herfindahl index value of segment sales (H_SALES) and segment assets (H_ASSETS) is calculated as the sum of the squares of each segment's sales (assets) as a proportion of the firm's total sales (assets) for that fiscal year. The inverse of the Herfindahl index values is used in this analysis. Tangible assets as a percentage of total assets (TAN) represent common equity minus intangible assets divided by total assets. Intangible assets as a percentage of total assets (INTAN) represent the net value of intangible assets divided by total assets. Return on assets (ROA) is the ratio of total revenue over total assets of the firm. Size (SIZE) is the log of the market value of a firm in millions of dollars calculated as the product of the price and the number of shares outstanding at the end of year (t). All variables are calculated using data from the CRSP-Compustat merged database. *t*-statistics are in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

Model	1	2	3	4	5	6
Market-to-book (MB)	0.0009**	0.0009**	0.0009**	0. 0009**	0. 0009**	0. 0009**
	(2.59)	(2.57)	(2.61)	(2.62)	(2.61)	(2.66)
Number of Business Segments (BUSSEG)	-0.0009			-0.0011		
	(-1.44)			(-1.66)		
1/Sales Herfindahl Index (1/H_SALE)		-0.0026**			-0.0023**	
		(-2.60)			(-2.29)	
1/Asset Herfindahl Index (1/H_Assets)			-0.0027***			-0.0026***
			(-4.05)			(-3.90)
Tangible Assets / Total Assets (TAN)	0.0156***	0.0157***	0.0154***			
	(2.91)	(2.94)	(2.84)			
Intangible Assets / Total Assets (INTAN)				-0.0522***	-0.0516***	-0.0511***
				(-7.79)	(-7.72)	(-7.49)
Return on Assets (ROA)	0.0313**	0.0281**	0.0305**	0.0350***	0.0343***	0.0343***
	(2.16)	(2.14)	(2.11)	(2.88)	(2.90)	(2.83)
Size	0.0004	0.0004	0.0004	0.0004	0.0003	0.0004
	(0.56)	(0.62)	(0.68)	(0.73)	(0.71)	(0.82)

3.5 Summary and conclusion

This chapter provides new evidence that the efficiency of internal capital markets is a source of financial constraints that are priced into stock returns of diversified firms. Using a sample of diversified firms and alternative specifications of growth options in the Fama-MacBeth regression framework, firms with inefficient ICMs have positive and significantly larger returns than firms with efficient ICMs. In addition, total asset growth and asset tangibility are documented to be persistent and significant drivers of ICM efficiency. These findings are interpreted as evidence that ICM efficiencies are sensitive to changes in the collateral value of a firm's existing and new assets which can be used to generate funds through collateralized financing, on the condition that such assets are tangible in order to satisfy contractibility requirements imposed by external lenders.

The results of this study complement findings in both the corporate finance and asset pricing literature. Corporate finance studies often emphasize the beneficial aspects of ICMs such as the avoidance of costly external markets and relaxation of financial constraints for new investment. Other studies emphasizing agency explanations for ICM inefficiencies suggest that internal funds from ICMs are subverted by managers for private benefit. This study reports evidence that supports both strands of literature by showing that the associated risk implied by both aspects of an ICM as indicated by a measure of ICM efficiency, absolute value added (AVA), is priced into stock returns.

A weakness in this study is that it does not explicitly incorporate elements such as corporate governance and executive compensation into the analysis. On one hand, studies based on efficient internal capital market reallocation theories have assumed that headquarters, unlike funding institutions in external financial markets, has absolute control rights that enable it to reallocate funds (for example, see Weston (1970) and Stein (1997)).

On the other hand, models of internal capital misallocation such as Rajan, et al. (2000) also rely on the discretionary use of internal funds by managers when asserting influence over the investment decision for private benefit. Taking into consideration that both assumptions of efficient or inefficient ICM reallocation rely on the insulation of management from the discipline of external capital markets, one can argue that corporate governance acts as an important driver of ICM efficiency. This perspective offers interesting opportunities for future research.

Chapter 4:

Global Diversification, Investment Flexibility and Internal Capital Markets

4.1 Introduction

Diversification across different national markets (global diversification) is a matter of increasing importance to corporate managers. Improved logistical connectivity, reduced political and trade barriers as well as increased domestic competition have altered the relative costs and benefits of industrial and global diversification. For example, the relative geographic isolation and small size of Australia's domestic market compound challenges to organic growth and increase the urgency for larger and more established firms to diversify internationally. Access to opportunities in foreign markets can help Australian firms overcome domestic growth challenges and enhance overall revenue performance. In contrast, industrial firms within the European Union (EU) have a common currency and no prohibitive trade barriers. As such, industrial firms within the EU can expand within its regional boundaries before considering global diversification for new growth.

Over the past few decades, much of the corporate finance literature has documented a debate on the causes and consequences of diversification across multiple lines of business (industrial diversification).[2] In contrast, considerably less attention has focused on the relation between global diversification and the unique features of industrially diversified firms. Industrially diversified firms have increased investment flexibility in the selection of risky growth options from different industries as well as the financing flexibility provided by efficient internal capital markets (ICMs).[3] Prior research suggests that global diversification benefits industrial firms further in at least two ways. First, global diversification improves the investment flexibility of industrial firms as they are now able to compare investment opportunities (growth options) between countries in which they have an operational presence

[2] See Martin and Sayrak (2003) for a survey of the literature.
[3] Chapter 1 of this thesis examines the investment flexibility of industrially diversified firms versus industrially focused firms, while Chapter 2 investigates the financing flexibility provided by efficient ICMs of industrially diversified firms to exploit growth options.

and are thus able to select growth options with the lowest systematic risk. Second, global diversification offers the diversification benefit of reducing the correlation of internal funds in an ICM due to operational cash flows from different countries that have imperfectly correlated economies.

Despite the popular belief held by corporate managers that global diversification offers important competitive advantages, especially for industrial firms in mature industries that have limited growth, little research has been done to test if this belief remains valid given the past few decades of increased economic and financial integration of global economies. Does the promise of greater investment flexibility and uncorrelated cash flows from having operations in multiple countries still hold, and what are the implications for firm value?

The underlying rationale for understanding implications of diversification for firm value is provided by the seminal work of Myers (1977) and Berk, et al. (1999). Myers (1977) established the economic principle that showed firm value is composed of two parts: the value of assets in place and the value of growth options. Berk, et al. (1999) extend this view with their study where the exercise of real investment options is related to the dynamics of risk and return across firms.[4] In their study, firm value is likewise comprised of heterogeneous, risky growth options, and existing assets in place that are generating cash flows. All things equal, growth options that have lower systematic risk are more attractive to the firm. As growth options with differing risk characteristics arrive and existing assets expire, firms respond optimally through their investment choices. Exercising these options through investment reduces the average systematic risk of the firm's cash flows in subsequent periods, leading to lower realized returns on average.

[4] The seminal work of Berk, et al. (1999) has been complemented by other theoretical and empirical studies documenting the relation stock returns and the interaction of growth options and assets in place. A non-exhaustive list of recent work includes Gomes, et al. (2003), Anderson and Garcia-Feijoo (2006) and Carlson, et al. (2004)

The model of Berk, et al. (1999) suggest that growth options with lower systematic risk are attractive to the firm for new investment. However, the extent to which a firm is able to influence its specific choice of investment is naturally limited to the growth options uniquely available to the industry that it participates in, and in a larger context, the national markets that it operates in globally. While industrially diversified firms are able to opportunistically select growth options with the lowest systematic risk from the cross-section of industries that it participates in, industrially focused firms are denied this privilege. On the other hand, global diversification affords both industrially focused and diversified firms the advantage of selecting growth options from different country markets, arguably allowing all globally diversified firms to exploit growth options with the lowest systematic risk.

While greater investment flexibility allows firms to select growth options with lower systematic risk, the ability of any firm to exploit growth options is dependent on the availability of funds. An important advantage available to industrially diversified firms is the availability of an ICM in which internal funds from operating divisions are reallocated to the most attractive investments within the firm. While ICMs reduce financial constraints on the firm and help it avoid costly external capital markets, the efficiency of a firm's ICM is sensitive to the correlation of internal funds. The potential benefit of global diversification for the efficient working of ICMs is that cash flows from operating divisions in different countries are less correlated.

However, with increased economic and financial integration of global economies, a further dimension in this investigation is whether industry or country factors dominate any diversification benefit from industrial or global diversification.[5] If industry factors dominate,

[5] Studies that show that country specific effects are more important than global industry factors include Beckers, Connor and Curds (1996), Tessitore and Usmen (2005) and Sonney (2009). Other studies that indicate a shift in importance towards industry effects, especially in the late 1990s include Baca Baca, Garbe and Weiss (2000), Cavaglia, Brightman and Aked (2000) and Wang, Lee and Huang (2003).

then managers will only realise diversification benefits from investments in different business segments. On the other hand, if country effects are important, then the purported beneficial effects of global diversification in enhancing investment flexibility and ICM efficiency discussed earlier would hold true.

This chapter provides evidence on the preceding discussion by examining the impact of global diversification on investment flexibility in selecting growth options and the efficiency of ICMs. Contrary to the perspective that increased global diversification substitutes for industrial diversification, this study finds no evidence that increased global diversification offers any increase in investment flexibility for the selection of growth options. The results are consistent for both industrially focused and diversified firms and robust to alternative measures of growth options, global diversification measures and portfolio variations. Moreover, globally diversified firms, despite having cash flows from operations in different countries, do not have more efficient ICMs than firms that operate in only one geographic segment. Overall the evidence suggests that industry specific effects outweigh country effects as drivers of any potential diversification benefit for industrial firms.

The findings are also consistent with theoretical models of firm value as being composed of assets-in-place and growth options such as Myers (1977), Berk, et al. (1999) and Anderson and Garcia-Feijoo (2006), as well as recent research investigating whether financial constraints are priced in the market, such as Whited and Wu (2006), Almeida and Campello (2007) and Livdan, et al. (2009). This chapter complements and extends their findings by providing evidence on the impact of global diversification on the selection of growth options and financial constraints for both industrially focused and diversified firms.

The study also adds to the strand of literature that investigates the dominance of either a country or industry effect on portfolio returns by extending the debate to the unique features of industrially diversified firms, namely investment flexibility in the selection of growth options and internal capital markets. This study shows that diversification benefits in the selection of growth options are dominated by industry factors and reduced financial constraints from more efficient ICMs as suggested by the literature are negligible, if present at all. Corporate managers are therefore more likely to realise greater benefit by embracing a corporate diversification strategy across different business segments.

The remainder of the chapter is organized as follows. Section 2 discusses the literature on global diversification with relevant implications for firm value in relation to the selection of growth options and ICMs. Section 3 describes the sample selection criteria and analysis methodology. Section 4 presents the results. Section 5 concludes.

4.2 Related literature

4.2.1 The potential costs and benefits of global diversification

The literature provides evidence of the beneficial effects of global diversification. The resource-based view suggests that economies of scale and scope, learning, operational flexibility and stable profits can be achieved through global diversification (see Kogut (1986), Amit and Livnat (1988) and Tallman and Li (1996), among others). For example, a globally diversified firm has the operational flexibility to shift production to the country in which production costs are lowest, or shift distribution to the country in which market demand is highest, essentially overcoming growth challenges by capitalizing on the most attractive investment opportunities.

Similarly, the globally diversified firm is able to exploit differences in tax systems across countries, thus effectively lowering the firm's overall tax liability. From the perspective of investment funding, assuming some degree of segmentation of capital markets for different countries, globally diversified firms can raise capital in the country where the costs of doing so are lowest. In the context of internal corporate funds, globally diversified firms have the flexibility to reallocate resources within an internal capital market to new investment in countries that have more promising prospects.

Essentially, the argument in favour of global diversification is similar to the "winner-picking" model of investment decisions articulated by Stein (1997) in relation to industrially diversified firms. In Stein’s study, the headquarters of a firm is assumed to have control rights in allocating scarce resources as well as superior information about the prospects of competing projects available to the firm. The overall effect is that headquarters is able to engage in winner-picking by comparing investment opportunities throughout the firm and allocating resources to the most attractive opportunities.

There are also plausible arguments against global diversification in the literature that stem primarily from an agency perspective. As is the case with industrial diversification, global diversification can lead to the inefficient cross-subsidization of less profitable business units. Rajan and Zingales (1998), Rajan, et al. (2000) and Scharfstein and Stein (2000) present models in which divisional managers exert influence to increase the assets under their control. This leads to less profitable divisions within the firm being subsidized by, and at the expense of, more profitable divisions.

In addition, managers may have private incentives to adopt and maintain value-reducing global diversification strategies, even if doing so reduces shareholder wealth. Managers can privately benefit from global diversification in at least three ways. First, managing a large, globally diversified corporation confers greater power and prestige on the manager (see Jensen (1986) and Stulz (1990)). Second, on average, levels of managerial compensation tend to be positively correlated with firm size (see Jensen and Murphy (1990)). Third, to the extent that the cash flows of global segments are imperfectly correlated, global diversification reduces the risk of the manager's relatively undiversified personal portfolio (see Amihud and Lev (1981)). If these private benefits exceed the manager's private costs, the firm may pursue value-reducing global diversification.

Given the mixed evidence in the literature, it is not surprising to find that the debate on the effects of global diversification remains vibrant. More importantly, however, the seminal work of Stein (1997) reconciles conflicting views on global diversification. Stein (1997) suggests that any reallocation of resources across divisions will still be in the direction of value-adding efficiency because the ability of the chief executive officer (CEO) to appropriate private benefits is commensurate with the value of the firm as a whole. As such, CEOs will always be incentivised to exploit all potential sources of value inside the firm in order to maximise such rents.[6] The alternative assumption that CEOs may systematically derive more private benefits from weak divisions, if not completely implausible from this perspective, appears to conflict with other competing agency motivations.

4.2.2 Global diversification and the selection of growth options

While prior studies have suggested that the trend for industrial diversification has been one that is decreasing over time (see John and Ofek (1995), Comment and Jarrell (1995) and Daley, Mehrotra and Sivakumar (1997)), there is no evidence in the literature pointing towards similar trends of a reduction in global diversification. For example, Denis, Denis and Yost (2002) report that global diversification has grown over time and, more importantly, does not serve as a substitute for industrial diversification.[7]

As is the case with industrial diversification, global diversification offers firms advantages in the selection of growth options with the lowest systematic risk.[8] In the context of industrial diversification, industrially diversified firms enjoy the advantage of increased investment flexibility over industrially focused firms as they are able to select from a diverse pool of growth options with a larger range of systematic risk, due to operations in multiple business segments and/or industries. A potential novel effect of global diversification is that this investment advantage is hypothetically extended to industrially focused firms as well. Despite being dedicated to a single business segment, industrially focused firms that have operations in multiple national markets are able to comparatively select growth options among multiple national markets. As such, both industrially diversified and focused firms are

[6] Matsusaka and Nanda (2002) present a similar argument about the potential benefits of an internal capital market.

[7] In their study, the authors find that firm-year changes in global diversification are positively correlated with changes in industrial diversification, suggesting that the two forms of diversification act as complements rather than substitutes.

[8] Berk, et al. (1999) establish a dynamic model that describes firm value through the interaction of growth options and assets-in-place. Investments with low systematic risk are attractive to the firm and when exercised, the average systematic risk of the firm in subsequent periods is reduced, leading to lower returns. This model is also discussed in greater detail in the first empirical chapter of this thesis.

able to benefit from a larger pool of growth options if they have operations in more than one country.

The observation that growth options specific to industries in different countries are likely to be uncorrelated due to varying degrees of market maturity further underscores the importance of a country effect in global diversification (see Baca, et al. (2000) and Tessitore and Usmen (2005)). For example, while the automobile industry in the United States is considered a mature industry, the automobile market is only beginning to develop in the Chinese market. Spurred by a growing middle-income class and increasing household wealth in recent years, the growth rate of the Chinese automobile market is significantly greater than that of the United States. From an investment standpoint, it is reasonable to expect that both markets would have growth options with different levels of systematic risk given considerations such as different industry growth trajectories, consumer demographics and competitive market forces, to name a few. Therefore, it can be argued that a globally diversified automobile firm participating in both countries will be able to compare and select from a pool of growth options with different levels of systematic risk.

However, there are recent arguments in the literature that any potential gain from global diversification is limited due to international economic and financial integration of global markets. In other words, the impact of country specific effects as a driver of diversification benefits from international investment has declined as opposed to industry specific factors. A higher degree of international integration of industrial activity implies an increase in the importance of industry specific factors in explaining international investment returns. Overall, this view suggests that diversification benefits arising from industrial diversification outweigh any potential diversification benefits from global diversification.

Examples of recent work that support this view include Cavaglia, et al. (2000) and Baca, et al. (2000) who find that industry factors have been growing in importance, and may now dominate country effects. More recently, Campa and Fernandes (2006) investigate the sources of gains from international portfolio diversification by using a sample of forty-eight countries and thirty-nine industries over the last three decades. They find that industry specific factors have significantly increased while country effects have remained relatively stable, and suggest that greater international financial integration within industries have increased the importance of industry factors in explaining returns.

While it remains clear that industrially diversified firms have greater investment flexibility in the selection of growth options with lower systematic risk than industrially focused firms, it remains ambiguous whether global diversification enables industrially focused firms increased flexibility in the selection of growth options. In other words, there will (not) be a diversification benefit for global diversification if country effects (industry factors) are the main drivers. This provides several testable predictions. If industry (country) specific factors dominate the effects of global diversification, then globally diversified industrially focused firms will have insignificant (significant) differences in returns from the selection of growth options than that of industrially focused firms which are not globally diversified.

Separately, since globally diversified firms are now able to compare investment opportunities not only from different business segments but also different national markets, global diversification should enhance the investment flexibility of industrially diversified firms in the selection of growth options with the lowest systematic risk. More specifically, if global diversification does not enhance the investment flexibility of industrially diversified firms, then globally diversified industrially diversified firms will have insignificant

(significant) differences in returns from the selection of growth options than that of industrially diversified firms which are not globally diversified.

4.2.3 Global diversification and internal capital markets

The importance of ICMs in reducing financial constraints for new firm investment is well established in the corporate finance literature (for example, see Fluck and Lynch (1999), Hubbard and Palia (1999), Matsusaka and Nanda (2002), Yan, et al. (2010), among others). Overall, the evidence suggests that ICMs function as a valuable and efficient substitute for diversified firms in a tightened external capital market. Recent research in the asset pricing literature that shows increases in financial constraints lead to higher stock returns offers further insight on the importance of ICMs to firm value. For example, Whited and Wu (2006) report that financial constraints present a source of undiversifiable risk that is priced in stock returns. Likewise, Livdan, et al. (2009) show that more financially constrained firms are riskier and earn higher expected stock returns than less financially constrained firms. The authors explain that the more financially constrained firms are riskier due to a greater degree of inflexibility in adjusting capital investment to mitigate the impact of aggregate shocks on dividend streams.

Assuming that managers reallocate internal funds to investments that maximise shareholder value, the viability of ICMs is ultimately dependent on the availability of cash flows from different divisions within the firm. In this context, global diversification offers the diversification benefit that Shapiro (1978) and others argue accrues to the globally diversified firm by having cash flows in less than perfectly correlated markets. In other words, global diversification allows ICMs to reduce the correlation of internal cash flows generated by business divisions if they were to come from a single country. Hahn and Lee (2009) demonstrate this importance by showing that risk associated with variations in the availability of internal funds is priced into the associated firm's stock price. In their study, firms with greater availability of internal funds have reduced financial constraints, lower risk and consequently lower returns.

Another diversification benefit offered by global diversification is that less correlated cash flows within an ICM offers greater access to external funds. Earlier empirical work by Peyer (2002) adds insight on how diversified firms with efficient ICMs lower the cost of access to external capital by alleviating information asymmetry problems between managers and investors. The study suggests that one way in which information asymmetry between managers and investors is reduced is by increasing the precision of the estimate of the optimal amount of capital needed from external markets. Of particular importance in this case, is that the precision of the estimate increases with the number of projects in the firm only if the projects' capital needs are imperfectly correlated. In this perspective, global diversification increases the precision of the estimate through the lower correlation of cash flows from different business divisions operating in multiple countries. Separately, taken together with the earlier "winner-picking" argument of Stein (1997), globally diversified firms with efficient ICMs are not only able to use more external capital according to Peyer (2002), but also have the added advantage of raising it in the country where the costs of doing so are lowest.

Overall, the literature provides clear evidence that firms with efficient ICMs have lower returns than firms with inefficient ICMs as they are able to relax financial constraints more as well as reallocate resources to more attractive growth opportunities. If global diversification reduces financial constraints on a firm by reducing the correlation of internal cash flows as well as increasing access to external capital, a testable prediction is that firms that are industrially diversified firms that are globally diversified should have significantly lower returns than industrially diversified firms that operate in only a single geographical market.

4.3 Sample selection and variable measures

4.3.1 Sample selection

Collated business segment and price data on all firms used in this study is from the CRSP/Compustat Merged Database (CCM). CCM data draws from two separate sources: monthly price data for firms listed on the NYSE, AMEX or NASDAQ exchanges from the Centre for Research in Security Prices (CRSP) database and business segment data from the Compustat Industry Segment (CIS) database. Financial Accounting Standards Board (FASB) regulation No. 14 and SEC Regulation S-K require firms to report audited footnote information for segments where sales, assets, or profits exceed 10% of consolidated totals for fiscal years ending after December 15, 1977. The number of segments in a firm is also reported. The initial data sample period before applying any data filters is from 1978 to 2012.

Segment data for a given fiscal year may have multiple records due to reporting adjustments made in subsequent years. Compustat does not eliminate these duplicate entries which can be identified by their source year. In the case of multiple adjustments, the most recent update is denoted by the latest source year. As such, only segment data for the latest source year of each segment-year observation is considered. Following Berger and Ofek (1995) and Lamont and Polk (2002), firm-year observations that do not have an allocated SIC code are eliminated. Consistent with Duchin (2010), while financial firms with SIC code '6' at the one-digit level are excluded, industrial firms with financial segments are included because excluding these would eliminate from the sample many large conglomerates that maintain a finance division.[9] Firms with segments that do not have any operations as noted by SIC code '9' are omitted from the sample. Firms are also required to have total sales of at

[9] Similarly, Duchin (2010) adopts a similar data filter in his study that finds an efficient link between corporate liquidity and diversification that corresponds to efficient fund transfers from low- to high-productivity divisions.

least $10 million without any missing or negative segment information on sales, assets or capital expenditures.

Finally, the sample is restricted to firm-years that have information required to calculate the relevant measures of growth opportunities (total asset growth (AG) and market to book (MB)), diversification measures (Herfindahl index value for geographic sales (H_SALES) and the number of geographic segments (GEOSEG)), as well as ICM efficiency (absolute value added (AVA)). For scaling purposes, the inverse of the Herfindahl index for geographic sales is used for the analysis. Firm-years without any of the required imputed values for the analyses are eliminated from the sample. In effect, this limits the sample to firms that survive any consecutive three-year period with complete data in all three years.

There are two data sets used. The first data set that is used to investigate the investment flexibility of industrially focused and diversified firms in relation to global diversification consists of 73,024 firm-year observations on 9,723 unique firms.[10] The second data set that is used to investigate the effects of global diversification on the efficiency of ICMs consists only of industrially diversified firms and consists of 14,505 firm-year observations on 2,641 unique diversified firms.

4.3.2 Measures of growth options

Growth options are by nature unobservable and suitable proxies are required to represent them. Two proxies are used in the empirical analysis for this chapter. A comprehensive measure of firm growth, total asset growth (AG), or the year-on-year percentage change in firm total assets, is used as one proxy for growth options. The market-to-book value of equity ratio (MB) is used as the second proxy for growth options. MB is

[10] Over the sample period, the sum of unique diversified firms and unique focused firms do not equal to the unique count of actual firms in the sample because firms undergo changes in the level of diversification, from focused to diversified or vice versa, over the long sample period.

constructed as the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity. Please refer to section 2.3.2 of chapter 2 in this thesis for a description of the proxies as well as arguments for their use as a measure of growth options.

4.3.3 Measures of diversification

Two diversification measures used by Comment and Jarrell (1995) are employed to calculate firm diversification: (1) the inverse of a geographic sales based Herfindahl index (1/H_SALES), and (2) the number of geographic business segments (GEOSEG) reported by management. The Herfindahl index is calculated across Nj, segments for the j^{th} firm in fiscal year t as the sum of the squares of each segment i's revenue as a proportion of total revenue, where X_{ijt} is the revenue attributable to a corporate segment:

$$\textit{Herfindahl Index}(t) = \sum_{i=1}^{Njt}\left(\frac{X_{ijt}}{\sum_{i=1}^{Njt} X_{ijt}}\right)^2 \qquad (1)$$

For example, a firm with only one business segment will have a Herfindahl index value of 1; if a firm has two industrial segments that each contributes 50 percent of the sales, its Herfindahl sales index value is 0.5. In other words, the Herfindahl index value decreases as sales diversification across different industries increases. A high Herfindahl index value describes a more focused firm with a concentration of activities in fewer industries. A low Herfindahl index value describes a more diversified firm with activities spanning multiple industrial segments. Therefore, a geographic sales-based Herfindahl index reflects the degree to which revenues are diversified across a company's geographic markets. As the inverse of the Herfindahl index value is used for analysis, a larger value for 1/H_SALES indicates sales revenues that are more geographically diversified.

The diversification measure of the number of geographic business segments (GEOSEG) is a direct count of the number of geographic segments declared by the managers of the firm. Focused firms have only one geographic business segment while diversified firms have more than one geographic business segment. As such, for the diversification measure of GEOSEG, firms are more geographically diversified as the number of geographic business segments increase.

4.3.4 Measure of ICM efficiency, absolute-value-added (AVA)

Stein (1997) shows that headquarters in a diversified firm must be able to distinguish between good and inferior projects in order for internal allocation to be optimal. To measure allocation efficiency of the internal capital market, this study uses the measure of "absolute value added by allocation" (AVA) defined by Rajan, et al. (2000) as :

$$AVA = \frac{\sum_{j=1}^{n} BA_j(q_j-1)\left(\frac{Capex_j}{BA_j} - \frac{Capex_j^{SS}}{BA_j^{SS}}\right)}{BA} \qquad (2)$$

Please refer to section 3.3.2 of chapter 3 in this thesis for a detailed description of AVA. Firms with high (low) values for AVA have ICMs that are more (less) efficient and are predicted to have less (more) financial constraints and lower (higher) risk.

4.3.5 Measures of firm productivity

The measure of productivity used is the return-on-assets (ROA) which measures how profitable a company's assets are in generating revenue. It is calculated as the ratio of total revenue over total assets of the firm.

4.4 Results

4.4.1 Global diversification constraints and the selection of growth options

4.4.1.1 Summary statistics for all firms

Table 1 presents summary statistics for the pooled sample of industrially focused and diversified firms over the period of 1979 to 2010. Industrially focused firms refer to firms that operate in only one industrial business segment. Industrially diversified firms refer to firms that operate in two or more industrial business segments. The pooled sample of all firms has a total of 73,024 firm-years observations. This consists of 21,556 firm-year observations on 3,357 unique diversified firms, and 51,468 firm-year observations on 7,995 unique focused firms.

Industrially focused firms outnumber industrially diversified firms in the sample. Of particular interest is the finding that both industrially focused and industrially diversified firms both have a median of one for the number of geographic segments per firm (GEOSEG). This suggests that the extent of global diversification in the sample is limited to a smaller group of firms. This is confirmed by the median value of zero for the ratio of total foreign sales divided by total sales generated by the firm (FOR_TOT), as well as the high percentage of domestic sales content as shown by the ratio of total domestic sales divided by total sales (DOM_TOT) where the lowest is 88.47%. The number of domestic markets has a value of one for each firm but is not reported in the summary statistics. The average firm size for industrially diversified firms is almost twice as large as the average firm size for industrially focused firms. This observation is consistent with the idea that diversified firms are usually larger conglomerates that have operations in multiple industrial business segments.

Table 1
Summary statistics

This table reports summary statistics for the full sample of both industrially diversified and industrially focused firms consisting of 73,024 nonfinancial firm-years from 1979 to 2010. Summary statistics for the subsample of diversified and focused firms are also reported. This consists of 21,556 firm-year observations on 3,357 unique diversified firms, and 51,468 firm-year observations on 7,995 unique focused firms. The number of geographic segments (GEOSEG) is the total number of geographic markets, including the domestic market, reported by management from which the firm generates revenue at the end of the fiscal year. The number of foreign markets (FOR_MKTS) is the number of geographic segments, excluding the domestic market, reported by management at the end of the fiscal year. Total domestic sales divided by total firm sales (DOM_TOT) is the proportion of total revenue generated in the home market. Total foreign sales divided by total firm sales (FOR_TOT) is the proportion of total revenue generated in foreign markets. The Herfindahl index value of segment sales (H_SALE) is calculated as the sum of the squares of each geographic segment's sales as a proportion of the firm's total sales for that fiscal year. The inverse of the Herfindahl index value is used in this analysis. Asset growth (AG) is the year-on-year percentage change in total assets for the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). Market-to-book (MB) is the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity in calendar year (t−1). Book-to-market (BM) is common equity divided by the product of the share price and common shares outstanding at the end of the fiscal year. Size (SIZE) is the market value of a firm calculated using the price and the number of shares outstanding at the end of year (t), in millions of dollars. Annual stock return (RET12) is the buy-and-hold return for one year from July (t) to June (t+1), where t is the portfolio formation year. All variables are calculated using data from the CRSP-Compustat Merged (CCM) database.

	All Firms			Focused			Diversified		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
Number of Geographic Segments (GEOSEG)	1.7597	1	1.2638	1.7201	1	1.2571	1.8542	1	1.2748
Number of Foreign Markets (FOR_MKTS)	0.7731	0	1.2773	0.7361	0	1.2733	0.8614	0	1.2826
Total Domestic Sales / Total Sales (DOM_TOT)	0.8847	1	2.7466	0.8904	1	3.2682	0.8711	0.9939	0.2267
Total Foreign Sales / Total Sales (FOR _TOT)	0.1364	0	0.2518	0.1383	0	0.2560	0.1319	0	0.2414
Inverse of Sales Herfindahl Index (1/H_SALE)	1.3319	1	0.6434	1.3307	1	0.6631	1.3349	1	0.5938
Asset growth (AG)	0.1918	0.0846	0.8389	0.2084	0.09241	0.8580	0.1521	0.0707	0.7902
Market-to-Book (MB)	2.6046	1.6613	36.3716	2.8276	1.7725	41.4079	2.0720	1.4624	19.6788
Book-to-Market (BM)	0.6515	0.5732	4.0995	0.6414	0.5320	1.8595	0.6756	0.6614	6.9768
Size (millions)	1,439	132	7,486	1,173	111	6,809	2,075	218	8,863
Annual Stock Return (RET12)	0.1559	0	1.8281	0.1739	-0.0080	2.1049	0.1131	0.0192	0.8602
Number of firm-year observations		73,024			51,468			21,556	

Table 2
Spearman's Rank Correlation Matrix

This table reports Spearman's rank correlations for the full sample of both industrially diversified and industrially focused firms consisting of 73,024 nonfinancial firm-years from 1979 to 2010. The number of geographic segments (GEOSEG) is the total number of geographic markets, including the domestic market, reported by management from which the firm generates revenue at the end of the fiscal year. The number of foreign markets (FOR_MKTS) is the number of geographic segments, excluding the domestic market, reported by management at the end of the fiscal year. Total domestic sales divided by total firm sales (DOM_TOT) is the proportion of total revenue generated in the home market. Total foreign sales divided by total firm sales (FOR_TOT) is the proportion of total revenue generated in foreign markets. The Herfindahl index value of segment sales (H_SALE) is calculated as the sum of the squares of each geographic segment's sales as a proportion of the firm's total sales for that fiscal year. The inverse of the Herfindahl index value is used in this analysis. Asset growth (AG) is the year-on-year percentage change in total assets for the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). Market-to-book (MB) is the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity in calendar year (t−1). Book-to-market (BM) is common equity divided by the product of the share price and common shares outstanding at the end of the fiscal year. Size (SIZE) is the market value of a firm calculated using the price and the number of shares outstanding at the end of year (t), in millions of dollars. Annual stock return (RET12) is the buy-and-hold return for one year from July (t) to June (t+1), where t is the portfolio formation year. All variables are calculated using data from the CRSP-Compustat Merged (CCM) database.

	GEOSEG	FOR_MKTS	DOM_TOT	FOR _TOT	1/H_SALE	AG	MB	BM	Size	RET12
Number of Geographic Segments (GEOSEG)	1									
Number of Foreign Markets (FOR_MKTS)	0.9926	1								
Total Domestic Sales / Total Sales (DOM_TOT)	-0.8756	-0.8933	1							
Total Foreign Sales / Total Sales (FOR _TOT)	0.9477	0.9656	-0.9259	1						
Inverse of Sales Herfindahl Index (1/H_SALE)	0.9760	0.9691	-0.9012	0.9718	1					
Asset growth (AG)	-0.0260	-0.0235	0.0152	-0.0231	-0.0292	1				
Market-to-Book (MB)	0.1205	0.1215	-0.1073	0.1191	0.1211	0.3137	1			
Book-to-Market (BM)	-0.1120	-0.1129	0.0997	-0.1127	-0.1135	-0.2542	-0.8432	1		
Size (US$millions)	0.3068	0.3082	-0.2805	0.2902	0.2991	0.1710	0.4263	-0.3907	1	
Annual Stock Return (RET12)	0.0076	0.0058	-0.0037	0.0016	0.0070	-0.0923	-0.1241	0.1207	-0.0399	1

Table 2 presents the correlation matrix for the variables of interest. Notably, the diversification measures such as GEOSEG, the number of foreign markets (FOR_MKTS), DOM_TOT, FOR_TOT and the inverse of the Herfindahl index value for segment sales (1/H_SALE) are all highly correlated with each other. This is of no surprise since they all essentially measure the extent to which revenues of the firm are dispersed across a number of geographic segments. The growth option proxies of asset growth (AG) and market-to-book (MB) are not correlated with any of the diversification measures used in this analysis. The correlation between the growth option proxy, market-to-book value of equity (MB) and book-to-market (BM) is 84.32% as both variables are basically the inverse of each other. Due to the high correlation, regression analysis that uses MB as a growth option proxy will not employ BM as a control variable to avoid multicollinearity issues.

Lastly, Table 2 shows that is little correlation between firm size and the number of geographic segments (foreign markets) that a company operates in. This is interesting as one would intuitively expect that firms are more likely to have international operations as they increase in size. One potential conjecture to explain this finding is that smaller firms do not face as much difficulty in internationalizing their operations as compared to prior decades due to a reduction in trade barriers, improvement in logistics and other factors that have facilitated international trade.

4.4.1.2 Univariate portfolio sorts

At the end of June of each year *t* over the sample period of July 1979 to June of 2010, stocks are allocated into decile portfolios based on key characteristics. The portfolios are held for 1 year, from July of year (t) to June of year (t+1), and then rebalanced. Equal-weighted portfolio returns are calculated for each decile every year around the portfolio formation year

(t) over the sample period. Firm return statistics for each decile are then reported for the time-series average of yearly returns.

Table 3 replicates earlier work on the asset growth effect by Cooper, et al. (2008), Gray and Johnson (2010) and Yao, et al. (2011) who document evidence of a significant and negative relation between asset growth (AG) and returns in the cross-section of stocks as well as international markets.[1] This test is thus repeated here to ensure that the asset growth effect is persistent in this sample of firms with both domestic and international operations.

The univariate sort on AG for the whole sample replicates the monotonic decrease in stock returns for firms with low AG (decile 1) to firms with high AG (decile 10), as reported in earlier studies. The return spread of low-minus-high AG portfolios (decile 1 minus decile 10 portfolio returns) is 20.88% per annum and significant at 1% with t-statistic of 6.59. This confirms that the AG effect is also present in the sample used for this study.

For robustness, an alternative measure of growth options is employed in subsequent tests to qualitatively confirm findings using AG. . The market-to-book value of equity (MB) is a commonly used proxy for growth options in the corporate finance literature (see Chung and Charoenwong (1991), Collins and Kothari (1989) and Graham and Rogers (2002) and Lewellen, et al. (1987)). The market value of equity measures the present value of all future cash flows to equity holders from both assets-in-place and growth options, whereas the book value of equity represents the accumulated value generated from existing assets-in-place only. Therefore, the MB ratio measures the mix of cash flows from assets-in-place and growth options.

[1] Specifically, Cooper, et al. (2008) reports evidence of the asset growth effect in US stocks. Gray and Johnson (2010) and Yao, et al. (2011) document a similarly robust negative relation between asset growth and returns in the Australian and nine Asian markets. Specifically, the nine Asian markets are Japan, China, Hong Kong, Taiwan, Korea, Malaysia, Singapore, Thailand, and Indonesia.

Table 3
Univariate portfolio returns sorted on key characteristics

This table presents average annual returns from univariate sorts on key characteristics over the period 1979 to 2010. At the end of June of each year (t), stocks are allocated into portfolios based on key characteristics. The portfolios are held for 1 year, from July of year (t) to June of year (t+1), and then rebalanced. Portfolio return statistics are reported every year around the portfolio formation year (t) over the sample period. Panel A reports returns from stock portfolios sorted into deciles according to their asset growth (AG) rates. AG is defined as the percentage change in total assets from the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). Panel B reports returns from stock portfolios sorted into deciles according to the market-to-book (MB) ratio. MB is the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity in calendar year (t−1). Panel C reports returns from stock portfolios sorted into deciles according to the inverse of the Herfindahl index value of segment sales (1/H_SALE). The Herfindahl index value of segment sales (H_SALE) is calculated as the sum of the squares of each geographic segment's sales as a proportion of the firm's total sales for that fiscal year. Panel D reports returns from stock portfolios sorted into deciles according to the number of geographic segments (GEOSEG). GEOSEG is the total number of geographic markets, including the domestic market, reported by management from which the firm generates revenue at the end of the fiscal year. All variables are calculated using data from the CRSP-Compustat merged database.

Panel A: Asset growth (AG)

Portfolio		1 (Low AG)	2	3	4	5	6	7	8	9	10 (High AG)	Spread (1-10)
AG	RET12	0.2150	0.1821	0.1513	0.1189	0.1082	0.0938	0.0766	0.0712	0.0528	0.0061	0.2088
	t-stat	(3.7)	(4.11)	(3.65)	(3.13)	(3.18)	(2.87)	(2.36)	(1.90)	(1.44)	(0.17)	(6.59)

Panel B: Market-to-book (MB)

Portfolio		1 (Low MB)	2	3	4	5	6	7	8	9	10 (High MB)	Spread (1-10)
MB	RET12	0.2563	0.1844	0.1389	0.1171	0.0920	0.0970	0.0676	0.0578	0.0417	0.0234	0.2330
	t-stat	(4.54)	(4.04)	(3.67)	(3.24)	(2.66)	(2.74)	(1.92)	(1.58)	(1.13)	(0.57)	(6.32)

Panel C: Inverse of the Herfindahl diversification index value for geographic sales (1/H_SALES)

Portfolio		1 (Focused)	2	3	4	5	6	7	8	9	10 (Diversified)	Spread (1-10)
1/H_SALES	*RET12*	0.1108	0.1031	0.1004	0.1122	0.1086	0.1068	0.0922	0.0806	0.0983	0.1054	0.0078
	t-stat	(2.96)	(2.48)	(2.76)	(2.95)	(2.68)	(2.73)	(2.45)	(1.86)	(2.45)	(2.47)	(0.57)

Panel D: Number of geographic segments (GEOSEG)										
Portfolio		1 (Focused)	2	3	4	5	6	7	8 (Diversified)	Spread (1-8)
GEOSEG	RET12	0.1108	0.1103	0.1001	0.0890	0.1169	0.1813	0.0648	0.1116	0.0134
	t-stat	(3.00)	(2.82)	(2.50)	(2.68)	(1.45)	(1.37)	(0.61)	(1.29)	(0.23)

As before, similar to AG, a univariate sort on MB of the sample in Panel B of Table 2 reveals a pervasive and negative relation between MB and stock returns that is also monotonically decreasing from low MB stocks to high MB stocks. The return spread of low-minus-high MB portfolios (decile 1 minus decile 10 portfolio returns) is also significant with a t-statistic of 6.32 and yields a large premium of 23.30% per annum. The results for the univariate sort on MB are similar in trend and direction to the univariate sort on AG. These results provide preliminary evidence that firms with a low number of growth options seem to be more risky and thus have higher returns, whereas firms stocks with a high number of growth options are less risky.

In addition, for comparison, separate univariate sorts are performed on other characteristics that describe the degree of international diversification of a firm, namely the inverse of the Herfindahl diversification index value in geographic sales (1/H_SALE) in Panel C as well as the number of geographic segments (GEOSEG) it has operations in Panel D. Unlike the previous results sorted on the characteristics AG or MB, there is no observable pattern in the returns across all deciles for both characteristics.

4.4.1.3 Fama and MacBeth regressions on the selection of growth options with lower systematic risk

To test if global diversification is a determinant for stock returns, the following cross-sectional regression is estimated:

$$RET12_{i,t} = b_0 + b_1(GEOSEG)_{i,t} + b_2(DOM\_TOT)_{i,t} + b_3(1/H\_SALE)_{i,t} + b_4(FOR\_MKTS)_{i,t} + b_5(FOR\_TOT)_{i,t} + b_6(AG)_{i,t} + b_7(BM)_{i,t} + b_8(SIZE)_{i,t} + \varepsilon_{i,t} \quad (3)$$

where RET12 is the is the buy-and-hold return for one year from July (t) to June (t+1), where t is the portfolio formation year. The number of geographic segments (GEOSEG) is the total number of geographic markets, including the domestic market, reported by management from which the firm generates revenue at the end of the fiscal year. The Herfindahl index value of segment sales (H_SALE) is calculated as the sum of the squares of each geographic segment's sales as a proportion of the firm's total sales for that fiscal year. The inverse of the Herfindahl index value is used in this analysis. Total domestic sales divided by total firm sales (DOM_TOT) is the proportion of total revenue generated in the home market. The number of foreign markets (FOR_MKTS) is the number of geographic segments, excluding the domestic market, reported by management at the end of the fiscal year. Total foreign sales divided by total firm sales (FOR_TOT) is the proportion of total revenue generated in foreign markets. Asset growth (AG) is the year-on-year percentage change in total assets for the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). Book-to-market (BM) is common equity divided by the product of the share price and common shares outstanding at the end of the fiscal year. Size (SIZE) is the log of the market value of a firm in millions of dollars calculated as the product of the price and the number of shares outstanding at the end of year (t).

Table 4 and Table 5 employ Fama and MacBeth (1973) regressions with annual stock returns as the dependent variable.[48] Separate cross-sectional regressions in each sample year are first estimated then, second, the average of the coefficients and standard errors across years are reported with corresponding t-statistics in brackets. Table 4 reports regressions with the use of AG as a growth option proxy, while Table 5 uses MB as the growth option proxy.

[48] This procedure is also similar to that used in Rajan, et al. (2000).

Table 4
Fama–MacBeth regressions of annual stock returns on key characteristics

This table presents Fama and MacBeth (1973) regressions with annual stock returns as the dependent variable during the sample period of 1979 to 2010. First, separate cross-sectional regressions in each sample year are estimated then, second, the average of the coefficients and standard errors across years are reported. Independent variables are composed as follows. The number of geographic segments (GEOSEG) is the total number of geographic markets, including the domestic market, reported by management from which the firm generates revenue at the end of the fiscal year. The Herfindahl index value of segment sales (H_SALE) is calculated as the sum of the squares of each geographic segment's sales as a proportion of the firm's total sales for that fiscal year. The inverse of the Herfindahl index value is used in this analysis. Total domestic sales divided by total firm sales (DOM_TOT) is the proportion of total revenue generated in the home market. The number of foreign markets (FOR_MKTS) is the number of geographic segments, excluding the domestic market, reported by management at the end of the fiscal year. Total foreign sales divided by total firm sales (FOR_TOT) is the proportion of total revenue generated in foreign markets. Asset growth (AG) is the year-on-year percentage change in total assets for the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). Book-to-market (BM) is common equity divided by the product of the share price and common shares outstanding at the end of the fiscal year. Size (SIZE) is the log of the market value of a firm in millions of dollars calculated as the product of the price and the number of shares outstanding at the end of year (t). Annual stock return (RET12) is the buy-and-hold return for one year from July (t) to June (t+1), where t is the portfolio formation year. All variables are calculated using data from the CRSP-Compustat merged database. t-statistics are in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

Model	1	2	3	4	5
Number of Geographic Segments (GEOSEG)	0.0172**				
	(2.06)				
Total Domestic Sales / Total Sales (DOM_TOT)		0.1292			
		(-1.64)			
Inverse Sales Herfindahl Index (1/H_SALE)			0.0371**		
			(2.08)		
Number of Foreign Markets (FOR_MKTS)				0.0211**	
				(2.37)	
Total Foreign Sales / Total Sales (FOR _TOT)					0.1479*
					(1.87)
Asset growth (AG)	-0.0982***	-0.0983***	-0.0974***	-0.0981***	-0.0970***
	(-3.55)	(-3.62)	(-3.54)	(-3.55)	(-3.60)
Book-to-Market (BM)	-0.0452**	-0.0445**	-0.0452**	-0.0451**	-0.0451**
	(-2.32)	(-2.30)	(-2.32)	(-2.31)	(-2.31)
Size	-0.0667***	-0.0670***	-0.0667***	-0.0672***	-0.0675***
	(-6.14)	(-6.39)	(-6.09)	(-6.21)	(-6.29)

Table 5

Fama–MacBeth regressions of annual stock returns on key characteristics

This table presents regressions with annual stock returns as the dependent variable during the sample period of 1979 to 2010. First, separate cross-sectional regressions in each sample year are estimated then, second, the average of the coefficients and standard errors across years are reported. Independent variables are composed as follows. The number of geographic segments (GEOSEG) is the total number of geographic markets, including the domestic market, reported by management from which the firm generates revenue at the end of the fiscal year. The Herfindahl index value of segment sales (H_SALE) is calculated as the sum of the squares of each geographic segment's sales as a proportion of the firm's total sales for that fiscal year. The inverse of the Herfindahl index value is used in this analysis. Total domestic sales divided by total firm sales (DOM_TOT) is the proportion of total revenue generated in the home market. The number of foreign markets (FOR_MKTS) is the number of geographic segments, excluding the domestic market, reported by management at the end of the fiscal year. Total foreign sales divided by total firm sales (FOR_TOT) is the proportion of total revenue generated in foreign markets. Market-to-book (MB) is the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity in calendar year (t−1). Size (SIZE) is the log of the market value of a firm in millions of dollars calculated as the product of the price and the number of shares outstanding at the end of year (t). Annual stock return (RET12) is the buy-and-hold return for one year from July (t) to June (t+1), where t is the portfolio formation year. All variables are calculated using data from the CRSP-Compustat merged database. t-statistics are in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

Model	1	2	3	4	5
Number of Geographic Segments (GEOSEG)	0.0192**				
	(2.27)				
Total Domestic Sales / Total Sales (DOM_TOT)		-0.1358			
		(-1.69)			
Inverse Sales Herfindahl Index (1/H_SALE)			0.0418**		
			(2.32)		
Number of Foreign Markets (FOR_MKTS)				0.0230**	
				(2.55)	
Total Foreign Sales / Total Sales (FOR _TOT)					0.1543*
					(1.92)
Market-to-Book (MB)	-0.0016**	-0.0015**	-0.0016**	-0.0016**	-0.0015**
	(-2.58)	(-2.53)	(-2.56)	(-2.58)	(-2.54)
Size	-0.0664***	-0.0667***	-0.0665***	-0.0670***	-0.0671***
	(-6.18)	(-6.34)	(-6.15)	(-6.24)	(-6.27)

Both proxies for growth options have a significant and negative relation (at the 1% level for AG and 5% level for MB) with returns in all models. This implies that stock returns are reduced as the number of growth options increases for a firm. All things equal, firms with a greater number of growth options are better positioned to select growth options with the lowest systematic risk. Consequently, such firms would have seemingly lower risk as they are less constrained than firms with fewer growth options.

Both measures of global diversification, the number of geographic segments (GEOSEG) and the inverse Herfindahl index value of geographic sales (1/H_SALE), display a positive and significant (at the 5% level) relation with returns in all regression models. The regression coefficients also suggest that geographical diversification influences returns positively albeit not as strongly as either growth option proxies. All characteristics retain their explanatory power even after controlling for other predictors of stock returns such as firm size and book-to-market. Lastly, measures for the number of foreign markets (FOR_MKTS) and percentage of foreign sales of total sales (FOR_TOT) both have positive and significant coefficients at the 5% level. In contrast, regression model two shows that the proportion of total sales that is made up by domestic sales (DOM_TOT) is not significant. These findings are consistent regardless of which growth option proxy is used.

4.4.1.4 Portfolio returns sorted on asset growth and international diversification

One of the motivations of this study is to investigate if global diversification provides an advantage of increased investment flexibility in selecting growth options with lower systematic risk from different national markets. Globally diversified firms are predicted to have an advantage over geographically focused firms in terms of selecting attractive growth options with lower systematic risk. This is because globally diversified firms are uniquely positioned in comparison to their peers to select from a pool of growth options that is not constrained to one country. As such, the growth options available for consideration are likely to be less correlated in systematic risk. Of course, this assumes that country factors are the main drivers of any diversification benefit from global diversification. Assuming that country factors dominate as a driver of global diversification benefits, then controlling for the same quantity of growth options, portfolio sorts of firms operating in a single GEOSEG should have significantly higher returns than firms operating in multiple GEOSEG.

However, if industry factors are the main drivers of any diversification benefit, then portfolio sorts on geographic diversification measures should provide contrary evidence. This opposing view which suggests that country factors are no longer drivers of any diversification benefit is supported by recent studies such as Cavaglia, et al. (2000), Baca, et al. (2000) and Campa and Fernandes (2006). In this case, this perspective predicts that any difference in returns between portfolios of firms operating in single or multiple GEOSEG should be insignificant.

To test the preceding predictions, independent portfolio sorts of annual stock returns are employed. Table 6 presents returns from independent portfolios of firms sorted on AG and the number of geographic sales segments diversification measure in Panel A, as well as the sort on AG and the inverse Herfindahl index value of geographic sales in Panel B.[1] At the end of June of each year (t) over 1979 to 2010, stocks are allocated by a two-by-two independent sorting process into 4 independently sorted portfolios based on two key characteristics. The portfolios are held for 1 year, from July of year (t) to June of year (t+1),

[1] Panel B employs the inverse Herfindahl index value of geographic sales i.e. international sales. For example, a focused firms operating in only one industry but in more than one country is diversified in international sales (1/H_SALE <1). Conversely, diversified firms operating in multiple industries but in only one country will have no diversification in international sales (1/H_SALE =1). As such, portfolios based on 1/H_SALE potentially may have both focused and diversified firms. This contrasts with analysis performed in Chapter 2 of this thesis which employs either dedicated portfolios of either industrially focused or diversified firms exclusively.

Table 6

Portfolio returns sorted on asset growth and global diversification measures

This table presents average equal-weighted returns from independent portfolio sorts over the period 1979 to 2010. Panel A presents independent portfolio sorts on asset growth (AG) and the number of geographic segments (GEOSEG). Panel B presents independent portfolio sorts on asset growth (AG) and the inverse of the Herfindahl index value of segment sales (1/H_SALES). Firms are ranked by the median value for AG into low and high AG stocks. Single GEOSEG represents industrial firms operating in a single geographic segment. Multiple GEOSEG represent industrial firms operating in more than one geographic segment. Firms are ranked by the median value for 1/H_SALES into low 1/H_SALES and high 1/H_SALES. At the end of June of each year (t), stocks are allocated by a two-by-two sorting process into four portfolios. The portfolios are held for 1 year, from July of year (t) to June of year (t+1), and then rebalanced. Portfolio returns around the portfolio formation year (t) over the sample period are then averaged with return statistics reported. Low-minus-high AG portfolios represent the return differential between low and high AG states. Single-minus-multiple GEOSEG (Low-minus-high 1/H_SALES) portfolios represent the return differential between portfolios of geographically focused and geographically diversified firms. The bottom right corner of each matrix represents the average return differential between the extreme portfolio sorts for each characteristic (e.g. Low AG-Single GEOSEG minus High AG-Multiple GEOSEG in Panel A). AG is defined as the percentage change in total assets from the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). GEOSEG is the total number of geographic markets, including the domestic market, reported by management from which the firm generates revenue at the end of the fiscal year. H_SALES is calculated as the sum of the squares of each geographic segment's sales as a proportion of the firm's total sales for that fiscal year. t-statistics are in parentheses. All variables are calculated using data from the CRSP-Compustat merged database.

Panel A: Independent Sort on Asset Growth (AG) and Geographic Segments (GEOSEG)

Variable	Single GEOSEG	Multiple GEOSEG	Single Minus Multiple GEOSEG
Low AG	0.1586	0.1458	0.0128
	(3.79)	(3.47)	(1.04)
High AG	0.0640	0.0552	0.0088
	(1.87)	(1.57)	(0.55)
Low Minus High AG	0.0946	0.0905	0.1034
	(6.44)	(5.87)	(5.20)

Panel B: Independent Sort on Asset Growth (AG) and Inverse Sales Herfindahl Index (1/H_SALES)

Variable	Low 1/H_SALES	High 1/H_SALES	Low Minus High 1/H_SALES
Low AG	0.1591	0.1456	0.013
	(3.77)	(3.49)	(1.13)
High AG	0.0655	0.0543	0.0113
	(1.90)	(1.54)	(0.73)
Low Minus High AG	0.0936	0.0914	0.1049
	(6.33)	(5.99)	(5.32)

and then rebalanced. Portfolio returns around the portfolio formation year (t) over the period of July 1980 to June of 2008 are then averaged, with return statistics reported.

In addition, the average return differential (for example, low minus high AG) between each portfolio in the same sort on a key characteristic (for example, firms with a single geographic segment versus firms with multiple geographic segments in Panel A) around the portfolio formation year (t) are likewise calculated for each year over the sample period and averaged over the time series. The bottom right corner of each matrix (low AG-single GEOSEG minus high AG-multiple GEOSEG portfolio sort) represents the average return differential between the extreme portfolio sorts for each characteristic. For example, in Table 6 Panel A, the return differential in the bottom right of the matrix represents the average difference in returns for a portfolio of firms with low AG with only a single geographic segment minus a portfolio of firms with high AG with multiple geographic segments.

For both panels A and B in Table 6, portfolio returns of low AG firms are significant and larger than portfolio returns of high AG firms. The low-minus-high AG differentials in portfolio returns are positive and significant irrespective of GEOSEG and 1/H_SALE sorts. The results are similar to the earlier findings in the univariate sorts on AG which suggest that firms with fewer growth options have less investment flexibility, are riskier and have higher returns than firms with more growth options.

Of particular interest are the differences in portfolio returns between single GEOSEG (low 1/H_SALES) and multiple GEOSEG (high 1/H_SALES) sorts for either low or high AG. Both Panels A and B document differences in return differentials that are not significantly different from zero. These results are aligned with the view that country factors, or global diversification, are no longer a driver of any diversification benefit, as reported by Cavaglia, et al. (2000), Baca, et al. (2000) and Campa and Fernandes (2006).

The low AG-single GEOSEG minus high AG-multiple GEOSEG portfolio sort in the bottom right corner of Panel A has positive and significant returns of 10.34% per annum. Similar results in both significance and magnitude are reported for Panel B. More importantly, the returns are only marginally higher than either low-minus-high AG return differentials based on single/multiple GEOSEG or low/high 1/H_SALE characteristics. Taken together with the insignificant returns reported above, these results support the interpretation that global diversification does not offer any incremental diversification benefit but may be viewed unfavourably by investors as a contributor of increased firm risk. The marginal increase in returns are also aligned with the findings from regressions in Table 3 that show both GEOSEG and 1/H_SALE have a positive relation with stock returns although the absolute influence is expected to be marginal given the small coefficients.

4.4.1.5 Portfolio returns sorted on asset growth and low (high) international diversification

To further test the conjecture that country factors no longer provide any diversification benefit from global diversification, independent portfolios of focused and diversified firms in the same category of geographic diversification are compared. For example, portfolios of industrially focused and diversified firms operating in only one single geographic segment are compared in Panel A of Table 7. Similarly, the same method of portfolio sorts for industrially focused and diversified is used in Panel B but only for firms that are globally diversified, that is these firms must operate in more than one geographic segment. The process is repeated using the global diversification measure of low and high sales in Panels C and D, respectively.

Portfolio analysis conducted by comparing industrially focused and diversified firms in one common category of global diversification allows for insight as to whether diversified firms are able to maintain or even increase the unique advantage of greater investment flexibility by participating not only in more than one industry, but also across multiple countries. As before, portfolio sorts of both industrially focused and diversified firms with low asset growth have significantly larger returns (as high as 10.50% per annum for industrially focused firms and 6.93% per annum for industrially diversified firms) than firms with high asset growth, regardless of the measure of global diversification used.

Of particular interest is that the portfolio differentials of "industrially focused minus industrially diversified" firms are consistently insignificantly different from zero for every measure of global diversification (i.e. geographic segments and the Herfindahl index of geographic sales) and also for every category of AG. These results are interpreted as additional evidence that global diversification, or country specific factors, no longer provides any additional diversification benefit as compared to industry specific factors.

Table 7

Portfolio returns sorted on asset growth and low (high) global diversification

This table presents average equal-weighted returns from independent portfolio sorts over the period 1979 to 2010. Panel A represents industrial firms that operate in only one geographic segment. Panel B represents industrial firms that operate in multiple geographic segments. Panel C represents industrial firms that have low geographic sales diversification as measured by the inverse of the Herfindahl index value of segment sales (1/H_SALES). Panel D represents industrial firms that have high geographic sales diversification as measured by the inverse of the Herfindahl index value of segment sales (1/H_SALES). Firms are ranked by the median value of 1/H_SALES into low and high 1/H_SALES groups. Firms are ranked by the median value for AG into low and high AG stocks. Focused firms operate in one industrial segment. Diversified firms operate in two or more industrial segments. At the end of June of each year (t), stocks are allocated by a two-by-two sorting process into four portfolios. The portfolios are held for 1 year, from July of year (t) to June of year (t+1), and then rebalanced. Portfolio returns around the portfolio formation year (t) over the sample period are then averaged with return statistics reported. Low-minus-high AG portfolios represent the return differential between low and high AG states. Focused-minus-diversified portfolios represent the return differential between portfolios of industrially focused and industrially diversified firms. The bottom right corner of each matrix represents the average return differential between the extreme portfolio sorts for each characteristic (e.g. Low AG-Focused minus High AG-Diversified in Panel A). AG is defined as the percentage change in total assets from the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). GEOSEG is the total number of geographic markets, including the domestic market, reported by management from which the firm generates revenue at the end of the fiscal year. H_SALES is calculated as the sum of the squares of each geographic segment's sales as a proportion of the firm's total sales for that fiscal year. t-statistics are in parentheses. All variables are calculated using data from the CRSP-Compustat merged database.

Panel A: Independent Sort on Asset Growth (AG) and Single Geographic Sales Segment (GEOSEG)

Variable	Focused	Diversified	Focused Minus Diversified
Low AG	0.1622	0.1366	0.0256
	(3.78)	(3.54)	(1.40)
High AG	0.0656	0.0711	-0.0055
	(1.82)	(2.11)	(-0.45)
Low Minus High AG	0.0966	0.0654	0.0964
	(6.20)	(3.87)	(4.09)

Panel B: Independent Sort on Asset Growth (AG) and Multiple Geographic Sale Segment (GEOSEG)

Variable	Focused	Diversified	Focused Minus Diversified
Low AG	0.1599	0.1135	0.0464
	(3.54)	(2.68)	(1.80)
High AG	0.0560	0.0635	-0.0075
	(1.44)	(1.89)	(-0.40)
Low Minus High AG	0.1039	0.0500	0.0910
	(5.86)	(3.13)	(5.29)

Panel C: Independent Sort on Asset Growth (AG) and Low Sales Diversification (1/H_SALES)

Variable	Focused	Diversified	Focused Minus Diversified
Low AG	0.1632	0.1390	0.0242
	(3.76)	(3.38)	(1.37)
High AG	0.0679	0.0698	-0.0019
	(1.87)	(2.05)	(-0.16)
Low Minus High AG	0.0953	0.0693	0.0934
	(6.01)	(4.06)	(5.25)

Panel D: Independent Sort on Asset Growth (AG) and High Sales Diversification (1/H_SALES)			
Variable	Focused	Diversified	Focused Minus Diversified
Low AG	0.1593	0.1100	0.0493
	(3.56)	(2.58)	(1.93)
High AG	0.0542	0.0653	-0.0110
	(1.40)	(1.92)	(-0.58)
Low Minus High AG	0.1050	0.0447	0.0940
	(6.07)	(2.59)	(3.91)

4.4.1.6 Portfolios of industrially focused and diversified firms sorted on asset growth and low (high) global diversification

Table 8 tabulates portfolio returns of industrially focused firms (Panel A) and industrially diversified firms (Panel B) independently sorted on AG and the global Herfindahl index measure of geographic sales. The purpose of this portfolio sort is to examine if firms within the same category of industrial diversification (industrially focused or diversified) do indeed have greater investment flexibility in selecting growth options with lower systematic risk when they globally diversify into more than one country.

The global Herfindahl index measure of geographic sales is used in this section instead of the number of geographic segments as it provides a more accurate measure of the extent to which an industrial firm is able to derive benefits from having global operations. Industrial firms with well-developed global diversification in sales will have sources of sales that are not dominated by its home market as opposed to having a token presence in a foreign market. This approach also effectively reduces the chance of a home bias in assessing the diversification benefit of global diversification.

For example, for analysis using the GEOSEG measure, firms that have operations in two different geographic markets may seem to have operations that are split equally. However, this crude measure may be inaccurate as 90% of total sales may be generated by only one market. In contrast, the 1/H_SALES measure is a more accurate of global diversification in this case as it takes into account the proportion of revenue from each market to determine if a home bias exists. Using the same analogy, a firm operating in two different geographic segments but with 90% of the revenue generated by one market will have a Herfindahl index value of 0.82 (or an inverse value of 1.22 for 1/H_SALES) whereas a firm operating in only one geographic market will have a Herfindahl index value of one.

Table 8
Portfolio returns of industrially focused and diversified firms sorted on asset growth and low (high) Herfindahl index values in global sales

This table presents average equal-weighted returns from independent portfolio sorts over the period 1979 to 2010. Panel A represents industrially focused firms that operate in only one industrial segment. Panel B industrially diversified firms that operate in two or more industrial segments. Firms are ranked by the median value for AG into low and high AG stocks. Firms are ranked by the median value of 1/H_SALES into low and high 1/H_SALES groups. At the end of June of each year (t), stocks are allocated by a two-by-two sorting process into four portfolios. The portfolios are held for 1 year, from July of year (t) to June of year (t+1), and then rebalanced. Portfolio returns around the portfolio formation year (t) over the sample period are then averaged with return statistics reported. Low-minus-high AG portfolios represent the return differential between low and high AG states. Low-minus-high 1/H_SALES portfolios represent the return differential between portfolios of geographically focused and geographically diversified firms. The bottom right corner of each matrix represents the average return differential between the extreme portfolio sorts for each characteristic (e.g. Low AG-Focused minus High AG-Diversified in Panel A). AG is defined as the percentage change in total assets from the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). H_SALES is calculated as the sum of the squares of each geographic segment's sales as a proportion of the firm's total sales for that fiscal year. t-statistics are in parentheses. All variables are calculated using data from the CRSP-Compustat merged database.

Panel A: Focused Firms - Independent Sort on Asset Growth (AG) and Sales Diversification (1/H_SALES)			
Variable	Low 1/H_SALES	High 1/H_SALES	Low Minus High 1/H_SALES
Low AG	0.1632	0.1593	0.0039
	(3.76)	(3.56)	(0.28)
High AG	0.0679	0.0542	0.0136
	(1.87)	(1.40)	(0.75)
Low Minus High AG	0.0953	0.1050	0.1089
	(6.01)	(6.07)	(5.09)

Panel B: Diversified Firms - Independent Sort on Asset Growth (AG) and Sales Diversification (1/H_SALES)			
Variable	Low 1/H_SALES	High 1/H_SALES	Low Minus High 1/H_SALES
Low AG	0.1309	0.1100	0.0290
	(3.38)	(2.58)	(1.78)
High AG	0.0698	0.0652	0.0045
	(2.05)	(1.92)	(0.32)
Low Minus High AG	0.0692	0.0447	0.0738
	(4.06)	(2.59)	(3.53)

Panel A of Table 8 consists only of focused firms from the pooled sample that are independently sorted by AG and 1/H_SALES. If global diversification offers a diversification benefit that is driven by country specific factors, then industrially focused (diversified) firms with sales from multiple geographical markets should have significantly lower returns than industrially focused (diversified) firms with sales from only one geographical market. The results contradict this prediction with low-minus-high portfolio differentials being insignificantly different from zero for both panels of industrially focused and diversified firms. This evidence remains consistent with earlier evidence that suggests global diversification does not provide any diversification benefit that is not already captured by industry specific factors.

4.4.1.7 Additional robustness tests using market-to-book as a proxy for growth options

For the purpose of robustness, an alternative measure of growth options calculated as the market value of assets to the book value of assets, or market-to-book (MB), is used in the analysis to replicate earlier portfolio sorts using AG. A high MB ratio thus indicates that a firm has many investment opportunities relative to its assets in place. Tables 9 to 11 tabulate the relevant results.

Consistent with earlier findings, portfolio differentials of "industrially focused minus industrially diversified" firms are consistently insignificantly different from zero for every measure of global diversification (GEOSEG and 1/H_SALES) and also for every category of low or high MB. These results are interpreted as additional evidence that global diversification, or country specific factors, no longer provides any additional diversification benefit as compared to industry specific factors.

Table 9

Portfolio returns sorted on market-to-book and global diversification measures

This table presents average equal-weighted returns from independent portfolio sorts over the period 1979 to 2010. Panel A presents independent portfolio sorts on market-to-book (MB) and the number of geographic segments (GEOSEG). Panel B presents independent portfolio sorts on MB and the inverse of the Herfindahl index value of segment sales (1/H_SALES). Firms are ranked by the median value for MB into low and high MB stocks. Single GEOSEG represents industrial firms operating in a single geographic segment. Multiple GEOSEG represent industrial firms operating in more than one geographic segment. Firms are ranked by the median value for 1/H_SALES into low 1/H_SALES and high 1/H_SALES. At the end of June of each year (t), stocks are allocated by a two-by-two sorting process into four portfolios. The portfolios are held for 1 year, from July of year (t) to June of year (t+1), and then rebalanced. Portfolio returns around the portfolio formation year (t) over the sample period are then averaged with return statistics reported. Low-minus-high MB portfolios represent the return differential between low and high MB states. Single-minus-multiple GEOSEG (Low-minus-high 1/H_SALES) portfolios represent the return differential between portfolios of geographically focused and geographically diversified firms. MB is the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity in calendar year (t−1). The bottom right corner of each matrix represents the average return differential between the extreme portfolio sorts for each characteristic (e.g. Low MB-Single GEOSEG minus High MB-Multiple GEOSEG in Panel A). GEOSEG is the total number of geographic markets, including the domestic market, reported by management from which the firm generates revenue at the end of the fiscal year. H_SALES is calculated as the sum of the squares of each geographic segment's sales as a proportion of the firm's total sales for that fiscal year. t-statistics are in parentheses. All variables are calculated using data from the CRSP-Compustat merged database.

Panel A: Independent Sort on Market-to-Book (MB) and Geographic Segments (GEOSEG)			
Variable	Single GEOSEG	Multiple GEOSEG	Single Minus Multiple GEOSEG
Low MB	0.1560	0.1569	-0.0009
	(3.83)	(3.64)	(-0.06)
High MB	0.0588	0.0561	0.0027
	(1.62)	(1.59)	(0.22)
Low Minus High MB	0.0972	0.1009	0.1000
	(5.01)	(5.63)	(4.18)

Panel B: Independent Sort on Market-to-Book (MB) and Inverse Sales Herfindahl Index (1/H_SALES)			
Variable	Low 1/H_SALES	High 1/H_SALES	Low Minus High 1/H_SALES
Low MB	0.1577	0.1579	0.0019
	(3.83)	(3.64)	(0.13)
High MB	0.0593	0.0561	0.0032
	(1.62)	(1.59)	(0.26)
Low Minus High MB	0.0984	0.0997	0.1016
	(4.97)	(5.71)	(4.27)

Table 10
Portfolio returns sorted on market-to-book and low (high) global diversification

This table presents average equal-weighted returns from independent portfolio sorts over the period 1979 to 2010. Panel A represents industrial firms that operate in only one geographic segment. Panel B represents industrial firms that operate in multiple geographic segments. Panel C represents industrial firms that have low geographic sales diversification as measured by the inverse of the Herfindahl index value of segment sales (1/H_SALES). Panel D represents industrial firms that have high geographic sales diversification as measured by the inverse of the Herfindahl index value of segment sales (1/H_SALES). Firms are ranked by the median value of 1/H_SALES into low and high 1/H_SALES groups. Firms are ranked by the median value for market-to-book (MB) into low and high MB stocks. Focused firms operate in one industrial segment. Diversified firms operate in two or more industrial segments. At the end of June of each year (t), stocks are allocated by a two-by-two sorting process into four portfolios. The portfolios are held for 1 year, from July of year (t) to June of year (t+1), and then rebalanced. Portfolio returns around the portfolio formation year (t) over the sample period are then averaged with return statistics reported. Low-minus-high MB portfolios represent the return differential between low and high MB states. Focused-minus-diversified portfolios represent the return differential between portfolios of industrially focused and industrially diversified firms. The bottom right corner of each matrix represents the average return differential between the extreme portfolio sorts for each characteristic (e.g. Low MB-Focused minus High MB-Diversified in Panel A). MB is the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity in calendar year (t−1). GEOSEG is the total number of geographic markets, including the domestic market, reported by management from which the firm generates revenue at the end of the fiscal year. H_SALES is calculated as the sum of the squares of each geographic segment's sales as a proportion of the firm's total sales for that fiscal year. t-statistics are in parentheses. All variables are calculated using data from the CRSP-Compustat merged database.

Panel A: Independent Sort on Market-to-Book (MB) and Single Geographic Sales Segment (GEOSEG)

Variable	Focused	Diversified	Focused Minus Diversified
Low MB	0.1605	0.1491	0.0115
	(3.86)	(3.74)	(0.85)
High MB	0.0597	0.0510	0.0087
	(1.55)	(1.47)	(0.52)
Low Minus High MB	0.1008	0.0980	0.1095
	(4.95)	(4.85)	(5.53)

Panel B:Independent Sort on Market-to-Book (MB) and Multiple Geographic Sale Segment (GEOSEG)

Variable	Focused	Diversified	Focused Minus Diversified
Low MB	0.1704	0.1394	0.0309
	(3.68)	(3.17)	(1.34)
High MB	0.06714	0.0460	0.0154
	(1.58)	(1.37)	(0.74)
Low Minus High MB	0.1090	0.0934	0.1244
	(5.84)	(4.82)	(4.97)

Panel C: Independent Sort on Market-to-Book (MB) and Low Sales Diversification (1/H_SALES)

Variable	Focused	Diversified	Focused Minus Diversified
Low MB	0.1629	0.1480	0.0149
	(3.86)	(3.62)	(1.18)
High MB	0.0607	0.0527	0.0080
	(1.57)	(1.53)	(0.56)
Low Minus High MB	0.1022	0.0953	0.1102
	(4.93)	(4.77)	(5.47)

Panel D: Independent Sort on Market-to-Book (MB) and High Sales Diversification (1/H_SALES)			
Variable	Focused	Diversified	Focused Minus Diversified
Low MB	0.1684	0.1406	0.0278
	(3.68)	(3.19)	(1.14)
High MB	0.0610	0.0440	0.0170
	(1.57)	(1.30)	(0.81)
Low Minus High MB	0.1074	0.0966	0.1244
	(5.92)	(4.60)	(5.11)

Table 11
Portfolio returns of industrially focused and diversified firms sorted on asset growth and low (high) Herfindahl index values in global sales

This table presents average equal-weighted returns from independent portfolio sorts over the period 1979 to 2010. Panel A represents industrially focused firms that operate in only one industrial segment. Panel B industrially diversified firms that operate in two or more industrial segments. Firms are ranked by the median value for market-to-book (MB) into low and high MB stocks. Firms are ranked by the median value of 1/H_SALES into low and high 1/H_SALES groups. At the end of June of each year (t), stocks are allocated by a two-by-two sorting process into four portfolios. The portfolios are held for 1 year, from July of year (t) to June of year (t+1), and then rebalanced. Portfolio returns around the portfolio formation year (t) over the sample period are then averaged with return statistics reported. Low-minus-high MB portfolios represent the return differential between low and high MB states. Low-minus-high 1/H_SALES portfolios represent the return differential between portfolios of geographically focused and geographically diversified firms. The bottom right corner of each matrix represents the average return differential between the extreme portfolio sorts for each characteristic (e.g. Low MB-Focused minus High MB-Diversified in Panel A). MB is the product of the share price and common shares outstanding at the end of the fiscal year divided by common equity in calendar year (t−1). H_SALES is calculated as the sum of the squares of each geographic segment's sales as a proportion of the firm's total sales for that fiscal year. t-statistics are in parentheses. All variables are calculated using data from the CRSP-Compustat merged database.

Panel A: Focused Firms - Independent Sort on Market-to-Book (MB) and Sales Diversification (1/H_SALES)

Variable	Low 1/H_SALES	High 1/H_SALES	Low Minus High 1/H_SALES
Low MB	0.1629	0.1684	-0.0055
	(3.86)	(3.68)	(-0.32)
High MB	0.0607	0.0610	-0.0003
	(1.57)	(1.57)	(-0.02)
Low Minus High MB	0.1022	0.1074	0.1019
	(4.93)	(5.792)	(3.88)

Panel B: Diversified Firms - Independent Sort on Market-to-Book (MB) and Sales Diversification (1/H_SALES)

Variable	Low 1/H_SALES	High 1/H_SALES	Low Minus High 1/H_SALES
Low MB	0.1480	0.1406	0.0075
	(3.62)	(3.19)	(0.40)
High MB	0.0527	0.0440	0.0087
	(1.53)	(1.30)	(0.57)
Low Minus High MB	0.0953	0.0966	0.1040
	(4.77)	(4.60)	(5.02)

4.4.2 Global diversification and ICM Efficiency

4.4.2.1 Summary statistics for diversified firms

Table 12 presents summary statistics for only diversified firms in the sample which consists of a total of 14,505 firm-year observations on 2,641 firms over the period of 1979 to 2010. On average, industrially diversified firms participate in at least three different business segments with revenue from two different geographic segments. While this may suggest that industrially diversified firms obtain a large proportion of overall revenues from multiple markets, the low average of 1.3458 and median of one in global sales diversification suggests that most industrially diversified firms have sales predominantly from one specific national market. This cursory observation is reinforced by the fact that domestic sales account for most of overall firm sales (88% on average). Table 13 presents the correlation table for the variables of interest.

4.4.2.2 Fama and MacBeth regressions with stock returns as the dependent variable

The advantage of an efficient ICM is that it reduces the financial constraints on the firm and facilitates new investment into attractive growth options with lower systematic risk. All things equal, firms with efficient ICMs should have less risky assets and lower risk overall than firms with inefficient ICMs. The measure of the value-adding efficiency of a firm's ICM, "Absolute Value Added by Allocation" (AVA), is thus expected to have a negative relation with returns.[2]

[2] The measure of ICM efficiency, "Absolute Value Added by Allocation" (AVA), is developed by Rajan, et al. (2000). It has been used by the authors, and other studies such as Peyer (2002), to investigate the value-adding efficiency of ICMs. As analysis of ICM efficiency is the focus of this section, the sample selection consists exclusively of industrially diversified firms only. Industrially focused firms are not included in the sample selection.

Table 12
Summary statistics for diversified firms

This table reports summary statistics for the sub-sample of industrially diversified firms consisting of 14,505 nonfinancial firm-year observations on 2,641 unique diversified firms from 1979 to 2010. Absolute value added by allocation (AVA) is the measure of allocation efficiency of an internal capital market as defined by Rajan, et al. (2000). The number of geographic segments (GEOSEG) is the total number of geographic markets, including the domestic market, reported by management from which the firm generates revenue at the end of the fiscal year. The Herfindahl index value of segment sales (H_SALE) is calculated as the sum of the squares of each geographic segment's sales as a proportion of the firm's total sales for that fiscal year. The inverse of the Herfindahl index value is used in this analysis. The number of foreign markets (FOR_MKTS) is the number of geographic segments, excluding the domestic market, reported by management at the end of the fiscal year. Total domestic sales divided by total firm sales (DOM_TOT) is the proportion of total revenue generated in the home market. Total foreign sales divided by total firm sales (FOR_TOT) is the proportion of total revenue generated in foreign markets. Asset growth (AG) is the year-on-year percentage change in total assets for the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). Annual stock return (RET12) is the buy-and-hold return for one year from July (t) to June (t+1), where t is the portfolio formation year. Return on assets (ROA) is the ratio of total revenue over total assets of the firm. Size (SIZE) is the market value of a firm calculated using the price and the number of shares outstanding at the end of year (t), in millions of dollars. All variables are calculated using data from the CRSP-Compustat Merged (CCM) database.

Variable	Mean	Median	Standard Deviation
Absolute Value Added by Allocation (AVA)	-0.0007	-0.0009	0.0573
Number of Geographic Sales Segments (GEOSEG)	1.8690	1	1.2831
Geographic Sales Diversification (1/H_SALE)	1.3458	1	0.6060
Number of Foreign Markets (FOR_MKTS)	0.8754	0	1.2924
Total Domestic Sales / Total Sales (DOM_TOT)	0.8700	0.9981	0.2238
Total Foreign Sales / Total Sales (FOR_TOT)	0.1338	0	0.2517
Asset growth (AG)	0.1513	0.0686	0.8909
Return on Assets (ROA)	0.0850	0.0892	0.0926
Size (US$millions)	1,943	193	8,256
Annual Stock Return (RET12)	0.1105	0.0155	0.9243

Table 13
Spearman's Rank Correlation Matrix

This table reports Spearman's rank correlations for the sub-sample of industrially diversified firms consisting of 14,505 nonfinancial firm-year observations on 2,641 unique diversified firms from 1979 to 2010. Absolute value added by allocation (AVA) is the measure of allocation efficiency of an internal capital market as defined by Rajan, et al. (2000). The number of geographic segments (GEOSEG) is the total number of geographic markets, including the domestic market, reported by management from which the firm generates revenue at the end of the fiscal year. The Herfindahl index value of segment sales (H_SALE) is calculated as the sum of the squares of each geographic segment's sales as a proportion of the firm's total sales for that fiscal year. The inverse of the Herfindahl index value is used in this analysis. The number of foreign markets (FOR_MKTS) is the number of geographic segments, excluding the domestic market, reported by management at the end of the fiscal year. Total domestic sales divided by total firm sales (DOM_TOT) is the proportion of total revenue generated in the home market. Total foreign sales divided by total firm sales (FOR_TOT) is the proportion of total revenue generated in foreign markets. Asset growth (AG) is the year-on-year percentage change in total assets for the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). Annual stock return (RET12) is the buy-and-hold return for one year from July (t) to June (t+1), where t is the portfolio formation year. Return on assets (ROA) is the ratio of total revenue over total assets of the firm. Size (SIZE) is the market value of a firm calculated using the price and the number of shares outstanding at the end of year (t), in millions of dollars. All variables are calculated using data from the CRSP-Compustat Merged (CCM) database.

	AVA	GEOSEG	1/H_SALE	DOM_MKTS	FOR_MKTS	DOM_TOT	FOR_TOT	AG	ROA	Size	RET12
Absolute Value Added by Allocation (AVA)	1										
Number of Geographic Sales Segments (GEOSEG)	-0.0015	1									
Geographic Sales Diversification (1/H_SALE)	0.0004	0.9642	1								
Number of Domestic Markets (DOM_MKTS)	-0.0145	-0.0552	-0.0652	1							
Number of Foreign Markets (FOR_MKTS)	-0.0008	0.9978	0.9625	-0.1075	1						
Total Domestic Sales / Total Sales (DOM_TOT)	-0.00036	-0.8501	-0.8898	0.1400	-0.8559	1					
Total Foreign Sales / Total Sales (FOR_TOT)	0.0020	0.9484	0.9875	-0.1462	0.9542	-0.8987	1				
Asset growth (AG)	0.1106	-0.0313	-0.0324	-0.0009	-0.0306	0.0094	-0.0285	1			
Return on Assets (ROA)	0.0993	0.0572	0.0544	0.0233	0.554	-0.0447	0.0438	0.2411	1		
Size (US$millions)	0.0928	0.3951	0.3852	-0.0359	0.3957	-0.3558	0.3764	0.0556	0.2580	1	
Annual Stock Return (RET12)	0.0092	0.0102	0.0097	0.0114	0.0093	-0.0020	0.0047	-0.0726	0.0124	-0.0101	1

To investigate the preceding assumption, Table 14 employs Fama and MacBeth (1973) regressions with annual stock returns as the dependent variable, as follows:

$$\text{RET12}_{i,t} = b_0 + b_1(\text{AVA})_{i,t} + b_2(\text{GEOSEG})_{i,t} + b_3(1/\text{H\_SALE})_{i,t} + b_4(\text{DOM\_TOT})_{i,t} + b_5(\text{FOR\_MKTS})_{i,t} + b_6(\text{FOR\_TOT})_{i,t} + b_7(\text{AG})_{i,t} + b_8(\text{ROA})_{i,t} + b_9(\text{SIZE})_{i,t} + \varepsilon_{i,t} \quad (4)$$

where RET12 is the is the buy-and-hold return for one year from July (t) to June (t+1), where t is the portfolio formation year. Absolute value added by allocation (AVA) is the measure of allocation efficiency of an internal capital market as defined by Rajan, et al. (2000). The number of geographic segments (GEOSEG) is the total number of geographic markets, including the domestic market, reported by management from which the firm generates revenue at the end of the fiscal year. The Herfindahl index value of segment sales (H_SALE) is calculated as the sum of the squares of each geographic segment's sales as a proportion of the firm's total sales for that fiscal year. The inverse of the Herfindahl index value is used in this analysis. The number of foreign markets (FOR_MKTS) is the number of geographic segments, excluding the domestic market, reported by management at the end of the fiscal year. Total domestic sales divided by total firm sales (DOM_TOT) is the proportion of total revenue generated in the home market. Total foreign sales divided by total firm sales (FOR_TOT) is the proportion of total revenue generated in foreign markets. Asset growth (AG) is the year-on-year percentage change in total assets for the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). Return on assets (ROA) is the ratio of total revenue over total assets of the firm. Size (SIZE) is the log of market value of a firm calculated using the price and the number of shares outstanding at the end of year (t), in millions of dollars.

Table 14
Fama–MacBeth regressions of annual stock returns on key characteristics

This table presents Fama and MacBeth (1973) regressions with annual stock returns as the dependent variable over the period of 1979 to 2010. First, separate cross-sectional regressions in each sample year are estimated then, second, the average of the coefficients and standard errors across years are reported. Independent variables are composed as follows. Absolute value added by allocation (AVA) is the measure of allocation efficiency of an internal capital market as defined by Rajan, et al. (2000). The number of geographic segments (GEOSEG) is the total number of geographic markets, including the domestic market, reported by management from which the firm generates revenue at the end of the fiscal year. The Herfindahl index value of segment sales (H_SALE) is calculated as the sum of the squares of each geographic segment's sales as a proportion of the firm's total sales for that fiscal year. The inverse of the Herfindahl index value is used in this analysis. The number of foreign markets (FOR_MKTS) is the number of geographic segments, excluding the domestic market, reported by management at the end of the fiscal year. Total domestic sales divided by total firm sales (DOM_TOT) is the proportion of total revenue generated in the home market. Total foreign sales divided by total firm sales (FOR_TOT) is the proportion of total revenue generated in foreign markets. Asset growth (AG) is the year-on-year percentage change in total assets for the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). Annual stock return (RET12) is the buy-and-hold return for one year from July (t) to June (t+1), where t is the portfolio formation year. Return on assets (ROA) is the ratio of total revenue over total assets of the firm. Size (SIZE) is the log of market value of a firm calculated using the price and the number of shares outstanding at the end of year (t), in millions of dollars. All variables are calculated using data from the CRSP-Compustat merged database. t-statistics are in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

Model	1	2	3	4	5
Absolute Value Added (AVA)	-0.6985**	-0.7101**	-0.7363**	-0.6983**	-0.7281**
	(-2.48)	(-2.49)	(-2.57)	(-2.48)	(-2.53)
Number of Geographic Segments (GEOSEG)	0.0128**				
	(2.13)				
Geographic Sales Diversification (1/H_SALE)		0.0241*			
		(1.88)			
Total Domestic Sales / Total Sales (DOM_TOT)			-0.0502		
			(-1.25)		
Number of Foreign Markets (FOR_MKTS)				0.0126**	
				(2.10)	
Total Foreign Sales / Total Sales (FOR_TOT)					0.0490
					(1.22)
Asset growth (AG)	-0.0847**	-0.0845**	-0.0864**	-0.0849**	-0.0865**
	(-2.46)	(-2.48)	(-2.56)	(-2.46)	(-2.55)
Return on Assets (ROA)	-0.2779	-0.2712	-0.2736	-0.2777	-0.2772
	(-1.47)	(-1.43)	(-1.44)	(-1.47)	(-1.46)
Size	-0.0424***	-0.0460***	-0.0452***	-0.0464***	-0.0448***
	(-6.17)	(-6.09)	(-6.04)	(-6.17)	(-6.00)

Independent variables include AVA, measures of international diversification as well as control variables such as the return on assets and firm size. Consistent with expectations, coefficients for AVA are negative and significant (at the 5% level) for all four regression models, regardless of the international diversification measure or control variables employed. Notably, AG continues to have a negative relation with returns but has lower significance now at the 5% level unlike earlier results in Table 4 where it was consistently significant at the 1% level in all regression models that did not include the AVA characteristic.

4.4.2.3 Portfolio returns sorted on ICM efficiency and total asset growth

Table 15 reports independent portfolio sorts for industrially diversified firms on the relation between AVA and AG. The purpose of this section is to replicate earlier findings that show financial constraints are priced into stock returns. Firms with inefficient ICMs (low AVA) are more financially constrained than firms with efficient ICMs (high AVA). Consistent with evidence in the literature that demonstrates financially constrained firms have higher risk, the expectation is that portfolios of firms with inefficient ICMs will have higher returns than firms with efficient ICMs. Independent portfolio sorts on AVA and AG produce results consistent with this perspective. Notably, the inefficient minus efficient portfolio reports significant returns of 6.12% per annum (t-statistic of 3.74) for low asset growth firms and 4.58% per annum (t-statistic of 2.02) for high asset growth firms.

Table 15
Portfolio returns sorted on ICM efficiency (AVA) and asset growth

This table presents average equal-weighted returns from independent portfolios sorted on absolute value added by allocation (AVA) and asset growth (AG) over the period 1979 to 2010. Firms are ranked by the median value for AVA into low and high AVA stocks. Firms are ranked by the median value for AG into low and high AG stocks. At the end of June of each year (t), stocks are allocated by a two-by-two sorting process into four portfolios. The portfolios are held for 1 year, from July of year (t) to June of year (t+1), and then rebalanced. Portfolio returns around the portfolio formation year (t) over the sample period are then averaged with return statistics reported. Low-minus-high AVA portfolios represent the return differential between inefficient and efficient ICMs. Low-minus-high AG portfolios represent the return differential between low and high AG states. AVA is the measure of allocation efficiency of an internal capital market as defined by Rajan, et al. (2000). AG is defined as the percentage change in total assets from the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). t-statistics are in parentheses. All variables are calculated using data from the CRSP-Compustat merged database.

Independent Sort on AVA Efficiency (AVA) and Asset Growth (AG)			
Variable	Low AG	High AG	Low Minus High AG
Low AVA	0.1312	0.1014	0.0298
	(3.10)	(2.54)	(1.78)
High AVA	0.0700	0.0556	0.0144
	(1.95)	(1.63)	(0.69)
Low Minus High AVA	0.0612	0.0458	0.0756
	(3.74)	(2.02)	(3.18)

4.4.2.4 Fama and MacBeth regressions with ICM efficiency returns as the dependent variable

As before, Table 16 employs the technique of Fama and MacBeth (1973) regressions with ICM efficiency AVA as the dependent variable instead. The purpose of regression models one and two is to understand if any of the geographic diversification factors are potential drivers of AVA. Contrary to the earlier expectation that a lower correlation of cash flows from different country markets should have a significant and positive relation with AVA, none of the global diversification measures are significant in any of the regression models. This suggests that country specific factors do not contribute to the stability of cash flows within a firm's ICM. It also provides evidence reinforcing recent findings reported by Cavaglia, et al. (2000), Baca, et al. (2000) and Campa and Fernandes (2006) that industry specific factors are the significant drivers of any diversification benefit.

Not surprisingly, coefficients for AG are significant (at the 1% level) and positive in relation to AVA for all regression models. This is expected as firms with low AG have fewer growth options and are comparatively less able to select attractive value-adding investment opportunities than firms with more growth options. The control variable of return-on-assets (ROA) also displays a positive albeit marginally significant relation (at the 10% level) with AVA, consistent with the interpretation that firms which have more efficient ICMs are also naturally more productive with operating assets.

An alternative explanation for the positive relation between AG and AVA is provided by the multiplier effect in collateral credit. When debts have to be secured by collateral, firms with higher debt capacity in the form of a larger asset base or assets with higher collateral value will be able to borrow more, which in turn allows more investment in assets that can serve as collateral for further borrowing (see Kiyotaki and Moore (1997)). An alternative

Table 16
Fama–MacBeth regressions of ICM Absolute-Value-Added (AVA) on key characteristics

This table presents Fama and MacBeth (1973) regressions with internal capital market efficiency as measured by absolute value added by allocation (AVA) as the dependent variable over the period of 1979 to 2010. First, separate cross-sectional regressions in each sample year are estimated then, second, the average of the coefficients and standard errors across years are reported. Independent variables are composed as follows. AVA is the measure of allocation efficiency of an internal capital market as defined by Rajan, et al. (2000). The number of geographic segments (GEOSEG) is the total number of geographic markets, including the domestic market, reported by management from which the firm generates revenue at the end of the fiscal year. The Herfindahl index value of segment sales (H_SALE) is calculated as the sum of the squares of each geographic segment's sales as a proportion of the firm's total sales for that fiscal year. The inverse of the Herfindahl index value is used in this analysis. Total domestic sales divided by total firm sales (DOM_TOT) is the proportion of total revenue generated in the home market. Total foreign sales divided by total firm sales (FOR_TOT) is the proportion of total revenue generated in foreign markets. The number of foreign markets (FOR_MKTS) is the number of geographic segments, excluding the domestic market, reported by management at the end of the fiscal year. Asset growth (AG) is the year-on-year percentage change in total assets for the fiscal year ending in calendar year (t−2) to fiscal year ending in calendar year (t−1). Return on assets (ROA) is the ratio of total revenue over total assets of the firm. Size (SIZE) is the log of market value of a firm calculated using the price and the number of shares outstanding at the end of year (t), in millions of dollars. Annual stock return (RET12) is the buy-and-hold return for one year from July (t) to June (t+1), where t is the portfolio formation year. All variables are calculated using data from the CRSP-Compustat merged database. t-statistics are in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

Model	1	2	3	4	5
Number of Geographic Segments (GEOSEG)	0.0002				
	(0.24)				
1/Sales Herfindahl Index (1/H_SALE)		0.003			
		(0.21)			
Domestic Sales / Total Sales			-0.0047		
			(-1.39)		
Foreign Sales / Total Sales				0.0066	
				(1.50)	
Number of Foreign Markets					0.0002
					(0.25)
Asset growth (AG)	0.0098***	0.0098***	0.0096***	0.0096***	0.0098***
	(3.55)	(3.46)	(3.50)	(3.56)	(3.55)
Return on Assets (ROA)	0.0274*	0.0278*	0.0303*	0.0307*	0.0274*
	(1.98)	(2.01)	(2.02)	(2.02)	(1.97)
Size	0.0001	0.0004	-0.0001	-0.0002	0.0001
	(0.19)	(0.08)	(-0.20)	(-0.27)	(0.18)

explanation for the positive relation between AG and AVA is provided by the multiplier effect in collateral credit. When debts have to be secured by collateral, firms with higher debt capacity in the form of a larger asset base or assets with higher collateral value will be able to borrow more, which in turn allows more investment in assets that can serve as collateral for further borrowing (see Kiyotaki and Moore (1997)). New assets are also created as growth options are exercised through capital expenditure. The collateral value these assets reduces financial constraints on the firm and increases the availability of internal funds through a firm's ICM, leading to enhanced ICM efficiency. In other words, there is a corresponding increase in AVA as the firm has positive asset growth.[1]

4.4.2.5 Portfolio returns sorted on ICM efficiency and international diversification measures

Perhaps the most important benefit of an ICM is that it relaxes financial constraints on the firm by allowing it to avoid costly external capital markets. However, this advantage is contingent on the assumption that internal cash flows from the various divisions are not perfectly correlated. Therein lies the potential diversification benefit that global diversification offers to an ICM. More specifically, global diversification reduces the correlation of internal cash flows because contributing business divisions operate in different countries and effectively increase the efficiency of an ICM. This view is supported by Hahn and Lee (2009) who demonstrate the importance of a low correlation in internal funds by showing that risk associated with variations in the availability of internal funds is priced into the firm value. In addition, according to Peyer (2002), firms with efficient ICMs are able to use more external capital. Collectively, the preceding arguments predict that globally

[1] See chapter two of this thesis for a discussion.

diversified firms should have fewer financial constraints due to more efficient ICMs, are less risky and have lower stock returns.

This testable prediction is contingent, however, on the assumption that country specific factors are important to any proposed diversification benefit offered by a global portfolio. Cavaglia, et al. (2000), Baca, et al. (2000) and Campa and Fernandes (2006) argue that country specific factors are no longer drivers of any diversification benefit from global diversification, but rather industry specific factors, due to greater economic and financial integration in the world's economies. If this is true, it can be argued that any increased ICM efficiency attributable to global diversification should be marginal, if not insignificant.

Table 17 tabulates results that investigate these conjectures by constructing independent portfolio sorts on AVA and measures of global diversification, namely GEOSEG in Panel A and 1/H_SALES in Panel B. Unlike earlier results in Table 15 where firms with low AVA earned higher returns than firms with high AVA, there is no significant difference between efficient or inefficient ICMs for both geographically focused and diversified firms, regardless of the global diversification measure used. Within the same grouping of low or high AVA, the return differential between firms that operate in a single country and those that are globally diversified is not significantly different from zero. Overall, the results suggest that global diversification offers no benefit in enhancing a firm's ICM, consistent with interpretations that industry specific factors dominate any diversification benefit due to greater economic and financial integration of the country economies.

Table 17
Portfolio returns sorted on ICM efficiency (AVA) and global diversification measures

This table presents average equal-weighted returns from independent portfolio sorts over the period 1979 to 2010. Panel A presents independent portfolio sorts on absolute value added by allocation by allocation (AVA) and the number of geographic segments (GEOSEG). Panel B presents independent portfolio sorts on AVA and the inverse of the Herfindahl index value of segment sales (1/H_SALES). Firms are ranked by the median value for AVA into low and high AVA stocks. Single GEOSEG represents industrial firms operating in a single geographic segment. Multiple GEOSEG represent industrial firms operating in more than one geographic segment. Firms are ranked by the median value for 1/H_SALES into low 1/H_SALES and high 1/H_SALES. At the end of June of each year (t), stocks are allocated by a two-by-two sorting process into four portfolios. The portfolios are held for 1 year, from July of year (t) to June of year (t+1), and then rebalanced. Portfolio returns around the portfolio formation year (t) over the sample period are then averaged with return statistics reported. Low-minus-high AVA portfolios represent the return differential between low and high AVA states. Single-minus-multiple GEOSEG (Low-minus-high 1/H_SALES) portfolios represent the return differential between portfolios of geographically focused and geographically diversified firms. The bottom right corner of each matrix represents the average return differential between the extreme portfolio sorts for each characteristic (e.g. Low AVA-Single GEOSEG minus High AVA-Multiple GEOSEG in Panel A). AVA is the measure of allocation efficiency of an internal capital market as defined by Rajan, et al. (2000). GEOSEG is the total number of geographic markets, including the domestic market, reported by management from which the firm generates revenue at the end of the fiscal year. H_SALES is calculated as the sum of the squares of each geographic segment's sales as a proportion of the firm's total sales for that fiscal year. t-statistics are in parentheses. All variables are calculated using data from the CRSP-Compustat merged database.

Panel A: Independent Sort on ICM Efficiency (AVA) and Geographic Sales Segments (GEOSEG)

Variable	Single GEOSEG	Multiple GEOSEG	Single Minus Multiple GEOSEG
Low AVA	0.1158	0.0919	0.0238
	(2.96)	(2.31)	(1.20)
High AVA	0.0786	0.0741	0.0045
	(2.18)	(2.02)	(0.26)
Low Minus High AVA	0.0372	0.0179	0.0417
	(1.81)	(1.13)	(1.84)

Panel B: Independent Sort on ICM Efficiency (AVA) and Geographic Sales Diversification (1/H_SALES)

Variable	Low 1/H_SALES	High 1/H_SALES	Low Minus High 1/H_SALES
Low AVA	0.1157	0.0908	0.0249
	(2.92)	(2.30)	(1.39)
High AVA	0.0790	0.0746	0.0044
	(2.19)	(2.07)	(0.32)
Low Minus High AVA	0.0367	0.01624	0.0411
	(1.88)	(1.00)	(2.03)

4.5 Summary and conclusion

Previous research in the corporate finance literature has documented a debate on the causes and consequences of industrial diversification. In contrast, little work has focused on the relation between global diversification and the unique benefits generated by industrially diversified firms such as increased investment flexibility in the selection of risky growth options and efficient ICMs. This chapter investigates if global diversification offers firms incremental advantages specifically in relation to increasing investment flexibility and ICM efficiencies. The results suggest that globally diversified firms do not have any incremental benefit over industrial firms that have operations concentrated in one country. The evidence is also supportive of findings in the literature that suggest industry specific factors, as opposed to country specific effects, are drivers of any diversification benefit for industrial firms.

The findings of this study provide an interesting contrast to much of conventional wisdom advocated by corporate managers today. The liberalization of emerging markets, removal of trade barriers and competitive necessity may have made global diversification seem more attractive. However the findings in this chapter suggest that global diversification does not improve the systematic risk of the firm with respect to new growth. Nor does global diversification, although it generates cash flows in less correlated national markets, improve the efficiency of ICMs and reduce financial constraints on the firm. Finally, a practical implication of this research is that corporate managers who wish to realise any diversification benefit in revenue streams may be justified in considering investment in different industrial business segments instead of alternative country markets.

Chapter 5:
Conclusion

5.1 A summary of the research objectives and results

The objective of this thesis is to understand the effect of corporate diversification on the selection of growth options with relevant implications for firm value. This is achieved by undertaking a theoretically grounded empirical analysis in three separate themes of study, namely the “investment flexibility” of diversified firms in the selection of growth options, the impact of “financial constraints” that arise from the efficiency of internal capital markets, and finally, the implications of both investment flexibility and the efficiency of internal capital markets in the context of global diversification for firm value.

Chapter 2 examines the “investment flexibility” of diversified firms in the selection of growth options versus focused firms. Investment flexibility points to the ability of a firm to manage its systematic risk by optimally selecting and exercising growth options available to it. In a portfolio context, the scope of growth options accessible to a firm is constrained to the business segments in which it participates. As such, it is hypothesized that the investment flexibility of diversified firms to select growth options from a cross-section of business segments allows it to optimize the systematic risk of its cash flows from capital investments better than focused firms which are constrained to only one business segment.

Managers may be motivated to select growth options with the lowest systematic risk for a variety of reasons. These include the motive to diversify away employment risk by lowering the overall risk of the firm as well as the motive to reduce the variability of internal funds available to internal capital markets (ICMs) so as to facilitate capital investment. This leads to the testable prediction that diversified firms have lower future returns than focused firms because they can select growth options with the lowest systematic risk from among the business segments that it operates in.

Empirical results show that, on average, focused firms earn economically and significantly higher future returns than diversified firms when few growth options are available, with no statistical difference in return spreads when both focused and diversified firms have many growth options. This is consistent with the interpretation that diversified firms have more investment flexibility than focused firms to select growth options with lower systematic risk. However, the benefits of investment flexibility are limited to states when both diversified and focused firms have few growth options available. The results are robust to a variety of diversification measures, growth option proxies and portfolio variations.

Chapter 3 discusses the implications for firm value due to financial constraints attributable to the efficiency of an ICM within diversified firms. The extant corporate finance literature has placed an emphasis on debating the "bright" and "dark" sides of ICMs that reallocate internal funds. The bright side of ICMs refers to the advantage of avoiding external capital markets and associated deadweight transaction costs in overcoming funding constraints for new capital investment. The dark side of ICMs refers to agency theories which suggest that an ICM insulates management from the discipline and constraints of costly external finance, thus allowing managers to subvert efficient investment decisions in pursuit of private benefit. In other words, efficient ICMs reduce financial constraints imposed on the firm while inefficient ICMs increase financial constraints.

The corporate finance literature, however, is silent on the implications that ICM efficiency may have for firm value. Recent work in the asset pricing literature shows that financial constraints present a source of risk that is priced in stock returns. Firms that are more financially constrained have less flexibility in adjusting new capital investment to mitigate the impact of aggregate shocks on dividend streams. In addition, by preventing firms from financing all desired investments, collateral constraints work against the dividend smoothing mechanism. Consequently, the more inflexible firms are in adjusting investments to smooth dividends due to financial constraints, the more dividends will covary with business cycles, and the higher their risk and expected returns. Given that efficient (inefficient) ICMs relax (increase) financial constraints, this suggests a positive constraints-return prediction for the relation between the efficiency of a diversified firm's ICM and stock returns. Therefore, a testable prediction is that diversified firms with inefficient ICMs are predicted to be more financially constrained, have higher risk and earn higher returns than firms with efficient ICMs.

Results from this thesis show ICM efficiencies are priced in asset markets. Using a sample of diversified firms and alternative specifications of growth options in the Fama-MacBeth regression framework, firms with inefficient ICMs have positive and significantly larger returns than firms with efficient ICMs. The positive relation between ICM efficiency and stock returns is consistently significant across a variety of portfolio variations, diversification measures and alternative growth option proxies. In addition, firm characteristics such as total asset growth and asset tangibility are documented to have a positive and significant relation with ICM efficiency. In contrast, a significantly negative relation between ICM efficiency and intangible assets is documented.

Finally, Chapter 4 examines the implications that both investment flexibility and financial constraints arising from ICM efficiency have for firm value within the context of global diversification. This is important because diversification across different national markets (global diversification) has become a matter of increasing importance to corporate managers in recent years. In contrast, much of the corporate finance literature has focused on the causes and consequences of diversification across multiple lines of business (industrial diversification), with considerably less attention on the effects of global diversification.

Global diversification could potentially improve the investment flexibility of industrial firms by enabling them to select growth options from not only a variety of industries but also across country markets. In addition, ICM efficiency could potentially increase if the correlation of funds available in an internal capital market is reduced due to the diversification benefit of having cash flows from different countries. In addition, with increased economic and financial integration of global economies, a further dimension in this investigation is whether industry or country factors dominate any diversification benefit from industrial or global diversification. If industry factors dominate, then managers will only realise diversification benefits from investments in different business segments. In this scenario, global diversification will not have any effect on the investment flexibility of firms or on ICM efficiency in diversified firms. On the other hand, if country effects are important, then the purported beneficial effects of global diversification in enhancing investment flexibility and ICM efficiency would hold true.

Contrary to the prediction that increased global diversification substitutes for industrial diversification, the results show that increased global diversification does not offer any increase in investment flexibility for the selection of growth options. The results are consistent for both industrially focused and diversified firms and robust to alternative measures of growth options, global diversification measures and portfolio variations. Moreover, globally diversified firms, despite having cash flows from operations in different countries, do not have more efficient ICMs than firms that operate in only one geographic segment.

5.2 Contributions to the literature

This thesis offers several contributions to the literature. While extensive work in both the corporate finance and asset pricing fields has demonstrated that firm value is made up of the value of assets-in-place and the value of growth options, little research has been done on the link between corporate diversification and growth options. This thesis is believed to be the first extensive study on the relation between corporate diversification, growth options and unique features of diversified firms.

A unique contribution of chapter two of this thesis to the corporate finance literature is the idea that the investment flexibility of a firm to optimally select growth options has important implications for firm value. Investment flexibility points to the ability of a firm to manage its systematic risk by optimally selecting and exercising growth options available to it. More specifically, diversified firms are able to optimize the systematic risk of its cash flows from investments better than focused firms because they are able to select growth options from a larger cross-section of business segments.

The greater investment flexibility of diversified firms to optimally select growth options with lower systematic risk also suggests that the business segments of diversified firms cannot be compared to industry medians of focused firms. Accordingly, the investment flexibility of diversified firms may also be a potential explanation for the documented diversification discount when diversified firms are compared to focused firms. In this sense, this thesis contributes to a recent and growing literature arguing against the existence of a diversification discount by suggesting that the difference in firm value is accounted for due to the difference in growth options selected.

Another important contribution is the finding that ICM efficiency is priced into stock returns. Corporate finance studies often emphasize the benefits of ICMs such as the avoidance of costly external markets and relaxation of financial constraints for new investment. Other studies emphasizing agency explanations for ICM inefficiencies often suggest that internal funds from ICMs can be subverted by managers for empire-building or other value-destroying growth. Separately, work in the asset pricing literature shows that financial constraints present a source of risk that is described by a positive relation between financial constraints and stock returns. Chapter three of this thesis reports evidence that supports both strands of literature. Financial constraints, as measured by ICM efficiency, which arise due to positive or negative aspects of an ICM, are also priced into stock returns.

Another contribution to recent work is evidence of a credit multiplier effect that is driven by an increase in firm assets with consequences for the efficiency of ICMs. Other than the reallocation of internal cash flows generated by business segments, another way ICMs relax financial constraints is by using the assets of one business segment as collateral to raise funds which are then directed to another business segment for investment. When debts have to be secured by collateral, firms with higher debt capacity in the form of an increasing asset base will be able to borrow more from external capital markets. This in turn facilitates even more investment in assets that consequently serve as additional collateral for further borrowing, giving rise to a credit multiplier effect.

Consistent with this perspective, a positive and significant relationship between ICM efficiency and total asset growth is observed. This is interpreted as evidence that the collateral value of newly created assets reduces financial constraints on the firm and increases the availability of internal funds through a firm's ICM. In relation to this, this thesis also lends support to recent work that suggests that tangible assets are an important requisite for the credit multiplier effect observed in ICMs because tangible assets satisfy contractibility requirements imposed by external lenders.

In addition, this thesis contributes to the body of knowledge by providing new evidence that there is no diversification benefit from global diversification in chapter four. Globally diversified firms do not have greater investment flexibility than their domestic peers, regardless of whether these firms are industrially focused (single business segment) or industrially diversified (multiple business segments). Moreover, despite the notion that lower correlations of cash flows from different countries should improve ICM efficiency by lowering the variability in internal funds, ICM efficiencies of diversified firms do not improve if a corporate strategy of global diversification is embraced. Overall, the results contribute new corroborating evidence to recent literature that suggests industry specific effects outweigh country effects as drivers of any potential diversification benefit for industrial firms.

Lastly, this thesis makes a contribution to the current debate on the asset growth effect. Several papers in the asset pricing literature have argued that the asset growth effect is a result of mispricing. Recent work has also argued that the asset growth effect is driven by changes in systematic risk. This thesis provides support for a risk based explanation for the total asset growth effect by relying on established theory to link the negative investment-return relation to the exercise of growth options with varying systematic risk. Empirical results from the use of total asset growth as a proxy for growth options is also empirically confirmed through the use of an alternative proxy for growth options that is popular in the literature.

5.3 Practical recommendations

Conventional wisdom among finance scholars suggests that corporate diversification destroys shareholder wealth such that the shares of diversified firms sell with an associated "diversification discount". However, recent work contradicts earlier findings by documenting evidence of measurement error, data sample bias and even a diversification premium. Another important contradiction against the notion that corporate diversification destroys firm value is the observation that many successful companies continue to embrace a diversification strategy in the marketplace. More importantly, results from this study offer insight as to *why* managers continue to pursue diversification strategies in the marketplace. Potential explanations include greater investment flexibility in the selection of growth options as well as enhancement of the efficiency of internal capital markets.

This has important ramifications for what is advocated in the classroom. For example, a leading MBA finance textbook suggests that ‘‘diversification, by itself, cannot produce increases in value’’ (see Ross, Westerfield and Jaffe (1999), p. 775). In contrast, results from recent research and this thesis show that diversification in itself is not necessarily value-destroying. In this perspective, the investment flexibility of diversified firms allows management to maximise utility by choosing to exercise growth options with low risk. Similarly, the efficient ICM of a diversified firm allows management to fund attractive low risk growth options that would otherwise have to be foregone due to costly external financing.

Separately, results from this thesis also offer practical recommendations for the boardroom. Managers who are evaluating corporate diversification strategies in order to realise benefits of investment flexibility or enhanced ICM efficiencies are best advised to consider diversification into other business segments (industries) instead of global diversification. Findings from the analysis suggest that industry specific effects outweigh country effects as drivers of any potential diversification benefit for industrial firms. This is consistent with the interpretation that increased economic and financial integration of global economies have reduced or even eliminated potential diversification benefits associated with global diversification. Corporate managers are therefore more likely to realise greater benefit by embracing a corporate diversification strategy across different business segments.

A practical recommendation for the investor is to consider ICM efficiencies as an important criterion when evaluating diversified firms for inclusion in investment portfolios.

This is because the efficiency with which internal funds are reallocated in an ICM has a direct influence on financial constraints imposed on a firm and consequently, stock returns.

5.4 Limitations of the thesis

This thesis uses data from the CRSP/Compustat Merged Database (CCM). CCM data draws from two separate sources: monthly price data for firms listed on the NYSE, AMEX or NASDAQ exchanges from the Centre for Research in Security Prices (CRSP) database and business segment data from the Compustat Industry Segment (CIS) database. Some limitations faced by this thesis pertain to the quality of the segment data from the CIS database. Segment data is given to corrections through reporting adjustments made by corporate managers in subsequent years. In the event that such corrections are warranted but are not filed, then inaccuracies will inevitably result. Fortunately, such inaccuracies are few, if any at all. As such, it is unlikely to affect findings of this thesis.

In addition, another limitation of the CIS database is the reliance on managerial declaration of segment data. It is a well-known fact that reporting measures are often manipulated by managers in an effort to conceal poor corporate performance or to manage the expectations of shareholders and market analysts. For example, through creative accounting, managers may reallocate sales revenue earned by one business segment to another in a bid to improve dismal performance. In the context of this thesis, such practices may result in inaccurate measures of a firm's diversification when using the Herfindahl index value for segment sales to measure corporate diversification. In order to circumvent this issue, alternative diversification measures such as the Herfindahl index value for segment assets are used. Segment assets are less easily manipulated across business segments due to depreciation and tax schedules for assets that are specific to a business segment (industry).

Through the use of different diversification measures, findings of this thesis are thus cross-examined and confirmed.

Further, growth options are not observable and proxies are needed to measure them. Unfortunately, there is also no consensus on a standard proxy for growth options in the literature. Adam and Goyal (2008) best describe the problem facing the researcher by stating that proxy variables all have their own advantages and disadvantages. This thesis attempts to overcome this limitation in two ways. First, total asset growth is used as a proxy for growth options because (i) the turnover of assets-in-place (change in total assets) alters the relative importance of growth options versus existing assets leading to its explanatory role for firm value; (ii) it is an economically and statistically significant predictor of the cross-section of stock returns; (iii) the ability of total asset growth to predict returns dominates other traditional growth measures; (iv) growth reflects the availability of assets from new investments that can serve as collateral for borrowing to finance future investment, and (v) the asset growth effect is persistent both in the cross-section of returns and over time. To avoid criticism that this thesis has opportunistically chosen total asset growth as a proxy in order to manipulate findings, an alternative and established proxy in the literature, the market-to-book value of equity, is also used for robustness. Results remain qualitatively the same.

5.5 Opportunities for further research

A variety of opportunities for further research exist. It can be argued that corporate governance has an important impact on the selection of growth options and ICM efficiency of a firm. On one hand, studies based on efficient reallocation theories have assumed that headquarters, unlike funding institutions in external financial markets, have better capability in selecting superior projects and have absolute control rights in the reallocation of internal funds (for example, see Weston (1970) and Stein (1997)). On the other hand, studies examining a model of internal capital misallocation such as Rajan, et al. (2000) are based on power considerations among managers. Further, agency explanations often suggest that ICMs insulate managers from the discipline of external capital markets, thus allowing them to pursue corporate investments for private benefit. Therefore, a potential venue for further research is to examine the extent that corporate governance facilitates decision making towards value maximization for the shareholder in relation to investment flexibility and ICM efficiency.

Another interesting area for future research is evaluating the impact of related versus unrelated diversification strategies on stock returns in relation to investment flexibility and ICM efficiency. Related diversification refers to diversification across business segments within the same industry grouping while unrelated diversification refers to diversification across different industries. “Relatedness” in diversification plays an important economic role for firms because the extent to which economies of scope for a firm’s resources and manufacturing operations can be exploited depend on its relevance across different business segments. For example, while resources and skills in the manufacturing of automobile engines have limited inputs for the manufacture of gardening equipment, a logistics network that delivers raw materials and finished goods is likely to offer synergies that can be exploited by both operations.

It can be argued that diversified firms which have a related diversification strategy would have less investment flexibility since investment opportunities in the same industry are likely to be more correlated. Likewise, cash flows from different business segments within the same industry are likely to have a higher correlation. Financial constraints arising from ICM efficiency in a related diversification context would thus be more dependent on a single industry's fortunes. In contrast, the opposite of these two scenarios would hold for firms that embrace an unrelated diversification strategy. In any case, both scenarios would provide greater insight into potential limitations of investment flexibility and financial constraints arising from ICM efficiency. These questions are left for future research.

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