

HOW DO OWNERSHIP AND DEBT
AFFECT R&D INVESTMENTS IN PRIVATIZED FIRMS?
EVIDENCE FROM THE EMERGING ECONOMY OF CHINA

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ABSTRACT

CHUANYIN XIE: How Do Ownership and Debt Affect R&D Investments in Privatized Firms? Evidence from the Emerging Economy of China

(Under the direction of Hugh M. O'Neill)

The effect of the privatization of publicly-traded firms (or leveraged buyouts) on innovation projects such as R&D has been the subject of much debate. On the one hand, private ownership is likely to motivate owner-managers to invest in R&D projects; on the other, a high level of debt financing would damage firms' financial flexibility due to debt payments, thus reducing firms' capability for R&D investments. Earlier studies demonstrated the negative relationship between buyouts and R&D investments, but recent research suggests buyouts may facilitate innovation such as R&D. This study attempts to untangle some controversies about R&D activities in privatized firms by extending the work on privatization of public firms in the West to formerly state-owned enterprises in China.

Specifically, I examine the effect of private ownership and firm debt on R&D investments in Chinese privatized firms. I argue that private ownership and firm debt may affect R&D investments both directly and indirectly. Private ownership could increase R&D investments because of its strong motivational effect and its link to effective governance structures for R&D activities. Debt would decrease R&D investments due to its financially constraining effect and its less likelihood as a financing tool for R&D investments. Given the risky nature of R&D investments, I also argue that private ownership and firm debt might affect R&D investments indirectly, mediated by risk perception. This indirect impact of

private ownership and firm debt would help resolve some conflicting arguments and evidence.

Data for testing hypotheses came from China and were obtained by survey. Two groups of industry were used: low and high R&D industries. The empirical results suggest that private ownership does not affect R&D investments directly or indirectly, but firm debt influences R&D investments both directly and indirectly. Risk perception was found to play an important role in managerial commitment to R&D projects in privatized firms. The findings of this study provide implications for academics, practitioners and policy makers in the field of privatization, which is an important corporate restructuring tool and has been used widely by both developed and developing economies.

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CHAPTER 1

INTRODUCTION

Organizations can be grouped in three ownership classes: publicly-traded, state-owned, and privately-owned. The different ownership structures, according to Mascarenhas (1989), lead to differences in the interests and constraints of owners and managers, and in the conflicts between owners and managers. Ownership structure is important because it influences organizational behaviors (Perry & Rainey, 1988).

Among the three types of organization, publicly-traded firms (“public firms” for short) are more visible because they are required to disclose information on their activities. Partly for this reason, they have received much research attention (Mascarenhas, 1989). According to Pagano et al (1998), there are at least three advantages a public firm possesses: first, it can gain access to stock markets for funds. Second, owners of a public firm enjoy the benefits of share liquidity and portfolio diversification. Share trading on an organized exchange is cheap, and shareowners can diversify their investments easily. The third advantage lies in monitoring management behavior. The stock market can serve as “a managerial discipline device” by creating a market for corporate control. In addition, shareholders can design efficient compensation programs for their managers based on stock price information, or create incentive programs by offering them stock options.

Public firms cannot obtain these advantages without a cost. A frequently-cited and also much-studied issue in public firms is the agency problem – an organizing problem that arises

when cooperating parties have different goals and interests (Ross, 1973). Because of the separation of ownership and control, owners (principals) of public firms engage managers (agents) to perform some services on their behalf through delegating some decision-making authority to the managers (Jensen & Meckling, 1976). This agency relationship causes agency problems because the interests of owners and managers may conflict and it is difficult or expensive for the owners to determine whether the managers have behaved properly (Eisenhardt, 1989). Managers are likely to pursue their own interests at the expense of the owners (Jensen & Meckling, 1976), and they may not have strong incentives to maximize the firm value.

To overcome or reduce the agency problem derived from the agency relationship, a variety of internal and external governance mechanisms have been developed, including boards of directors, ownership concentration, managerial stock ownership, stock options, the market for corporate control, and golden parachutes (Phan & Hill, 1995). These governance mechanisms are intended to achieve two goals: effective monitoring and the alignment of interests via incentives. Despite expectations, their role is limited due to three factors: information asymmetry, low levels of motivation to control on the part of the board of directors, and management entrenchment (Walsh & Seward, 1990). Unresolved agency problems often trigger firm privatization via leveraged buyouts (Fox & Marcus, 1992), which was a notable phenomenon in corporate America during the 1980s.

1.1 Privatization of Publicly-Traded Firms

The privatization of public firms, or buyouts, is an often-used corporate restructuring method (Bruton et al, 2002). In buyout transactions, firms are taken private by converting public stock ownership to private ownership (Phan & Hill, 1995). Because buyouts are often

led by incumbent managers and financed by large debts, they are sometimes termed as management buyouts (MBOs) or leveraged buyouts (LBOs). It was reported that in a period from 1981 to 1989, more than 2540 publicly-traded firms went through a buyout, and the total buyout transactions involved a market value of over \$297 billion and accounted for 17.0 percent of all the corporate restructuring activities in terms of value (*Mergerstat Review*, 1989).

Though this buyout wave in the United States has long been past, as an accepted corporate restructuring practice (Bruton et al, 2002), it still keeps occurring. Recently, the buyout practice has shown a growing trend in other countries. For example, United Kingdom had seen an explosion of buyout activities in the 1990s, with the transaction value reaching £17 billion in 1999 from £3 billion in 1990 (Harris et al, 2005). In Japan, buyouts were not common in the early 1990s, but started to gain momentum in late 1990s and amounted to 116 billion yen by value in 2001 (Wright & Kitamura, 2003).

A classical explanation of the widespread buyout practice is that buyouts can serve as an effective device to overcome the agency problem existing in the public-traded firms, which arises when ownership and control are separated (Fama & Jensen, 1983; Jensen, 1986). According to Jensen (1989), the agency problem is aggravated when the monitoring role of investors decreases, a common phenomenon in public firms with diluted ownership structures. The decreased monitoring effort leads to increased managerial discretion to use resources for their own purposes such as engaging in unprofitable diversifications. Therefore, the privatization of public firms “was a correction for overexpansion and overdiversification” which were at the expense of firm value (Bethel & Liebeskind, 1993).

After buyouts, the privatized firms enjoy two advantages: managerial motivation and discipline (Jensen, 1986; Jensen & Meckling, 1976). Magowan (1989) argued that managers are now transformed into owners – owners' money is also the managers' money, so they have incentives to improve operational efficiency so as to create more value for their own assets. Managerial discipline is associated with high-levels of debt most buyout firms have involved. Jensen (1986) reasoned that the need to repay debt in buyout firms could discipline management behavior by forcing them to use cash more efficiently. The debt burden encourages managers to further improve efficiency through removing unprofitable investment projects, disposing of excessive resources or assets, and increasing accountability.

Given the twin spurs of managerial motivation and debt-based discipline, it is expected that privatized firms could not only improve their short-term profitability, but also likely their long-term growth. On the one hand, private ownership is likely to motivate owner-managers to invest in longer-term R&D projects; on the other, debt discipline would facilitate firms' more productive behavior such as restricting unproductive R&D projects (Long & Ravenscraft, 1993) and focusing on core competencies (Wiersema & Liebeskind, 1995).

Despite the theories in favor of privatization, scholars debate the positive effect of buyouts (Fox & Marcus, 1992). Centering on the debate is the financing method of buyouts – a mountain of debt. According to Seth and Easterwood (1993), heavy debt loads may cause two unfavorable results: first, managers may raise cash for debt service by selling valuable assets at prices less than their value, which reduces competitive advantages; second, heavy debt burden limits firm flexibility and responsiveness to competitive environments due to debt payments. Therefore, buyout firms are likely to focus on short-term performance at the expense of long-term investments like R&D projects (Hill et al, 1988; Reich, 1989). Because

of the negative consequences of high levels of debt financing, the effect of buyouts on managerial commitment to innovation has become a controversial issue (Zahra, 1995).

In response to the opposing views on privatization from both advocates and critics, a number of empirical studies have been conducted. Generally, the empirical evidence has supported the view of efficiency improvement (e.g., Bruton et al, 2002; Kaplan, 1988; Phan & Hill, 1995; Singh, 1990), but generated less encouraging prospects for innovation in post-buyout firms. Zahra and Fescina (1991), in an influential review of the past research, found more negative than positive effects of buyouts on R&D in most sample firms. Long and Ravenscraft's (1993) reported a similar finding: buyouts cause R&D intensity to drop by 40 percent.

Though many of those studies were conducted more than ten years ago, the debate regarding the relationship between privatization and innovation has not been solved to date. Recently, some researchers (Wright et al; 2000; Wright et al, 2001) have again raised the innovation issues in privatized firms. They proposed that the role of private ownership in innovation can be more than providing incentives. Private ownership can also lead to effective governance structures for innovation. According to Francis and Smith (1995), agency incentives and monitoring are not effective for innovation. Because innovation is characterized by its long-term nature, high-risk, and unpredictability, the contracting and monitoring costs associated with innovation would be especially high. In addition, contractual arrangements are likely to restrain experiments, so they may not encourage innovation efforts. Therefore, Wright et al (2000) reasoned that "independence might be an important antecedent for innovation". They further argued that private ownership would "become an important way of encouraging and governing R&D activity". In another study,

Wright and colleagues (2001) showed how privatized firms are committed to developing new products and technologies, obtaining patent rights, and engaging in R&D joint ventures.

1.2 Research Question

The above review on the privatization of public firms indicates that the body of research work regarding the relationship between privatization and innovation, focused in the U.S., has produced conflicting arguments and empirical results (Zahra, 1995). On the one hand, private ownership is likely to motivate owner-managers to invest in long-term projects such as R&D; on the other, high levels of debt financing could damage firms' financial flexibility due to debt payment, thus reducing firms' capability for innovation investments. Earlier studies demonstrated a negative relationship between buyouts and R&D investments (Long & Ravenscraft, 1993), but recent research suggests buyouts may facilitate innovation (Wright et al, 2001). This study attempts to untangle some controversies about innovation in privatized firms by extending the work on privatization of public firms in the West to formerly state-owned enterprises ("SOEs" for short) in China.

Specifically, I examine how private ownership and firm debt may affect R&D investments in Chinese privatized SOEs. I focus on Chinese privatized firms converted from small- and medium-sized SOEs. This context permits an examination of the effect of private ownership and debt on managerial pursuit of R&D projects while minimizing the impact of other factors. First, Chinese privatized firms usually do not face pressure to seek immediate gains or even sell valuable assets to service the debt loads. Second, these privatized firms, controlled by the management, make their own decisions on R&D investments. Though differences exist between privatization of public firms in the Western context and privatization of SOEs in the Chinese context, the similarities in rationale for privatization, as

discussed in the following chapter, provide a basis on which the empirical results from the Chinese context could be compared to those of similar studies in the Western context. This comparison may shed light on some unsolved issues to date.

By addressing how private ownership and firm debt might influence R&D investments, this study would enrich our understanding of privatization. Private ownership and debt financing are two basic components of privatization. Existing studies have used incentive-based models to explain the effect of private ownership (Fox & Marcus, 1992; Wright et al, 2000; Zahra, 1995). However, incentives may also cause risk averse behavior (Beatty & Zajac, 1994; Sanders, 2001), thus discouraging R&D investments. Heavy debt has been argued to influence R&D investments negatively because of its constraining effect on both strategic and financial flexibilities due to debt payments (Rappaport, 1990; Seth & Easterwood, 1993). However, there is also evidence that leveraged buyout firms did not reduce their investment effort in unrelated businesses more than comparable public firms (Wiersema & Liebeskind, 1995). This evidence suggests that debt may restrict financial capabilities for R&D investments but may not restrict managerial behavior to engage in R&D activities. Therefore, the effect of privatization on R&D investments may be more complex than the traditional explanations.

Privatization has become a major vehicle to revitalize the national economy in the developing countries which formerly adopted centralized economic systems. One assumption behind the privatization initiatives is that private ownership is superior to state ownership (Arens & Brouthers, 2001; Ramamurti, 2000). In spite of the expectation, privatization may not always achieve success in the emerging economies (McDonald, 1993; Wright et al, 1998). Given the importance of innovative activities such as R&D investments in privatized firms

(Wright et al, 1998; Zahra, 1995), by investigating how private ownership and debt might affect managerial pursuit of R&D projects, this study sheds light on how we might better use privatization as a restructuring tool in decentralizing economies.

1.3 Summary of the Dissertation

1.3.1 Theoretical Framework

In addressing the effect of private ownership and firm debt on R&D investments, I integrate the traditional theories with a risk perception framework. Traditional theories have predicted direct effects of private ownership and firm debt on R&D investments. Private ownership may affect R&D investments positively because private ownership produces strong incentives and effective governance structures for R&D activities. Debt may influence R&D investments negatively because of reduced financial capability resulting from debt payments. In addition, debt may not contribute to R&D investments for two other reasons. First, the risky nature of R&D investments would make debt less likely become a financing tool for R&D projects; second, firms may prefer internal financing for R&D activities in order to reduce information disclosure.

Given the risky nature of investments in R&D projects, and the controversial evidence about the traditional explanations of the effect of private ownership and firm debt on R&D investments, this study also establishes a risk perception framework to explore the indirect relationship between private ownership/firm debt and R&D investments. This framework suggests that there might be a link between private ownership/firm debt and R&D investments. This link is managerial risk perception of R&D projects. Private ownership could decrease and also increase risk perception. Risk perception in turn would affect managerial behavior in R&D investments. Firm debt could restrict investment capability in

R&D projects, but it may also influence R&D through risk perception. This risk perception framework may explain some conflicting evidence regarding the relationship between private ownership/firm debt and R&D investments, thus complementing the traditional theories.

1.3.2 Empirical Results

The integration of traditional theories with the risk perception framework leads to two sets of hypotheses: direct and indirect effects of private ownership and firm debt on R&D investments. The hypotheses were tested from the data collected in China. The data came from two groups of industries with low and high R&D intensity respectively. The empirical results provided strong support for the direct effect of firm debt on R&D investments. The relationship between private ownership and R&D investments was mixed.

In testing the indirect impact of private ownership and firm debt on R&D investments, risk perception was found to have strong negative effect on R&D investments. The relationship between debt and R&D investment was found to be partially mediated by risk perception. Though there was no evidence about a mediated relationship between private ownership and R&D investments, private ownership did have impact on risk perception.

After the sample was broken up into two groups consisting of low and high R&D industries, new evidence was found about the influence of private ownership and firm debt on R&D investments. The new evidence also suggests the importance of risk perception in managerial pursuit of R&D projects in privatized firms.

1.3.3 Overview of Dissertation

This dissertation includes five additional chapters. Chapter 2 first reviews the privatization of SOEs in the emerging economies. The review shows similarities between the privatization of public firms and SOEs. Those similarities form a basis on which the results

from one type of privatization may be compared to those from the other. Next, I describe the privatization of SOEs in the Chinese context. This description sets a context for hypothesis development.

In Chapter 3, I first review theories about the relationship between private ownership/firm debt and R&D investments. Then, I discuss the risk perception framework and its application in a Chinese context. Finally, I develop specific hypotheses which are tested in Chapter 4.

Chapter 4 presents the research methodology employed in this dissertation, including the sample, data collection, and measures. Chapter 5 reports the results of the data analysis. Chapter 6 presents conclusions and implications of the research.

CHAPTER 2

PRIVATIZATION OF STATE-OWNED ENTERPRISES

The purpose of this Chapter is twofold. First, I review the literature on SOEs and the privatization of SOEs, largely in the context of emerging economies. Second, I discuss the privatization of SOEs in China, the world's largest emerging economy. By describing the privatization of SOEs in the emerging economy of China, this Chapter sets up a context for the development of hypotheses presented in Chapter 3.

2.1 State-Owned Enterprises and Privatization

2.1.1 State-Owned Enterprises

SOEs rely on the state as owner, planner, and fund provider (Child, 1994). State governments plan key issues in SOEs, such as controlling production, determining careers, providing resources, and defining legitimacy (Arens & Brouthers, 2001). Because of the state-control, SOEs are “less sensitive to market incentives and influenced more by external political interests and public accountability”, and SOE managers have “less autonomy than managers of other ownership types due to external rules, such as civil service policies and rigid, hierarchical reporting requirements to government controllers” (Mascarenhas, 1989). The state protection of SOEs affords them preferential positions in markets, thus generating controversy about “unfair competition” (Walters & Monsen, 1979). As a result, SOEs have low motivation to conduct innovative activities (Nguyen et al, 2005), and are less adaptive and competitive in the market than their counterparts – privately-owned firms (Arens &

Brouthers, 2001). SOE managers' role is more administrative than market-oriented (Nguyen et al, 2005). Because SOEs do not take profit maximization as an important goal and often have diverse and intangible obligations such as preserving industries and employment, they usually evidence low efficiency (Mascarenhas, 1989).

SOEs are widespread in socialist systems, where they are the major organizational form. Under socialism, the philosophy of collective ownership is dominant (Kostera & Wicha, 1996), and government agencies usually represent the "owners" to exercise supervising power over SOEs (Lin & Zhu, 2001). Though SOE properties are supposed to belong to society as a whole, they belong to no single actor or organization (Boycko et al, 1995). Poorly defined property rights (and responsibilities) put SOEs in a situation without principals (Aharoni, 1982). As a result, both governmental agencies and SOE managers lack incentives to maximize the performance of their enterprises (Ramamurti, 2000).

In the SOE setting, the society or collective citizens are owners and are responsible for monitoring management behavior. Because SOEs' goals, such as maximizing public interests, are often vague, it is difficult for citizens as owners to monitor the agents' or managers' behavior and motivate them through incentive programs (Ramamurti, 2000). Though government agencies usually act on behalf of the society to play the supervising role, they do not need to take responsibilities for SOEs' negative consequences, because poor performance can be aided by the state bailout money (Peng & Heath, 1996), which is often referred to as "soft budget constraint", a common practice in SOE systems (Majumdar, 1998). As a result, SOEs have little motivation to improve financial performance, which leads to "inefficiency, waste of human and natural resources, slow technological progress and low labor morale" (Zhang, 2000).

From the above analysis, we can see that under socialist systems, one major problem with SOEs is their unclear property rights. This problem leads to low managerial motivation. Another related problem is the agency problem caused by agency relationships between collective citizens and government agencies, and between government agencies and SOE managers.

Due to cumulative and widespread effects of low efficiency of SOEs, the privatization of SOEs has spread throughout the world. The past two decades have witnessed the mass privatization practice in the formerly socialist countries (Hoskisson et al, 2000). Through the transfer of state ownership, SOEs become private entities with clearer property rights and more direct control over management decisions and objectives (Ramamurti, 2000).

2.1.2 Privatization of State-Owned Enterprises

Privatization of SOEs is the transfer of firm ownership from the state to private investors. Starting from the United Kingdom in the early 1980s, and then progressing to other developed and emerging economies, this type of privatization has become a popular strategy for restructuring the national economies and promoting free market system. In the last decade of the twentieth century, more than \$700 billion of state assets had been privatized throughout the world. Among them, 40 percent had occurred in the emerging economies (Ramamurti, 2000). The objectives of privatization may not be the same between developed and emerging economies. According to De Castro and Uhlenbruck (1997), privatization in the developed economies is more a philosophical issue, i.e., promoting free market systems, but in the emerging economies it is a development imperative. However, the privatization programs in both types of economies are usually guided by the same assumption: private ownership is superior to state ownership (Arens & Brouthers, 2001; Ramamurti, 2000). For

the purpose of this study, this section focuses on the privatized firms converted from SOEs in the context of the emerging economies.

In the emerging economies, SOE managers, sometimes including employees, often become an important interested party in the privatization process, especially in small- or medium-sized SOEs, where they have more potential to purchase the SOEs (Ramamurti, 2000). Managers and employees often can get preferential treatment in terms of discounted price and deferred payment, in part due to the lack of personal capital sources (Boycko et al, 1996). In China, for example, a local governmental report about state ownership restructuring (*Zhenjiang Government Report*, 2003) describes a variety of measures the government has adopted to help the privatization of SOEs, including the use of net assets rather than total assets to price SOEs, the removal of bad assets, the deduction of losses and social burdens, etc. Due to these measures, buyers in emerging markets pay less in purchasing the SOEs.

After SOEs are privatized, the new form of organization possesses at least three advantages: first, property rights are clearly defined. Specific individuals – the owners – become responsible for monitoring firm performance (Ramamurti, 2000). Second, the management ownership stake in privatized firms overcomes agency problems resulting from agency relationships. The private owners have strong incentives to improve their firms' performance in order to increase their wealth and avoid bankruptcy (Hanke, 1987). Third, the privatized firms operate on market rules instead of administrative orders: they employ capable managers and use incentive programs (Andrews & Dowling, 1998), they reduce redundant employees (Arens & Brouthers, 2001), they respond to customers on whom they rely for existence (Andrews & Dowling, 1998), etc.

Though private ownership can facilitate the improvement of firm performance through its motivational mechanisms, it may incur some disadvantages, compared with state ownership, in market competition. According to Mascarenhas (1989), SOEs enjoy government subsidies and bank loan guarantees. They also benefit from government assistance which forestalls competition, thus helping them build market share. Once privatized, however, SOEs would lose this government assistance. For example, bank loans can be more difficult to obtain. In addition, the government support for remaining SOEs may create unfair market competition (Mascarenhas, 1989).

Because private ownership is believed to be superior to state ownership, the general hypotheses associated with SOE privatization are that privatized firms perform better than SOEs, and privatized firms improve their performance after privatization (Cuervo & Villalonga, 2000). Many empirical studies have supported these general hypotheses (e.g., Boubakri & Cosset, 1998; Frydman et al, 1997; Goic, 1999; Villalonga, 2000). However, controversial results are also reported concerning the success of privatization (Dharwadkar et al, 2000). For example, research conducted by McDonald (1993) and Wright and colleagues (1998) provides the evidence that many Polish and Russian firms did not accomplish efficiency after privatization.

Explanations for the failed success after privatization vary, but problems in political, environmental, and managerial aspects are often cited. For example, the under-developed legal systems and the inefficient input and output markets would make it difficult to take advantage of the benefits of privatization in the emerging economies (Cuervo & Villalonga, 2000). The former SOE managers may not be able to adapt to the new competitive market conditions after they have become the owners of their enterprises (Barberis et al, 1996).

2.1.3 A Comparison between Privatization of SOEs and Public Firms

The analysis of privatization of SOEs in the emerging economies, compared with the privatization of public firms in the U.S. context discussed in the previous chapter, leads to the following conclusion: though public firms and SOEs are different organizations, they display similar features in privatization. As shown in Table 2.1, both public firms and SOEs are privatized for the purpose of performance improvement through reducing agency problems and increasing managerial motivation. The performance implications are also similar in the two types of firms: generally, privatization can improve organizational efficiency. These similarities form a basis for a comparison between the two types of firms in their privatization practice.

Table 2.1
A Comparison in Privatization of Public Firms and SOEs

	Privatization of Public Firms	Privatization of SOEs
Main Purpose	<ul style="list-style-type: none">▪ Improve performance	<ul style="list-style-type: none">▪ Improve performance
Problems Solved	<ul style="list-style-type: none">▪ Agency problem minimized▪ Strong managerial motivation▪ Managerial discipline from debt	<ul style="list-style-type: none">▪ Clear property rights▪ Agency problem minimized▪ Strong managerial motivation
New Problems	<ul style="list-style-type: none">▪ Limited financing capability▪ High debt burden	<ul style="list-style-type: none">▪ Limited financing capability▪ Application problems due to insufficient political, environmental, and managerial conditions
Performance Implications	<ul style="list-style-type: none">▪ Increased short-term performance▪ Controversial long-term performance	<ul style="list-style-type: none">▪ Reported short-term performance improvement▪ Unclear long-term performance

2.2 The Chinese Context

2.2.1 Chinese State Sector and Reform

SOEs were once the dominant economic organizations in China. They played a key role in its economy, and also took most of social welfare responsibilities such as “housing, education, medical services, and retirement incomes” (Oswald et al, 2005). Though SOEs were organized based on collective ownership, government agencies usually represented the “owners” to exercise supervising power over SOEs. Government control was often substantial (Lin & Zhu, 2001). Due to operational inefficiency and low productivity (Zhang, 2000), the state began the reform of its SOEs in 1979.

Unlike the former Soviet States and Eastern European countries which took the top-down approach in their economic reform, China has adopted a bottom-up approach in reforming its SOEs. Experiments were conducted in some selected places and then spread across the country. Lin and Zhu (2001) reviewed the Chinese SOE reform history and divided it into three periods: pilot reform (1979-1983), increasing enterprise autonomy (1984-1992), and ownership restructuring (from 1993 on). The pilot reform began when China started its policy of “opening-up to the outside” and economic reform in 1978. In this first period, some SOEs were selected for experimentations; decision-making power moved to the enterprise level and rewards were tied to performance. Two measures were adopted for the purpose of increasing financial incentives and strengthening budget constraints: “tax for profit” and “loan for (fiscal) grant”, which means using tax to replace annual profit requirements, and turning grants into loans.

The second period of reform, characterized by further increase in the decision-making authority enjoyed by SOEs, began in 1984 with the introduction of the “SOE Management

Responsibility System”, which was gradually promoted in the entire state sector. This new measure created robust performance improvements in SOEs in the following years, which lasted till the end of 1980s. After that, the SOE performance began to decrease and the percentage of loss-making SOEs increased steadily despite their greater autonomy. The lack of incentives on the sides of both government agencies and SOEs was one major contributing factor in this decline. Government agencies, though they represented SOE “owners” to monitor SOE operations, had limited motivation because they lacked the legal rights to claim the residual income as the private owners did. For SOE managers, the link of rewards to enterprise performance was often weak because of the influence of “egalitarianism”, an ideology of equal distribution of incomes.

Two undesired outcomes accompanied the deteriorating performance. One was frequent intervention from government agencies. Though the decentralization of decision power to the enterprise level was obvious, interference from government officials seemed to increase (Zhang, 1999). The second was an increase in managerial corruption due to increased managerial autonomies. For example, managers and workers often made gains at the expense of the enterprise (Fong & Lam, 2004). These undesired phenomena, as well as the worsening performance, paved the way to the third period of reform: ownership restructuring or privatization of SOEs.

For political reasons, China never uses the term of privatization in reference to the ownership restructuring of SOEs (Wei et al, 2005). Instead, it uses the term of “shareholding system”. In order to be consistent with the privatization literature, I use the term of privatization to describe government sales or partial sales of state ownership to private investors in the Chinese context.

2.2.2 Privatization of SOEs

China began its massive privatization initiative in 1993 when the Company Law was introduced, with a basic framework partially modeled on Western corporate organizations. Privatization in China means transferring firms' ownership status from state-owned to non-state-owned. Three types of ownership transfer have occurred: from SOEs to publicly-traded firms, to joint ventures owned by institutional investors, and to private firms owned by limited number of individuals (mostly managers). In each case, the government sometimes maintained a very limited share of ownership (Lin & Zhu, 2001). In this study, I focus on the third type of privatization, a form similar to management buyouts in the US context.

In China, the ownership restructuring occurred through arranged sales, auction, merger, bankruptcy, leasing and so on. There are four major actors in this process: the local government, SOE managers, SOE workers, and the banks (Garnaut et al, 2003). Local governments played a dominant role in the restructuring process because they legally controlled SOEs. SOE managers actively participated in this process because they often became the new owners in privatized firms. They often had significant bargaining power in negotiating terms with the local government. The SOE workers were primarily concerned with their job security. Banks were involved in the restructuring process because many SOEs owed debts to them.

Two factors became significant constraints in the privatization of SOEs: large number of surplus workers and heavy debt in SOEs. Surplus labor means that SOEs usually had far more employees than necessary. According to the citation by Hassard et al (2002) from *South China Morning Post* (May 7, 1997), the State Commission for Economic Restructuring predicted that 15-20 million surplus workers in the state sector would lose their jobs by 2000

and the estimated total number of surplus workers in SOEs were 54 million, close to half of the total workforce. Heavy debt burden is another constraining factor. Based on the Statistics on Industrial SOEs in *Statistic Yearbook* (China), the average debt-equity ratio in industrial SOEs from 1993 to 1999 is 1.89. That is to say, the debt level in SOEs was close to twice as much as equity.

In order to push forward the privatization process, the government provided some assistance in handling surplus workforce and heavy debt (Lin & Zhu, 2001). For example, the government sometimes helped placing the redundant work force. Financial liabilities sometimes were handled through debt-equity swaps, and some enterprises were granted preferential conditions or special treatments in debt payment based on different situations like management bargaining power. Despite the assistance from the government, the privatized firms often bear partial or full responsibilities to solve the problems of surplus workforce and heavy debt burden.

After privatization, four types of shareholders owned the former SOEs: the state (as a partial owner), institutions (mostly in the context of publicly-traded firms), management (often relatively or absolutely controlling the privatized firms), and employees. The corporate governance structures usually included shareholders and boards of directors.

The scope of privatization in China was substantial. According to Jesserson and Su (2006), the number of SOEs fell by nearly 50 percent in a five-year period from 1997 to 2001. More than 70 percent of small-sized SOEs have been privatized; the number of medium- and large-sized SOEs declined from 14,811 to 8675. Most of the remaining SOEs were waiting for privatization in the following years (Garnaut et al, 2003). By the time of 2003, the non-state sector in China had contributed more than 60 percent of its industrial production and

employed over 90 percent of Chinese employees. In addition, the total taxes contributed by the non-state sector to the Chinese government accounted for more than 70 percent.

Therefore, “China is indeed a market-oriented economy” (Fung, et al, 2006).

2.3 Competitive Environment for Privatized Firms

After SOEs are privatized, they may not enjoy the protection and support from the government any more. They have to handle market competition effectively for survival and growth. The remaining SOEs become their competitors. Because of possible “unfair competition” with SOEs (Walters & Monsen, 1979), owner-managers in privatized firms may need to be more innovative than employee-managers in SOEs (Tan, 2001).

Another group of competitors is from foreign countries. Since China opened its door to the outside world in late 1970s, its huge market size has been attracting numerous foreign investors. It has been the second biggest host for foreign direct investment (FDI) since 1994, surpassed only by the United States (Deng, 2001). In 2002, China surpassed the United States to become the world’s largest FDI recipient (Ng & Tuan, 2004). This situation has put China’s markets at a high competitive level because the competition is global: American, Japanese, European and local firms compete (Stuttard, 2000).

This competitive environment is likely to encourage privatized firms to use innovation such as R&D investments to gain competitive advantages. In addition, the extensive local presence of western firms creates pressures on Chinese firms, which benchmark the “best practice” found in the Western firms, and as such, the privatized firms in China can be compared to their Western counterparts.

2.4 Privatization Research in China

Most studies on privatization in China have been in the field of economics (e.g., Fung et al, 2006; Jefferson & Su, 2006; Lin & Zhu, 2001), emphasizing the privatization of SOEs to publicly-traded firms or to firms owned by institutional investors. These studies have focused on the antecedents of privatization (Guo & Yao, 2005), the privatization process (e.g., Fung et al, 2006; Lin & Zhu, 2001), and economic performance (e.g., Wei et al, 2005; Sun et al, 2002).

There is one study that focuses on “insider privatization”, in which insider managers purchase the firm from the government (Li & Rozelle, 2004). This type of privatization is similar to management buyouts in the Western context. Li and Rozelle studied how buyout contracts affect the economic performance in these privatized firms. Insider privatization in China usually occurs in small or medium-sized firms because it is more likely for managers to purchase them.

There is very little research on how privatization might influence managerial behavior in R&D investments in China. This dissertation attempts to fill the research gap by focusing on the “inside privatization”, i.e., management buyouts and investigating the relationship between privatization and R&D investments. Next chapter addresses the theoretical issues and hypotheses regarding the effect of privatization on R&D investments.

CHAPTER 3

THEORETICAL FRAMEWORK AND HYPOTHESES

This Chapter establishes the theoretical framework and develops the testable hypotheses. It includes three sections. The first section discusses R&D investments in privatized firms. This section focuses on the traditional theories and their problems in explaining the relationships between private ownership/firm debt and R&D investments. The traditional theories form a basis for the establishment of the direct impact of private ownership and firm debt on R&D investments. The second section presents a risk perception framework which would complement the traditional theories in addressing how private ownership and firm debt might affect R&D investments. The risk perception framework forms a basis for the establishment of the indirect impact of private ownership and firm debt on R&D investments. The last section develops specific hypotheses for testing. Figure 3.1 presents the research model of this study. In this model, risk bearing is an inferred construct.

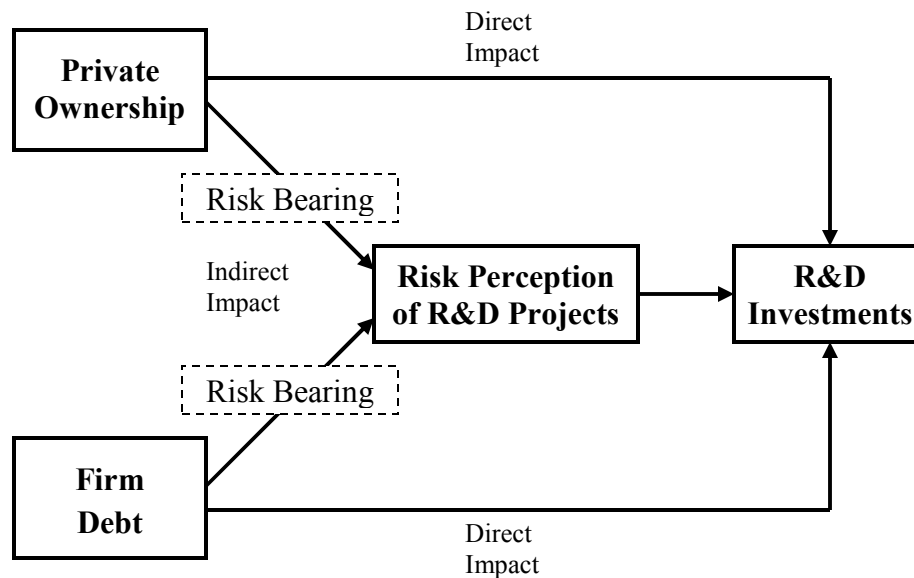
3.1 R&D Investments in Privatized Firms

3.1.1 R&D Investments

R&D investments have been treated as a critical innovation activity because of their importance to firm survival and growth. Research found that R&D investments have strong positive effect on firms' growth opportunities (Ho et al, 2006). There is also evidence that R&D investments are critical to privatized firms (Wright et al, 1998). For example, buyout firms with high R&D intensity outperformed other buyout firms with no R&D expenditures

(Long & Ravenscraft, 1993). Despite their importance, R&D investments are risky and involve a great likelihood of failure (Baysinger et al, 1991; Graves & Langowitz, 1993).

Figure 3.1 Research Model



The riskiness of R&D investments results from the situation that the outcomes of R&D investments are neither immediate nor certain (Lee & O'Neill, 2003; Wiseman & Gomez-Mejia, 1998). This intrinsic uncertainty in R&D investments leads to cost uncertainty of the project. During the stages of research and development, information is revealed to the innovators gradually, and investments can be sunk (Qian & Xu, 1998). Because of their risky nature, R&D projects may not produce any productive results (Dierickx & Cool, 1989). If a failure occurs, managers' personal wealth and job security could be influenced. In addition, R&D investments influence firms' short-term performance by decreasing net returns on the

current balance sheet (Baysinger & Hoskisson, 1989). Therefore, managers are often reluctant to invest in long-term R&D projects (Baysinger et al, 1991).

In addition to the risky nature, R&D investments are often firm specific because they generate knowledge-based assets within the firm (David & O'Brien, 2006). This firm specific feature of R&D investments creates causal ambiguity for outsiders (Dierickx & Cool, 1989). In addition, outsiders usually do not possess private information about R&D projects. Therefore, it would be difficult for outsiders to evaluate or monitor R&D activities (Chen & Huang, 2006; Dierickx & Cool, 1989). As a result, outsiders are often unwilling to finance R&D projects (Peyer and Shivdasani, 2001).

3.1.2 Theories about Private Ownership and R&D Investments

It has been argued that private ownership contributes to managerial behavior in R&D investments (Francis & Smith, 1995; Wright et al, 2000). There are two basic explanations for this argument. One explanation is associated with “high-powered incentives” produced by private ownership (Wright et al, 2000). This explanation has its roots in agency theory and the theory of property rights, which are interrelated. Agency theory deals with the agency problem derived from the agency relationship between a principal and an agent (Jensen & Meckling, 1976). An agency problem arises when goal conflict exists between the principal and the agent, and it is difficult and expensive for the principal to monitor the agent (Eisenhardt, 1989). Private ownership can be an effective way to solving the agency problem because of the owner-manager alignment. This alignment leads to strong incentives for managers to create more wealth for both the firm and themselves. For this reason, private ownership is expected to have positive impact on innovation projects such as R&D investments (Zahra, 1995).

Property rights theory argues that private ownership is more efficient than public ownership because the “concentration of benefits and costs [associated with business activities] on owners creates incentives to utilize resources more efficiently” (Demsetz, 1967). Under a public ownership system, an owner of a public property right does not need to bear the full costs of his activities. Others may not be willing to pay him appropriately for his activities. The owner cannot exclude others from enjoying the benefits of his efforts. Under this circumstance, the owner is unlikely to have the incentives to optimize the utilization of resources. R&D investments are often a long-term initiative and need sustained commitments (Dierickx & Cool, 1989). The success of R&D projects could produce high returns. However, if others ignore the innovator’s efforts and can enjoy the benefits of R&D success, the innovator may not have incentives to conduct R&D activities. With a private ownership, the resource owner is motivated to maximize the value of output because others would not enjoy the benefits without appropriate contributions (Henry, 1999). Under this circumstance, R&D investments are more likely to occur.

The second explanation for the positive relationship between private ownership and R&D investments is associated with the governance of R&D activities. Holmstrom (1989) argued that contractual governance structures or diffuse ownership structures are not effective for R&D projects. Because of the risky and firm specific nature of R&D, contracting and monitoring costs would be “especially high”. Reliable performance measures are hard to design due to high costs of obtaining information. Through the alignment of ownership with control, contracting and monitoring costs can be minimized. Francis and Smith (1995) found that diffusely-held firms have fewer patent awards and are more

sensitive to the timing of R&D investments, so they concluded that diffusely-held firms are less innovative than closely-held firms.

3.1.3 Theories about Debt and R&D Investments

Debt could be an important tool for financing investment projects. However, much research has shown that debt is negatively associated with R&D investments (Bhagat & Welch, 1995; Singh & Faircloth, 2005). One major explanation is the risky and firm-specific nature of R&D projects. On the firm's side, revealing information about the projects is a necessary condition for obtaining outside financing. However, the cost of revealing R&D information could be significant. Competitors may imitate or copy innovation ideas, decreasing the value of R&D know-how. Therefore, firms are urged to finance R&D projects internally (Hall, 1992; Myers & Majluf, 1984). Bloch's (2005) study found that internal funds are important in explaining R&D investments.

On the investor or lender's side, it is important to evaluate R&D projects before selection and to monitor their ongoing development process effectively. However, the uncertainty of R&D investments makes them difficult to measure and assess, so outside investors are likely to face adverse selection problems (David & O'Brien, 2006). Monitoring R&D projects is difficult because of information asymmetry and causal ambiguity (David & O'Brien, 2006; Dierickx & Cool, 1989). For this reason, debt holders are inclined to adopt a policy in favor of cash flow generation in the short term rather than supporting uncertain R&D ventures (Peyer and Shivdasani, 2001). If outsider investors are willing to finance R&D projects, they may ask for a high return due to high risk. That is to say, firms would incur a high cost of external financing. Therefore, firms are likely to choose to maintain lower levels of leverage (Singh & Faircloth, 2005).

Evidence has shown that R&D projects are less likely to be financed by debt. When examining how investment projects are financed, Hall (1992) found that firms are more likely to use debt to finance physical investment but not R&D projects because of the risky nature of R&D. Chiao's (2002) further study on the relationship between debt, R&D and physical investment had similar results. Chiao divided industries into nonscience-based and science-based and found that in nonscience-based industries, debt is a resource to finance both physical investment and R&D projects, but in science-based industries debt is only a resource to finance physical investment but not R&D.

Another explanation for the negative relationship between debt and R&D investments is the constraining effect of debt on investments due to debt payments (David & O'Brien, 2006; Rappaport, 1990). Debt reduces financial slack by incurring interest costs, thus substantially influencing firms' investment decisions (Devereux & Schiantarelli, 1990). The financial constraints resulting from high leverage would lead firms to invest in short-term cash flow projects (Whited, 1992). In order to "safeguard" financial strength, high R&D firms may opt to adopt lower leverage levels (Bhagat & Welch, 1995). Singh and Faircloth's (2005) empirical study found that debt negatively influence R&D expenditures.

3.1.4 Summary

The above literature review suggests a positive relationship between private ownership and R&D investments, and negative relationship between firm debt and R&D investments. Two factors contribute to the positive impact of private ownership on R&D investments: strong monetary incentives and better governance structures for R&D activities. Firm debt would influence R&D investments negatively because of the risky and firm-specific nature of

R&D investments, and the financial constraining effect of debt. From these theories, private ownership and firm debt would have direct impact on R&D investments.

However, there is also evidence that conflicts with these predicted relationships. For example, Beatty and Zajac's (1994) empirical study suggests that the larger the equity stakes held by managers, the more risk averse they are. The main reason is that equity stakes tie managers' wealth to firm performance, while firm performance is hard to predict. Therefore, managers are cautious about risky and uncertain projects. Sanders (2001) had similar findings that stock ownership makes managers less risk-taking. Because innovative activities such as R&D investments need risk-taking behavior (Jassawalla & Sashittal, 2002; Traynor & Traynor, 1997), ownership positions seem to have negative effect on R&D activities. Thus, private ownership does not necessarily lead to more innovative behavior, as predicted by the incentive-based models.

Wiersema and Liebeskind's (1995) study found that leveraged buyouts did not reduce their investments in unrelated businesses, compared with similar public firms. That is to say, high levels of debt were not found to have negative impact on firms' further investments. This finding suggests that the constraining effect of debt on investments may not always hold true. Debt may reduce firms' financial capability to invest, but debt may not reduce managerial behavior to invest. From this perspective, the negative relationship between debt and R&D investments, as explained by current theories, needs to be reexamined.

The conflicting evidence with existing theories discussed above may require new theoretical explanations on how private ownership and firm debt might influence R&D investments. R&D investments are risky (Baysinger et al, 1991). Based on their risky nature, R&D investments may be associated with how managers deal with risk. From this point of

view, private ownership and firm debt may influence R&D investments through managerial risk behavior. The following section introduces a risk perception framework to describe the risk issue owner-managers face in their pursuit of R&D projects. I argue that managerial risk perception toward R&D projects could be a possible link between private ownership/firm debt and R&D investments, that is to say, private ownership and firm debt may influence R&D investments indirectly. This indirect relationship might be used to explain the conflicting evidence presented by Beatty and Zajac (1994), Sanders (2001) and Wiersema and Liebeskind (1995).

3.2 A Risk-Perception Framework

The risk perception framework includes the following concepts: managerial perspectives of risk, risk perception of R&D projects, risk bearing, risk-taking behavior, and wealth motivation. Table 3.1 presents the definitions of these key terms in this study. In the following sub-sections, I explain these concepts in details and discuss how private ownership and firm debt might be linked to these concepts. These links form a basis for the hypotheses associated with the indirect impact of private ownership and firm debt on R&D investments.

3.2.1 Managerial Perspectives of Risk

In decision-making theory, risk is usually defined as “variation in the distribution of outcomes, their likelihoods, and their subjective values” (March & Shapira, 1987). It is most frequently associated with “outcome uncertainty” (Sitkin & Pablo, 1992), often measured by the variance of the probability distribution of possible gains and losses related to a specific alternative (Pratt, 1964).

Table 3.1
Definitions of Key Terms

Terms	Definitions
Managerial perspectives of risk	Managers treat risk as (1) uncertainty about negative outcomes; (2) magnitude of possible negative outcomes; (3) subjective risk
Risk perception of R&D projects	Perceived risk relative to R&D projects
Risk bearing	Perceived risk relative to managerial wealth
Risk-taking behavior	Decision-making behavior in risky contexts in which the expected outcomes of the decisions are uncertain
Wealth motivation	Managerial motivation to pursue wealth because of private ownership positions

In the business context, however, risk is often not perceived in the calculative process defined in decision theory. According to March and Shapira (1987), three differences between the normative theory concerning risk and managerial responses to risk are obvious. First, for most managers, risk is treated as uncertainty about negative outcomes. Uncertainty about positive outcomes is not looked upon as risk. Second, managers do not see risk as a probability concept. Instead, the magnitudes of possible outcomes would be more prominent to them. Third, managers do not objectively calculate risk. They “feel” risk, or perceive risk subjectively.

Two empirical studies, one by MacCrimon and Wehrung (1986) which used 509 Canadian and American executives as a sample, the other by Shapira (1986) which used 50 American and Israeli executives as a sample, provided support for March and Shapira’s (1987) managerial perspectives on risk. This study investigates managerial behavior in R&D

investments in the business contexts, so March and Shapira's managerial perspective on risk is appropriate.

3.2.2 Private Ownership, Motivation, and Risk Perception of R&D Projects

Private ownership creates strong motivation for managers to maximize their own wealth (Fox & Marcus, 1992). The wealth motivation would lead to cognitive biases. According to Tiger (1979), strong motivation tends to produce optimistic bias, which can be defined as "an inflated tendency to expect things to turn out well" (Baron, 2004). The optimistic bias creates overconfidence, an unrealistic optimism about future and an illusion of control (Kahneman & Lovallo, 1993; Simon et al, 1999).

Examples in the entrepreneurship literature demonstrate these cognitive biases. Cooper and colleagues' (1988) research has shown that in pursuing entrepreneurial opportunities, entrepreneurs tend to be more optimistic than non-entrepreneurs in their assessments of business situations. Other studies (Busenitz & Barney, 1997; Simon et al, 1999) have also provided evidence that entrepreneurs are subject to cognitive biases such as overconfidence and illusion of control.

Baron (1998) used an "affect infusion" model to explain why individuals' emotions would influence their cognitive process. The theory suggests that current affective states derived from one experience can influence or "infuse" judgments about other events. This model can be exemplified by the following observations: if an individual is experiencing a good mood, he or she tends to evaluate things or people around favorably. On the contrary, if an individual is feeling irritable, he or she would perceive things or people around negatively.

Theoretically, affect infusion can be defined as a process through which "affectively loaded information exerts an influence on and becomes incorporated into the judgmental

process, entering into the judge's deliberations and eventually coloring the judgmental outcome" (Forgtas, 1995). According to Forgtas, affect may influence people's thinking and judgments in many ways, including its valence effect, arousal features, motivational impact, and cognitive appraisal patterns.

Baron (1998) noted that a large body of literature supports the impact of affect on judgmental outcomes. For example, when decision makers are eager to do something, they are likely to overestimate their abilities and may not recognize the possible uncertainties (Busenitz & Barney, 1997). Thus, I propose that managers' strong wealth motivation triggered by private ownership would make them subject to cognitive biases such as overconfidence in their decision making.

When motivation for wealth causes cognitive biases, these cognitive biases in turn would influence individual risk perception of R&D projects. According to Kahneman and Lovallo (1993), cognitive biases like over-optimism could reduce individual perceived risk, and produce "bold forecasts" about the future. Some empirical studies offered support for this argument. For example, Keh et al (2002) used owners of small and medium-sized firms in Singapore as a sample and found that managers' illusion of control reduces their perceived risk. Simon et al (1999) had similar findings based on students' response to survey. Simon and Houghton's study (2002) showed that cognitive bias would make managers underestimate the threat of competition.

3.2.3 Risk Bearing and Risk Perception of R&D projects

According to agency theory, incentive programs should align the interests between stockholders and managers in public firms (Eisenhardt, 1989), so managers are supposed to act in stockholders' interests and improve the firm value. Despite expectations, though,

incentive programs in public firms, including outcome-based rewards, stock options, and equity positions, do not always work as expected because they sometimes make managers risk averse, thus discouraging managers' innovative behavior (Zahra, 1996).

When explaining why this would occur, Beatty and Zajac (1994) argued that organizational research has generally emphasized the positive side of incentives, but neglected one important negative outcome the incentive device would produce for managers: risk bearing, which is defined as perceived risk to one's wealth. They used managerial compensation as an example: though pay-for-performance contracts provide strong incentives for managers to improve firm performance, these contracts also cause managers to bear risk due to firm performance uncertainty, or firm risk. The link of firm risk to managerial risk bearing is through the nature of the managers' investment in their firms, which is "nondiversifiable and nontradable" human capital. With job loss, the manager loses the source of the capital. This potential loss is a risk bourn by the manager.

Because risk bearing is a kind of perceived risk, it is subject to change with situational factors. Wiseman and Gomez-Mejia (1998) proposed several factors may influence individual risk bearing: firm performance, stock options design, and the form of evaluation criteria. When the firm's performance has been strong, executives, to the extent that their wealth is linked to firm performance, tend to perceive themselves as risk bearers. Because executives' wealth is tied to firm performance, they face the possibility of losing more when they possess more. In contrast, bad conditions would make them bear low risk because they have little wealth to lose. While stock option programs can increase executives' risk bearing, the design of the options may lessen the risk. If the down-side risk of stock options is set to zero, that is, "the stock option value is insulated from any adverse consequences of risk

taking”, the program may not create risk bearing for the executives. The use of behavioral criteria, as opposed to outcome-based criteria, can increase managerial risk bearing because managers feel uncertain about how performance will be evaluated.

With these examples, we can see that the level of risk bearing is associated with two factors; one is the amount of wealth which could be influenced, and the other is how uncertain individuals perceive in the future. These factors are consistent with managerial perspectives of risk (MacCrimon & Wehrung, 1986; Shapira, 1986): the magnitudes, instead of probability, of possible negative outcomes are more important, and executives “feel” rather than quantify uncertainty.

In privatized firms, the risk owner-managers bear can be greater than employee-managers in public firms. Capital investments and their nondiversifiable nature make managers have more of their wealth attached to their firms. Future firm performance is hard to predict, so owner-managers would inevitably bear risk in the form of possible loss of their investments or wealth created by their investments. In addition, debt financing is often a condition for privatization. High levels of debt financing increase debt payments. This would have negative impact on short-term firm performance (Smart et al, 2004). Because managerial wealth is attached to firm performance, heavy debt loads would also make managers bear more risk.

Managers’ perceived risk to their wealth, i.e., risk bearing, is likely to contribute to their risk perception of R&D projects. According to affect infusion theory (Baron, 1998; Forgas, 1995), when managers feel that their wealth in the firm is being threatened, this affective state would influence their judgments about the R&D projects. They are likely to perceive more risk toward R&D investments because their wealth is perceived at risk.

In this study, risk bearing is used as an inferred construct which serves as a theoretical explanation on the relationships between the independent variables, i.e., private ownership and firm debt, and the moderator, i.e., risk perception of R&D projects.

3.2.4 Risk Perception and Risk Behavior

Risk behavior can be defined as individuals' decision-making behavior in risky contexts in which the expected outcomes of the decisions are uncertain, decision goals are difficult to achieve, or the potential outcomes include some unusual consequences (Sitkin & Pablo, 1992). Risk behavior can be risk-averse, risk-taking, or risk-neutral. According to Wiseman and Gomez-Mejia (1998), when people are risk averse, they prefer lower risk options at the expense of returns; if people are risk taking, they accept options where risk may not be fully compensated; and finally, when people display risk neutral behavior, they seek options where risk is compensated.

Much research has taken the assumption that risk perception affects risk behavior because decision makers are likely to perceive a risky situation first before making any decisions. Many studies have agreed that the relationship between risk perception and risk behavior is negative (Sitkin & Pablo, 1992). According to Sitkin and Pablo, this negative relationship is consistent with the findings of prospect theory, though prospect theory does not take into account risk perception explicitly. People are more likely to be risk averse when they are experiencing possible loss of their assets, i.e., high risk perception, than they are when there is nothing to lose, i.e., low risk perception.

Empirical studies have supported this negative relationship between risk perception and risk-taking decisions. For example, Sitkin and Weingart (1995) used MBAs and undergraduates as two separate samples and found that in both samples, the more risk

individuals perceive, the less likely they make risky decisions. The entrepreneurship literature has also provided much evidence about the negative effect of risk perception on risk-taking behavior. Using a scenario approach to determine if entrepreneurs exhibit unique cognitive processes in dealing with risk-taking, Palich and Bagby (1995) found that entrepreneurs do not perceive themselves as being more predisposed to risk-taking than non-entrepreneurs, but they perceive more strengths than weaknesses, more opportunities than threats, and more potential for performance improvement than deterioration. A study by Simon et al (1999) indicated that the risky new venture creation is associated with a lower level of risk perception. Cooper and his colleagues' (1988) also found that 95% of entrepreneurs are confident in their ventures' success, though statistics show that more than half of new ventures have failed.

3.2.5 Summary

The above analysis leads to the following theoretical framework for privatization: private ownership may reduce risk perception of R&D projects because of wealth motivation. Wealth motivation could cause over-optimistic biases, which in turn would decrease perceived risk to R&D investments. Private ownership may also increase risk perception of R&D projects because of risk bearing. Firm debt could contribute to risk perception of R&D projects because debt payments may increase risk bearing. Risk perception of R&D projects would have direct impact on managerial risk behavior toward R&D. These theoretical arguments lead to specific hypotheses associated with indirect impact of private ownership and firm debt on R&D investments, which is presented in the following section.

3.2.6 Theoretical Applications in China

This study adopts the incentive-based model which has been used to predict how privatization might influence R&D investments in the West. The incentive-based model should also apply in the Chinese context. SOEs were once a dominant economic organization in China. Because of unclear property rights, managerial motivation to improve firm performance was low. One major purpose of reforming SOEs was to increase managerial motivation. Linking managerial rewards to firm performance was an important incentive program. This link had produced significant performance improvement for some time (Lin & Zhu, 2001). Because of limitations of this non-ownership-based incentive, privatization was finally launched. Private ownership was expected to become a more powerful incentive device for managers to improve organizational effectiveness, and finally to improve the whole national economy. Therefore, incentives have also been recognized as critical in economic activities in the Chinese context.

The risk perception framework, which is developed to predict indirect effect of private ownership and firm debt on R&D investments, rests on the assumption of managerial perspectives of risk, i.e., subjective view of risk and magnitude rather than probability of negative outcomes being important. The managerial perspectives of risk should also apply to the Chinese context. A number of studies have been conducted about how Chinese people perceive risk and how their risk perception is influenced (e.g., Bontempo et al, 1997; Schmidt & Wei, 2006; Weber & Hsee, 1998). Among those influencing factors, cultural context is one of them.

According to McGrath and her colleagues (1992), uncertainty avoidance is a classic feature in Chinese culture. Change should not be forced by individuals because people assume “events have a natural course of action”. This culture has its origin in Confucianism,

with its emphasis on harmony and stable relationships (Ambler & Witzel, 2000). Hofstede (1980) and Trompenaars' (1994) cultural studies have shown that China has strong tendency toward uncertainty avoidance.

Bontempo and colleagues (1997) proposed that cultural factors should affect individuals' risk perception. In a culture characterized by high levels of risk avoidance, individuals' perceived risk would be affected more by potential losses and less by potential gains. Their empirical study on cross-cultural differences in risk perception found that compared with those from Western countries, respondents with Chinese cultural roots are more sensitive to the magnitude of potential losses and less influenced by the probability of positive outcomes. This finding is consistent with the managerial perspectives of risk identified by Shapira (1986) and MacCrimon and Wehrung (1986) in the Western context.

3.3 Hypotheses

3.3.1 Direct Impact of Private Ownership and Firm Debt on R&D Investments

a) Private Ownership and R&D Investments

Private ownership can produce strong incentives for owner-managers to pursue innovative projects such as R&D (Wright et al, 2000; Zahra, 1995) because R&D is likely to bring more value to the firm and the managers. In addition, private ownership would lead to more effective governance structures for R&D activities (Holmstrom, 1989; Francis & Smith, 1995). Francis and Smith's (1995) empirical study suggests that firms with diffuse ownership structures are less innovative than those with concentrated ownership structures. Therefore, owner-managers in privatized firms are likely to be more committed to R&D investments in order to create more wealth for themselves. The alignment of ownership with control would

minimize contracting and monitoring costs associated with R&D investments, thus making R&D activities more effective.

In the Chinese context, research on the relationship between ownership types and R&D investments is rare. One study by Zhang and colleagues (2003) examined how ownership might influence R&D efficiency. They used 8341 Chinese industrial firms as a sample and found that non-state firms have significantly higher R&D efficiency than state firms. They explained that high R&D efficiency may result from high R&D intensity. A possible reason is that R&D investments need a sustained commitment of energy and resources (Dierickx & Cool, 1989). Because of low R&D efficiency in the state sector, Zhang et al (2003) suggested that state ownership in centralized economies would stifle firm innovative activities such as R&D.

Because of the importance of monetary incentives in Chinese economy, as evidenced by the reform of SOEs, and the risky nature of R&D investments, I extend theories developed in the Western context to the Chinese context. I predict that more private ownership would strengthen motivational effects and governance structures for R&D activities. Chinese privatized firms are usually dominated by the largest owner-managers. The larger the stake these managers hold in their firms, the greater the incentives they would have, and the more effective the governance structures for R&D could be. These arguments lead to the following hypothesis:

Hypothesis 1: All other things being equal, the size of largest owner-managers' ownership is positively associated with R&D investments

b) Firm Debt and R&D Investments

The literature has identified a negative relationship between firm debt and R&D investments (e.g., Bhagat & Welch, 1995; Whited, 1992). On the one hand, debt would limit firms' financial capability to invest in R&D projects. On the other, debt is less likely to contribute R&D investments. Lenders may shy away from R&D projects because of their risky nature and information asymmetries; the innovator, in turn, would not be willing to use outside financing for fear of disclosing firm-specific R&D information.

In China, heavy debt burden in SOEs has become one major factor inhibiting privatization. It is not uncommon that the net value of many SOEs is negative. In this case, the government may have to compensate the new owners (Guo & Yao, 2005). The debt is largely the loan from the state banks. In order to obtain cooperation from the bank in privatization, many firms have to bear a significant level of debt (Guo & Yao, 2005; Lin & Zhu, 2001). Heavy debt would push managers to focus more on cash generation (Sing & Faircloth, 2005).

After privatization, the separation of the firm with the government is likely to put the firm in a difficult situation in obtaining bank loans, especially for the purpose of R&D investments. In market economies, lenders are often in favor of projects with strong cash generation prospects (Peyer and Shivdasani, 2001). As marketization progresses in China, the state bank is likely to become more market-oriented. It may also distance itself from the long-term uncertain projects such as R&D. Therefore, it would become hard for Chinese privatized firms to use debt to finance their R&D projects. That is to say, it is not very likely that a significant level of debt would contribute to R&D investments.

From the above arguments, the negative relationship between debt and R&D investments may still hold true in a Chinese context. Thus,

Hypothesis 2: All other things being equal, firm debt is negatively associated with R&D investments

3.3.2 Indirect Impact of Private Ownership and Firm Debt on R&D Investments

Hypothesis 1 and 2 predict direct relationships between private ownership/firm debt and R&D investments. This prediction does not take into account the risky nature of R&D investments, which may need risk-taking behavior. However, people may not be risk-taking by nature (Eisendardt, 1989). If this is true, how would owner-managers launch risky R&D investments? This question leads to the arguments about indirect relationships between private ownership/firm debt and R&D investments.

a) Private Ownership and Risk perception of R&D Projects

Ownership positions represent the extent of interest owner-managers hold in their firms, and also represent the extent to which managers identify their interests with the interests of the firm. More ownership means more managerial interests in the firms, which in turn would trigger higher managerial motivation to create more firm interests. Strong motivation tends to bring about optimistic bias (Tiger, 1979). This optimistic bias could reduce individual risk perception (Kahneman & Lovallo, 1993). Therefore, managers with high personal stake in their firms are likely to perceive low risk related to R&D projects.

High ownership positions may also lead to high risk bearing because managers have tied much of their personal interests to the firm performance (Wiseman & Gomez-Mejia, 1998). However, when high motivation occurs, managers are likely to ignore the possible uncertainties lying ahead of them (Busenitz & Barney, 1997). From this point of view, high motivation would soften risk bearing. In a Chinese context, most managers had been earning

limited salary in their previous SOEs. The economic transition provides them with attractive opportunities to earn more money (Hoskisson et al, 2000). This situation possibly strengthens owner-managers' motivation to pursue personal interests which were hardly obtainable previously.

Though low ownership positions mean low risk bearing, managers' motivation to create firm value could also be low because of limited personal stake in the firm. Chinese culture is characterized by uncertainty avoidance which would lead to risk averse behavior (Yates & Lee, 1996). Under this culture, managers may not change their risk attitude without influencing factors. For example, Tse and colleagues (1988) investigated whether managers' home culture would influence their decision-making and found that executives in mainland China were more likely to decrease their exposure to failure than Hong Kong and Canadian executives. Though executives from Hong Kong may share traditional Chinese heritages, they were influenced by their exposure to Western business practices. As a result, they were more likely to adjust their risk behavior. Other studies have shown that hostile environments lead individuals to become more risk-taking in China (Tan, 1996; Tan, 2001). In this study, I argue that high personal stakes in the firm could also make Chinese people adjust their risk behavior because high stakes would create high motivation.

In China, the largest owner-managers usually hold dual positions: chairperson of the board of directors and general manager (equivalent of CEO). This "CEO duality" would provide the largest owner-manager with undivided formal authority, thus leading to non-separation of decision management and decision control (Finkelstein & D'Aveni, 1994). That is to say, the largest owner-manager would have the dominant power to determine the firm's strategic and operational issues. Therefore, it can be reasonably argued that the largest

owner-manager's behavior would influence the firm behavior dominantly, and the largest owner-manager's risk perception could represent the firm-level risk perception. These arguments lead to the following hypothesis:

H3: All other things being equal, the size of largest owner-managers' share is negatively associated with risk perception of R&D projects

b) Firm Debt and Risk Perception of R&D Projects

A high level of debt can reduce operating margin due to the payment of high loan interests (Smart et al, 2004), and damage operating effectiveness such as reducing flexibility to environmental change, and reducing ability to seize new opportunities (Seth & Easterwood, 1993). Thus, heavy debt loads would influence firm performance negatively.

In Chinese privatized firms, managers may not bear much personal debt. Debt is often associated with the firm and inherited from previous SOEs. However, this firm debt could also impose significant impact on the owner-managers. After SOEs were privatized, the owner-managers would find it difficult to diversify their investment risk, as well as their employment risk. As the marketization process advances in China, the labor market is gradually becoming mature. If a manager cannot run his own business well, his or her reputation is likely to be influenced negatively. As a result, finding a good job in other places would become difficult. Therefore, it is likely that the Chinese owner-managers have attached their wealth and personal career tightly to their firms. If their firms fail, they would lose everything. Under this circumstance, the uncertainty about firm performance could increase managerial risk bearing significantly. Because a high level of debt would have

negative impact on firm performance, managers are likely to bear high risk associated with their wealth in their firms.

Because current emotional states could influence individuals' judgments about other events (Baron, 1998; Forgtas, 1995), it is expected that when owner-managers have more perceived risk to their wealth due to increased debt level in their companies, this perceived risk would contribute to their risk perception towards the R&D projects. That is to say, debt may have positive impact on managerial risk perception. The above arguments lead to the following hypothesis:

H4: All other things being equal, firm debt is positively associated with risk perception of R&D projects

c) Risk Perception of R&D Projects and R&D Investments

Because of the risky nature of investments in R&D projects, a large body of research has proposed that innovative activities such as R&D need risk-taking behavior (e.g., Jassawalla & Sashittal, 2002; Traynor & Traynor, 1997). Because risk perception has been reported to have a negative relationship with risk-taking behavior (Palich & Bagby, 1995; Simon et al, 1999; Sitkin & Weingart, 1995), it seems that perceiving low risk would facilitate managerial pursuit of R&D.

Conventional wisdom suggests that risk and return are positively correlated (Brealey & Myers, 1981). If a negative relationship between risk perception and R&D pursuit exists, it appears that people prefer lower-return projects. However, the proposed negative relationship between risk perception and R&D investments may not conflict with individuals' pursuit of high-return projects. This can be explained by the difference between subjective and

objective risk associated with a project. In the business field, managers take a risky action because they may not perceive the action's riskiness (Kahneman & Lovallo, 1993; March & Shapira, 1987). That is to say, risk-taking behavior might not respond to the real risk messages (Brown, 2005). There is evidence that people even deliberately adjust their perception about risk to reduce anxiety related to risk taking (Lieberman & Chaiken, 1992). Thus, perceiving low risk toward a project does not necessarily mean managers prefer low-return.

Chinese culture is generally characterized by uncertainty avoidance (McGrath et al, 1992). This type of culture even more likely pushes individuals to perceive low levels of risk before taking any risky actions. Thus, the following hypothesis is developed:

H5: All other things being equal, risk perception of R&D projects is negatively associated with R&D investments

d) Mediated Relationship between Private Ownership and R&D Investments

Hypothesis 3 and Hypothesis 5 propose that private ownership influences risk perception, and risk perception in turn influences R&D investments. These arguments suggest that risk perception of R&D projects might be a link between private ownership and R&D investments. In other words, risk perception of R&D projects may mediate the relationship between private ownership and R&D investments. Sitkin and Pablo (1992) have recognized the role of risk perception in mediating the relationship between situational factors and individual risk behaviors. When a situation increases one's perceived risk, risk aversion often arises; if a situation reduces one's risk perception, a risk taking behavior may be triggered, though the objective risk may still be unknown.

Mediation can be full or partial. A partial mediation means that an independent variable influences a dependent variable both directly and indirectly (Simon et al, 1999). This study explores the relationship between private ownership and managerial behavior in R&D investments through a risk perception lens, but it does not exclude the possibility that private ownership may influence R&D activities directly. Hypothesis 1 predicts the direct relationship between private ownership and R&D investments. Therefore, I develop the following hypothesis:

H6: All other things being equal, the relationship between the largest owner-managers' share and R&D investments is partially mediated by risk perception of R&D projects

e) Mediated Relationship between Firm Debt and R&D Investments

Hypothesis 4 predicts that firm debt affects risk perception of R&D projects, and Hypothesis 5 proposes that risk perception of R&D projects affects R&D investments. Therefore, it could be that risk perception of R&D mediates the relationship between firm debt and R&D investments. Because firm debt might influence R&D investments directly, as predicted in Hypothesis 2, the mediated relationship between firm debt and R&D investments is likely to be partial. Therefore, I develop the following hypothesis:

H7: All other things being equal, the relationship between firm debt and R&D investments is partially mediated by risk perception of R&D projects

In summary, I propose two sets of hypotheses: one set is associated with the direct effect of private ownership and firm debt on R&D investments, and the other set associated with the indirect effect of private ownership and firm debt on R&D investments. Table 3.2

summarizes the two sets of hypothesis and the underlying theories which support those hypotheses. In the next chapter, I discuss data sources, collection, and analysis to test all the hypotheses.

Table 3.2
Summary of Hypotheses and Underlying Theories

	H	Independent Variables	Dependent Variables	Relationship	Basic Ideas	Authors
Direct Impact of Private Ownership and Firm Debt	H1	Private ownership	R&D investment	Positive	Private ownership produces strong incentives for R&D Private ownership leads to effective governance structures for R&D	Wright et al (2000) Zahra (1995) Holmstrom (1989) Francis & Smith (1995)
	H2	Firm debt	R&D investment	Negative	Debt reduces financial flexibility R&D investments are less likely financed by debt	Rappaport (1990) Singh & Faircloth (2005) Bloch (2005) Peyer & Shivdasani (2001)
Indirect Impact of Private Ownership and Firm Debt	H3	Private ownership	Risk perception	Negative	Motivation causes cognitive biases, reducing risk perception	Tiger (1979) Baron (2004) Kahneman & Lovallo (1993)
	H4	Firm debt	Risk perception	Positive	Debt reduces operational performance Risk bearing leads to risk perception due to affect infusion	Smart et al (2004) Seth & Easterwood (1993) Baron (1998) Forgas (1995)
	H5	Risk perception	R&D investment	Negative	Innovative activities such as R&D needs risk-taking behavior Negative relationship between risk perception and risk-taking behavior Managerial perspectives of risk	Jassawalla & Sashittal (2002) Traynor & Traynor (1997) Simon et al (1999) Sitkin & Weingart (1995) March & Shapira (1987)
	H6	Private ownership	R&D investment	Partially mediated	Integrating H1, H3, and H5	
	H7	Firm debt	R&D investment	Partially mediated	Integrating H2, H4, and H5	

CHAPTER 4

RESEARCH METHODOLOGY

This chapter describes the research methods employed in this study. First, I discuss the sample appropriate for this study, and explain the data collection procedures. Second, I discuss the survey design and the pre-test to check the applicability of the survey in the Chinese context. Third, I describe the dependent, independent, moderator, and control variables included in this study and discuss how I measure them.

4.1 Sample

4.1.1 Data Collection and Survey Design

Data for testing the hypotheses came from China and were obtained by survey. The sample is composed of privatized companies who were formerly small to medium-sized SOEs. In order for all the sampled companies to be comparable, I only focused on those which are in the manufacturing field. In addition, the size of the sampled companies satisfies the following two conditions: the number of employees exceeds 100 and the value of total assets exceeding 8 million *yuan* (approximately \$1 million). For the purpose of this study, the sampled companies were privatized by means of management buyouts or “insider privatization” (Li & Rozelle, 2004).

The sample is focused on two types of industries with high and low R&D intensity respectively. R&D intensity is defined as the percentage of R&D expenditures to sales in an industry. R&D investments in privatized firms are likely to be affected by industries’ R&D

intensity (Fox & Marcus, 1992). Therefore, this design can compare two groups of industries, and the empirical results would provide implications on how industry characteristics might affect the relationship between private ownership/firm debt and R&D investments. The data for industry R&D intensity were obtained from *China Statistical Yearbook on Science and Technology*. Because of the unavailability of the data in the years of 2002, 2003, and 2005, I used a three-year average (2000, 2001, and 2004) to measure the industry R&D intensity. The group of high R&D industries is composed of four industries with an average of R&D intensity being 2.43; the group of low R&D industries also comprises four industries with an average R&D intensity being 0.50. The difference in R&D intensity between the two groups of industry is nearly five times. This difference ensures a comparison between the two groups of industry. Table 4.1 shows a description of the two groups of industry.

Table 4.1
High and low R&D industries

High R&D Intensity Industries (%)					
	2000	2001	2004	Average	Group Average
Chemical Products	2.07	1.8	1.6	1.84	2.43
Electronic & Telecom	2.98	2.8	1.8	2.60	
Electrical equipment	3.02	3.4	2.0	2.90	
Measuring Instruments	2.46	2.0	1.9	2.38	
Low R&D Intensity Industries (%)					
	2000	2001	2004	Average	Group Average
Garment/Fiber products	0.53	0.50	0.40	0.48	0.50
Miscellaneous	0.47	0.50	0.15	0.37	
Food Manufacturing	0.54	0.50	0.70	0.58	
Furniture Manufacturing	0.57	0.80	0.30	0.56	

Note: Miscellaneous products include those products made from wood, bamboo, leather, fur, etc.
(Source: China Statistical Yearbook on Science and Technology)

The background of this study is the controversy about the relationship between privatization and firm innovative activities such as R&D in the U.S. context. In order to for this study to shed light on this controversy, it is necessary to make the sampled firms more comparable to the buyout firms in the US context. Therefore, I chose two most developed provinces in terms of total number of private companies: Zhejiang and Jiangsu. Both provinces are on the top 5 list based on a five-year average (from 1997 to 2001, data source: *China Statistical Yearbook*). Besides, these two provinces are adjacent to each other with similar economic and cultural conditions. Table 4.2 describes Top 5 provinces in terms of the number of private enterprises.

Table 4.2
Number of Private Enterprises by Province (1,000)

Provinces	1997	1998	1999	2000	2001	Average	Ranking
Guangdong	120	141	161	184	211	163	1
Zhejiang	92	100	146	179	209	145	2
Jiangsu	70	108	136	174	225	143	3
Shanghai	69	95	110	138	176	118	4
Shandong	77	98	121	141	145	116	5

Because privatization and marketization are progressing hand in hand in China (Child & Tse, 2001), the regions with more private businesses can also be more developed in terms of market-oriented operation. In addition, marketization is often associated with the development of market-based institutions (Meyer, 2001), which ensure that private businesses can operate based more on market rules. These conditions would reduce the influence of non-market-related factors, especially political factors, on managers' innovative behavior in their privatized firms.

The survey was originally developed in English and then translated into Chinese by a person who is bilingual. Then, the two versions of survey were cross-checked by two bilingual Ph.D. students in Kenan-Flagler business school. I finally sent the Chinese version of questionnaire to two business managers in China to make sure that no misunderstanding existed.

The survey subjects are the largest owner-managers in privatized firms, who are usually the chairperson and general manager. I entrusted the task of data collection to two persons in China: one was a bank employee in Zhejiang province, and the other was a government employee in Jiangsu province. In China, the bank and the government are two organizations which are able to get access to businesses widely and relatively easily. A two-step pretest was first conducted in Zhejiang province to check the applicability of the survey design and the reliability level of the risk perception measure developed by Simon and colleagues (1999). The bank employee first obtained the basic information about the privatized firms from his bank database. Then, he selected those companies which matched the requirements of my study.

The first pre-test was made in order to check the applicability of the survey. This pre-test exposed the difficulty in data collection with the originally designed survey. Two problems existed. One was that many general managers refused to answer some “sensitive questions” like personal investments in their companies. The reason is that they did not really invest as much money as proportionate to their share percentages because they enjoyed some preferential treatments. The second problem with the original survey was gathering historical data in a five-year period. Many of owner-managers were unwilling to track the financial data more than three years ago. In a period of one and a half months, only six complete

responses were obtained. Based on this feedback, I modified the initial questionnaire, including removing the sensitive items and changing the historical period from five years to three years.

After the survey was modified, the second pre-test was started to check the reliability of the risk perception measure. This pretest was based on 41 completed questionnaires. The internal consistency was validated by high Cronbach's alpha coefficient ($\alpha = 0.82$). After the confirmation of the variable reliability, data collection in Zhejiang province continued and also started in Jiangsu province. The data collection process was different in these two provinces. In Zhejiang province, the bank employee used client visits to get the survey filled out. He sent the questionnaire to different offices across the province and asked his colleagues to bring the survey to the general managers of the privatized firms when they were paying customer visits.

Data collection in Jiangsu province was conducted through a mail survey. The government employee first obtained a list of privatized firms from the relevant governmental office. The office keeps a record of basic information about all the privatized firms, including company size and business scopes, so the government employee could select those companies which meet the requirements of the survey. Then, he randomly selected 100 companies and mailed the questionnaire to the selected companies. In order to encourage the business owners to respond, he, as a government official, wrote a letter and attached the letter to the questionnaire, and he also made calls personally to some companies.

A total of 127 responses were finally obtained in the two provinces. Among them, 11 responses were not complete, 16 did not meet the requirements of the study, and 7 were "outliers" because the R&D investments in these companies were ten times more than the

average of all other companies in each group of industry. Therefore, the usable size of the sample is 93. Table 4.3 describes the distribution of the sample.

Table 4.3
Sample Distribution (n = 93)

Locations		Industries	
Zhejiang Province	Jiangsu Province	High R&D Intensity	Low R&D Intensity
n = 54	n = 39	n = 51	n = 42

4.1.2 Sample Size

According to Verma and Goodale (1995), sample size is a function of three factors: the significance level (α), statistical power, and effect size. Because Type I and Type II errors are dependent upon each other and reducing Type I will increase Type II error, a high level of α leads to a low level of statistical power. In most of the social and behavioral sciences, α is taken to 0.05, and statistical power should be 0.80 to test the hypotheses (Cohen, 1992). Effect size is used to measure the strength of relationship between populations of interest. Because of the complexity of calculating effect size, Cohen (1988) suggested three levels of effect size – small, medium, and large effects – as rough guidelines in social and behavioral sciences. Dallal (1986) calculated the sample sizes associated with the three levels of effect size based on α equal to 0.05 and statistical power to 0.80 and concluded that the sample size should be 17 on a large effect, 44 on a medium effect, and 271 on a small effect. In this study, the sample is privatized firms converted from SOEs in the manufacturing field. The survey subjects are the largest owner-managers of the privatized firms and who were also the leaders of their previous SOEs. These common features in the sample can ensure a certain level of

similarity between the sample and the whole population. Therefore, a medium level of effect size should be sufficient. Because the minimum requirement of the sample size is 44, a sample size of 93 in the study meets this requirement.

4.2 Measures

a) Independent Variables

In this study, independent variables include the largest owner-manager's share and firm debt level. I measured the *Largest Owner-Manager's Share* as the relative share position the largest owner-managers hold in their privatized firms. *Firm Debt* was measured as the ratio of debt to assets and calculated as an average in a three-year period (2003-2005).

b) Dependent Variable

The dependent variable, *R&D Investment*, was measured as the percentage of R&D expenditures to sales based on a three-year average (2003-2005).

c) Mediator

In this study, the mediator is *risk perception of R&D projects*. The largest owner-manager's risk perception was used to represent firm-level risk perception. This study adopted a measure developed by Simon et al (1999) which includes eight items. The scale had a Cronbach's alpha of 0.85. For the purpose of this study, I adapted this scale by changing the term used to describe the new project (ODI's contact lens) to R&D projects. The largest owner-managers were asked to describe their attitude toward R&D projects in the past three years (2003-2005). A seven-point scale was used (where 1 = strongly disagree and 7 = strongly agree). The final score was based on the average of the eight items. Among eight

questions, two were reversely scored. The risk perception measure used in this study is as follows:

I often thought that ...

1. The probability of R&D projects doing poorly would be low
2. There was great uncertainty about how well R&D projects would do in the future
3. The amount my company could lose by introducing R&D projects was substantial
4. The overall riskiness of R&D projects was low
5. The option of introducing R&D projects was something negative
6. The introduction of R&D projects was a potential loss
7. The introduction of R&D projects would have positive ramifications for my company's future
8. There would be a high probability of my company losing a great deal by introducing R&D projects

d) Control Variables

SOE Tenure After Chinese SOEs were privatized, the former SOE leaders usually became the largest owners and also the general managers of the privatized firms. Research on Chinese SOE managers has shown that they tend to be conservative and avoid risky decisions (Adler et al, 1992; Nee, 1992; Tan, 2001). According to Abelson (1976), individuals' past behavior would shape their cognitive structures which in turn influence their future behavior. Nguyen and colleagues' (2005) empirical study on SOE reform in Vietnam supports Abelson's proposal: SOE managers' traditional ideology has imposed serious obstacles to their innovative behavior in the SOE reform processes. The formation of individuals' cognitive structures is a gradual process. The more times individuals have experienced similar episodes in similar situations, the more stable the cognitive structures (Abelson, 1976). Therefore, the largest owner-managers' tenure at SOEs might influence their

innovation behavior in their privatized firms. This study controls for this possible effect, which is measured as the years when the largest owner-managers served as the leaders at SOEs.

Government ownership In the Chinese context, the government sometimes retains some shares (called state-share) in privatized firms. This state-share arrangement makes the government an interested party in these firms. Though the Chinese economy is transitioning from the centrally-planned to the more market-oriented one, the government still can impose significant influence on the private sector. For example, most privatized firms usually bear a significant level of debt which often takes the form of bank loans inherited from previous SOEs. After SOEs were privatized, the bargaining power of the bank would increase because the privatized SOEs have lost the government protection they enjoyed before. According to Smith and Warner (1979), this increased power on the side of debt providers will lead to managerial risk aversion behavior because the debt providers are usually hesitant to provide financial support for the risky projects. If the government is an interested party, it would likely offer assistance to the privatized firms such as helping firms ease immediate payback pressure by negotiating preferential loan terms for the firms. This support would decrease the degree of owner-managers' risk aversion when they are facing increased bargaining power on the side of the bank. Therefore, the effect of the government should be controlled. One dummy variable is used, with government ownership coded 1 and non government ownership coded 0.

Industry This study uses data from two types of industry with low and high R&D intensity individually. It would be very likely that high R&D industries require more R&D

investments for firms to survive and grow. One dummy variable is used, with high R&D industries coded 1 and low R&D industries coded 0.

SOE performance The performance of privatized firms could be influenced by their previous SOEs' performance. Good performance can increase firms' financial capability which may facilitate R&D activities. Given the situation that the independent sources of SOE performance data are not available in China, I asked the general managers to assess their previous SOEs' performance status based on a five-point scale (where 1 = very poor and 5 = very good).

Employee Redundancy Under the former centrally-planned economic system of China, most SOEs were over-staffed because recruitment was not based on business needs but on "plan" or "quotas" created by the government agencies. In the privatization process, the placement of "redundant employees" has become a serious problem (Gao & Yao, 2005; Lin & Zhu, 2001). In many situations, the privatized firms are required to "absorb" those redundant employees, which would decrease firms' financial capability, and thus R&D investments. Employee redundancy is measured by the number of employees who were thought to be redundant and placed by the privatized firms, instead of by the government.

Firm Size The literature offers contradictory findings about the relationship between firm size and innovative behavior (Damanpour, 1992). Large firms may facilitate R&D activities due to rich resources, but they are also likely to obstruct R&D initiatives because of possible rigidity and bureaucracy. In this study, I expect that firm size would impose negative influence on firm R&D activities because inefficient large SOEs may not change their bureaucratic practices quickly after being privatized. Firm size is measured as the logarithm of firm assets.

Managerial Age In this study, I expect managerial age would negatively influence innovative behavior. The older a manager is, the longer he or she would have stayed in SOEs, and the more difficult the manager could adjust to the market-based practice. SOE managers have been found to be less innovative than entrepreneurs (Tan, 2001). A long time of exposure in SOEs would have negative impact on their innovative behavior. Managerial age is measured as the largest owner-managers' age.

e) Summary

The measurement of the independent and dependent variables and the moderator is summarized in Table 4.4.

4.3 Data Analysis

SPSS 13.0 was applied to test all the hypotheses, including direct relationships and mediated relationships. I used three regression analyses to test the direct relationship proposed in Hypotheses 1, 2, 3, 4, and 5. The first model tested Hypotheses 1 and 2 by regressing R&D investments on private ownership and firm debt. The second model examined Hypothesis 3 and 4 by regressing risk perception on private ownership and firm debt. Model 3 investigated Hypothesis 5 by regressing R&D investments on risk perception.

To test the mediated relationship posited in Hypotheses 6 and 7, I used Baron and Kenney's (1986) method that four conditions have to be met to establish a mediated relationship. The first condition is that the independent variables affect the mediator, which is the second regression model in this study. The second condition is the influence of the independent variables on the dependent variable. The first regression model examines if two independent variables, private ownership and firm debt, affected R&D investments directly.

Therefore, Model 1 tests the second condition. The third mediation condition is whether the mediator influences the dependent variable. In this study, the Model 3 describes this condition. Finally, the fourth condition is met if the effect of the independent variable on the dependent variable is less when the mediator exists than when the mediator does not exist. I used a fourth model by regressing R&D investments on private ownership, firm debt, and risk perception. If mediation exists, the effect of private ownership and firm debt on R&D investments should decrease when risk perception is included in the equation. A partial mediation means the effect of private ownership and firm debt on R&D investments is significant when the four conditions are met.

Table 4.4
Variables and Their Measurement

Variables	Measurement
R&D investments	Percentage of R&D expenditures to sales, based on a three-year average (2003-2005)
Risk perception of R&D projects	Largest owner-managers' risk perception towards R&D projects in the past three years (2003-2005), using eight-item average based on seven-point scale
Private ownership	Largest owner-manager's relative ownership position
Firm debt	Ratio of debt to asset, based on a three-year average (2003-2005)
Industry	Dummy variable
State ownership	Dummy variable
Firm size	Measured as assets (<i>yuan</i>) based on a three-year average (2003-2005)
Employee redundancy	Redundant employees placed by privatized firms
SOE performance	Largest owner-managers' assessment of SOE performance based on five-point scale
SOE tenure	Years during which the largest owner-managers served as a leader in SOEs
Managerial age	Largest owner-manager's age

CHAPTER 5

RESULTS

This Chapter presents the empirical results in three sections. First, I describe descriptive statistics and bivariate correlations for key variables used in the study. Second, I present multivariate analyses based on pooled sample combining both low and high R&D industries. Finally, I conduct multivariate analyses based on separate samples, i.e., low and high R&D industries.

5.1 Descriptive Statistics

First, the data were screened for potential problems such as violations of assumptions of normality. Skewness values range from -0.20 to 2.11, indicating normal distributions. Except for 7 outliers initially identified and removed from the final sample, no other outliers were detected. Table 5.1 summarizes the descriptive statistics and bivariate correlations.

As seen from Table 5.1, SOE Tenure and Managerial Age are highly correlated. Given that both variables are associated with the same person and measured with years, it is appropriate to remove one variable in order to avoid multi-collinearity. In this study, I keep the variable of SOE Tenure.

Table 5.2 and 5.3 summarize the descriptive statistics and bivariate correlations associated with two separate groups of industry: low and high R&D industries. One difference between the separate samples and the pooled sample deserves attention: R&D investments and risk perception are not correlated in pooled sample, but correlated in both

Table 5.1
Descriptive Statistics and Bivariate Correlations (Pooled Sample)

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10
1. R&D investments	1.89	1.24										
2. Risk perception	2.91	0.94	-0.04									
3. Private ownership	0.45	0.16	0.11	-0.29**								
4. Firm debt	0.58	0.13	-0.46**	0.30**	-0.18							
5. Industry	0.55	0.50	0.77**	0.34**	-0.08	-0.22*						
6. State ownership	0.14	0.35	-0.03	0.17	-0.30**	0.17	0.12					
7. Firm size	3.88	0.40	-0.10	0.14	-0.49**	0.22*	0.03	0.39**				
8. Redundancy	66.89	113.63	-0.01	0.07	-0.27*	0.11	0.09	0.33**	0.47**			
9. SOE performance	2.32	0.57	0.21*	-0.29**	0.08	-0.16	0.06	0.10	0.00	-0.02		
10. SOE tenure	7.05	2.34	-0.06	0.23*	-0.12	0.05	0.03	0.10	0.11	0.06	-0.23*	
11. Managerial age	48.74	4.57	-0.14	0.17	0.01	0.23*	-0.12	0.07	0.19	0.16	-0.24*	0.58**

Table 5.2
Descriptive Statistics and Bivariate Correlations (Low R&D Industries)

Variables	Mean	SD	1	2	3	4	5	6	7	8	9
1. R&D investments	0.84	0.40									
2. Risk perception	2.56	0.65	-0.50**								
3. Private ownership	0.47	0.15	0.47**	-0.51**							
4. Firm debt	0.61	0.09	-0.42**	0.40**	-0.29						
5. State ownership	0.10	0.30	-0.07	0.13	-0.19	0.25					
6. Firm size	3.87	0.39	-0.33*	0.32*	-0.47**	0.27	0.24				
7. Redundancy	55.74	86.43	-0.22	0.14	-0.34*	0.19	0.17	0.48**			
8. SOE performance	2.29	0.51	0.34*	-0.35*	0.14	-0.05	0.14	-0.01	-0.22		
9. SOE tenure	6.98	2.41	-0.23	0.28	-0.31*	0.07	0.07	0.23	0.18	-0.35*	
10. Managerial age	49.36	4.42	-0.19	0.36*	0.15	0.19	0.12	0.33*	0.24	-0.36*	0.54**

Table 5.3
Descriptive Statistics and Bivariate Correlations (High R&D Industries)

Variables	Mean	SD	1	2	3	4	5	6	7	8	9
1. R&D investments	2.76	1.01									
2. Risk perception	3.20	1.05	-0.52**								
3. Private ownership	0.44	0.17	0.24	-0.18							
4. Firm debt	0.55	0.15	-0.48**	0.40**	-0.17						
5. State ownership	0.18	0.39	-0.22	0.15	-0.35**	0.18					
6. Firm size	3.88	0.38	-0.17	0.06	-0.51**	0.22	0.49**				
7. Redundancy	75.24	132.13	-0.10	0.01	-0.23	0.12	0.39**	0.49**			
8. SOE performance	2.35	0.63	0.26	-0.33*	0.05	-0.18	0.07	0.01	-0.06		
9. SOE tenure	7.12	2.30	-0.12	0.23	-0.04	0.06	0.20	0.01	0.01	-0.15	
10. Managerial age	48.24	4.68	-0.04	0.17	0.10	0.22	0.07	0.10	0.15	-0.15	0.64**

separated samples. There are three differences between the two groups of industries. First, the mean of R&D investments in high R&D industries is more than 3 times as much as that in low R&D industries. Second, the mean of risk perception of R&D projects in high R&D industries is higher than in low R&D industries. Third, private ownership is correlated with R&D investments and risk perception in low R&D investments, but not in high R&D industries. In both groups of industry, SOE tenure and managerial age are highly correlated, so it is appropriate to remove one of them.

5.2 Findings from Multivariate Analysis

Multivariate regression analyses were performed to test all seven hypotheses. The analyses were conducted in two steps. The first step was to test the hypotheses on the basis of a pooled sample combining both low and high R&D industries. The second step was to use low and high R&D industries separately. The purpose of the second step was to examine how private ownership and firm debt might influence R&D investments in different types of industry. Table 5.4 and Table 5.5 summarized the results of the two-step analyses.

5.2.1 Findings from Pooled Sample

(a) Direct Impact of private ownership and firm debt on R&D investments

Hypothesis 1 suggested a positive relationship between private ownership and R&D investments, and Hypothesis 2 proposed a negative relationship between firm debt and R&D investments. Model 1 presents the results for the two hypotheses, after controlling for industry, state ownership, firm size, employee redundancy, SOE performance, and SOE tenure. The relationship between private ownership and R&D investments is not significant.

Table 5.4
Multivariate Regression Results (Pooled Sample)

	<u>Model 1</u>	<u>Model 2</u>	<u>Model 3</u>	<u>Model 4</u>
	R&D	Risk Perception	R&D	R&D
Risk perception			-0.40***	-0.22**
Private ownership	0.10	-0.19 ^a		0.06
Firm debt	-0.25***	0.31**		-0.19**
Industry	0.73***	0.40***	0.88***	0.81***
State ownership	-0.05	0.06	-0.06	-0.04
Firm size	0.00	-0.03	-0.05	-0.00
Redundancy	0.00	-0.07	-0.02	-0.01
SOE performance	0.12*	-0.23*	0.08	0.07
SOE tenure	-0.02	0.13	0.02	0.00
R ²	0.72	0.38	0.72	0.75
Adjusted R ²	0.69	0.32	0.70	0.72
F statistic	26.56***	6.3***	30.89***	27.16***

^a < 0.1; * p < 0.05; ** p < 0.01; *** p < 0.001

Table 5.5
Multivariate Regression Results (Low and High R&D Industries)

	Low R&D Industries				High R&D Industries			
	<u>Model 1</u>	<u>Model 2</u>	<u>Model 3</u>	<u>Model 4</u>	<u>Model 1</u>	<u>Model 2</u>	<u>Model 3</u>	<u>Model 4</u>
	R&D Investments	Risk Perception	R&D Investments	R&D Investments	R&D Investments	Risk Perception	R&D Investments	R&D Investments
Risk perception			-0.35*	-0.15			-0.47**	-0.35*
Private ownership	0.32 ^a	-0.37*		0.26	0.14	-0.16		0.09
Firm debt	-0.31*	0.27 ^a		-0.27 ^a	-0.41**	0.33*		-0.29*
Industry								
State ownership	0.05	0.03	0.00	0.05	-0.13	0.09	-0.13	-0.10
Firm size	-0.14	0.14	-0.19	-0.12	0.05	-0.12	-0.08	0.01
Redundancy	0.07	-0.19	-0.03	0.04	-0.01	0.02	-0.01	-0.01
SOE performance	0.30 ^a	-0.32*	0.21	0.25	0.18	-0.24*	0.12	0.10
SOE tenure	0.01	0.04	-0.01	0.02	-0.04	0.16	0.04	0.01
R ²	0.40	0.44	0.32	0.42	0.30	0.28	0.32	0.39
Adjusted R ²	0.28	0.33	0.20	0.27	0.19	0.16	0.22	0.27
F statistic	3.29*	3.8**	2.73*	2.94*	2.64*	2.36*	3.38**	3.34**

^a < 0.1; * p < 0.05; ** p < 0.01; *** p < 0.001

Therefore, Hypothesis 1 is not supported. There was a significant and negative relationship between firm debt and R&D investments ($\beta = -0.25$, $p < 0.001$), thus providing strong support for Hypothesis 2.

(b) Indirect Impact of private ownership and firm debt on R&D investments

Hypothesis 3 examined the relationship between private ownership and risk perception of R&D projects. As shown in Model 2, the coefficient of private ownership is not significant at the level of $p < 0.05$, but significant at the level of $p < 0.1$, after controlling for industry, state ownership, firm size, employee redundancy, SOE performance, and SOE tenure. Thus, private ownership had negative but weak effect on risk perception ($\beta = -0.19$, $p < 0.1$), providing a weak support for Hypothesis 3. Model 2 also tested Hypothesis 4, which suggested that firm debt had positive impact on risk perception. The result provided strong support for the positive relationship between firm debt and risk perception ($\beta = 0.31$, $p < 0.01$).

Hypothesis 5 proposed that risk perception affects R&D investments negatively. The results of Model 3 suggest that there is a strong negative relationship between risk perception and R&D investments ($\beta = -0.4$, $p < 0.001$), after controlling for industry, state ownership, firm size, employee redundancy, SOE performance, and SOE tenure. Therefore, Hypothesis 5 is supported.

Among control variables, the high R&D industries were found to have more R&D investments than low R&D industries. In Model 1, the relationship between SOE performance and R&D investments is significant and positive ($\beta = 0.12$, $p < 0.05$). In Model 2, SOE performance was found to have significant negative relationship with risk perception ($\beta = -0.23$, $p < 0.05$). In addition, industry had strong impact on risk perception ($\beta = 0.40$, $p <$

0.001), that is, managers perceived more risk to R&D projects in high R&D industries than in low R&D industries.

Model 1, 2, 3 and 4 were used to test the mediated relationships between private ownership/firm debt and R&D investments. Hypothesis 6 predicted that risk perception partially mediates the relationship between private ownership and R&D investments. Four conditions should be met for the partial relationship to exist. The first condition is that private ownership should affect risk perception. The result from Model 2 indicates a weak relationship between private ownership and risk perception. Model 1 tested the second condition: private ownership has direct relationship with R&D investments. However, the coefficient of private ownership is not significant, after controlling for industry, state ownership, firm size, employee redundancy, SOE performance, and SOE tenure. Thus, the second condition is not satisfied. The third condition is the existence of relationship between risk perception and R&D investments, which was supported by Model 3. Model 4 explored the effect of risk perception on the relationship between private ownership and R&D investments. The result suggests that no effect exists. Therefore, there is no mediated relationship between private ownership and R&D investments, providing no support for Hypothesis 6.

Hypothesis 7 suggested risk perception partially mediates the relationship between firm debt and R&D investments. The results from Model 2 and 3 indicate that the first and third conditions are met, that is, firm debt has relationship with risk perception, and risk perception has relationship with R&D investments. The second condition is met from Model 1, which suggests that firm debt affects R&D investments significantly ($\beta = -0.25$, $p < 0.001$). Model 1 and 4 shows that the effect of debt on R&D investments is less when risk perception was

added in the equation ($\beta = -0.19, p < 0.01$) than in the third equation when risk perception was excluded ($\beta = -0.25, p < 0.001$). Thus, the fourth condition is also satisfied. Given that all the four conditions are met, Hypothesis 7 was supported.

5.2.2 Findings from Low R&D Industries

As seen in Table 5.5, empirical results in low R&D industries show some differences from those in the pooled sample. The results of Model 1 propose that private ownership has positive but weak relationship with R&D investments ($\beta = 0.32, p < 0.1$), providing weak support for Hypothesis 1. The relationship between debt and R&D investments is negative and significant ($\beta = -0.31, p < 0.05$), so Hypothesis 2 was supported. Model 2, which tested Hypotheses 3 and 4, indicates that private ownership has a negative relationship with risk perception ($\beta = -0.37, p < 0.05$). Therefore, Hypothesis 3 was supported. The effect of firm debt on risk perception is positive but weak ($\beta = 0.27, p < 0.1$), providing a weak support for Hypothesis 4. Model 3 reports that risk perception affects R&D investments negatively ($\beta = -0.35, p < 0.05$), thus supporting Hypothesis 5. Among control variables, the relationship between SOE performance and risk perception is significant and negative ($\beta = -0.32, p < 0.05$). SOE performance also has a positive but weak relationship with R&D investments ($\beta = 0.30, p < 0.1$).

Model 4, together with Model 1, 2, and 3, tested the mediated relationship between private ownership/firm debt and R&D investments, i.e., Hypothesis 6 and 7. The four conditions, required for a mediated relationship, were not met for Hypothesis 6 and 7. Therefore, the mediated relationships between private ownership/firm debt and R&D investments do not exist in low R&D industries.

5.2.3 Findings from High R&D Industries

From Table 5.5, results from high R&D industries have shown a picture quite different from those in low R&D industries. Model 1 proposes no effect of private ownership on R&D investments, and significant effect of firm debt on R&D investments ($\beta = -0.41$, $p < 0.01$). The results of Model 2 show no significant relationship between private ownership and risk perception, and significant positive relationship between firm debt and risk perception ($\beta = 0.33$, $p < 0.05$). Model 3 suggests a strong negative relationship between risk perception and R&D investments ($\beta = -0.47$, $p < 0.01$). Model 4, together with Model 1, 2, and 3, indicates that risk perception mediates the relationship between firm debt and R&D investments. There is no mediated relationship between private ownership and firm debt. SOE performance was found to have negative impact on Risk perception ($\beta = -0.24$, $p < 0.05$).

5.2.4 Summary of the Findings

The findings from both pooled and separate samples are summarized in Table 5.6. Discussion of these findings is presented in the next chapter.

Table 5.6
Summary of Key Results

	Proposed Relationship	Pooled Sample	Low R&D Industries	High R&D Industries
Hypothesis Testing: <i>Direct impact of private ownership and firm debt</i>	H1: Positive relationship between private ownership and R&D investments	Not Supported	Supported weakly (p < 0.1)	Not supported
	H2: Negative relationship between firm debt and R&D investments	Supported	Supported	Supported
Hypothesis Testing: <i>Indirect Impact of private ownership and firm debt</i>	H3: Negative relationship between private ownership and risk perception	Supported weakly (p < 0.1)	Supported	Not supported
	H4: Positive relationship between firm debt and risk perception	Supported	Supported weakly (p < 0.1)	Supported
	H5: Negative relationship between risk perception and R&D investments	Supported	Supported	Supported
	H6: Risk perception partially mediates the relationship between private ownership and R&D investments	Not supported	Not supported	Not supported
	H7: Risk perception partially mediates the relationship between firm debt and R&D investments	Supported	Not supported	Supported
Other Findings	<u>Pooled Sample:</u> (1) High R&D industries had more R&D investments than low R&D industries; (2) Managers had higher risk perception in high R&D industries than in low R&D industries; (3) SOE performance had negative impact on risk perception and positive impact on R&D investments <u>Low R&D industries:</u> SOE performance had negative impact on risk perception and positive but weak impact on R&D investments <u>High R&D industries:</u> SOE performance had negative impact on risk perception			

CHAPTER 6

DISCUSSION AND IMPLICATIONS

“Without innovation, (we are) waiting for death; with innovation, (we are) courting death”

A note left on a returned questionnaire by a respondent (a Chairman and General Manager of a privatized firm located in Zhejiang province of China)

This Chapter discusses the empirical results and presents implications from these results. First, I explain the major findings from this study. Second, I suggest implications for academics, practitioners, and policy makers. Finally, I discuss some major limitations of the study and present research directions in the future.

6.1 Discussion

6.1.1 Discussion of Findings

(a) Direct impact of private ownership and firm debt on R&D investments

Privatization is often characterized by two components: private ownership and debt financing. This study starts with the controversial arguments about the relationship between privatization and innovative activities such as R&D in the Western context. Private ownership aligns interests between owner-managers and their firms, so it is expected to produce strong incentives for owner-managers to engage in innovative activities. Heavy debt financing would decrease firms' financial flexibility due to debt payments. When a firm's financial flexibility decreases, its capability for further investments would also decrease. Therefore, it has been argued that leveraged buyouts could “kill” innovation (Zahra &

Fescina, 1991). Rappaport (1990) even proposed that high leverage makes buyouts “worse than the disease”. These arguments suggest that private ownership increases R&D investments and debt decreases R&D investments.

I extended these arguments in the Western context to the Chinese context, and developed and tested hypotheses regarding the direct effect of private ownership and firm debt on R&D investments. The empirical results show a strong negative relationship between firm debt and R&D investments, thus supporting the argument about the negative impact of debt on R&D activities. This result suggests that existing theories regarding the relationship between debt and R&D investments also apply in the Chinese context. A high level of debt may reduce financial flexibility for R&D investments due to interest payments. In addition, the risky R&D projects may be less likely to be financed by debt.

The results for the relationship between private ownership and R&D investments are mixed. Private ownership was not found to increase R&D investments in the pooled sample and high R&D industries. However, in low R&D industries private ownership had positive but weak impact on R&D investments. These findings did not strongly support the incentive-based models, and suggest that the motivational effect of private ownership may not apply in all situations. According to Beatty and Zajac (1994), ownership incentives would also produce a negative impact on innovation – risk averse behavior. This could be one reason why private ownership was not found to contribute to firm R&D investments to a significant level.

(b) Indirect impact of private ownership and firm debt on R&D investments

Given the risky nature of R&D investments and controversial arguments and evidence regarding the relationship between private ownership/firm debt and R&D investments, I

argued that private ownership and firm debt might affect R&D investments indirectly, and their relationships could be mediated by risk perception of R&D projects. Therefore, I developed a risk perception framework to test the indirect relationships between private ownership/firm debt and R&D investments. Private ownership is likely to increase and also decrease R&D because it is likely to produce risk bearing, as well as motivational effects. Firm debt may not constrain owner-managers to conduct R&D activities if their risk perception is low.

The empirical results show that risk perception strongly reduces R&D investments, which suggests that risk perception might play an important role in managerial innovation behavior in Chinese privatized firms. Private ownership ties managerial wealth to firm performance. Though R&D investments could bring more value to the firm and the owner-managers, R&D projects are very likely to fail (Dierickx & Cool, 1989) and may not result in any productive results because of their uncertain nature (Lee & O'Neill, 2003). If R&D projects fail, it will impose negative impact on firm performance, thus managerial wealth. Therefore, owner-managers are likely to take great precaution toward these risky projects.

Though high risk is often presumably associated with high return (Brealey & Myers, 1981), this study suggests that in Chinese privatized firms, owner-managers do not seem to deliberately pursue risky projects for possible high returns. However, this does not necessarily mean that owner-managers prefer low return projects in order to meet their risk averse preference. According to managerial perspectives of risk (March & Shapira, 1987), managers often perceive risk instead of calculating risk. It is possible that managers may perceive low levels of risk even though the inherent risk of a project is high. The disparity

between subjective and objective risk helps explain the risk-return dilemma faced by managers.

The strong negative relationship between risk perception and R&D investments can also be explained by risk bearing theory (Beatty & Zajac, 1994; Wiseman & Gomez-Mejia, 1998). Owner-managers have a high stake in their firms, so they bear more risk than the employee-managers. Managers' risk bearing increases as the uncertainty of firm performance increases. R&D investments, often long-term oriented, are likely to be made at the expense of short-term projects such as operational efficiency and market promotion, so R&D investments could have negative impact on short-term performance (Baysinger & Hoskisson, 1989). If R&D projects are unsuccessful, they may also influence firms' long-term performance negatively. R&D projects often consume a large amount of monetary resources. Any failure would render recouping these resources difficult or impossible. This outcome can influence firms' long-term development. Therefore, R&D investments are likely to cause managerial risk bearing. Owner-managers may select those R&D projects with a low level of perceived risk in order to reduce their risk bearing.

As predicted, firm debt was found to increase risk perception strongly. Though debt is an important corporate financing tool, it appears that a high level of debt is not welcome in Chinese privatized firms. Debt may reduce operational margins due to interest payments. The reduced short-term performance would increase risk bearing. That is to say, owner-managers would perceive that their wealth is threatened as the debt level increases. When they do not feel safe with their wealth, they could treat the risky R&D projects negatively. This phenomenon can be explained by Baron's (1998) "affect infusion" theory, that is, individuals' judgments about one event are influenced by their experience with other events.

Firm debt was also found to decrease R&D investments partially through risk perception. The partially mediated relationship between debt and R&D investments suggests that debt influences R&D investments indirectly, as well as directly. The indirect relationship between debt and R&D investments indicates that the effect of debt on R&D investments may go beyond the financial capability explanation. When managers' risk perception is low toward R&D projects, high debt loads may not necessarily constrain their behavior in investments. This finding would challenge the agency-based argument that high leverage would discipline managerial behavior in investments (Jensen, 1986; Jensen & Meckling, 1976). Wiersema and Liebeskind's (1995) study on managerial behavior in LBO firms did not find support for one hypothesis predicted by a rational perspective: LBO firms will have a lower level of investments in unrelated businesses than comparable public firms. The mediation role of risk perception could provide an explanation to this result. Though managers in LBO firms may be constrained to make further investments due to high leverage, their wealth motivation could possibly reduce their risk perception. The reduced risk perception is likely to facilitate their investment initiatives.

This study only found weak impact of private ownership on risk perception. This may be explained by the tension between wealth motivation and risk bearing which are likely created simultaneously by private ownership. Wealth motivation may decrease managerial risk perception because of cognitive biases, but risk bearing could increase risk perception. This finding provides some support for Beatty and Zajac's (1994) argument: incentive devices like equity position do not always have positive effect on managerial innovative behavior. They can increase managers' risk bearing relative to their wealth. Risk bearing is likely to discourage innovative behavior.

In low R&D industries, private ownership was found to reduce risk perception significantly. This result suggests that the effect of wealth motivation could be stronger than that of risk bearing in low R&D industries. From pooled sample, it was found that managers perceive less risk in low R&D industries than in high R&D industries. When managers perceive low levels of risk, their wealth motivation could increase because they can be less concerned with the risk factors associated with new opportunities.

Among control variables, SOE performance was found to have a negative impact on risk perception and positive impact on R&D investments. Though SOE performance was a pre-privatization phenomenon, it can be reasonably assumed that SOE performance contributes to the performance in privatized firms, especially in the near term. Based on this assumption, it can be assumed that good performance in privatized firms could reduce managerial risk perception and increase R&D investments. The reason may be associated with R&D financing. Because R&D projects are less likely to be financed from outsider sources (Singh & Faircloth, 2005), good performance can provide more internal resources for managers to conduct R&D activities.

The negative relationship between firm performance and risk perception seems to be contradictory with prospect theory (Kahneman & Tversky, 1979). According to prospect theory, individuals tend to be risk averse in a gain situation because they have something to lose, but risk-taking in a loss situation where they have nothing to lose. In Chinese privatized firms, good performance, which is linked to a gain situation, appears to decrease risk perception and increase risk-taking behavior. One explanation for this phenomenon could be that private ownership produces strong wealth motivation, and the execution of wealth motivation is more likely in a situation with good performance. After Chinese SOEs were

privatized, they lose assistance and support from the government. They may find it more difficult to get the financial support from the bank for their R&D projects. Under this circumstance, good performance can equip privatized firms with good conditions to pursue new opportunities through R&D initiatives.

State ownership was predicted to have significant influence on risk perception and R&D investments, but the result did not support this prediction. One reason could be the low levels of ownership position the government holds in the privatized firms. Though the influence of the government on the private sector will still be strong (Child & Tse, 2001), the forces of marketization and privatization are likely to reduce its influence. When private ownership dominates in a firm, the owner-managers would have to take responsibilities by their own. They may not rely much on the government for support, such as requiring protection or financial resources, as they did before.

This study obtained samples from two groups of industry with low and high R&D intensity respectively. The empirical results show both similarities and differences in these two groups of industry. Risk perception influences R&D investments negatively in both industries. This evidence confirms one major assumption of this study: risk perception might play an important role in managerial pursuit of risky projects in privatized firms. However, the results also show that the influence of risk perception on R&D investments is stronger in high R&D industries. A possible explanation is that managers perceive more risk to R&D projects in high R&D industries, an empirical result of this study. According to Chiao (2002), firms in science-based industries would face more persistent competition than in non-science-based industries. Therefore, R&D investments in high R&D industries are likely to be more uncertain than in low R&D industries.

In low R&D industries, the influence of firm debt on risk perception and R&D investments was not as strong as in high R&D industries. This result suggests that financial capability may not be a strong effect on managerial pursuit of R&D in low R&D industries. Given the finding that private ownership has impact on both risk perception and R&D investments in low R&D industries, the motivational effect from private ownership could be greater than the constraining effect from debt. Because managers perceive relatively low levels of risk to R&D projects in low R&D industries, they are more likely to be motivated to create wealth through investing in these projects.

6.1.2 Summary

The above discussion of the research findings leads to the following conclusions. First, private ownership was not found to have significant impact on R&D investments, but it still could influence R&D investments directly, depending on contextual situations. In low R&D industries where managers perceive relatively low risk to R&D projects, private ownership is likely to increase R&D investments. Though private ownership was not found to influence R&D investments indirectly, it could have impact on risk perception, depending on contextual situations. Risk perception in turn would affect R&D investments.

Second, firm debt may influence R&D investments directly. This direct effect is likely to result from two explanations: constrained financial capability due to debt payments and less likelihood of using debt to finance R&D projects. Debt could influence R&D investments indirectly, i.e., mediated by risk perception. This result suggests that debt may reduce firms' financial capability to invest in R&D projects, but may not constrain managerial behavior in conducting R&D activities.

Third, risk perception may play an important role in managerial commitment to R&D projects in privatized firms. This result may have something to do with the fact that owner-managers have tied their wealth and employment career to the firm performance. The concept of risk bearing, which is developed in the Western context, may also apply in the Chinese context.

Lastly, good financial conditions contribute to managerial pursuit of R&D in Chinese privatized firms. Low levels of risk perception could be important for starting risky R&D projects, but risky behavior may also need financial resources as support. Financial resources are also likely to strengthen motivational effect.

6.2 Implications

6.2.1 Theoretical Implications

A major theoretical implication emerging from the research findings is a call for new theoretical perspectives to investigate the impact of privatization on managerial innovative behavior in R&D. The two findings of this study, no strong effect of private ownership on R&D investments and strong effect of risk perception on R&D investments, suggest that the incentive-based models, derived from agency theory and property rights theory, may not be sufficient to explain the managerial innovative behavior in the Chinese context. The introduction of a risk perception perspective may be appropriate for three reasons. First, privatization ties owner-managers' wealth to firm performance. Because firm performance is often uncertain, privatization puts owner-managers in a risky situation. Second, R&D investments are risky and require risk taking behavior. However, people are often assumed to be risk averse (Eisenhardt, 1989). That is to say, not all people are risk taking. Third, Chinese culture is characterized by uncertainty avoidance, which may reduce the role of incentives.

By integrating the risk perception concept into the traditional incentive-based models, this study takes a step toward understanding of the effect of privatization on managerial commitment to innovative activities such as R&D.

Though this implication is derived from the Chinese context, I argue that it could also be important in the Western context. For example, Beatty and Zajac (1994) questioned the exclusive emphasis on the positive side of incentive devices. Their study found that the magnitude of executives' equity positions influences their willingness to take further risk. The larger the equity stakes they hold, the less likely they will use the risky compensation contracts such as stock options. Their finding suggests that the motivational effect of incentive devices can be diluted by their negative consequence of risk averse behavior. Sanders (2001) also had a similar finding: the downside risk of stock ownership is likely to make CEOs less willing to engage in risky strategies. From these studies conducted in the Western context, it can be argued that human risk behavior may go beyond the cultural effects.

This study suggests the importance of risk perception in managerial pursuit of innovative projects such as R&D. Risk perception is "an individual's assessment of how risky a situation is" (Sitkin & Weingart, 1995). This assessment is a cognitive process in which individuals collect and process information, and form perceptions (Scherer & Cho, 2003). Based on the link between risk perception and cognition, it may be useful to extend the risk perception concept to a broad cognitive perspective, integrating a cognitive perspective with the traditional incentive-based models.

From a cognitive perspective, privatization may change managers' cognitive structures after they become owner-managers. A cognitive structure is a "hypothetical link between

stimulus information and an ensuing judgment” (Bieri et al, 1966). This hypothetical link is associated with knowledge storage or structures. Privatization provides strong stimulus information. By studying the “hypothetical link” between privatization and owner-managers’ ensuing behavior, we may better understand how privatization might influence managerial behavior. This cognitive perspective is consistent with Walsh’s (1995) argument about the importance of managerial cognition in answering the “how” question. According to Walsh, agency theory views managers as source of variance in firm performance, but it cannot answer “how managers might increase or decrease firm value”. “Enter[ing] cognition” would answer the “how” question.

A cognitive perspective may also be used as a theoretical framework to explain other managerial behaviors, as well as innovation behavior, in privatized firms. For example, it is still unclear whether privatization contributes to managerial commitment to long-term performance. Given the uncertain nature of long-term performance, Wright and colleagues (2000) suggested that the explanation of strategic growth in privatized firms requires an understanding of entrepreneurial cognition, as well as managerial incentives. Monetary incentives would motivate managers to pursue firms’ long-term performance, but the role of these incentives is limited without entrepreneurial cognition. Wright and colleagues argued that without entrepreneurial cognition, owner-managers would be “frugal with R&D expenditure”. This behavior can be represented by the overall decline in R&D intensity in leveraged buyout firms (Long & Ravenscraft, 1993).

The findings of this study suggest the theoretical importance of a cognitive perspective in the field of privatization. In addition, this study also sheds light on theoretical issues in other fields. In the entrepreneurship literature, for example, it has long been debated whether

entrepreneurs are inherent risk-takers. Given the risky nature of entrepreneurship, it has been suggested that risk-taking propensity is one of the most distinctive features of entrepreneurial behavior, and it fundamentally distinguishes entrepreneurs from managers (e.g., Gasse, 1982; Leibenstein, 1968). Along with the argument that entrepreneurs are risk-takers, there are disagreements. McClelland (1961) proposed that entrepreneurs are pursuing tasks which are not like gambling in Las Vegas. Therefore, entrepreneurs tend to assess risks carefully before taking any risky actions. This study suggests that Chinese entrepreneurs may fall in the category of the latter argument: entrepreneurs might not take risk deliberately. After SOEs are privatized, the owner-managers become a kind of entrepreneurs. Because their risk perception influences their entrepreneurial behavior strongly, it seems that entrepreneurs may not necessarily possess some inborn traits such as risk-taking.

Finally, the findings of this study also contribute to the application of prospect theory in the Chinese context. SOE performance was found to influence risk perception negatively, and to encourage managerial behavior to invest in risky R&D projects. This result is not consistent with the prediction from prospect theory: gain situations would discourage risk taking behavior. Probably, the application of prospect theory is contextual. In China, privatization has provided managers with unprecedented opportunities to create wealth for themselves. When managers are motivated to pursue their goals, a gain situation could become good conditions for them to achieve those goals. Therefore, gain situations may facilitate innovative behavior. This implication may extend beyond the Chinese context. For example, Slattery and Ganster's (2002) study in the US context found that in a dynamic uncertain environment, decision makers who have reached their goals set more risky goals in subsequent decisions, so they questioned the universal applicability of prospect theory.

6.2.2 Practical Implications

The research findings offer insights into how to make owner-managers more innovative so that they can pursue risky projects such as R&D in their privatized firms. Risk perception of R&D projects was found to strongly discourage owner-managers' innovative behavior. It is necessary to manage their risk perception. Risk perception is a kind of cognitive state which is formed by individuals' processing of information (Scherer & Cho, 2003). Therefore, it is possible to change one's risk perception through manipulating information. Brown (2005) has mentioned that risk takers may minimize their risk perceptions by strategies such as further assessment of risk messages, avoidance of thinking about risk, de-emphasizing the importance of outcomes, and so on. When owner-managers are conducting innovative activities such as R&D, they are likely to reduce their risk perception through a range of strategies, including negative problem framing, emphasis on process controls (Sitkin & Pablo, 1992), learning while innovating (Van de ven & Polley, 1992), etc.

Private ownership was not found to have strong effect on R&D investments. This result suggests that incentives from private ownership did not play a significant role in the sampled companies. It is suspected that managerial risk perception could be high. This risk perception may have neutralized the motivational effect. At the beginning of this Chapter, I displayed the note left by a survey respondent. This respondent treated innovation, referring to R&D projects, as critical to the firm survival. However, he also looked upon innovation as so dangerous that it would cause the firm failure. This dilemma implies that risk perception may have become a serious problem for Chinese owner-managers because their wealth is tied to firm performance. Innovation is important, but managers are never sure whether innovation can lead to success. The failure of innovation is likely to pose serious negative influence on

firm performance, thus managers' wealth. As a result, owner-managers could become extremely conservative toward the innovation projects.

How to resolve this dilemma? Risk perception management, as described above, could be one approach. Because of the link between risk perception and cognition, it may also be important to change owner-managers' mindset. Wright et al (2001) have recognized the importance of appropriate managerial mindsets in privatized firms. They suggested that managers in buyout firms should treat privatization as an entrepreneurial opportunity through which they can take advantage of both high-powered incentives and discretions. R&D projects are risky, but concerns about these risky projects "tend to be overruled" by the opportunity managers recognized (Wright et al, 2000). Through a change of mindset, managers could be both innovative and not afraid of being innovative, thus avoiding the dilemma faced by the survey respondent.

The last practical implication is associated with debt. Debt financing is often a necessary condition for privatization. This study found debt influences R&D investments both directly and indirectly. Because of the direct influence of debt on R&D investments, the level of debt financing should not reach a point where managers are forced to focus on short-term gains. Debt would also influence R&D investments through risk perception. When debt levels are high, it is necessary to manage risk perception in order to keep the firm innovative.

6.2.3 Implications for Policy Makers

In emerging economies, the privatization of SOEs has become a critical tool to improve the national economy. If the policy makers want to sustain the benefits derived from privatization, it is necessary for privatized firms to keep innovating. Firm innovation through R&D has been found important in privatized firms (Long & Ravenscraft, 1993; Wright et al,

1998). However, ownership transfer alone may not be sufficient to ensure innovative behavior. This study did not find a positive relationship between private ownership and R&D investments. A possible reason could be related to owner-managers' strong risk perception of R&D projects.

Though policy makers may not be able to reduce owner-managers' risk perception of R&D directly, they could help reduce risk perception through creating a safe environment. This study uses a concept of risk bearing, i.e., risk perception of wealth. Though this study did not test the effect of risk bearing, I would argue that risk bearing may exist in privatized firms. Owner-managers tie their wealth to the firm performance, while firm performance is often uncertain. Therefore, owner-managers are likely to feel uncertain about their wealth. Based on affect infusion theory, this risk perception of wealth may influence risk perception of R&D projects. From this point of view, it could be possible to reduce risk perception of R&D through reducing risk perception of wealth.

Risk perception is formed through information processing. Social contexts are an important source for information and can shape individuals' attitude and behavior (Salancik & Pfeffer, 1978). In emerging economies, governments are adopting market-based policies to decentralize their national economy. However, the development of market-based institutions such as legal systems and capital markets has been slow and difficult (EBRD, 1998). There also exist economic and political instabilities (Hoskisson et al, 2000), which would greatly increase uncertainty for privatized firms. Under these circumstances, owner-managers may not feel safe with their private assets. That is to say, they could perceive non-trivial risk to their wealth. If policy makers can speed up the construction of market-based institutional

infrastructures, owner-managers' perceived risk to their wealth is likely to be reduced. This reduced risk perception of wealth could be helpful for their innovative behavior.

In emerging economies, SOEs are often characterized by organizational inefficiency. In the Chinese case, heavy debt burden and a large number of surplus employees are a common phenomenon (Lin & Zhu, 2001). This study found that the performance of former SOEs could influence managers' innovative behavior after SOEs were privatized. This finding indicates that the financially over-burdened SOEs might require some "unloading" before they are converted into privatized firms. Privatization is one of the most important tools to improve the national economy in developing countries. Policy makers should not transfer too much historical burden with SOEs to the privatized firms. If they are doing so, they may rid themselves of the inefficient public sector in the short term. In the long run, however, the over-burdened privatized firms may not do any good for the whole economy.

6.3 Limitations and Future Research Directions

6.3.1 Limitations

This study has several limitations. First, the largest owner-manager's risk perception of R&D projects might not exactly represent the firm-level risk perception. In privatized firms, there is usually more than one shareholder. Corporate governance takes the form of the board of directors. Though the dual position of the largest owner-manager – chairperson and general manager – would make him or her dominate the board and the managerial team, other shareholders may also have voices in decision making.

Second, the retrospective approach to measuring risk perception may not be accurate. In order to ensure that the respondents answer the survey questions responsibly, I asked people from two influential organizations, the government and the bank, for help. They

interviewed the respondents in person or contacted them by phone and letters. These measures would minimize the errors from irresponsible responses, but may not remove the errors from other factors.

Third, data for testing hypotheses came from two groups of industry: high and low R&D industries. The classification of industry was based on the data from *China Statistic Yearbook on Science and Technology* in which industry is classified broadly. A broadly defined industry can include a number of sub-fields. Different sub-fields may require different levels of R&D investments. This study could not identify how sub-fields within a broad industry are linked to R&D investments.

Finally, the study did not control for risk propensity, which might influence managerial risk perception (Sitkin & Pablo, 1992). Individuals may have different risk preferences: risk taking or risk averse. Traditionally, individual risk propensity is conceptualized as a stable dispositional attribute (Rowe, 1977). However, Stikin and Weingart (1995) define risk propensity as “an individual’s current tendency to take or avoid risks”. This definition indicates that individual risk propensity may change over time. Because of the complexity of risk propensity, this study did not include it as a control variable.

6.3.2 Future Research Directions

Opportunities for future research are ample and may come from two streams. One stream of future research is associated with the limitations of this study. First, the largest owner-managers’ risk perception may not represent the firm level risk perception because other managers may also pose their influence. It can be meaningful to research how the dominant managers’ behavior is influenced by other less important stakeholders. In emerging economies such as China, the privatized firms are often dominated by a single manager. This

domination would help establish clear lines of authority and responsibility, and facilitate decision-making (Finkelstein & D'Aveni, 1994). However, this single-person domination may lead to opportunistic behavior which damages other stakeholders' interests (Jensen & Meckling, 1976) and compromise effective decision-making (Finkelstein & D'Aveni, 1994). By researching how the largest owner-managers' behavior is affected, we would provide implications on addressing both advantages and disadvantages of privatized firms dominated by single managers.

Given the difficulty of measuring an individual's past cognitive state, this study assumed that managerial risk perception is relatively stable in a certain period of time. Future research may address whether risk perception is a relatively stable attribute and how risk perception might change over time. This study also assumed that risk perception is influenced by outside factors such as private ownership and firm debt. It may be interesting to research whether individual characteristics are likely to affect risk perception.

The specific features of an industry can influence innovation behavior of the firms within it. This study only broadly classified industries into two groups with low and high R&D intensity. It merits further investigation on how industry characteristics and dynamics might affect owner-managers' pursuit of R&D projects. It can be interesting to study how industry players at different points of the industry value chain are influencing each other in their R&D activities.

The other stream of future research comes from some theoretical issues in the study of the research questions. At least three issues deserve research attention. First, wealth motivation and risk bearing from privatization are one major theoretical argument in this study. However, the relative strength between wealth motivation and risk bearing is unknown.

Given the importance of wealth motivation in privatization and the negative effect of risk bearing, it could be meaningful to investigate their relative strength and how it varies with situational factors. The different empirical results from two groups of industry, i.e., low and high R&D industries, have provided some insights into this question. It seems that wealth motivation is more likely to play a role in environments with low perceived risk. That is also to say, when risk bearing is low, wealth motivation could be high.

The second research issue is associated with debt. Debt seems to be a two-edged sword. On the one hand, it can be an important financing tool; on the other, it would reduce firms' financial flexibility in investments. An interesting question is: what might be an ideal level of debt financing in privatization? The mediation role of risk perception between debt and R&D investments opens opportunities for researching how to take advantage of debt as a financing tool and at the same time minimize the constraining effect of debt on innovation investments. For example, when debt levels are high, is it possible to reduce the negative impact of debt through manipulating managerial risk perception?

Finally, this study extended the research on privatization in the U.S. context to the formerly state-owned enterprises in China. It is unclear from this study how different the two groups of privatized firms, those converted from public firms and those transformed from SOEs, are in their pursuit of R&D projects. Though the fundamental reasons for privatization of public firms and SOEs in the two contexts are similar, the innovation behavior of privatized firms in the two contexts may be different. A comparison of privatized firms between the two contexts would help us better understand privatization, which is an important corporate restructuring tool and has been used widely by both developed and developing economies.

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