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ENVIRONMENTAL DYNAMISM, CAPITAL STRUCTURE AND INNOVATION: AN EMPIRICAL TEST

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Innovation is at the heart of firm success in today's competitive environment. Those factors contributing to successful innovation efforts should be important topics of research. In this study we formulated hypotheses linking the interaction between environmental dynamism and capital structure with firm innovation. Using U.S. firms as our research setting, we show that for firms in environments characterized as highly dynamic, high levels of debt are negatively related to innovation, and in stable environments, high levels of debt are positively related to innovation. Contributions, practical implications, and future extensions are considered.

A central question in strategic management is how to position the firm for survival in the long-term (Ansoff, 1965; Rumelt, Schendel, & Teece, 1994). This question has gained in importance as evidence mounts that U.S. firms may be losing their competitive advantage within the global economy (Margolis & Kammen, 1999; Stokes, 1999). Clearly, effective strategic choices are crucial for firms to enhance their competitiveness. As several strategy and finance scholars have demonstrated, there is a relationship between a firm's decisions concerning the capital structure, and the impact such decisions have on the strategic choices available to managers (e.g., Barton & Gordon, 1988; Bromiley, 1990; Kochhar & Hitt, 1998), and the competitive capabilities of the firm (Balakrishnan & Fox, 1993; De Long & Summer, 1991; Kester & Luehrman, 1992; Kochhar & Hitt, 1998; Porter, 1992; Scherer & Ross, 1990).

The purpose of this paper is to extend this line of research by examining the relationship between the firm's capital structure and the ability to innovate. We draw on the theoretical foundations of transaction cost economics (Coase, 1937; Williamson, 1975, 1985) and strategic management (Child, 1972; Bettis & Hitt,

1995; D'Aveni, 1994; Lengnick-Hall & Wolff, 1999) to show that decisions concerning capital structure affect the strategic choices available to managers, and that these choices have an impact on firms' innovative capabilities. More specifically, we formulate and empirically test the positive impact of the match between environmental dynamism and capital structure on firm innovation.

Background and Hypotheses

Scholars from Hayes and Abernathy (1980) to Porter (1998) have talked about the importance of investment in innovation, and have warned about the possible decline in U.S. competitiveness due to a lack of investment. The focus on innovative capability is not misplaced as it is directly related to the ability of firms to compete. Schumpeter (1950) pointed out that innovation was the essence of change, both destroying and creating markets and organizations (creative destruction). As an element of strategy, it is a means of erecting barriers to competition, and creating sustainable competitive advantage (Porter, 1990) in order to achieve above average economic rents. Moreover, since global competition has shifted from process improvements to new product development (Hitt, Hoskisson, & Kim, 1997), those firms making the necessary investments in innovation are more likely to gain competitive advantage in international and global markets (Brown & Eisenhardt, 1995; Conner, 1991; Franko, 1989; Porter, 1990). Accepting that the global economy is an irreversible trend (Bryan, Fraser, Oppenheim, & Ral, 1999), it would appear that firms must develop a widening set of capabilities and core competencies in order to survive in the long-term (D'Aveni, 1994; Kaounides, 1999; Prahalad & Hamel, 1990). Innovation is at the center of this set of capabilities and core competencies.

Despite these compelling arguments, recent reports from the Council on Competitiveness (Van Opstal, 1999) and the National Institute of Standards and Technology (NIST) (Tassy, 1999) indicate that as a nation we are not following this advice. According to the NIST: "the Index indicates that the United States may be living off historical assets that are not being renewed. Investment in the fundamentals of innovative capacity reached a peak in 1985 and then fell. During the first half of the 1990s, the U.S. Innovation Index remained flat. The report details the causes underlying the decline and stagnation in the U.S. Index over the past decade, revealing several critical areas where low investment and inattention have led to the relative weakening of our ability to continue innovating at the international frontier" (Tassy, 1999, p. 7).

The Council on Competitiveness echoes these concerns. Its study found that the "dominance of the United States as a source of technology for other economies is declining, with reduced shares in practically every foreign market. Moreover, technology acquired by U.S. domestic companies through imports has more than tripled over the last two decades" (Van Opstal, 1999, p. 5).

When searching for a cause of this decline in innovative capability, most responses suggest that managers have a short-term horizon, and that they are not able to plan for the long-term due to pressures inherent in our economic system (Porter, 1992). Two causes of short-termism mentioned by Laverty (1996) are

impatient capital and information asymmetry. Jacobs (1991) suggested that impatient capital results from a breakdown in the relationships between managers and both their debt and equity sources. We feel that one cause of this breakdown could be the result of information asymmetry. That is, investors do not have complete information concerning the value of firms' assets or managerial decisions. Brennan (1990) and Myers and Majluf (1984) provide support for the argument that investors do not have full information about a firm's value.

Impatient capital and information asymmetry may be working together to produce constraints that prevent firms from pursuing promising strategies and engaging in value-generating innovations. Investors often do not have sufficient information on firm strategic moves, including efforts toward innovation. Furthermore, since many investors are not intimately involved in strategy-making activities in organizations, they are unable to appreciate the efficacy of various moves firms may initiate to gain long-term competitive advantage. Thus we believe information asymmetry is associated with both a lack of firm-specific information, and a lack of competitive environment-specific knowledge that would allow investors to adequately evaluate firms' strategic moves and innovations. The information asymmetry exhibited between firm management and investors, coupled with the short-term orientation prevalent in the investment community, may create considerable barriers to firm innovation.

Innovation

Dosi (1988) defined innovation as "the search for and the discovery, development, improvement, adoption and commercialization of new processes, products, and organizational structures and procedures" (Dosi, 1988, p. 1122). Teece, Pisano, and Shuen (1997) use the term *dynamic capabilities* to explain the process of how a subset of organizational competencies or capabilities results in firms creating new products and processes in response to changing market circumstances. These dynamic capabilities can be seen as the resources and knowledge necessary for the development, improvement, adoption and commercialization of new processes, products, and organizational structures and procedures. Thus innovation requires both the means and the ability to transform resources into economic gain within the competitive environment.

Yeoh and Roth (1999) point out that expenditures on the development of innovative capabilities do not necessarily lead to improved firm economic performance, indicating that other factors may be responsible for positive outcomes. In other words, commitment to innovation is a necessary but not sufficient condition for positive results. They further state that knowledge is embedded in resources and is transformed through capabilities.

Transaction Cost Economics

In this section we provide the theoretical justification for an argument that a firm's choice of capital structure must be aligned with its competitive environment, and that this alignment will have an impact on the innovative capabilities of the firm. Coase (1937) raised the question concerning the size and scope of the firm. If

organizations (hierarchies) form to reduce the costs of market transactions, why then aren't all transactions governed by one large firm? Williamson (1985) suggested that as firms become larger, their efficiency is attenuated by their sizes. Argyres and Liebeskind (1999) offer another explanation. They propose that the "greater the difference is between a transaction's optimal governance mechanism and a firm's governance arrangements in place, the greater the cost will be to the firm of internalizing that transaction" (p. 60).

This is true, they argue, due to a condition which they call "*governance inseparability*—a condition in which a firm's past governance choices significantly influence the range and types of governance mechanisms that it can adopt in future periods" (p. 49, emphasis in the original). This concept is closely related to the strategy notion that the selection of a strategy in one time period will limit the choice of another strategy in a later time period. The argument is that once a particular governance arrangement is accepted, it may limit the ability of a firm to economize on future transactions. Further, once a governance mechanism is established, it may limit the ability of a firm to internalize a future transaction even if internalization were the optimal solution.

Williamson (1999) challenges researchers to examine the question of the relationship between governance and competitive capabilities. He asks the question: "How should firm A, with its pre-existing strengths and weaknesses, reposition for the future in relation to the strategic situation of which it is a part or to which it can relate" (p. 1103)? Markets and organizations are both instruments for conducting transactions. The choice of which instrument to use will be a product of the efficiencies that can be gained from either. These efficiencies are moderated by the characteristics of the individual decision makers; that is, their propensity for opportunistic behavior, and bounded rationality in decision-making (Williamson, 1975). However, Williamson (1988) also argues that when market forces are insufficient to reduce transaction costs or to control managerial opportunistic behavior, the board of directors is responsible for protecting the interests of the stockholders. Hierarchical control is seen as a substitute for market efficiencies.

The most important dimension of the transaction is the specificity of the assets germane to the contract (Williamson, 1991). Specificity refers to the redeployability of the assets: the higher the redeployability of the asset, the lower the specificity. For highly redeployable assets, such as nuts and bolts, there will be complete knowledge within the factor market concerning their present and future value, and their degree of redeployability. This low specificity reduces the risk associated with any given transaction, and theoretically, it should lead to more efficient transactions. The most appropriate instrument for financing transactions for assets with a low degree of specificity would be debt. This is because the value of the preemptive claims of the debt-holder should be known with reasonable certainty, and the cost of the transaction would be minimized.

For assets with low redeployability, such as highly specialized production equipment, or highly skilled workers, or investments in R&D and marketing, or innovation projects, the knowledge within the factor markets concerning the present and future value of the assets may be very limited, thus increasing the cost of the

transaction. This makes debt an unattractive alternative because the value of the preemptive claim of debt-holders declines in relation to the increase in asset specificity. It is the lack of knowledge about the future value of an asset that increases the risk for debt-holders, and increases the cost of using debt for project financing.

The use of equity shifts responsibility for governance from external capital markets to internal boards of directors. External debt-holders normally have an arms-length arrangement with a firm, becoming intrusive only when the firm fails to meet its debt covenants. The board of directors, as representatives of the residual claimants, has the responsibility and capacity for maintaining a continuous administrative and governance role (Williamson, 1988). This would indicate that under certain circumstances the board of directors and corporate managers should have relatively more complete knowledge about the future value of highly specialized assets. Therefore, debt and equity are less financial instruments and more a means of corporate governance. More importantly, from a strategic management perspective, there is a clear indication that external factors can influence the efficacy of the capital structure decision with respect to the ability of the firm to make critical choices in response to competitive pressures.

The concept of asset specificity can be linked to information asymmetry. Outsider investors may have limited knowledge and ability to understand the impact of those investments in highly specific assets necessary to maintain the innovative capabilities of the firm. We repeat Williamson's (1999) question, under what conditions will this most likely occur? Research in strategic management provides a possible answer.

Environmental Dynamism

A primary focus of strategic management is the emphasis it places on the firm's competitive environment (e.g., Chandler, 1962; Child, 1972; D'Aveni, 1994; Porter, 1980). An objective of the selection of strategy is to find a match or fit between the demands of the competitive environment and the firm's internal management systems in order to succeed over the long-term (Venkatraman, 1990). The management system most appropriate for any given firm will be a product of the specific set of environmental contingencies being faced (Drazin & Van de Ven, 1985). While every firm will be unique in the totality of its design (Andrews, 1971), there are limited sets of equally effective designs that can match a configuration of contingencies facing organizations in a given environmental context (Hambrick, 1984).

Across industries there are significant differences in the environmental characteristics impacting firms. Most relevant among these characteristics is environmental dynamism, defined as the degree and the instability of changes in a firm's competitive environment (Child, 1972; Dess & Beard, 1984). Environmental dynamism is the product of several forces operating at one time. These include an increase in the size and number of organizations within an industry, and an increase in the rate of technological change and its diffusion throughout that industry.

Empirical studies have demonstrated that greater environmental uncertainty is associated with greater environmental dynamism (e.g., Duncan, 1972; Milliken, 1987, 1990; Tung, 1979). For all parties involved (including top managers, stockholders, debt-holders and others), as environmental dynamism increases it will result in actors'

increased inability to assess accurately both the present and future state of the environment. This limits their ability to determine the potential impact of decision-making on current and future business activities, and to evaluate viable alternatives which managers could pursue (Milliken, 1987). This means that one result of increasing levels of environmental dynamism is the reduced access to knowledge needed to make critical decisions. This, in turn, reduces the stability and predictability of relations among firms and their constituents within an industry.

For firms within industries exhibiting greater environmental dynamism top managers must develop innovative capabilities and creative strategies to deal effectively with this major challenge (D'Aveni, 1994; Thompson, 1967). The current strategy literature suggests that firms must invest in firm specific assets that help build temporary competitive advantages (D'Aveni, 1994; Lengnick-Hall & Wolff, 1999). Investing in firm specific assets to build temporary competitive advantage and to eliminate the static competitive advantages of other firms (D'Aveni, 1994; Grimm & Smith, 1997) also entails greater risk, and requires the buildup of yet more firm specific assets.

Relating this to transaction cost economics, a primary purpose of economic organizations is to "craft governance structures that economize on bounded rationality while simultaneously safeguarding the transactions in question against the hazards of opportunism" (Williamson, 1988, p. 569). As environmental dynamism increases, the knowledge available for decision-making is reduced (Milliken, 1987). Firms may tend to use those novel and creative strategies, and may also engage in activities to create more competitive uncertainty in order to build and enhance barriers to imitation (Hamel, 1996, 1998; Grimm & Smith, 1997). For firms operating in such environments the lack of certain knowledge would make it more difficult for the factor markets to value accurately the assets being employed, and for stakeholder groups to accurately evaluate the appropriateness of managerial decisions. This argues for the increased need for equity financing in more dynamic environments to reduce transaction costs.

The theory provided indicates that the degree of environmental dynamism should be a significant determinant in the management of a firm's capital structure. Consonant with prior theoretical work in this area, we view environmental dynamism as existing on a continuum ranging from stable to dynamic (Dess & Beard, 1984; Keats & Hitt, 1988). Firms operating in environments that could be classified as relatively low on a measure of environmental dynamism should consider the use of debt financing over equity financing. The overriding consideration would be the availability of lower cost debt financing, and the ability of debt-holders to appreciate the competitive moves initiated by top managers.

As the rate of environmental dynamism increases, equity financing should be used to reduce transaction costs arising from increased risk. The use of equity financing also has the advantage of removing capital market constraints associated with the inability of managers to convey complete information concerning competitive moves. This would allow managers to pursue a variety of strategies that are deemed necessary for survival and success in highly dynamic environments. The ability of firms to adapt to changes within the environment either through responding to market signals or changes in governance structures produces organizational efficiencies that

improve the economic performance of the firm (Williamson, 1996). This reasoning is supported by Balakrishnan and Fox (1993), who noted that the firm's ability to manage its relationship with lenders was a key source of competitive advantage. Our argument is that as environments become more dynamic, this ability is eroded.

Integrating the theoretical arguments presented above allows us to make definitive statements about the relationship among the three constructs, innovation, capital structure and environmental dynamism. Specifically, we argue that those firms that have capital structures containing relatively low levels of debt, and which are in highly dynamic competitive environments, are more likely to develop and utilize innovative capabilities. We expect the reverse to also be true. Therefore, we state:

Proposition: The interaction between environmental dynamism and capital structure will influence firm innovation.. More specifically,

Hypothesis 1: In a dynamic environment, lower leverage will lead to greater innovation, and

Hypothesis 2: In a stable environment, higher leverage will lead to greater innovation.

Method

Our research proposition is that the interaction or match between environmental dynamism and capital structure will have a positive impact on firm innovation. Below we discuss variables employed in this study, along with the research setting, empirical testing, and finally, basic findings.

Variables

Innovation. There is evidence that firms develop their competitive position by consistently investing in innovative capabilities and accumulating knowledge which is protected by patents (Peretto, 1999). DeCarolis and Deeds (1999) argued that patents represent the stock of organizational knowledge because they are "physical, codifiable manifestations of innovative ideas, techniques, and products that embody the knowledge of one or several employees" (p. 958). Patents are also an accepted measure of the technology strategy and competitive capabilities (Van der Eerden & Saelens, 1991).

Eaton and Kortum (1999) demonstrated that a firm's patents contribute to the growth of an industry on a global scale, and, more importantly, affect the return to ideas within the same firm. Silverman (1999) constructed a measure of corporate technological resources using patent data to demonstrate a positive relationship between these resources and the likelihood of firms employing those resources. Investments in research and development represent an important source of competitive advantage (Yeoh & Roth, 1999), and patents are an indication of the attempt to gain competitive advantage.

This study used patent data provided by CHI Research, Inc. as the measure of innovation. We employed two variables provided by this firm: the number of patents, and the technological strength of the patent. The former is a simple count of the patents a company accumulated in a five year span (1990 to 1994 in our case).

Technology strength was computed by multiplying the number of patents issued to a firm, with the number of times a company's most recent five years of patents are cited in the current year. The first measure reflects the tangible outcome of the innovation process, the second measure taps the product of such innovation effort as reflected in the stock of firm knowledge and the degree to which it is being employed by the firm. This data set has been used in studies by Harhoff, Narin, Scherer, and Vopel (1999), Deng, Lev, and Narin (1999), as well as by the National Institute of Science and Technology.

Patent data has been criticized as a limited measure of firm innovation. For example, firms may not patent all knowledge, keeping secrets to protect competitive advances, and issuing patents as a signaling devise to competitors (Silverman, 1999). Other studies support the use of patent data. For example, Hall, Jaffe, and Trajtenberg (1998) provided evidence that the intensity of citations of companies' patents is contemporaneously associated with their market values. Deng et al. (1999) also find that technological strength is linked to better stock performance. Also, Rivette and Kline (2000) point out that firms are beginning to appreciate the degree to which patents can contribute to corporate economic value.

Environmental Dynamism. Researchers generally use variation-based indexes to tap into the overall level of degree of and instability in industry level changes or environmental dynamism. This tradition dates back to Tosi, Aldag, and Storey (1973) and Bourgeois (1980). Those authors used variations in net sales, ROE and technological volatility in industries as their measure of environmental dynamism. Dess and Beard (1984) conducted a large-scale study measuring key dimensions of environment using a factor analytical approach. In their study, they used the theoretical conceptions advanced in Aldrich (1979) about environmental dimensions, and used a number of industry level indicators to construct measures of environmental dynamism, complexity, and munificence. A later study by Rasheed and Prescott (1992) was able to replicate and demonstrate the convergence of multiple measures used to measure the same construct. Keats and Hitt (1988) observed convergence between the dynamism measure derived from sales and operating income and content analysis of annual reports, thereby adding further credence to the validity and reliability of the dynamism measure. This set of empirical evidence and conceptual development has become the basis for using variations in industry level revenue as the key indicator when assessing environmental dynamism (Boyd, 1995).

This study used archival data of industrial level revenue to construct an environmental dynamism measure. This approach has been used in a number of prior studies (Boyd, 1995; Keats & Hitt, 1988; Rasheed & Prescott, 1992; Wholey & Brittain, 1989) and is viewed as being at the appropriate level of analysis when considering the impact of task environment (Bourgeois, 1980). Specifically, we regressed the industry value of shipments over five years against time (1988–1992), and used the standard error of the regression coefficient related to a time dummy variable divided by the average value of industry shipments to produce a standardized index of environmental dynamism.

Leverage. As argued earlier, we are concerned with how the firm's capital structure interacts with environmental dynamism to influence firm innovation.

Capital structure is composed of debt and equity. We chose to use leverage to represent the capital structure of the firm. The leverage measure we used was the ratio of debt to equity. Our measure of leverage included the use of fixed charge securities in the form of fixed-charge debt and preferred stock. The financial leverage measure for each firm in the data set was averaged over a four-year period to control for spurious events (1989–1992).

Controls. The literature suggests that firm size has a strong influence on a firm's structure, decision-making, and other activities (Bluedorn, 1993). Furthermore, Schumpeter (1950) also suggests that large firms are the major centers of innovation. We, therefore, included firm size measured by the log of the full time employees as a key control variable in our study. In addition, we also included relative R&D spending as a control variable. Clearly, firms that spend more on R&D will be able to generate both tangible benefits in terms of patents obtained and intangible benefits in terms of knowledge generated (other things being equal). The impact of R&D spending, therefore, should be controlled for. For this measure, we considered R&D per employee and R&D per total asset dollar. Our empirical assessment shows that both measures are highly correlated [r (197) = .98]. We, therefore, employed R&D/employees as our control for relative R&D spending.

Setting

The current study used a sample of 197 large U.S. firms in a variety of industries. We used several data sources to generate our data base for this study. The CHI Research Inc. patent database provided the measures for patents and technological strengths (1990–1994); the U.S. Industry Outlook, 1994 edition, provided industry values of shipment data (1988–1992) for environmental dynamism measure. Other financial data (including leverage and R&D spending) and firm demographic data were collected from the Research Insight (formally Compustat) database. The firms included in the database represent large firms in various manufacturing sectors of the U.S. economy.

Analytical Approach

Our theoretical proposition and resultant hypotheses posit that innovation will be a function of leverage and the moderating effects of environmental dynamism. To test the proposed relations, we employed a multiple regression methodology with an interactive term between leverage and environmental dynamism. This method has been proposed as an effective one for studying interactive relationships (cf., Aiken & West, 1991; Blalock, 1965; Cohen & Cohen, 1983; Jaccard, Turrisi, & Wan, 1990; Pedhazur, 1982).

Results

Table 1 presents both descriptive statistics and the correlation matrix for our study sample. To remove the multicollinearity threat posed by the product term of two main effect variables (leverage and dynamism in this case) we centered those two variables by taking away the respective mean from each value (see Aiken & West, 1991), and formed the interactive term with centered variables. Our prelimi-

nary assessment indicated that the sample size of the database was reasonably large, and the data to be analyzed did not pose a multicollinearity threat.

Table 1
Descriptive Statistics and Correlation Matrix

Variables	*Mean*	*SD*	Correlation Coefficients 1	2	3	4	5	6	7
1. Number of patents	459.33	693.49	1.00						
2. Tech strength	493.94	853.39	.95	1.00					
3. Dynamism	.00	.01	.02	−.02	1.00				
4. Leverage	.00	1.88	.17	.11	.11	1.00			
5. Dynamism leverage	.001	.01	−.09	−.09	−.02	−.10	1.00		
6. Size (Log of employees)	.25	.50	.61	.56	.15	.28	−.01	1.00	
7. R&D–Employees	11.76	39.29	−.03	−.01	−.16	−.12	.10	−.24	1.00

Note: $N = 197$, for absolute value of $r > .147$. $p < .05$. $r > .24$. $p < .01$. (two-tailed)

The empirical tests consisted of two moderated multiple regression equations (Aiken & West, 1991) summarized in Table 2. We used the number of patents and technological strength as our dependent variables in two models respectively, entered in the models leverage, dynamism, the interaction terms between the two as hypothesis testing variables, and size and R&D employees as control variables. With the introduction of the interactive term, the standardized beta weights were difficult to interpret, so we included both regular and standardized beta weights in Table 2.

Both multiple regression models were statistically significant as the F statistics indicated, passing the first test in our assessment. The results from both models indicate a statistically significant negative impact of the interactive term between dynamism and leverage on firm innovation (number of patents and technological strengths), clearly supporting the hypothesized relationship between leverage and innovation (negative under dynamic conditions and positive under stable conditions).

In addition to the above findings, it is important to note that size did contribute in a positive fashion to firm innovation, and furthermore, relative R&D spending also had a positive impact on firm innovation. These findings add further credence to the importance of large firms in innovation (Schumpeter, 1950), and to the importance of R&D spending (cf., Bowonder & Yadav, 1999).

Table 2
Regression Results

Independent Variables	Regression Models: Number of Patents			Technological Strength		
	b	β	*t*	*b*	β	*t*
Leverage	1.88	.01	.09	−21.10	−.05	−.76
Dynamism	−6123. 90	−.06	−1.0	−11176.43	−.09	−1.45+
Dynamism by leverage	−7575.84	−.10	−1.69*	−9659.78	−.10	−1.68*
Size (Log of employees)	891.74	.65	10.84***	1037.62	.61	9.78***
R&D–Employees	2.32	.13	2.25**	2.75	.13	2.07*
Constant	−665.77		−5.92***	−815.46		−5.63***
R^2	.40			.35		
Adjusted R^2	.39			.33		
F	25.72*** (*df* = 5, 191)			20.24*** (*df* = 5,191)		

Note: $N = 197$.
$+p < .10$. $*p < .05$. $**p < .01$. $***p < .001$.

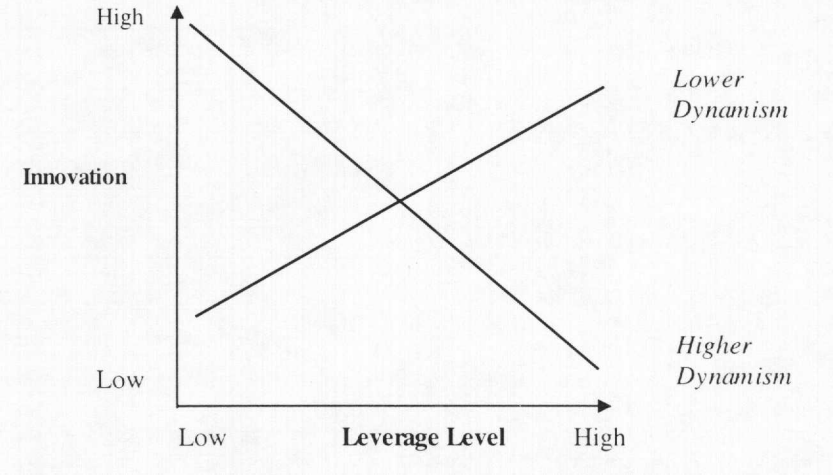
Conclusion

Our purpose in doing this research was to demonstrate theoretically and empirically that the capital structure decision has an effect on the ability of firms to innovate. The analysis supported our argument that firms with high levels of debt, which are in dynamic competitive environments, will be less successful at innovation. These results also support our theoretical argument which suggests that in dynamic environments, the cost of transactions becomes prohibitively high for firms with relatively large amounts of debt, thus limiting their strategic flexibility.

The overall findings of our research are best represented by Figure 1, which illustrates the changes in the impact of leverage on innovation performance at two possible points on the environmental dynamism continuum. For firms experiencing stable environments (lower dynamism), leverage is positively linked to innovation, and for firms experiencing dynamic environments, leverage is negatively related to innovation.

These findings should have significant implications for managers. Current thinking from areas such as agency theory suggest that the use of debt is a mechanism for maximizing shareholder wealth. Our findings indicate that this is only true in environments that can be characterized as stable. Increasing dynamism limits the ability of stakeholders to understand the decisions made by managers, or to properly value the assets created. Therefore, the capital structure decision is one with long-term implications for the survivability of firms.

Figure 1
An Illustration of Capital Structure and Innovation Relationship Under Different Levels of Environmental Dynamism



Our study supports and extends the theory provided by Argyres and Liebeskind (1999). There is support for their argument that governance inseparability can contribute to a loss of competitive capability by limiting managerial flexibility.

We also provide support for research by Hitt, Hoskisson, and Kim (1997). Their study demonstrated that there was a relationship between innovation and competitive advantage. Our findings support their contention that overemphasis on financial controls can negatively impact long-term investments in innovative activities.

A potential limitation of this study is the large firm bias in the study database. The need to compile data from multiple sources necessarily limited our focus to large firms. Whether or not the conclusions in this study apply to medium size firms remains an empirical question. Furthermore, by focusing on patent related outcome variables, we focus on manufacturing sector firms. Innovation, however, does not have to be limited to manufacturing firms. Many service firms also engage in innovation to develop new products and new processes as a means to enhance their competitiveness. Future studies need to address these issues. Clearly, the results of this study may reflect the particular time period from which the observations were made.

Many academics have noted that investments in innovation are critical to the development of knowledge capital necessary to create and sustain a competitive advantage. Knowledge is embedded in resources and is transformed through capabilities (Yeoh & Roth, 1999). Any factor that limits this capability impacts not only the firm, but also the industry of which it is a part (cf., Porter, 1990). From this standpoint, it is necessary that we re-examine the basis for applying finance-based techniques that provide short-term rewards at the expense of long-term survival.

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