Three Essays on Corporate Cash Holdings

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Submitted to the Faculty of Economics at the University of Neuchâtel

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Three Essays on Corporate Cash Holdings

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Le doyen

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Executive Summary

This dissertation is constituted of three distinct chapters. The first chapter focuses on the real consequences of cash policy by examining how cash holdings influence firms' behavior and performance in their product market. The paper provides compelling evidence that corporate cash policy encompasses a substantial strategic dimension. In particular, the analysis reveals that larger relative-to-rivals cash reserves lead to systematic future market share gains at the expense of industry rivals. Notably, the documented effect is exacerbated when rivals face tighter financing constraints and when firms interact intensively in their product market. Moreover, the competitive effect of cash contributes to increase firm value and operating performance. Cash-rich firms partly gain market shares by drawing down their reserves to increase capital and R&D investment, as well as to expand their work force. From a different perspective, firms' cash policy significantly distorts rivals' product market decisions. Particularly, the analysis shows that incumbents' cash reserves restrain the entry of potential competitors and hamper the expansion of rivals by curbing both their investment and acquisition policies.

The second chapter sheds new light on the process whereby firms accumulate their cash reserves, i.e. their savings decisions. Remarkably, the investigation illustrates that stock prices, and more importantly, the private information they contain, play a crucial role in explaining firms' savings choices. I start by documenting that a firm' savings are highly sensitive to its stock price. This positive association indicates that firms tend to transfer more resources into their cash balances when the market foresees valuable future prospects. Strikingly, such a precautionary mechanism turns out to be amplified when the market price contains a larger content of private investors' information. Hence, the findings are consistent with the view that managers learn from observing the level of their stock price. Moreover, further test show that this defensive learning is not due to the uncaptured effect of market mispricing or financing constraints. Overall, the analysis importantly highlights that the nature and precision of the available information about firms' future prospects are crucial ingredients of their saving choices.

The last chapter takes a corporate governance perspective and investigates the effect of a U.S. cross-listing on the risk that cash holdings are channeled into value destroying ventures. In a nutshell,

the analysis reveals that the potential for value destruction embodied in large cash positions is significantly lessened when foreign firms benefit from the strength of U.S. institutions and monitoring environment. Indeed, investors systematically place a valuation premium on the excess cash of foreign firms that cross-list on U.S. markets compared with that of their domestic counterparts. The uncovered excess cash premium turns out to be magnified for firms established in countries in which shareholder protection is weak. Also, in spite of a host of initiatives to develop governance quality worldwide, the valuation differential significantly persists over time and is still at work nowadays. In addition, the analysis further dissects the results and put in light that two complementary forces explain the excess cash premium of cross-listed firms. On one hand, investors perceive the strength of U.S. legal environment as effective to tie managers' hand. On the other hand, the additional scrutiny by analysts and large investors that is associated with a U.S. listing also enhances investors' confidence that cash holdings will not be dissipated.

Key words: cash holdings; corporate liquidity; liquidity management; cash management; strategic interactions; product market competition; stock price informativeness; corporate savings; corporate governance; international cross-listings.

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Chapter 1

«And what about the cash, my existence's jewel? »

Charles Dickens, *Mr. Mantalini in Nicholas Nickleby, ch. 17, p. 207 (1839)*

Introduction

Why firms hold cash? How they save? Is there an optimal level of liquid assets? What factors influence these choices? How cash holdings affect firm value and performance? How they impact the rest the economy? These questions are of long standing and lie at the heart of corporate finance. Indeed, from funding day-to-day operations to financing long-run investment, internal funds represent the simple most important source of financing. According to Mayer (1990), approximately 75% of *all* net financing occurs through the use of cash reserves, as opposed to debt, convertibles and equity. As a result, understanding cash policy appears to be an essential element if we want to enrich our knowledge of how corporations are financed, and what are the real implications of their financing choices. Surprisingly, despite their ubiquitous role in corporate life, cash holdings have long been left unexplored by finance researchers. Recently, however, the finance profession has progressively started to pay a closer attention to firms' cash positions. By and large, two related facts have contributed to place corporate cash holdings under the spotlight.

First, this growing attention takes root in the observed tendency of firms to stockpile unusually large amount of cash. For instance, Microsoft Corp. and Exxon Mobile Corp. had more than $30 billion in cash sitting in the bank at the end of 2006. Apple Inc. and Google Inc. held more than $10 billion. These colossal positions are not isolated cases but generalize to a vast majority of firms. According to an estimate by *The Economist*, the average American public firm held more than 15% of its total assets in the form of cash and equivalent at the end of 2005.[1] Notably, such a hoarding trend is not bounded to US companies but spreads out worldwide.[2] Unsurprisingly, this universal phenomenon has not escaped the notice of investors and has attracted much coverage in the media and political circles. Overall, observers have casted serious doubt on the rationale for holding so much cash and are largely worried about the potential consequences of such cash-heavy status.

In parallel, surveys of corporate executives highlight indirectly the relevance of cash holdings in firms' financial strategy. As a matter of fact, Harvey and Graham (2001) and Bancel and Mittoo

[1] See "The Corporate Savings Glut", *The Economist*, July 7, 2006.
[2] See for instance Fortune (29th November 2003), The Wall Street Journal (1st December 2004).

(2004) report evidence that raise many questions about the validity of existing theories of financing choices. In contrast to many theoretical predictions, corporate executives emphasize that the most important driver of their financing strategy is the desire to attain and preserve financial flexibility. Arguably, cash reserves play a major role in shaping firms' flexibility. Indeed, with cash on hand firms secure their ability to finance current and future growth opportunities. As such, recent survey evidence bolsters the idea that cash holdings represent a substantial component of firms' optimal financing structure.

Taken together, the recent figures combined with the evidence from the field have underscored the necessity for additional thought on corporate cash holdings, and have concomitantly stimulated growing research interest. The result of this new research program is palpable in light of the increasing number of recent studies that investigate the multifaceted dimensions of cash policy. Broadly speaking, the literature on cash policy can be divided in two related categories. The first line of research seeks to understand the determinants of observed cash levels. To do so, researchers primarily try to identify factors and circumstances that are associated with firms' demand for cash. The second looks at what firms actually do with their cash reserves, and importantly gauges their implications for valuation and performance.

Certainly, the first strand has proved fruitful to identify various determinants of firms' cash holdings. A considerable number of studies documents variables that predict cash levels in the cross-section.[3] On the whole, these studies point to three different motives for holding cash. First, firms retain cash for precautionary reasons. As a matter of fact, having sufficient internal resources enable them to better cope with adverse shocks, particularly when their access to capital market is limited or non-existent. We observe that smaller firms, with more valuable investment opportunities, riskier cash flows and poor access to external capital tend to hold more cash. These stylized findings are in line with the intuition that cash reserves are instrumental in defining firms' financial flexibility. From a different perspective, governance quality turns out to be linked to cash reserves. Firms where managers are left unchecked by shareholders and/or located in countries where minority shareholders

[3] A complete list of the factors affecting cash holdings as well as the related studies is exposed comprehensively in Bates, Kahle and Stulz (2008).

are poorly protected sit on larger amounts of cash. Such an agency perspective motive corroborates Jensen (1986) argument that unrestricted managers aim at building up excessive cash balances and, at times, use them unwisely. Alternatively, corporate taxes also appear to drive firms' preference for cash holdings. For instance U.S. multinational firms that would incur tax consequences of repatriating foreign earnings prefer to transform foreign earnings into cash balances.[4]

In complement, the second strand of research provides valuable evidence on the real consequences of cash holdings. Specifically, cash holdings are found to contribute positively to increase firms' value when firms have valuable growth opportunities to exploit but limited access to external capital. For instance, the effect of cash reserves on firm valuation is considerably larger when firms are facing binding financing constraints or more uncertain investment opportunities. In sharp contrast, when combined with poor corporate governance, cash holdings prove to be negatively associated with firm value and performance. Indeed, absent strong incentives to act in shareholders' best interests, managers tend to spend cash holdings quickly, and on value destroying ventures such a bad acquisitions or the consumption of private benefits.

Taken as a whole, active and plural research efforts in this area have improved considerably our understanding of the various facets of firms' cash policy. Numerous studies help to delineate a more accurate picture of why firms hold cash. Also, various works underline that cash holdings bear real consequences, thereby making it clear that cash policy constitutes a key dimension of firms' financial architecture. However, notwithstanding substantial achievements, it is fair to say that much works needs to be done in this area as many questions remain unanswered. In particular, we still lack a precise understanding of mechanisms through which cash holdings impinge on value and performance. In a similar vein, it is not clear whether the so-called precautionary motive is really effective? Also, the literature remains remarkably silent on the exact origin of actual cash levels. Are they the results of accumulated retained earnings, systematic changes in assets' structure, or unused proceeds from security issuances? From a different angle, we are still short of a clear view on the connections between cash and other sources of financing as well as their relative contribution in shaping firms' financing structure. Furthermore, what are the real risks embedded in excessive cash holdings, and

[4] See Foley, Hartzell, Titman and Twite (2007).

what devices can prevent unchecked managers from fritting away those reserves are questions that are yet to be answered.

Addressing these and other related issues represent an important challenge for corporate finance researchers. At this stage, broadening our understanding of corporate cash holdings appears to be a natural step towards a better and more realistic comprehension of observed corporate finance practices. The three essays constituting this dissertation make distinct contributions in that direction. Specifically, each essay uses a specific angle of attack to study corporate cash policy.

The first essay focuses on the real consequences of cash policy by examining how cash holdings influence firms' behavior and performance in their product market. The paper provides compelling evidence that corporate cash policy encompasses a substantial strategic dimension. In particular, the analysis reveals that larger relative-to-rivals cash reserves lead to systematic future market share gains at the expense of industry rivals. Notably, the documented effect is exacerbated when rivals face tighter financing constraints and when firms interact intensively in their product market. Moreover, the competitive effect of cash contributes to increase firm value and operating performance. Cash-rich firms partly gain market shares by drawing down their reserves to increase capital and R&D investment, as well as to expand their work force. From a different perspective, firms' cash policy significantly distorts rivals' product market decisions. Particularly, the analysis shows that incumbents' cash reserves restrain the entry of potential competitors and hamper the expansion of rivals by curbing both their investment and acquisition policies.

The second essay sheds new light on the process whereby firms accumulate their cash reserves, i.e. their savings decisions. Remarkably, the investigation illustrates that stock prices, and more importantly, the private information they contain, play a crucial role in explaining firms' savings choices. I start by documenting that a firm' savings are highly sensitive to its stock price. This positive association indicates that firms tend to transfer more resources into their cash balances when the market foresees valuable future prospects. Strikingly, such a precautionary mechanism turns out to be amplified when the market price contains a larger content of private investors' information. Hence, the findings are consistent with the view that managers learn from observing the level of their stock price. Moreover, further test show that this defensive learning is not due to the uncaptured effect of market

mispricing or financing constraints. Overall, the analysis importantly highlights that the nature and precision of the available information about firms' future prospects are crucial ingredients of their saving choices.

The last essay[5] takes a corporate governance perspective and investigates the effect of a U.S. cross-listing on the risk that cash holdings are channeled into value destroying ventures. In a nutshell, the analysis reveals that the potential for value destruction embodied in large cash positions is significantly lessened when foreign firms benefit from the strength of U.S. institutions and monitoring environment. Indeed, investors systematically place a valuation premium on the excess cash of foreign firms that cross-list on U.S. markets compared with that of their domestic counterparts. The uncovered excess cash premium turns out to be magnified for firms established in countries in which shareholder protection is weak. Also, in spite of a host of initiatives to develop governance quality worldwide, the valuation differential significantly persists over time and is still at work nowadays. In addition, the analysis further dissects the results and put in light that two complementary forces explain the excess cash premium of cross-listed firms. On one hand, investors perceive the strength of U.S. legal environment as effective to tie managers' hand. On the other hand, the additional scrutiny by analysts and large investors that is associated with a U.S. listing also enhances investors' confidence that cash holdings will not be dissipated.

Overall, I believe that this dissertation ultimately delivers novel and valuable insights on the determinants and consequences of corporate cash policy. Nevertheless, as pointed out earlier, several crucial questions remain unanswered and deserve further investigation. As a logic prolongation of this dissertation, I am currently working on two related sets of questions. In a first project[6], I delve into the complex relationship between cash and debt. Indeed, for a long time, cash holdings were considered as the "negative" of debt because they can be readily used to redeem debt contracts. However, by providing compelling evidence that cash holdings are a relevant component of firm's financial structure, the findings in this dissertation indirectly contradicts this claim. To gain a better understanding on the interplay between cash and debt, this project explores the potential effects of

[5] Joint with Carolina Salva (Vlerick Business School).
[6] Joint with Michael R. Roberts (The Wharton School, University of Pennsylvania) and Philip Valta (Swiss Finance Institute and Ecole Polytechnique Fédérale de Lausanne).

cash holdings on the structure of private debt contracts. Specifically, using private loans data, the projects seeks to investigate whether and how corporate cash holdings affect the nature and characteristics of private loans (maturity, pricing and covenant structure) and whether cross-sectional and time-series differences in cash holdings can be explained by contractual features such as financial covenants and/or operating restrictions.

In a second project, I explore in depth the real origins of corporate cash reserves. So far, the literature has remained relatively silent on the potential sources that contribute to supply cash balances. In this project, I conjecture that the origin of observed cash holdings matter. As a matter of fact, observed cash levels are the results of various past decisions. For instance, it could be that actual levels results from the systematic saving of corporate profits. Alternatively, it could be that firms have raised funds externally and stored them in the form of cash. On this ground, the project aims at identifying where does all the cash come from and explores whether and how the "origin" of cash reserves is linked to their use and explains their impact on firm value and performance.

Chapter 1: Financial Strength and Product Market Behavior: The Real Effects of Corporate Cash Holdings

1.1. Introduction

Contemplating the record amount of cash stockpiled by U.S. firms, the finance profession has started to worry about these hoards. In particular, observers have recently cast serious doubt on the rationale for holding so much cash.[7] This concern has led to important research intended to clarify the multifaceted dimensions of firms' cash policy. Although rapid developments have considerably enriched our understanding of the factors driving firms' cash holdings, the literature has paid little attention to whether cash policy has a real effect on firms' day-to-day operations. This paper helps to bridge that gap by examining whether and how cash reserves affect firms' product market decisions.

Following simple economic intuition, one can think of several reasons why cash holdings may influence a firm's product market choices and those of its competitors. Primarily, a cash-rich firm can use its war chest to finance competitive strategies. For instance, a firm can rely on a strong balance sheet to hurt rivals' bottom lines and prospects through aggressive pricing; see Bolton and Scharfstein (1990). More generally, a firm may use its cash reserves to fund a number of alternative competitive policies such as the location of stores or plants, the construction of efficient distribution networks, advertising targeted against rivals, or even the employment of more productive workers. From a different perspective, a firm's stock of cash can signal the possibility of aggressive behavior, thereby distorting competitors' actions in the product market. Accordingly, one can view cash holdings as a preemptive device that may affect, for instance, rivals' entry or capacity expansion decisions; see Benoit (1984).

On these grounds, theory predicts that cash holdings may have both direct and indirect effects on competitive outcomes. To gauge the importance of these mechanisms and to shed additional light on the implications of corporate cash policy, this paper empirically explores the link between firms'

[7] "Behind Those Stockpiles of Corporate Cash," by Mark Hulbert, *Wall Street Journal*, October 22, 2006. "Looking for Trouble," *The Economist*, April 21, 2005. "The Corporate Savings Glut", *The Economist*, July 7, 2005. "Companies Are Piling Up Cash", by Diana B. Henriques, *New York Times*, March 4, 2008.

cash holdings and their behavior in the product market. I start the analysis by arguing that irrespective of the mechanism at work, if cash holdings really influence product market outcomes, we should observe cash-rich firms gaining market share at the expense of their competitors. To test this prediction, I gather firm-level data from a panel of 105 well-defined product markets over three decades and study the effect of cash holdings on market share dynamics. Consistent with the idea that cash policy encompasses an effective strategic dimension, I first document strong evidence that a firm's stock of cash is associated with future market-share expansion at the expense of industry rivals. More specifically, after controlling for relative size, fixed capital and R&D investment, selling expenses, leverage, labor productivity, and past profitability as well as firm- , time- and industry-specific effects, I find that firms with markedly higher cash reserves expand their market shares relatively more than their competitors in future years. The estimates reveal an economically important "cash" effect. Across all industries, a one standard-deviation increase in relative-to-rivals cash holdings enables the average firm to gain share of 1.8 percent in its product market. Numerous specifications and robustness checks offer additional evidence that the estimates truly reflect the positive impact of cash reserves on competitive performance rather than other strategic effects, biases due to the endogeneity of cash policy, or unobserved industry factors.

To provide further support for these results, I take advantage of the cross-industry nature of the sample and investigate how the effect of cash holdings on competitive performance depends on industry characteristics. In particular, I explore how rivals' financial status alters the competitive effect of cash holdings. Consistent with the idea that a surfeit of cash confers a strategic advantage over cash-poor rivals, I observe that the cash-performance sensitivity is magnified when rivals have weak financial positions. In a similar vein, I investigate to what extent the competitive effect of cash is determined by the intensity with which firms interact within their industry. The evidence points to noticeable differential effects. In particular, the effect of cash on market share growth turns out to be twice as large in concentrated markets as in competitive markets. Moreover, the larger the fraction of growth opportunities shared with rivals, the greater the effect of cash. In the same way, product market performance is more sensitive to cash in sectors in which R&D efforts are crucial to market share gains or when a firm operates in the technological core of its industry. Consistent with a strategic

dimension, the impact of cash holdings on product market performance appears to depend on rivals' financial condition and industry- related characteristics.

To reinforce the interpretation of the results, I also examine the impact of relative cash reserves on firm value and operating performance. Using different specifications, I show that firms with markedly large cash reserves experience increases in both market value and return on assets in comparison with their cash-poor rivals. This finding, which is robust to the inclusion of several control variables for investment opportunities, suggests that the competitive effect of cash is value-enhancing.

Next, I explore in greater depth the origins of the competitive advantage associated with cash reserves. In particular, I examine whether the strategic benefits are achieved through the direct use of firms' war chests to finance competitive actions and/or because rivals perceive the possibility of strategic moves and adjust their product market choices accordingly. To do so, I first document that cash-rich firms actively use their war chests to fund competitive actions. Indeed, the analysis reveals that deep-pocketed firms spend an important fraction of their cash resources on fixed capital and R&D investment, advertising, and additions to their work force. On this ground, I examine whether the way cash-rich firms use their money explains their better performance in the product market. Several regressions reveal that cash-rich firms that draw down their reserves to increase investment in fixed capital, R&D, and the labor force obtain a larger share of their product market. In contrast, I find no evidence that expenditures on advertising or acquisitions explain market share gains. Importantly, these findings confirm that part of the competitive advantage provided by large cash reserves materializes through their direct strategic use.

Alternatively, I examine whether a firm's cash holdings play a preemptive role that distorts rivals' actions. In particular, I analyze whether incumbents' cash holdings influence firms' decisions to enter new markets. By specifying an empirical model of entry, regressions show that incumbents' average cash reserves negatively predict entry intensity. Noticeably, the estimates point out a substantial deterrent effect. As a matter of fact, a one-standard-deviation increase in incumbents' cash reduces expected entries by 5 percent. Moreover, consistent with a curbing effect of incumbents' cash holdings, I further show that there is less entry in markets in which deep-pocketed firms dominate sales. With analogous logic, I look at capacity expansion decisions. As with the effect on entry choices,

cash reserves may alter rivals' decisions. Using standard investment specifications, I find strong support for the claim that rivals' average cash reserves affect expansion policy negatively. All else being equal, firms competing against deep-pocketed rivals display investment rates that are 2 percent below the median sample corporate investment. In addition, the analysis reveals that in the presence of cash-rich rivals, firms adapt their actions and invest suboptimally compared with what would be justified by growth opportunities. Taken together, these results unambiguously support the view that cash holdings play a strategic role that indirectly affects rivals' product market actions. Therefore, they suggest that the better performance of cash-rich firms is also partly due to the preemptive effect on competitors of large cash reserves.

Overall, this paper contributes in two main areas. First, the study adds to the burgeoning literature on corporate cash holdings. By providing compelling evidence that cash policy encompasses a substantial product market dimension, the analysis broadens our understanding of the implications of corporate cash reserves. Prior research depicts a dark side of cash holdings by arguing that entrenched managers use them in ways that destroy value; see Harford (1999), Dittmar and Mahrt-Smith (2006), and Harford, Mansi, and Maxwell (2006). In contrast, other studies argue that cash reserves can benefit shareholders by allowing firms to take efficient advantage of their growth prospects; see Opler, Pinkowitz, Stulz, and Williamson (1999), Mikkelson and Partch (2003), and Haushalter, Klasa, and Maxwell (2006). The results in this paper add significantly to this line of research by showing that cash reserves bring real benefits. Corroborating the precautionary nature of cash policy, the analysis confirms that cash enables firms to finance value-enhancing product market actions. More specifically, by underlining the importance of cash to product market success, the findings shed light on one way in which the hoarding strategy turns out to be beneficial. The study also illustrates that a firm's cash reserves significantly affect rivals' actions, which suggests that cash policy might also encompass a valuable signaling dimension.[8] Taken as a whole, the documented strategic effect of cash appears substantial. As such, it needs to be taken into account when assessing the soundness of firms' levels of cash and whether and how investors should be concerned.

[8] The idea that cash reserves serve a signaling purpose has recently been put forth by Servaes and Tufano (2006). In their international survey, they argue that cash holdings may play an important role in signaling firm quality to the stock market or to credit rating agencies.

Second, this study complements the evidence relating finance and product markets. A growing literature, starting with Titman (1984) and Brander and Lewis (1986), examines the interactions among firms in output markets and their financial and operating choices. The bulk of the empirical research in this area has revolved around analyzing the association between debt and product market strategies; see Opler and Titman (1994), Chevalier (1995), Phillips (1995), Kovenock and Phillips (1997), Zingales (1998), Khanna and Tice (2000, 2006), and Campello (2003, 2006). Certainly, by establishing a link between cash holdings and product market outcomes, my results point out an additional channel through which finance affects product market behavior. In this respect, the results confirm that the interactions between financial and other decisions clearly go beyond the association between debt financing and competitive strategies. In a related perspective, the analysis pins down several direct and indirect mechanisms through which finance affects product market outcomes. In particular, by documenting that firms' cash positions affect rivals' entry and expansion decisions, the study confirms that firms do not operate in isolation but incorporate rivals' financial status and competitive positions in their decision processes. This latter point calls our attention to the fact that firms' interactions need to be considered when one is investigating corporate financial decisions.

In the next section, I review the relevant literature and develop the main hypothesis. Section 1.3 describes the methodology and details the sample. Section 1.4 analyzes and characterizes the impact of cash holdings on firms' product market performance. In section 1.5, I dissect the potential mechanisms through which cash reserves impinge on business performance. Section 1.6 presents my conclusions.

1.2. Related literature and hypothesis development

While much effort has recently been devoted to studying the determinants of firms' cash policy,[9] evidence on the implications of firms' cash reserves remains relatively scarce. There are, however, a few notable exceptions. Blanchard, Lopez-de-Silanes, and Shleifer (1994), who study a

[9] Several studies investigate the determinants of cash holdings; see, for instance, Kim et al. (1998), Opler et al. (1999), Dittmar et al. (2003), Hartzell et al. (2007), Haushalter et al. (2006), Bates et al. (2007), Capkun and Weiss (2007).

small sample of firms that received cash windfalls from lawsuits, and Harford (1999), who studies acquisitions by firms with unusual cash holdings, document that managers with weaker incentives to maximize value tend to spend large holdings of cash inefficiently. In a similar spirit, Dittmar and Mahrt-Smith (2006) and Harford, Mansi, and Maxwell (2006) find that poorly governed firms tend to dissipate their cash quickly in ways that destroy firm value. In contrast, consistent with a precautionary principle, Kim, Mauer, and Sherman (1998), Opler, Pinkowitz, Stulz, and Williamson (1999), and Mikkelson and Partch (2003) document that persistent cash holdings do not hinder profitability and do not hurt firm value. Although these studies shed light on important facets of the impact of corporate cash holdings, many implications of firms' cash policy are not yet fully understood. In particular, prior empirical work has paid little attention to the potential effects of firms' cash holdings on their actions and performance in the product market.

Yet from an intuitive as well as a theoretical viewpoint, the idea that firms' cash reserves might impinge on product market outcomes is of long standing. For instance, Tesler (1966) and later Bolton and Scharfstein (1990) argue that cash-rich firms may increase their output to drive down industry prices. To the extent that rivals face difficulties in accessing funds, the decrease in output price may induce losses for financially weak firms and may possibly drive them out of the market. Consequently, limited access to external funds can hinder a cash-poor firm's ability to compete vigorously in the product market, which may in turn prompt cash-rich rivals to adopt "predatory" behaviors. Chevalier and Scharfstein (1996) also suggest that cash-poor firms may be less inclined to invest in building market share. In their model, firms directly decrease product prices as a means to secure long-term market share instead of maximizing short-term profits. More generally, cash holdings may be used to fund strategic practices other than predatory pricing. As pointed out by Campello (2006), examples of such policies may comprise decisions about capital outlays, research and development expenses, the location of stores or plants, distribution networks, advertising targeted against rivals, the recruitment of more productive workers, or the acquisition of key suppliers or business partners. Overall, this line of research suggests that cash-rich firms can use their war chests to directly finance competitive strategies that may, in turn, enhance their performance in the product market.

From a related angle, a firm's stock of cash may also influence other players' actions indirectly. Certainly, one can view cash reserves as a preemptive weapon that may distort competitors' strategies. For instance, Benoit (1984) formalizes this idea by showing that if a potential entrant faces financing constraints, the threat of competitive actions by cash-rich incumbents may be sufficient to prevent entry. Consequently, by limiting entry, incumbents' cash holdings can be viewed as a potential driver of industry dynamics and hence affect firms' competitive performance.[10] Similarly, cash holdings may act as a credible threat of competitive retaliation, that is, a "second strike" capability against potential capacity expansion by industry rivals.[11] In this spirit, a firm's cash holdings may affect rivals' decisions to increase capacity and hence indirectly alter competitive outcomes.

Surprisingly, while previous work suggests both direct and indirect links between a firm's cash reserves and product market conduct, the empirical assessment of the interplay between finance and the product market concentrates mainly on linking firms' competitive performance to some measure of debt financing.[12] In view of that, deep-pocketed firms are assumed to be those displaying low levels of leverage. Specifically, because of their limited capacity to raise additional funds, highly indebted firms are assumed to be financially fragile and thus can be severely affected by unlevered rivals' competitive strategies. Yet recent evidence challenges this unilateral focus in several dimensions and clearly suggests a potential role for cash holdings in explaining product market outcomes. First, Acharya, Almeida, and Campello (2006) and Gamba and Triantis (2007) show that cash reserves and negative debt (debt capacity) are not equivalent when there is uncertainty about future cash flow. Importantly, Gamba and Triantis (2007) further argue that different combinations of cash and debt may have different effects on firm value and performance. This work draws attention to the fact that when external finance is costly, cash should not be considered as the opposite of debt. In such a context, it is likely that cash and debt play distinct roles in influencing competitive outcomes.

[10] In a recent paper, Hege and Henessy (2007) suggest another channel through which cash holdings might affect entry decisions. They argue that deep-pocketed incumbents may actually prompt entry by increasing creditors' recovery in liquidation, thereby providing potential entrants with funds. The analysis in section 5.2.1 reports results that contradict their claim.

[11] Consistent with this effect but without relying on strategic interactions, the model of Chemla and Winter (2007) also predicts that the level of investment by one firm is decreasing in the cash reserves of its rivals.

[12] While some studies report that high indebtedness leads to poor performance in the product market (for example, Chevalier (1995), Phillips (1995), Kovenock and Philips (1997), Zingales (1998), Khanna and Tice (2000), and Campello (2003)), others find that debt increases firms' aggressiveness in the product market competition (for example, Campello (2006), Lyandres (2006)).

Second, some recent works assert that the supply of capital has important implications for corporate capital structure. In particular, Faulkender and Petersen (2006) show that, all else being equal, firms that have access to the public bond market are more levered. Hence, their results suggest that a low level of leverage may not necessarily indicate high debt capacity but may instead be a sign of saturated debt capacity. The same intuition prevails in the work of Lemmon and Roberts (2006) and Sufi (2007). Under such circumstances, a low level of leverage may not be an accurate proxy for financial strength.

Third, a number of recent studies show that corporate liquidity is empirically associated with business risk. In particular, Opler et al. (1999) document that firms with riskier cash flow and limited access to external capital hold more cash. In a similar vein, Almeida, Campello, and Weisbach (2004) find that financially constrained firms save cash out of cash flow, while unconstrained firms do not. More recently, Bates et al. (2007) report a dramatic increase in the average cash-to-asset ratio for U.S. firms since 1980 and show that this increase is mainly a response to increased business risk.[13] By and large, as business risk is endogenously determined by competitive interactions in the product market, the recent evidence suggests a connection between cash policy and product market performance.

On this ground, Haushalter, Klasa, and Maxwell (2006) look at the influence of product market dynamics on cash policy. They argue that, when deciding on their optimal amount of cash, firms take into account the risk that rivals may prey on them. Considering three variables that proxy for predation risk, they document that the level of cash is positively associated with the risk of predation. In a related spirit, Schroth and Szalay (2007) show that large cash balances increase the probability of winning patent races in the U.S. pharmaceutical industry. To the extent that patents confer competitive advantage in the product market, these results confirm the idea that cash holdings are important drivers of product market success in this specific industry.

While those two papers provide primary evidence of a connection between cash and the product market, whether and through which channels cash holdings affect a firm and its rivals' competitive behavior remains an open question calling for more investigation. In this paper, I take a

[13] Other related papers include Kim, Mauer, and Sherman (1998), Harford (1999), Pinkowitz and Williamson (2001), Mikkelson and Partch (2003), Faulkender and Wang (2006), and Acharya, Almeida and Campello (2006).

step in that direction by empirically examining whether cash holdings encompass a strategic dimension. Also, I attempt to identify potential channels through which cash operates. To do so, I first hypothesize that if cash holdings have a strategic influence on competitive outcomes, then one should ultimately observe, all else being equal, cash-rich firms gaining market share at the expense of industry rivals. Below, I confirm this claim and provide compelling evidence on the mechanisms through which cash policy affects competitive outcomes.

1.3. Methodology and data

1.3.1. Identifying the impact of cash on product market outcomes

As a first step in exploring the interplay between cash holdings and product market outcomes, I investigate the link between cash and market share growth. As a matter of fact, one can argue that irrespective of the mechanism at work, if cash holdings encompass a valuable strategic component, it will ultimately be reflected in firms' performance in their product markets. Therefore, I examine whether firms with large cash reserves expand their market shares more than their industry rivals. To do so, I follow Campello (2003, 2006) and specify the following baseline model[14]:

$$\begin{aligned}\Delta MarketShares_{i,t} = {} & \vartheta(zCash_{i,t-2}) + \beta \text{Ind.Adj}(size_{i,t}) + \sum_{k=1}^{2} \lambda_k \text{Ind.Adj}(Investment_{i,t-k}) \\ & + \sum_{k=1}^{2} \gamma_k \text{Ind.Adj}(RDExpenses_{i,t-k}) + \sum_{k=1}^{2} \varphi_k \text{Ind.Adj}(\Delta labor_{i,t-k}) \\ & + \sum_{k=1}^{2} \rho_k \text{Ind.Adj}(Leverage_{i,t-k}) + \sum_{k=1}^{2} \delta_k \text{Ind.Adj}(SellingExpenses_{i,t-k}) \\ & + \sum_{k=1}^{2} \phi_k \Delta MarketShares_{i,t-k} + \alpha_i + \eta_t + \varepsilon_{i,t}\end{aligned} \quad (1)$$

where the subscripts *i* and *t* represent respectively the firm and the end of the year. The dependent variable, *ΔMarketShares*, is sales growth minus its industry-year average, so that this variable measures a firm's sales expansion in relation to that of its competitors or equivalently serves as a

[14] Note that this empirical specification is very similar to those of Opler and Titman (1994), Campello (2003, 2006), Campello and Fluck (2006), and Dimitrov and Tice (2006).

proxy for market share growth.[15] To reliably gauge the effects of cash holdings on market share dynamics, I need to characterize a firm's cash position compared with those of its rivals. For that purpose, I follow MacKay and Phillips (2005) and "z-score" the ratio of cash to total assets within each industry-year. Specifically, I compute *z-Cash* by subtracting from the cash-to-asset ratio its industry-year mean and divide the difference by the industry-year standard deviation. The motivation for z-scoring cash can be illustrated by the following example. Imagine that a firm has 5 percent more cash than its average rival. Clearly, the competitive advantage contained in this deviation is a function of the industry-year cash-to-assets dispersion. Indeed, a 5 percent cash deviation in an industry in which the standard deviation is 2 percent is likely to provide more strategic value than in an industry with a 15 percent standard deviation. Hence, I assume that the dispersion of liquid assets within an industry-year conditions the advantage provided by a firm's cash reserves.

Next, to consistently estimate the competitive effect of cash on changes in firm's share of industry sales, I include control variables designed to capture other direct sources of product market performance that may directly correlate with firms' cash positions. First, it is likely that cash holdings enable firms to invest fully in their growth opportunities. For instance, Haushalter et al. (2006) report that firms are more likely to increase investment relative to their industry peers if they have larger cash holdings. Even though their study remains silent on whether such a higher investment rate enables cash-rich firms to compete more successfully in the product market, one may expect that capital spending in one period translates into sales growth in the next period. Accordingly, the relationship between firms' market-share expansion and cash holdings should account for fixed investment (*Investment*). In a similar spirit, I add R&D expenses (*R&DExpenses*). As a matter of fact, as suggested by Schroth and Szalay (2007), R&D efforts are likely to affect firms' competitive performance, especially in R&D-intensive industries. Also a firm may use its available cash to finance marketing strategies such as advertising, promotions, or discounts. To the extent that such selling devices may boost sales, I follow Campello (2006) and add proxies for past sales efforts. Specifically, I introduce *Selling Expenses*, which is defined as the sum of advertising expenditures and selling

[15] In unreported tables, I redo the analysis by modifying the dependent variables. Specifically I consider changes in a firms percentage sales of its total industry sales to measure market share growth. The results are virtually the same and are available upon request.

expenses divided by total assets. Then, to control for the potential effects of labor productivity on firms' product market performance, I include lagged changes in the number of employees (*ΔLabor*). Importantly, the literature examining the interplay between finance and product market choices provides extensive evidence that debt financing affects product market conduct[16]. Since cash and debt are intimately related, there is a possibility that a correlation between cash and market share growth might just reflects the unspecified effect of capital structure. For that reason, I also include lagged *Leverage* in specification (1). Further, I include past market share development (*ΔMarketShares*) to capture the effect of other firm characteristics that may have drive competitive performance in the recent past, such as change in store location or distribution network. Here again, I minimize the potential effect of industry-specific factors by subtracting from all the control variables their industry mean in each year. Finally, I account for time-invariant firm heterogeneity and time trend by including firm fixed effects as well as time dummies (α_i and η_t).

In estimating equation (1), my primary interest is in the sensitivity of market share expansion to relative-to-rivals lagged cash holdings (ϑ). In other words, I focus on the statistical and economic significance of the residual correlation between cash and market share growth after controlling for firm size, fixed capital and R&D investment, selling efforts, labor productivity, debt financing, and past performance as well as firm-, time- and industry-specific effects. Even though this measure is too general to pin down the specific channels through which cash holdings shape product market actions, it summarizes relevant information from the combination of direct and indirect strategic effects and is available for a large cross-section of industries.

1.3.2. Endogeneity of cash holdings

The literature on cash holdings raises two important concerns about the estimation of specification (1). First, Opler et al. (1999) and Bates et al. (2007), among others, document that cash holdings vary with industry characteristics. This suggests that a correlation between a firm's cash position and its performance may be spurious, simply because both cash policy and product market

[16] See Maksimovic (1995) for a survey.

performance may be jointly affected by unobserved firm and industry factors. The second issue concerns the endogeneity of firms' cash policy. Arguably, because we know that cash holdings may help firms manage their business risk [Haushalter et al. (2006)], cash is likely to be a function of the managers' expectations about its strategic value. As a result, it is not clear whether it is the firm's cash holdings that affect its competitive performance or rather the product market rivalry that determines its cash policy.

Fortunately, the test design naturally addresses the problem of spurious correlation in two ways. First, I include in equation (1) different control variables that should help capture firm characteristics that drive product market performance beyond the effect of cash. Second, as put forth by Campello (2006), the use of relative-to-industry variables minimizes the concern of spurious correlation driven by unobservable industry effects, since all industry-related factors are removed from the estimates. In a similar fashion, the inclusion of firm-fixed effects should capture unobservable firm effects and further limit potential spurious correlation.

A more important concern relates to the endogeneity of firms' cash policy. To consistently estimate the effect of cash on product market performance, I need instruments that correlate with cash holdings but that are not likely to be correlated with relative-to-industry sales growth, aside from the cash channel itself. The literature on cash holdings provides guidance concerning possible identification strategies. While many variables have been shown to affect cash policy[17], I include in the set of instruments for cash two of its own lags as well as contemporaneous asset tangibility. The lags of cash are used to capture differences in the levels of cash. Finally, I instrument cash with contemporaneous asset tangibility. Recently, Capkun, and Weiss (2007) reveal a strong association between firms' cash holdings and "hard" assets such as inventory, receivables, or fixed capital. While a firm's asset tangibility may correlate with its cash reserves, the tangible attributes of a firm's assets should not influence its product market performance other than through the association with financial strength itself. To construct a proxy for the tangible nature of a firm's assets, I follow Berger, Ofek, and Swary (1996) and define *Tangibility* as a function of receivables, inventory, and fixed capital. In the analysis below, I use detailed identification tests to show that the instruments succeed in

[17] See Bates et al. (2007) for an extensive list of determining variables.

identifying specification (1) parameters. Note also that in specification (1), I use a one-year lag between the measurement of financial strength and the measurement of performance. This should further minimize the endogeneity bias.

As a result, I estimate the base-line specification (1) in two steps. First, I regress the ratio of cash to total assets on the instrumental variables. Then, I z-score the predicted values to get a measure of financial strength that identifies reliable relative-to-rival behavior while accounting for the fact that cash may be predetermined. For the rest of the analysis, I denote a firm's z-scored predicted value of cash by *z-Cash* and use it in model (1) to estimate the sensitivity of market share growth to relative-to-rivals cash. I adjust the estimates' standard errors for within-firm-period error clustering and heteroskedasticity; see Petersen (2007).

1.3.3. Sample construction and industry definition

I gather annual firm-level data from COMPUSTAT's tapes over the period 1973-2005. Then, I exclude firm-years for which information on sales, cash holdings, and total assets are not available. I also eliminate observations with negative equity, sales, or asset growth larger than 200 percent. I classify product markets (industries) at the four-digit SIC level and restrict my focus to manufacturing firms (2000-3999 SIC range). As pointed out by Clarke (1989) and Kahle and Walking (1996), some of the three- and four-digit codes may fail to define sound economic markets. To minimize such concerns, I follow Clarke (1989) and exclude four-digit SIC codes ending with 0 and 9. Moreover, since the estimations use industry-adjusted data, I restrict the sample to include only industry-years with a minimum of ten firms with available information on sales, cash, and total assets. This selection procedure leaves me with a sample of 105 four-digit industries. Appendix A details the definitions of the variables used in the following analysis, and Appendix B presents the descriptive statistics.

1.4. Results: The effect of cash on market share growth

1.4.1. Main findings

I start by estimating model (1) for firms in all industries, using predetermined and z-scored cash as a measure of financial strength. Table 1.1 displays the first important findings of this paper. Of most interest is the coefficient estimate of the average effect of relative-to-rivals cash holdings on market share growth (ϑ). The coefficient on *z-Cash* is significantly positive, suggesting that cash-rich firms outperform their more financially fragile rivals in the product market. In terms of economic magnitude, all else being equal, a one-standard-deviation increase in cash in relation to rivals in year *t* leads to a 1.8 percent (significant at 1 percent) gain in market share between years *t+1* and *t+2*. Notably, the *p*-value associated with the tests of overidentifying restrictions (*J*-statistics) is 34 percent, confirming that the instruments overidentify the model's parameters.[18] Overall, these first results are consistent with the idea that cash reserves have a positive effect on product market performance.

Note that the estimated coefficients of the control variables have the expected signs. Indeed, past capital expenditures and past labor productivity contribute positively to firms' market share expansion. Next, consistent with Opler and Titman (1994), Campello (2003), Campello and Fluck (2006), and Dimitrov and Tice (2006), we observe a negative association between two-years lagged *Leverage* and future market-share development (-0.008 with a t-stat of 3.65). In essence, this result corroborates the argument that excessive debt hurts product market performance. However, we note that cash turns out to have a markedly larger impact on future market-share gains.[19] These results are reassuring, since they indicate that the effect of cash reserves on product market performance is not a byproduct of the effect of capital structure.

[18]In appendix C, I provide an additional test to address the potential endogeneity of cash holdings. Specifically, I investigate how cash contributes to future market-share expansion in the aftermath of unexpected economic downturns. This provides a natural way to investigate how firms use existing financial conditions to react to new product market conditions. The results in appendix C confirm that cash helps cash-rich firms capture market share from their rivals.

[19] In unreported regressions, I also use a z-scored version *Leverage*. Moreover, I add short-term debt in the definition of *Leverage*. The results still hold. They are available upon request.

Table 1.1 The impact of cash on market share growth (base-line estimation)

This table presents results of panel regressions examining the effect of relative-to-rivals cash holdings on market share growth (specification (1)). The dependent variable is Δ*MarketShares*, the annual market-share growth given by industry-adjusted sales growth at time *t* [(*Sales*$_t$ − *Sales*$_{t-1}$)/*Sales*$_{t-1}$]. *Cash* is the ratio of cash and marketable securities divided by total assets. *Size* is the natural logarithm of assets. *Investment* is given by (*PPE*$_t$ − *PPE*$_{t-1}$)/*PPE*$_{t-1}$. *R&D Expenses* is spending on research and development over assets. Δ*Labor* is the annual change in the number of employee over assets. *Leverage* is long-term debt over assets. *Selling Expenses* is the ratio of advertising and selling expenses to total sales. All variables are adjusted for their four-digit SIC industry-year means, with *Cash* further standardized (i.e., z-scored) within each industry-year, *z-Cash*. All regressions contain firm and time fixed effects. The sample period is 1973 through 2005. IV estimations display diagnostic statistics for instrument overindentification restrictions (p-values for *J*-statistics reported). The estimations correct the error structure for heteroskedasticity and within-firm error clustering using the White-Huber estimator. *t*-statistics in brackets. ** and * denote statistical significance at the 1% and 5% level, respectively.

	(1) IV	(2) OLS	(3) IV	(4) OLS
z-Cash$_{t-2}$	0.018**	0.030**		
	[7.61]	[12.76]		
z-Cash$_{t-1}$			0.030**	0.027**
			[12.56]	[11.24]
Size$_{t-1}$	0.038**	0.037**	0.036**	0.038**
	[13.50]	[13.57]	[13.42]	[13.99]
Investment$_{t-1}$	0.104*	0.096*	0.091*	0.188**
	[2.32]	[2.22]	[2.09]	[4.32]
Investment$_{t-2}$	-0.061	0.076	0.066	0.052
	[1.40]	[1.83]	[1.58]	[1.26]
R&DExpenses$_{t-1}$	-0.132**	-0.158**	-0.14**	-0.131**
	[2.82]	[3.61]	[7.45]	[2.97]
R&DExpenses$_{t-2}$	0.475**	0.486**	0.483**	0.469**
	[10.21]	[11.05]	[10.90]	[10.64]
Δ*Labor*$_{t-1}$	0.078**	0.080**	0.082**	0.102**
	[8.88]	[9.66]	[9.75]	[12.16]
Δ*Labor*$_{t-2}$	-0.001	0.017	0.018	0.014
	[0.23]	[1.67]	[1.85]	[1.89]
Leverage$_{t-1}$	0.002	0.004	0.004	0.005*
	[1.06]	[1.67]	[1.78]	[2.03]
Leverage$_{t-2}$	-0.008**	-0.013**	-0.012**	-0.011**
	[3.65]	[3.84]	[4.34]	[3.69]
Selling Expenses$_{t-1}$	0.139**	0.123**	0.125**	0.121**
	[13.48]	[13.32]	[13.18]	[13.08]
Selling Expenses$_{t-2}$	-0.006	0.010	0.005	0.014
	[0.60]	[1.15]	[0.63]	[1.55]
Δ*MarketShares*$_{t-1}$	0.012*	0.012*	0.011	0.016**
	[1.99]	[2.08]**	[1.86]	[2.67]
Δ*MarketShares*$_{t-2}$	-0.047**	-0.039	-0.041**	-0.040**
	[7.83]	[7.11]	[7.45]	[7.19]
# Obs	28222	31791	31554	31789
R^2	0.25	0.25	0.26	0.25
J-statistic (*p*-value)	0.34		0.25	
Durbin-Hausman-Wu	0.02		0.03	

It is worth noting that the one-year lagged R&D estimate is significantly negative (-0.132), while its two-year counterpart turns out to be positive and larger (0.475). This might indicate that investment in R&D can boost competitive performance but this effect takes time to materialize. Also, past performance explains a large portion of current performance. Moreover, lagged changes in labor force and selling efforts appear to be effective, as they play a positive role in increasing a firm's share of its industry's sales. For completeness, I also estimate equation (1) by OLS where cash is z-scored (but not instrumented and present the results in column 2. As before, the coefficient estimate for cash is significantly positive. For the rest of the analysis, while both estimations lead to similar qualitative conclusions, a Durbin-Hausman-Wu "endogeneity test" strongly rejects the null hypothesis that OLS yields consistent estimates (*p*-values of 0.02). Hence, as expected, the endogeneity of cash significantly affects the OLS inference. Henceforth, I use instrumental-variables estimations to measure the cash-market share sensitivities consistently and use the same instrumental set to identify cash holdings. Note that in columns 3 and 4, I repeat this analysis by considering a one-year lag of relative-to-rivals cash instead of the previous two-year lag. This change has no bearing on the conclusions.

To give additional support to the results, I extend the analysis in two dimensions. First, I examine whether the positive coefficient on cash truly reflects the strategic impact of cash holdings on product market performance rather than possible unspecified effects. Second, I address the possibility that the significance of the estimates is misstated. I start the first set of tests by controlling for past acquisition activity. As shown in Harford (1999), cash-rich firms are more likely to attempt acquisitions. Hence, the above results might simply translate the fact that cash-rich firms mechanically gain market share via external growth. Column 1 of Table 1.2 reveals that the competitive effect of cash is not altered by the inclusion of acquisition intensity (dollars spent on acquisitions scaled by assets). As expected, the one-year lagged acquisition intensity positively contributes to market share expansion, whereas the two-year lagged estimate shows a negative sign. Interestingly, this negative effect is in line with Harford (1999), who documents that acquisitions by cash-rich firms are followed by abnormal declines in operating performance.

Table 1.2 The impact of cash on market share growth (robustness)

This table presents additional results of panel regressions examining the effect of relative-to-rivals cash holdings on market share growth (specification (1)). The dependent variable is Δ*MarketShares*, the annual market-share growth given by industry-adjusted sales growth at time *t* [$(Sales_t - Sales_{t-1})/Sales_{t-1}$]. *Cash* is the ratio of cash and marketable securities divided by total assets. All specifications include the same set of control variables as in Table I [*Investment*, *R&DExpenses*, Δ*Labor*, *Leverage*, *Selling Expenses* and past Δ*MarketShares*]. All variables are adjusted for their four-digit SIC industry-year means, with *Cash* further standardized (i.e., z-scored) within each industry-year, *z-Cash*. *Acquisitions* is the amount spent on acquisitions over assets. *SalesAcquisitions* is the sales contribution of acquisitions. *Market-to-Book* is the market value of equity plus the book value of assets minus the book value of equity minus deferred taxes, scaled by total assets. The sample period is 1973 through 2005. IV and GMM estimations display diagnostic statistics for instrument overindentification restrictions (*p*-values for *J*-statistics reported). The estimations correct the error structure for heteroskedasticity and within-firm error clustering using the White-Huber estimator. *t*-statistics in brackets. ** and * denote statistical significance at the 1% and 5% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Additional Controls			IPO<5yrs	IPO<10yrs	GMM	#firms>30	Adj. Cash	Skewness
z-Cash$_{t-2}$	0.017**	0.015**	0.017**	0.017**	0.014**	0.020**	0.023**	0.155**	0.016**
	[7.13]	[5.51]	[7.38]	[6.85]	[4.98]	[10.85]	[8.54]	[12.19]	[3.68]
Acquisitions $_{t-1}$	0.497**								
	[10.29]								
Acquisitions $_{t-2}$	-0.255**								
	[5.15]								
SalesAcquisitions $_{t-1}$		0.270**							
		[11.12]							
SalesAcquisitions $_{t-2}$		0.004							
		[1.19]							
Market-to-Book$_{t-1}$			0.051**						
			[27.00]						
Market-to-Book$_{t-2}$			0.008**						
			[4.70]						
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# Obs	27347	21669	27275	26355	17527	29299	13671	29929	11734
R^2	0.26	0.28	0.28	0.26	0.25	0.18	0.33	0.22	0.34
J-statistic (*p*-value)	0.39	0.26	0.45	0.27	0.22	0.11	0.75	0.23	0.39

In column 2, I repeat this analysis by considering the sales contributions of acquisitions instead of the dollar amount spent on them. The results are virtually unchanged. I also take into account lagged market-to-book value to control for the residual effect of potential growth opportunities not captured by past sales growth and investment. Column 3 reveals that this addition leads to similar results. Next, I consider the potential effect of firm age on my inference. Indeed, as documented in Bates et al. (2007), firms that have recently gone public could have more cash because

of the IPO proceeds and because they often issue equity in a seasonal offering within a few years of the IPO. This "fresh" cash might drive part of my results. Alternatively, it could also be argued that it is easier for small (young) firms to increase sales substantially as they enter a market. For those reasons, in columns 4 and 5, I report estimates for the cash-performance sensitivity when I eliminate young firms, that is, firms that had an IPO within five and ten years respectively. Although the effect decreases slightly, the effect of relative-to-rivals cash on market share gains is still positive and significant.

To further verify the validity of the inference, I estimate alternative versions of model (1). First, like cash policy, fixed capital and R&D investment, selling efforts, debt levels, and the firm's work force may also be endogenously chosen in anticipation of their impact on competitive outcomes. To address this concern, I explicitly treat those control variables as endogenous regressors and re-estimate the model using a (two-step) GMM estimator. In addition to the variables used to instrument cash holdings, I follow Campello (2006) and instrument *Investment* by using two lags of the capital stock and the other control variables with two of their own lags. The results are presented in column 6. We observe that treating the control variables as endogenous regressors does not change the cash coefficient, which remains economically and statistically significant. Note also that the p-value associated with the test of overidentifying restrictions (*J*-Statistics) is not rejected at the 10 percent level.

Another important concern relates to the use of z-scored cash to identify relative-to-rivals financial strength. Actually, the z-scoring procedure relies on estimates of the industry-year standard deviations of the cash-to-asset ratios. However, the requirement of a minimum of ten observations by industry-year induces a skewed distribution of cash-to-asset ratios for each industry-year that might twist the inference.[20] I address this concern in three ways. First, in column 7, I restrict the sample to observations from industry-years with a minimum of 30 firms. In column 8, I avoid using standard-deviation estimates and replace z-scored cash with its industry-adjusted value. Finally, following Campello (2006), I consider only observations from industry-years in which the skewness of cash-to-

[20] Unreported figures displaying the distribution of the industry-year skewness confirm the need to address this issue.

asset ratio is between -1 and 1 and report the results in column 9. Although these estimations lower the number of observations considerably, these changes have no bearing on the conclusions.

Taken together, this first set of results provides strong evidence that cash has a systematic positive effect on market share expansion. Below, I further characterize the nature of the competitive effect of cash.

1.4.2. Characterization: Interindustry differences

To further dissect the nature of the competitive effect of cash, I investigate how the effect of cash on market share growth differs across and within industries. In particular, I explore how rivals' financial policies condition the competitive effect of cash holdings. Then, I analyze whether the strategic advantage of cash reserves depends on the quantity of interactions between firms.

1.4.2.1. The effect of rival's finance

I start the interindustry investigation by testing whether the impact of cash holdings on market shares gains is more pronounced in industries in which rivals have a harder time obtaining external funds. Naturally, we might expect the strategic effect of cash reserves to be larger when competitors are financially vulnerable. To examine this prediction, I measure the average industry rival's financial strength with several proxies. First, I define the financial status of competitors using the average cash holdings across industries. Accordingly, in industries characterized by low cash holdings, the average competitor is assumed to be financially weak. Next, I consider industry *Net Leverage* to summarize rivals' balance-sheet strength. In addition, I use two indices of financial constraints found in the literature: the Kaplan and Zingales (1997) and the Whited and Wu (2006) index.[21]

For each year and for each proxy, I rank the sample industries according to their average value and assign firms from industries in the bottom and top quartile to "low" and "high" industries respectively. Next, for each proxy, I estimate equation (1) via a seemingly unrelated regression (SUR) system combining the two subgroups based on the two-years lagged rankings. To compare estimates

[21] I define these two indices in appendix A.

of the cash-performance sensitivities (ϑ) across low and high industries, I construct a Wald test of the differences between the two subgroups using the standard errors provided by the joint estimation.

Panel A of Table 1.3 reports which firms benefit more from large cash reserves to boost their market shares.[22] Across all specifications, the cash-performance sensitivities are larger when industry rivals have weaker financial positions. More specifically, row 1 presents regression results for subgroups based on the average rivals' cash reserves. A comparison of coefficients across subgroups shows that the sensitivity of market share growth to cash holdings is significantly larger in industries in which rivals are relatively cash-poor. The coefficients decrease by 32 percent when one moves from cash-poor to cash-rich industries. A Wald test rejects the equality of the cash coefficient across subgroup estimations (*p*-value 0.001). Hence, as expected, a stronger balance sheet than that of rivals translates into larger future competitive gains if average competitors have few internal resources.

When I split the firm-years according to industry *Net Leverage*, I find that relative-to-rivals cash is related to better sales performance in industries in which the average competitor is highly indebted. In industries that rely more on net debt financing, a one-standard-deviation increase in cash in year *t* converts to 2.7 percent sales growth expansion between years *t+1* and *t+2*. In contrast, this competitive effect is reduced to 1.8 percent in low-debt industries.

When I split the industry-years on the basis of the two proxies for financial constraints, I obtain similar patterns. For both indices, a higher value indicates that firms face larger financing constraints. Interestingly, the cash-market share sensitivity is significantly larger in industries in which the average competitor faces more financing constraints. In industry-years in which the average rivals have difficulty accessing capital (large value of Kaplan and Zingales indices), an extra unit of cash in relation to competitors leads to a 2.4 percent market-share enhancement over rivals. Although significant at the 1 percent level, the effect is much smaller when competitors are relatively unconstrained.

[22] I only report the estimated cash-market share sensitivities (ϑ). The full table is available upon request.

Table 1.3 Cross-industries impact of cash on market share growth

This table reports the estimates for *z-Cash* (ϑ) from a series of IV estimations of specification (1). The dependent variable is Δ*MarketShares*, the annual market-share growth given by industry-adjusted sales growth at time *t* [($Sales_t - Sales_{t-1}$)/$Sales_{t-1}$]. I classify industries on the basis of different proxies for the average rival's financial status (Panel A) and a firm's interaction with its rivals (panel B). All specifications include the same set of control variables as in Table I [*Investment*, R&*DExpenses*, Δ*Labor*, *Leverage*, *Selling Expenses* and past Δ*MarketShares*]. In classifying industries according to *Cash*, *Net Leverage*, *Kaplan and Zingales* and *Whited and Wu* Indices (*KZ* and *WW*), *R&D Expenses* and the *Correlation with industry*, I compute the industry-year average of those variables. Then, Low industries are those ranked in the bottom quartile of the respective distribution and High industries are those ranked in the top quartile of the same distribution. Concentration data (Herfindhal index) are from the Census of Manufacturers. *Low* concentration corresponds to an Herfindhal index below 1,000 ("competitive industry") while *High* concentration corresponds to an Herfindhal index above 1,800 ("concentrated industry"). Concerning the classification based on *Similarity of Operations*, in each industry-year, I assign firms in the Low (High) group, those for which *Similarity* is below their industry-year median value. All regressions contain firm and time fixed effects. The sample period is 1973 through 2005. The standard errors for the differences between High and Low are computed with a SUR system that estimates industry group jointly. *t*-statistics in brackets. ** and * denote statistical significance at the 1% and 5% level, respectively.

Panel A	Low	High	Low-High (*p*-value)	**Panel B**	Low	High	Low-High (*p*-value)
Cash	0.0256**	0.0176**	0.001**	*Industry Concentration*	0.017**	0.036**	0.03*
	[8.85]	[5.3]			[5.60]	[2.68]	
	(14890)	(8440)			(7636)	(1247)	
Net Leverage	0.0161**	0.0288**	0.001**	*Similarity of Operations*	0.009**	0.024**	0.004**
	[5.69]	[8.69]			[3.12]	[7.86]	
	(10368)	(10813)			(7306)	(8592)	
Kaplan and Zingales Index	0.0156**	0.0244**	0.001**	*Correlation with Industry*	0.013**	0.022**	0.05*
	[7.61]	[6.49]			[4.38]	[5.57]	
	(14604)	(9884)			(6303)	(6366)	
Whited and Wu Index	0.0118**	0.0176**	0.001**	*R&D Expenses*	0.006**	0.023**	0.001**
	[3.75]	[7.71]			[2.84]	[6.02]	
	(12444)	(9861)			(10141)	(7589)	

Overall, the results I obtain when I split industry-years by financial status support the view that cash holdings enable firms to gain in the product market, and that the magnitude of these gains is conditioned on competitors' financial status. In other words, this analysis provides supplementary evidence that the competitive impact of cash holdings is determined jointly by the firm's and its rivals' financial strength. Interestingly, while the sensitivity of sales performance to cash reserves is larger when rivals are financially weak, it is also significantly positive in industry-years in which competitors turn out to be financially strong. This suggests that when a firm is facing financially tough competitors, building a war chest enables it to perform better in the product market. Hence, cash holdings appear to play a systematic role in determining firms' performance in the product market

1.4.2.2. The effect of industry characteristics

Now, I take a different perspective and analyze whether the competitive effect of cash holdings depends on the quantity of strategic interactions between firms within an industry. Specifically, I examine whether and how the importance of cash reserves for product market performance is related to competitive risk, that is, when it is more important to have resources available to fight competitors. Like Haushalter et al. (2006), I assume that competitive risk is positively related to the quantity of strategic interactions between rival firms. Hence, the higher the interdependence among firms in a product market, the higher the costs of losing business share. I use four schemes as proxies for the risk of losing share to rivals. The first is the degree of industry concentration. Following MacKay and Phillips (2005), I collect four-digit SIC industry concentration ratios (Herfindahl-Hirschman Index, HHI) from the Census of Manufacturers for the years 1982, 1987, 1992 and 1997.[23] The Census of Manufacturers reports these ratios every five years. Following the Department of Justice's guidelines, I denote as "concentrated" those industries for which the HHI index is greater than 1,800, and as "competitive" those industries for which that index is

[23] As noted in MacKay and Philips (2005), this measure of concentration provides us with an independent and reasonably timely measure of industry concentration.

less than 1,000. In assigning firms to either concentrated or competitive markets, I use the timeliest information on their industries' HHI index within a five-year window from 1980 to 1999.[24]

As a second proxy for the competition risk, I follow Haushalter et al. (2006) and employ the covariation between competitors' growth opportunities. To compute this measure, I follow Parrino (1997) and rely on correlations between stock returns. I regress each firm's monthly stock returns on the monthly equally weighted market return and an equally weighted portfolio containing firms in the same industry (excluding the firm itself). Then I use the regression coefficient on the industry portfolio return as a proxy for the interdependence of growth options. Acknowledging that such interdependence may change over time, I estimate this proxy using a 36-month rolling-regression approach.

The third proxy for the interdependence between firms is whether a firm operates at the technological core of its industry or on the fringe. Following MacKay and Phillips (2005), I define the typical technology as the median capital-labor ratio for a given industry-year. Then, I compute the similarity of operation as the absolute value of the difference between a firm's *Capital-Labor ratio* and the industry-year median ratio.[25] To make it comparable across industries, the difference is divided by the industry-year range of the *Capital-Labor ratio*. A smaller value of this proxy reflects a greater similarity of a firm's operation with the operations of industry rivals an, therefore, a higher risk of losing market share.

The last proxy I use to characterize competitive risk is the industry R&D intensity. The idea here is that R&D is an indicator of the specialization of the firms' products that drives innovation. Accordingly, I conjecture that the market share loss of cash-poor firms might be larger in R&D- intensive industries. I define industry R&D intensity as the average ratio of R&D spending to total assets for each year.

To assess whether cash holdings contribute differently to product market performance with different degrees of competitive risk, I again split industries for each year and for each proxy into "low"

[24] More precisely, I use the 1982 census data for COMPUSTAT firm-fiscal years in the 1980-1984 period, and the 1997 census data for firms in the 1995-1999 period. Hence the use of this variable considerably restricts the size of the sample.

[25] Note that the industry-year median is weighted by each firm's share of industry sales and excludes the firm itself.

and “high” categories. Then, I estimate equation (1) again via a seemingly unrelated regression system combining the two industry subgroups based on the two-years lagged rankings. I report the estimated cash-market share (ϑ) sensitivities in panel B of Table 1.3.

Irrespective of the proxy, this table confirms that relative-to-rivals cash holdings have a differential impact depending on firms’ exposure to competitive risk. In particular, row 1 indicates that the importance of cash reserves to expanding sales more than rivals is almost twice as large in concentrated markets as in competitive markets. In row 2, we observe that the competitive effect of cash is much larger when the firm is close to the technological core of its product market than when it lies on the fringe. Row 3 reports similar conclusions when the correlation of a firm’s stock returns with the stock returns of its industry is used to measure the interdependence between competitors. Notably, the larger the fraction of growth options shared with rivals, the greater the impact of cash on business performance. If we look at row 4, we note an analogous pattern. Having more cash on hand than rivals turns out to be more beneficial in industries characterized by intensive spending on R&D. Interestingly, this latter result substantiates the findings of Schroth and Szalay (2007), who document that cash holdings increase the probability of winning patent races in the U.S. pharmaceutical industry. The results suggest that performance is more sensitive to cash in sectors in which R&D efforts are crucial to reap market share.

While Haushalter et al. (2006) show that the average firm increases its holdings of cash when facing competitive risk, the analysis above provides some evidence on the effectiveness of such a hoarding strategy. In particular, evidence reveals that holding more cash than competitors effectively translates into better product market performance when the interdependence among rivals is important.

1.4.3. Impact on firm value and operating performance

The results above suggest that relative-to-rivals cash holdings are positively related to future product market performance. In this context, a natural question arises. How do the competitive effects of cash affect firm value? To provide some evidence on the valuation consequences of the cash effects, I

examine how measures of market value and operating performance are related to relative-to-rivals cash. As a measure of market value, I use the market-to-book ratio. As a measure of operating performance, I use return on assets (*ROA*), defined as EBITDA divided by assets.

Table 1.4 The impact of cash on firm value and operating performance

This table presents results of panel regressions examining the effect of relative-to-rivals cash holdings on firm value and operating performance. In columns (1) and (2), the dependent variable is the (industry-adjusted) *Market-to-Book* ratio at time *t*. In columns (3) and (4), the dependent variable is the (industry-adjusted) return on assets (*ROA*) at time *t*. *Cash* is the ratio of cash and marketable securities divided by total assets. *Size* is the natural logarithm of assets. *Investment* is given by $(PPE_t - PPE_{t-1})/PPE_{t-1}$. *Leverage* is the ratio of long-term debt over assets. *Cash Flow* is net operating income divided by assets. *Dividend* is a dummy that equals one if the firm pays dividend and zero otherwise. *R&D Expenses* is spending on research and development over assets. *Sales Growth* at time *t* are given by $(Sales_t - Sales_{t-1})/Sales_{t-1}$. All variables are adjusted for their four-digit SIC industry-year means, with *Cash* further standardized (i.e., z-scored) within each industry-year, *z-Cash*. The sample period is 1973 through 2005. IV estimations display diagnostic statistics for instrument overindentification restrictions (*p*-values for *J*-statistics reported). All regressions contain firm and time fixed effects. The estimations correct the error structure for heteroskedasticity and within-firm error clustering using the White-Huber estimator. *t*-statistics in brackets. ** and * denote statistical significance at the 1% and 5% level, respectively.

	Market-to-Book		ROA	
	(1)	(2)	(3)	(4)
$z\text{-}Cash_{t-1}$	0.061**	0.017*	0.004**	0.001*
	[7.18]	[2.35]	[3.74]	[1.97]
$Size_{t-1}$	-0.276**	-0.181**	-0.018**	-0.021**
	[27.42]	[19.85]	[12.08]	[18.04]
$Investment_{t-1}$	0.977**	0.037	-0.003	-0.035
	[6.27]	[0.27]	[0.17]	[1.65]
$Leverage_{t-1}$	-0.173**	0.071	-0.022*	-0.005
	[2.79]	[1.29]	[2.38]	[1.57]
$Cash\ Flow_{t-1}$	0.112**	0.199**	0.232**	0.299**
	[2.3]	[3.97]	[33.47]	[12.95]
$Dividend_{t-1}$	0.04	0.006	0.015**	0.012**
	[1.87]	[0.33]	[4.79]	[3.87]
$R\&D\ Expenses_{t-1}$		1.242**		-0.034
		[9.52]		[1.80]
$Sales\ Growth_{t-1}$		0.036		
		[1.92]		
$Market\text{-}to\text{-}Book_{t-1}$		0.377**		
		[29.68]		
ROA_{t-1}				0.332**
				[14.23]
# Obs	33813	32910	34613	34404
R^2	0.5	0.58	0.61	0.62
J-statistic (*p*-value)	0.21	0.18	0.23	0.25

Table 1.4 presents regression results of industry-adjusted market-to-book ratio and *ROA* on lagged z-scored cash holdings. To control for other sources of value besides relative-to-rivals cash, I include firm *Size*, *Cash Flow*, *Investment*, *Leverage* and *Dividend*, a dummy that equals one if the firm pays a dividend and zero otherwise. Since I explain relative-to-rivals valuation, I subtract from the control variables their industry means in each year. Given that payout policy and asset tangibility may directly affect firm value, I have to restrict the instrument set and include only two lags of cash to compute predetermined cash holdings. Moreover, I include firm's fixed and time effects and adjust the estimates' standard errors for within-firm-period error clustering and heteroskedasticity.

In column 1, firm value increases significantly in lagged *z-Cash* (0.061 with a *t*-stat of 7.18). All else being equal, financially strong firms have higher valuations than their industry rivals. Hence, the market places a premium on firms that have more internal resources than their competitors. Noticeably, the economic magnitude of this premium is significant. A one-standard-deviation increase in cash relative to rivals translates into a 6 percent increase in the mean market-to-book ratio over the average competitor. Consistent with previous literature, the coefficients on *Size* and *Leverage* are negative, while those on *Investment*, *Cash Flow*, and *Dividend* are positive. Similarly, column 4 reveals that relative-to-rivals cash also enhances operating performance. The estimates indicate a significant effect on *ROA* (0.004 with a *t*-stat of 3.75).

A potential concern with the results in Table 1.4 is that a company with a lot of growth opportunities may hold much larger cash balances than rivals. To further limit the potential effect of endogeneity inherent in the level of cash, I include four additional variables as proxies for firms' growth options. Specifically, I introduce lagged relative-to-rivals R&D expenses, sales growth, market-to-book ratio and ROA. In columns 2 and 4, although the magnitude of *z-Cash* coefficients declines slightly, they remain significantly positive.[26] In particular, with the additional control for growth options, a one-

[26] Although I make cash instumental by its own two lags and control for growth opportunities (and find it to be positively and significantly related to market-to-book), it is also possible that I do not fully capture growth opportunities. Thus, we could expect to observe a positive correlation between firm value and relative-to-rivals cash balances, but it does not necessarily follow that the financial strength *causes* the higher firm value.

standard-deviation increase in cash relative to rivals yields a 1.7 percent value premium over the average rival.

Overall, these findings are consistent with the hypothesis that financial strength contributes positively to firm value and operating performance. Alternatively, the results of this section support the idea that the market actually prices the expected market share gains associated with cash holdings.

1.5. The origins of the competitive effect of cash

So far, the analysis has provided compelling evidence that cash-rich firms expand market share relatively more than their industry rivals. Although the results above confirm that cash holdings boost product market performance, the origins of such gains remain unidentified. In particular, it is still unclear whether such strategic benefits are obtained through the direct use of a war chest to finance strategic actions and/or because rivals perceive the threat of aggressive strategies and adapt their product market actions accordingly. In this section, I attempt to evaluate some of these ideas by discriminating between war-chest and preemptive effects of cash holdings on product market performance.

1.5.1. The use of war chests

To gain insights into the actual mechanisms driving the competitive effect of cash, I start by investigating whether and how cash-rich firms use their war chests to finance product market actions. Arguably, one can think of many channels through which a firm can use its cash reserves strategically. For instance, a cash-rich firm can increase its distribution network, launch aggressive marketing and advertising campaigns, change the location of its stores and plant, raise its effort on innovation and development, hire or snatch more skilled and productive workers, or even acquire key suppliers or

business partners. As proxies for these potential channels, I consider five strategic ways to spend cash reserves: fixed capital investment, selling expense, R&D expenses, work force growth and acquisitions.[27]

Table 1.5 Spending patterns based on market-to-book ratio and previous year's cash holdings

This table presents statistics on the way firms spend their cash reserves. Firm-years are ranked into quartiles by market-to-book. High [Low] market-to-book firms are those ranked into the top [bottom] quartile. The firm-years are also independently broken into quartiles based on the previous year's relative-to-rivals [and z-scored] cash holdings [z-*Cash*]. The table shows the cross-tabulations of high and low market-to-book firm years and quartiles of relative-to-rivals cash holdings. The cash quartiles are generated for every year, and firms are regrouped each year. Only firms with positive relative-to-rivals cash are considered. Panel A shows expenditures on fixed capital investment [*Investment*], Panel B shows expenditures on R&D [*R&Dexpenses*], panel C shows expenditures on advertising [*Selling expenses*], Panel D shows expenditures on the labor force [Δ*labor*], and Panel E shows expenditures on acquisitions [*Acquisitions*]. The *t*-statistic is generated from the difference of means test between the first and fourth quartiles of z-*Cash* [column values] or the difference of means between high and low market-to-book [row values]. ** and * denote statistical significance at the 1% and 5% level, respectively.

	Quartiles of previous year relative-to-rivals cash holdings [z-*Cash*]				
Market-to-book ratio	**First**	**Second**	**Third**	**Fourth**	**[*t*-statistic]**
Panel A : Investment					
High Market-to-book firms	0.1621	0.2008	0.2133	0.2713	[11.68] **
Low Market-to-book firms	0.0505	0.0498	0.0645	0.0577	[3.41] **
[*t*-statistic]	[8.02]**	[10.74] **	[9.88] **	[13.82] **	
Panel B : R&D expenses					
High Market-to-book firms	0.1268	0.1505	0.1739	0.1576	[4.97] **
Low Market-to-book firms	0.0514	0.0650	0.0749	0.0659	[6.28] **
[*t*-statistic]	[13.96] **	[14.86] **	[15.85] **	[15.40] **	
Panel C : Selling Expenses					
High Market-to-book firms	0.5084	0.5046	0.5774	0.7003	[7.32] **
Low Market-to-book firms	0.2978	0.3370	0.3590	0.4722	[11.22] **
[*t*-statistic]	[7.80] **	[6.26] **	[7.47] **	[6.40] **	
Panel D : Labor force					
High Market-to-book firms	-0.0809	-0.0409	-0.0076	0.0470	[40.95] **
Low Market-to-book firms	-0.0334	-0.0212	-0.0185	0.0163	[49.60] **
[*t*-statistic]	[-4.11] **	[-1.76]	[0.90]	[2.50] *	
Panel E : Acquisitions					
High Market-to-book firms	0.0079	0.0067	0.0057	0.0056	[-7.18] **
Low Market-to-book firms	0.0107	0.0124	0.0111	0.0106	[-0.13]
[*t*-statistic]	[-2.01] **	[-4.16] **	[-4.09] **	[-3.91] **	

[27] Note that this list is not exhaustive. However, I believe that those five variables provide a large spectrum of the potential strategic use of funds.

Table 1.5 shows how these spending patterns in year *t+1* are related to relative-to-rivals cash holdings in year *t*. I restrict this analysis to firms that have positive relative-to-rivals cash holdings, that is, to deep-pocketed firms. Given that the use of funds is likely to depend on growth opportunities, firm-years are first separated into quartiles on the basis of the market-to-book ratio. Then, I compute relative-to-rivals cash quartiles and compare firms in the highest and lowest quartile of the market-to-book measure for different quartiles of cash. Table 1.5 reveals that firms that are relatively richer than their rivals do spend an important fraction of their money. Remarkably, we note that fixed capital investment, R&D expenses, selling expenses and work force growth increase monotonically in relative-to-rivals cash for both high and low market-to-book firms. These patterns indicate that, all else being equal, deep-pocketed firms invest a larger amount in strategies that can enhance their advantage in the product market. In contrast, spending on acquisitions does not increase with a larger war chest, since cash-rich firms with large growth opportunities spend less on acquisitions than firms with fewer internal resources. However, consistent with Harford (1999), the last row of Table 1.5 confirms that firms with few growth opportunities spend a large part of their cash on acquisitions.

Overall, these descriptive results indicate that firms with more cash than their rivals spend markedly more on investment, R&D, advertising, and the work force. To examine whether this additional spending effectively provides a lead in the product market, I further investigate whether the way cash-rich firms use their reserves explain their better performance in the product market. To do so, I hypothesize that the impact of relative-to-rivals cash on market share growth should be larger for firms that draw down their cash reserves and should depend on the way cash is spent. To identify the impact of the use of cash on market share dynamics, I augment specification (1) and regress a firm's market-share growth on past relative-to-rivals cash holdings as well as proxies for the potential ways firms spend their cash. Accordingly, I estimate the following model:

$$\begin{aligned}\Delta MarketShares_{i,t} &= \vartheta[zCash_{i,t-2}] + \varphi[zCash_{i,t-2} \cdot \mathbf{I}_{\{\Delta Cash_{i,t-1}<0\}}] + \psi[zCash_{i,t-2} \cdot \mathbf{I}_{\{\Delta Cash_{i,t-1}<0\}} \cdot \Delta Spending_{i,t-1}] \\ &\quad + \boldsymbol{\beta}'\mathbf{Controls}_i + \alpha_i + \eta_t + \varepsilon_{i,t}\end{aligned} \tag{2}$$

where the subscripts *i* and *t* represents the firm and the end of the year respectively. As before, the dependent variable, *ΔMarketShares*, is sales growth minus its industry-year average, so that this variable measures a firm's sales expansion relative to that of its competitors or equivalently serves as a proxy for market share growth. The variable of interest *zCash* represents the relative-to-rivals (z-scored and instrumented) cash holdings. $\mathbf{I}_{\{\Delta Cash<0\}}$ is a indicator variable that equals one if *Cash* at time *t-1* is smaller that *Cash* at time *t-2*, in other words, if a firm decreases (uses) its cash holdings between year *t-2* and *t-1*, and zero otherwise. Δ*Spending* corresponds to the yearly change of the channels through which cash may be spent between year *t-2* and *t-1*. As before, I consider five potential spending patterns: fixed capital investment, selling expense, R&D expenses, work force growth, and acquisitions. Hence, in specification (2), the coefficient ϑ measures the effect of past relative-to-rivals cash holdings on market share growth, φ gauges whether this effect is larger for firms employing part of the cash, and ψ identifies whether the competitive effect of cash originates in a specific spending channel. Specification (2) comprises the same control variables as specification (1) and also includes time and firm fixed effects (η_t and α_i). Moreover, in estimating equation (2), I adjust the estimates' standard errors for within-firm-period error clustering and heteroskedasticity.

The results are reported in Table 1.6. In column 1, we first remark that the coefficient on lagged *zCash* is of similar magnitude as in the base-line specification (1), confirming that cash-rich firms gain market share at the expense of more financially fragile firms. More interestingly, column 1 reveals that the coefficient on $\mathbf{I}_{\{\Delta Cash<0\}}$ is significantly positive (0.031 with a *t*-stat of 1.98). Hence, having markedly larger cash reserves than rivals in year *t* leads to superior market-share gains between years *t+1* and *t+2* when part of the cash reserve is used between years *t* and *t+1*. Overall, this result is in line with the idea that cash-rich firms gain shares of their product market by using their financial resources directly to fund competitive actions. Columns 2 to 6 further characterize this result by looking specifically at the potential channels through which this effect may operate.

Table 1.6 The impact of cash and the use of cash on market share gains (Direct effects)

This table presents results of panel regressions examining the effect of relative-to-rivals cash holdings and the way they are spent on market share growth (specification (4)). The dependent variable is Δ*MarketShares*, the annual market-share growth given by industry-adjusted sales growth at time *t* [$(Sales_t - Sales_{t-1})/Sales_{t-1}$]. *Cash* is the ratio of cash and marketable securities divided by total assets. All regressions include the same set of control variables as in Table I [*Investment*, *R&DExpenses*, Δ*Labor*, *Leverage*, *Selling Expenses* and past Δ*MarketShares*]. All the control variables are adjusted for their four-digit SIC industry-year means, with *Cash* further standardized (i.e., z-scored) within each industry-year, *z-Cash*. $\mathbf{I}_{\{\Delta Cash,t-1<0\}}$ is an indicator variable that equals one if a firm decreases (uses) its cash reserves between *t-2* and *t-1*. $\Delta Investment_{t-1}$, $\Delta R\&D_{t-1}$, $\Delta SellingExpenses_{t-1}$, $\Delta Labor_{t-1}$ and $\Delta Acquisition_{t-1}$ represent respectively yearly changes of the channels through which cash may be spent between year t-2 and t-1. All regressions contain firm and time fixed effects. The sample period is 1973 through 2005. IV estimations display diagnostic statistics for instrument overindentification restrictions (*p*-values for *J*-statistics reported). The estimations correct the error structure for heteroskedasticity and within-firm error clustering using the White-Huber estimator. *t*-statistics in brackets. ** and * denote statistical significance at the 1% and 5% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
$z\text{-}Cash_{t-2}$	0.017**	0.017**	0.017**	0.017**	0.017**	0.017**
	[7.32]	[6.99]	[7.02]	[7.33]	[6.91]	[6.57]
$z\text{-}Cash_{t-2} \times \mathbf{I}_{\{\Delta Cash,t-1<0\}}$	0.031*	0.028	0.035*	0.031*	0.035*	0.01
	[1.98]	[1.77]	[2.26]	[1.96]	[2.23]	[0.61]
$z\text{-}Cash_{t-2} \times \mathbf{I}_{\{\Delta Cash,t-1<0\}} \times \Delta Investment_{t-1}$		0.087**				
		[2.44]				
$z\text{-}Cash_{t-2} \times \mathbf{I}_{\{\Delta Cash,t-1<0\}} \times \Delta R\&D_{t-1}$			0.656**			
			[3.48]			
$z\text{-}Cash_{t-2} \times \mathbf{I}_{\{\Delta Cash,t-1<0\}} \times \Delta SellingExpenses_{t-1}$				-0.05		
				[1.24]		
$z\text{-}Cash_{t-2} \times \mathbf{I}_{\{\Delta Cash,t-1<0\}} \times \Delta Labor_{t-1}$					0.083*	
					[2.49]	
$z\text{-}Cash_{t-2} \times \mathbf{I}_{\{\Delta Cash,t-1<0\}} \times \Delta Acquisition_{t-1}$						0.045
						[1.57]
Control Variables from specification (1)	Yes	Yes	Yes	Yes	Yes	Yes
# Obs	30729	30205	30601	30651	29201	29671
R^2	0.23	0.24	0.23	0.23	0.24	0.24
J-statistic (p-value)	0.18	0.22	0.16	0.14	0.19	0.25

In column 2, the interaction between $\mathbf{I}_{\{\Delta Cash<0\}}$ and yearly changes in fixed capital investment (*ΔInvestment*) turns out to be significantly positive (0.087 with a *t*-stat of 2.44). Hence, cash-rich firms that employ their liquid reserves and simultaneously increase capital spending are able to reap a larger fraction of the shares of their market in subsequent years. Similarly, columns 3 and 4 reveal similar effects when cash-rich firms use part of their war chest and boost R&D expenses (*ΔR&D*) or enlarge their work force (*ΔEmployee*). In contrast, in columns 4 and 5, the coefficients on the interaction between $\mathbf{I}_{\{\Delta Cash<0\}}$

and changes in selling expenses or acquisitions are not significant. Accordingly, the effect of cash on market share gains cannot be attributed to increased advertising expenses or more intense acquisition activity.

Taken as a whole, the results of this section importantly reveal that part of the competitive advantage of cash reserves materializes through their direct use to implement competitive strategies. In particular, the estimates indicate that the larger gains accrue to cash-rich firms that draw down part of their reserves and simultaneously increase investment in fixed capital, R&D, and the size of the work force. Alternatively, the findings also show that firms' cash reserves affect their product market performance even when they do not use the reserves directly. This observation suggests that a firm's cash holdings are likely to affect its' rivals product market decisions indirectly, thereby affecting competitive outcomes.

1.5.2. The preemptive effects

1.5.2.1. Incumbents' cash and entry decisions

To examine whether a firm's cash reserves affect its rivals' decisions, I look first at the effect of cash holdings on the dynamics of industry entry. As put forth by Benoit (1984), the threat of aggressive behavior by cash-rich incumbents may discourage potential entrants. Accordingly, if a firm's stock of cash strategically affects potential rivals' decisions, we can expect to see less entry into markets populated by deep-pocketed incumbents.

To gauge the dissuasive impact of incumbents' cash holdings on entry decisions, I identify, for each year,[28] entrants as firms that appear in each industry (SIC4) in that year but not before.[29] Table 1.7 presents descriptive statistics for entrants and incumbents. Several interesting patterns emerge. First, and as expected, entrants have markedly higher market-to-book ratio than incumbents, suggesting that firms

[28] Note that I start in 1974 to avoid the large number of entrants artificially created by the database initial date.
[29] Importantly, as pointed out by MacKay and Phillips (2005), data limitations prevent me from determining the type of firm entry precisely. For instance, I cannot distinguish between privately held incumbents that go public and new firms that actually add productive capacity to their industry.

entering an industry have higher growth prospects. Next, in line with the predictions of Williams (1995), Fries, Miller, and Perraudin (1997), and Lambrecht (2001), entrants carry less debt than incumbents. We note also that entrants are smaller than incumbent firms. Turning to cash holdings, we observe that entrants display an average cash-to-asset ratio that is more than 64 percent higher than that of incumbents (the p-value of the difference is 0.01). At first glance, these descriptive figures suggest that financially strong firms, that is, firms with sufficient internal funds and low leverage, are more likely to enter a product market. These findings support the view that only cash-rich firms can enter new product markets and withstand the risk of tough competition.

To expand on the findings of Table 1.7 and to further understand the link between incumbents' cash holdings and entry decisions, I directly investigate whether and how incumbents' reserves of cash affect potential entrants' decisions. To do so, I specify the following model of industry entry dynamics:

$$\left(\frac{\#entrants}{\#incumbents}\right)_{j,t} = \xi IncumbentsCash_{j,t-1} + \boldsymbol{\beta}' \mathbf{Controls_j} + \omega_j + \eta_t + \varepsilon_{j,t} \qquad (3)$$

where the subscripts j and t represent the industry and the year respectively. I measure industry entry dynamics by considering the intensity of entry. Hence, for each industry-year, the dependent variable is the number of entrants (*#entrants*) divided by the number of incumbents (*#incumbents*). Next, as a proxy for incumbents' strength, I use the average lagged cash-to-asset ratio of incumbent firms as the variable of interest (*IncumbentsCash*). Accordingly, the coefficient ξ measures the effect of incumbent cash-richness on the intensity of industry entry. If, all else being equal, large cash holdings act as a credible threat and alter other players' behavior by restricting entry, one should expect ξ to be negative.

I include control variables that capture the effect of other drivers of industry dynamics. First, I consider variables that serve as proxies for changes in industry demand conditions. Undeniably, we can expect to see more entries in an industry in which business prospects are good. To account for these effects, I include past incumbents' average sales growth and market-to-book ratios, as well as changes in

industrial production and GDP (*ΔIndustrial Production* and *ΔGDP*).[30] Second, I include proxies for the level of industry risk. Specifically, I add the past within-industry standard deviation of sales growth and market-to-book. Next, to pick up persistence in entry dynamics that is unexplained as a result of any potential misspecification, I incorporate the lagged entry intensity.

Table 1.7 Descriptive statistics for entrants and incumbents

This table reports summary statistics for the main variables used in the empirical analysis for entrants and incumbents. *Entrants* are firms that appear in each industry (SIC4) in year *t* but that were not included in year *t-1*. *Incumbents* are firms that appear in each industry (SIC4) in year *t* that were already included in year *t-1*. *Cash* is the ratio of cash and marketable securities divided by total assets. *Leverage* is long-term debt over assets. *Market-to-Book* is the market value of equity plus the book value of assets minus the book value of equity minus deferred taxes scaled by total assets. *Sales Growth* is given by $(Sales_t - Sales_{t-1})/Sales_{t-1}$. *Assets* are total assets. The sample period is 1973 through 2005.

Incumbents	#Obs	Mean	Std.Dev	Min	Max
Cash	48716	0.177	0.207	0.001	0.925
Leverage	48999	0.142	0.146	0.000	0.726
Assets ($Million)	48592	733	2372	1.131	26352
Market-to-book	47640	1.937	1.718	0.524	14.178
Sales Growth	47219	0.092	0.279	-1.215	1.650

Entrants	#Obs	Mean	Std.Dev	Min	Max
Cash	5141	0.285	0.286	0.001	0.926
Leverage	5322	0.111	0.141	0.000	0.723
Assets ($Million)	5267	291	1337	1.131	24442
Market-to-book	4819	2.722	2.256	0.526	14.151
Sales Growth	5237	0.104	0.326	-0.784	1.089

Moreover, I account for the potential effect of incumbents' debt financing on entry decisions by including incumbents' average leverage ratio in specification (3). Indeed, the industry equilibrium models

[30] These series are taken from http://research.stlouisfed.org/fred2/

of Poitevin (1989), Williams (1995), Fries et al. (1997), and, more recently Zhdanov (2006), predict that incumbents' leverage impinges on potential entrants' choices. All variables are defined in detail in Appendix A. Finally, to account for possible entry seasonality and industry heterogeneity, I add time and industry fixed effects (η_t and ω_j). Because the dependent variable is bounded at zero, I estimate specification (2) by fitting a Tobit model.[31]

Table 1.8 presents the results of the Tobit estimations. Of most interest is the coefficient of the effect of incumbents' cash holdings on entry intensity. In the first column, we observe that this estimate is significantly negative (-0.12 with a t-stat of 2.55). This first result is consistent with a deterrent effect of incumbents' cash reserves and turns out to be economically important. In point of fact, a one-standard-deviation increase in incumbents' cash reduces the expected entry intensity by 5 percent.[32] Turning to the control variables, the estimates roughly match expectations. The average size of incumbents is negatively associated with the number of entrants but industry average market-to-book, sales growth, changes in industrial production, and GDP all predict entry decisions positively. In addition, we note that the coefficient on past entry intensity exhibits a strong positive sign. Moreover, incumbents' leverage does not appear to play a significant role in explaining entry dynamics.[33] Overall, this first round of results clearly indicates that incumbents' cash reserves discourage entry by others.

To give additional support to the claim that rivals' cash holdings threaten potential entrants, I extend the analysis in two dimensions. First, I modify my proxy for incumbents' strength to account for a possible influence of market structure on entry intensity. Second, I modify specification (3) to assess the strength of the inference. I start by changing the proxy of incumbents' strength. So far, I have used the average cash holdings of incumbents to measure deep pockets.

[31] Alternatively, I estimate model (2) by OLS. This procedure yields similar results.
[32] Note that this represents the marginal effect evaluated at the mean values of the covariates.
[33] Note that in an unreported table I also estimate model (2) by replacing the incumbents' average cash holdings by the average leverage ratio. Interestingly, all else being equal, the coefficient on incumbents' leverage is significantly positive. This results corroborates Lambrecht's (2001) prediction and is in line with the empirical evidence presented by Chevalier (1995) and Kovenock and Phillips (1997) that firms that are highly levered experience more aggressive investment behavior from their rivals. However, the fact that the effect of incumbents' debt vanishes when I include incumbents' cash holdings highlights again that the effect of cash subsumes that of debt in predicting strategic outcomes.

Table 1.8 The impact of cash on rivals' entry decisions (Tobit estimations)

This table presents results of panel tobit regressions examining the effect of incumbents' cash holdings on entry intensity (specification (3)). The dependent variable is the intensity of industry entry defined as the number entrants divided by the number of incumbents (*#entrants/#incumbents*) in each industry-year. *Incumbents Cash* is the average *Cash* of incumbent firms. *Market shares of 50% (75%) Cash-rich* is the market shares held by the 50% (75%) cash-richest incumbents. *Incumbent Leverage*, *Size*, *Sales Growth* and *Market-to-book* represent the average value of incumbents' *Leverage*, *Size*, *Sales Growth* and *Market-to-Book* as defined in Appendix A. Δ*GDP* and Δ*Industrial Production* are the annual change in real GDP and industrial production. *Sigma Sales Growth* $_{t-1}$ and *Sigma Market-to-Book* $_{t-1}$ are the within-industry standard deviation of *Sales Growth* and *Market-to-Book*. Column (1) reports the base-line Tobit estimation of specification (2). Columns (2) to (5) include alternative proxies for incumbents' financial strength. Column (6) reports the results when incumbents' cash is further z-scored. Column (7) presents results when the median incumbents' cash replaces the average as a proxy for financial strength, and column (8) displays the results when the dependent variable is *log(1+#entrants)*. All regressions contain year and industry fixed effects. The sample period is 1973 through 2005. *t*-statistics in brackets. ** and * denote statistical significance at the 1% and 5% level, respectively.

	(1) Baseline	(2)	(3) Additional	(4) Controls	(5)	(6) z-scored	(7) median	(8) Log
Incumbents Cash $_{t-1}$	-0.126*			-0.141**	-0.132**	-0.083*	-0.01*	-1.03**
	[2.55]			[2.83]	[2.67]	[2.02]	[2.20]	[2.62]
Market shares of 50% Cash-rich		-0.025*		-0.03*				
		[2.06]		[2.39]				
Market shares of 75% Cash-rich			-0.04*		-0.043			
			[1.98]		[1.94]			
Incumbents Leverage $_{t-1}$	0.057	0.135*	0.13*	0.052	0.052	0.08	0.112	0.425
	[0.82]	[2.12]	[2.05]	[0.75]	[0.75]	[1.18]	[1.69]	[0.77]
Incumbents Size $_{t-1}$	-0.019**	-0.017**	-0.018**	-0.017**	-0.018**	-0.019**	-0.018**	-0.102**
	[6.41]	[5.61]	[5.91]	[5.70]	[6.05]	[6.21]	[6.05]	[4.21]
Incumbents Sales Growth $_{t-1}$	0.078*	0.088**	0.087**	0.078*	0.078**	0.081*	0.085**	0.997**
	[2.46]	[2.77]	[2.74]	[2.48]	[6.05]	[2.57]	[2.70]	[3.94]
Incumbents Market-to-Book $_{t-1}$	0.043**	0.028**	0.029**	0.041**	0.042**	0.04**	0.033**	0.457**
	[4.22]	[3.06]	[3.23]	[4.02]	[4.11]	[3.96]	[3.56]	[5.63]
Δ*GDP*	0.62**	0.571**	0.58**	0.569**	0.581**	0.592**	0.581**	-3.256**
	[4.60]	[4.19]	[4.26]	[4.18]	[4.28]	[4.38]	[4.18]	[3.05]
Δ*Industrial Production*	0.715**	0.718**	0.721**	0.706**	0.711**	0.71**	0.717**	5.041**
	[8.83]	[8.86]	[8.90]	[8.73]	[8.79]	[8.74]	[8.82]	[7.86]
Sigma Sales Growth $_{t-1}$	-0.006	-0.017	-0.014	-0.001	-0.002	-0.002	-0.01	-0.348
	[1.12]	[1.02]	[0.89]	[0.57]	[0.34]	[0.82]	[0.72]	[1.28]
Sigma Market-to-Book $_{t-1}$	-0.008	-0.002	-0.003	-0.007	-0.008	-0.007	-0.005	-0.105
	[1.18]	[0.81]	[0.55]	[1.06]	[1.18]	[1.07]	[0.70]	[1.79]
#entrants/#incumbents $_{t-1}$	0.229**	0.231**	0.231**	0.230**	0.233**	0.228**	0.227**	
	[6.05]	[6.09]	[6.07]	[6.09]	[6.05]	[6.01]	[5.96]	
ln(1+#entrants) $_{t-1}$								2.246**
								[7.45]
#obs	2038	2038	2038	2038	2038	2038	2038	2038
Log Likelihood	424.09	422.97	422.45	422.97	425.99	422.88	421.39	-2314

However, it is likely that the competitive position of deep-pocketed firms also plays a role in shaping entry decisions. To account for this possibility, I replace in specification (3) the average cash holdings of incumbents by the market shares of the firms with the most cash. This variable picks up information about the intensity with which cash-rich firms dominate their product markets.

To begin, I define cash-rich firms as firms that have larger liquid assets than the median value of their industry-year and compute their total market shares. In column 2, we observe a significantly negative coefficient (-0.025 with a t-stat of 2.06) on the market shares held by cash-rich firms. This finding confirms the idea that the competitive position of cash-rich firms influences entry decisions strategically. In column 3, I refine the cash-richness criterion and classify firms as rich if they have larger cash reserves than 75 percent of their industry-year rivals. Again, we notice less entry in product markets dominated by cash-rich incumbents. Next, I include the average incumbents' cash holdings together with the market shares held by deep-pocketed incumbents. Columns 4 and 5 show that irrespective of the definition of cash-richness, both variables still negatively predict industry entry.

To further verify the strength of the findings above, I estimate alternative versions of model (3). First, I replace the average incumbents' cash holdings by the z-scoring version to account for the potential effects of the within-industry dispersion of financial strength. I compute this z-scored proxy by dividing the average incumbents' cash holdings by the industry-year standard deviation of the cash-to-assets ratio. Column 6 shows that we still observe the negative association between incumbent cash holdings and entry intensity. In a similar spirit, column 7 displays the estimates when I replace the average cash holdings by their median value. There is virtually no difference. Next, I change the proxy for industry entry by using the log(1+*#entry*) instead of entry intensity as the dependent variable. Column 8 reports the estimates of the Tobit estimation. Confirming previous results, this modification does not have any consequences.

1.5.2.2. Cash holdings and rivals' expansion

I continue the investigation of whether cash holdings influence rivals' actions by looking at expansion decisions. One could argue that large cash holdings can act as a credible threat of predatory

retaliation, that is, a "second-strike" capability, against potential expansion by competitors. So, to gauge whether a firm's stock of cash daunts rivals' expansion, I examine the impact of rivals' cash reserves on investment decisions. For that purpose, I use standard specifications and regress a firm's investment on the average cash holdings of competitors and control variables. The corresponding base-line equation is as follows:

$$Investment_{i,j,t} = \chi RivalsCash_{j,t-1} + \boldsymbol{\beta}' \mathbf{Controls}_{i,j} + \alpha_i + \omega_j + \eta_t + \varepsilon_{i,j,t} \quad (4)$$

where the subscripts *i*, *j*, and *t* represent the firm, industry, and fiscal year respectively. The dependent variable *Investment* in a given year is defined as the difference between the gross property, plant, and equipment (PP&E) at the end of the year and that at the beginning of the year, divided by gross PP&E at the beginning of the year. I use this measure as a proxy for a firm's expansion rate since it includes information concerning both internal and external growth. Then, to gauge the effect of rivals' cash holdings on a firm's investment, I compute the industry-year average by excluding the firm itself (*RivalsCash*). Therefore, in specification (4), the coefficient χ measures the sensitivity of a firm's investment to its rivals' cash reserves. If, as hypothesized, the threat of retaliation by cash-rich rivals restrains expansion, one may expect this coefficient to be negative.

The vector of control variables includes standard variables used in the investment literature. Specifically, it comprises the market-to-book ratio, the ratio of cash flow to total assets , firm size, sales growth, and leverage; see for instance Baker, Stein, and Wurgler (2003) or Clearly, Povel, and Raith (2007).[34] In the context of strategic interactions, Haushalter et al. (2006) recently reported that firms' stock of cash is an important driver of corporate investment. Following their results, I include lagged firm cash holdings as an additional control. Finally, I account for time-invariant heterogeneity and time trend by including firm- and industry- fixed effects as well as time dummies and I adjust the

[34] I define all the variables in appendix A.

estimates' standard errors for within-firm-period error clustering and heteroskedasticity; see Petersen (2007).

Table 1.9 displays the estimation results of the base-line investment specification (4). Column 1 reveals that the coefficient on the average rivals' cash holdings (χ) is significantly negative (-0.61) at the 1 percent level. Moreover, the effect of rivals' cash holdings on investment turns out to be economically important. A one-standard-deviation increase in rivals' cash holdings reduces the average firm investment by 0.07 percent. In terms of magnitude, this represents a decrease of 2 percent (1.6%) of median (average) corporate investment. Notice that the signs of coefficients on the control variables display patterns that are consistent with the findings of previous research. Of particular interest is the coefficient on a firm's own lagged cash holdings. Confirming economic intuition and the findings of Haushalter et al. (2006), a firm's stock of cash allows flexibility in investment decisions and therefore positively predicts future investment spending. By and large, these estimates ascribe an important role to rivals' finances in shaping investment behaviors.[35]

Next, to lend additional support to these results, I first change the measure of firms' expansion and replace change in PP&E (*Investment*) by capital expenditures (*Capex*). Column 2 confirms that rivals' cash equivalently hampers capital expenditures. Then I consider the year-to-year change in total assets (Δ*Assets*). This alternative measure of expansion summarizes the combined effects of all the potential changes in a firm's assets' composition and hence is not restricted to the expansion of capital assets. Similarly to the results obtained for fixed investment, column 3 reveals that the average rivals' cash holdings have a strong negative effect on total asset growth. Furthermore, I specifically look at the effect of rivals' cash on firms' external growth. To do so, I replace *Investment* by firm acquisition intensity

[35] In unreported tables, I estimate specification (4) using the Erickson and Whited (2000) measurement errors consistent GMM estimator. Indeed, if Tobin's q is measured with errors, theist coefficient will be biased toward zero, and the coefficients on other variables may be biased in unknown directions. Specification (4) may suffer from this bias, since every control variable may pick up information about future investment opportunities not captured by the market-to-book ratio. When the Erickson and Whited (2000) estimation procedure is used, previous conclusions continue to hold. These results are reassuring in that they suggest that mismeasurement in empirical Tobin's q does not seem to translate into biased inference about the effect of rivals' finance.

(*Acquisition*) in specification (4).[36] Column 4 indicates that rivals' cash also constrains firms' external expansion. Although the magnitude of this effect seems to be less important, this result provides additional evidence of an indirect strategic effect of rivals' financial strength on firms' expansion.[37]

I continue by examining how rivals' cash reserves modify the response of investment to proxies for investment opportunities. Certainly, if rivals' cash holdings really constrain a firm's expansion, we would expect investment to be less responsive to changes in the investment opportunity set when rivals are deep-pocketed. To examine this claim, I add in specification (3) the interaction between the market-to-book ratio and my proxy for rivals' internal resources. Interestingly, the three measures of expansion (columns 5 to 8) indicate that the coefficients for the interacted term are significantly negative. This result clearly corroborates the idea that fearing predatory retaliation by cash-rich rivals, firms adapt their actions and invest suboptimally compared with what would be justified by a simple NPV rule.

Overall, the results presented in this section unambiguously support the view that cash holdings play a strategic role that influences rivals' competitive actions. In that respect, they suggest that the better business performance of relative-to-rivals cash-rich firms is partly due to the pre-emptive effect that large cash reserves have on competitors. Moreover, the analysis sheds some interesting light on the claim that firms do not operate in isolation but take into account rivals' potential actions when making their own competitive choices. In particular, these results validate recent theoretical developments that stress the importance of considering competitive interactions to explain firms' investment or acquisition policies; see for instance Grenadier (2002), Novy-Marx (2007), or Morellec and Zhdanov (2007).

[36] Note that this measure of acquisition prevents me from correctly identifying external expansion made through the acquisition of industry rivals (horizontal acquisitions).
[37] Another interpretation could be that cash-rich rivals have the flexibility to overbid for potential targets. While this scenario differs from a preemptive effect of cash, it also confers a strategic dimension on firms' cash holdings.

Table 1.9 The impact of cash on rivals' expansion decisions

This table presents panel regressions examining the effect of rivals' cash holdings on a firm's expansion decisions (specification (4)). For each industry-year *Rivals' Cash* is the industry average *Cash* (excluding the firm itself). *Cash* is the ratio of cash and marketable securities divided by total assets. *Market-to-Book* is the market value of equity plus the book value of assets minus the book value of equity minus deferred taxes scaled by total assets. *Cash Flow* is net operating income divided by assets. *Size* is the natural logarithm of assets. *Leverage* is long-term debt over assets. *Sales Growth* are given by $(Sales_t - Sales_{t-1})/Sales_{t-1}$. In columns (1) and (5) the dependent variable is *Investment*, computed as $(PPE_t - PPE_{t-1})/PPE_{t-1}$. In columns (2) and (6), the dependent variable is *Capex*, computed as capital expenditures minus sales of capital divided by assets. In columns (3) and (7) the dependent variable is $\Delta Assets$ defined as $(Assets_t - Assets_{t-1})/Assets_{t-1}$. In columns (4) and (8) the dependent variable is *Acquisitions* which represents the amount spent on acquisitions over assets. All regressions contain firm, time and industry fixed effects. The sample period is 1973 through 2005. The estimations correct the error structure for heteroskedasticity and within-firm error clustering using the White-Huber estimator. *t*-statistics in brackets. ** and * denote statistical significance at the 1% and 5% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ΔPPE	*Capex*	*ΔAssets*	*Acqu.*	*ΔPPE*	*Capex*	*ΔAssets*	*Acqu.*
Rivals' Cash $_{t-1}$	-0.614**	-0.051**	-0.462**	-0.014**	-0.469**	-0.020**	-0.357**	-0.001
	[18.03]	[10.39]	[17.49]	[3.20]	[12.19]	[3.67]	[11.89]	[1.28]
Market-to-Book $_{t-1}$	0.041**	0.003**	0.052**	0.001*	0.062**	0.008**	0.066**	0.002**
	[30.65]	[18.18]	[48.66]	[2.58]	[21.23]	[18.99]	[29.98]	[6.03]
Cash Flow $_t$	0.329**	0.007**	0.671**	-0.005**	0.327**	0.007**	0.67**	-0.006**
	[29.93]	[5.05]	[55.55]	[4.14]	[29.79]	[4.82]	[27.43]	[4.25]
Size $_t$	0.018**	-0.004**	0.026**	0.007**	0.019**	-0.004**	0.026**	0.008**
	[8.68]	[13.62]	[45.68]	[27.79]	[8.84]	[13.45]	[15.81]	[27.89]
Cash $_{t-1}$	0.428**	0.020**	0.061**	0.025**	0.425**	0.019**	0.062**	0.024**
	[30.55]	[10.22]	[5.65]	[13.47]	[30.35]	[9.93]	[5.77]	[13.34]
Leverage $_{t-1}$	-0.3**	-0.033**	-0.26**	-0.019**	-0.302**	-0.032**	-0.258**	-0.019**
	[20.80]	[15.75]	[22.89]	[10.10]	[20.60]	[15.45]	[22.70]	[9.93]
Sales growth $_{t-1}$	0.14**	0.019**	0.04**	0.001**	0.139**	0.019**	0.039**	0.001
	[24.85]	[23.92]	[9.22]	[1.63]	[24.57]	[23.55]	[8.95]	[1.43]
Rivals'Cash $_{t-1}$ *x Market-to-Book* $_{t-1}$					-0.072**	-0.015**	-0.052**	-0.006**
					[8.06]	[11.98]	[7.28]	[5.46]
#obs	37973	37553	38134	37676	37973	37553	38134	37676
R^2	0.31	0.46	0.39	0.23	0.31	0.46	0.41	0.23

1.6. Conclusions

The main message of this paper is that firms' cash holdings strategically influence product market outcomes. In particular, I first report that larger relative-to-rivals cash reserves lead to systematic future market-share gains at the expense of industry rivals. Importantly, this "competitive" effect of cash turns

out to be magnified when rivals face tighter financing constraints and when firms interact intensively in their product market. Also, the analysis reveals that the competitive effect of cash contributes to increase firm value and operating performance. Next, I explore in more depth the origins of the positive effect of cash holdings on product market performance. Interestingly, cash-rich firms partly gain share in their product market by drawing down their reserves to invest in fixed capital and R&D as well as an expansion of their labor force. From a different perspective, the analysis reveals that firms' cash policy also plays a significant preemptive role that distorts rivals' financial and real decisions. Specifically, consistent with a deterrent effect of deep pockets, incumbents' cash reserves significantly curb the entry of potential competitors, and considerably hamper the expansion of rivals by constraining both their investment and acquisition policies.

In a nutshell, my results unambiguously highlight that firms' cash policy encompasses an important strategic dimension. As such, the findings in this paper provide at least three important insights. First, the results add to the growing literature on corporate liquidity by suggesting that the strategic value of cash is substantial. Consequently, future research aiming at assessing the soundness of the recent cash hoards, and at understanding whether and how investors should be worried, should not ignore the strategic nature of cash holdings. Second, the present study sheds some new light on the connections between finance and product market. Arguably, by establishing a link between cash holdings and product market outcomes, the results in this paper point out that the interactions between firms' financial and real decisions clearly go beyond the simple association between debt financing and competitive strategies. Finally, the analysis confirms that firms do not operate in isolation but incorporate rivals' financial status and competitive position in their (financial) decision process. Although this idea has recently emerged in diverse theoretical developments, it is fair to say that, so far, the empirical evidence remains patchy.

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Appendix A : Definition of the main variables

Total Assets	Total assets (Compustat item 6) (in million USD)
Sales	Sales (item 12)
Size	Logarithm of total assets (item 6)
Δ*MarketShares*	Growth in sales computed as $Sales_t$ minus $Sales_{t-1}$ divided by $Sales_{t-1}$ minus industry-year average
Cash	Cash and short-term investment (item 1) scaled by total assets
Investment	Growth in property, plant, and equipment (PPE) (item 7) computed as PPE_t minus PPE_{t-1} divided by PPE_{t-1}
Capex	Capital expenditures computed as capital expenditures (item 30) minus sales of property, plant, and equipment (item 107) divided by total assets
ΔLabor	Growth in the number of employees (item 29) computed as $\#employees_t$ minus $\#employees_{t-1}$ divided by $assets_{t-1}$
Selling Expenses	Sum of advertising expenses (item 45) and selling, general, and administrative expenses (item 189) scaled by total assets
Leverage	Long-term debt (item 9) scaled by total assets
Total Dividend	Sum of preferred (item 19) and common (item 21) dividends scaled by total assets
Tangibility	0.715**Receivables* (item 2) plus 0.547**Inventories* (item 3) plus 0.535* *Fixed capital* (item 8) [see Berger et al. (1996)]
R&D Expenses	Research and development expense (item 46) scaled by total assets
Cash flow	Sum of net income before extraordinary items (item 18) and depreciation and amortization (item 14) scaled by total assets
Capital stock	Gross property, plant, and equipment (item 7)
Market-to-Book	Market value of equity (item 24 multiplied by item 25) plus book value of assets minus book value of equity minus deferred taxes (item 6 – item 60 – item 74), scaled by total assets
Net Leverage	Long-term debt (item 9) minus cash and short-term investment scaled by total assets
Capital-Labor ratio	Gross property, plant, and equipment (item 7) divided by the number of employees (item 29) multiplied by 1,000
ROA	Ratio of operating income before depreciation and amortization expenses (item 13) to total assets
Acquisitions	Amount spent in acquisitions (cash) (item 129) scaled by total assets
SalesAcquisitions	Sales contribution of acquisition (item 249) scaled by total assets

Δ*Assets*	Growth in total assets computed as total $assets_t$ minus $assets_{t-1}$ divided by $assets_{t-1}$
Herfindhal index (HHI)	Four-digits SIC industry concentration ratios gathered in the Census of Manufacturers (1982, 1987, 1992, and 1997 editions)
#entrants	Number of firms that appear in each industry (SIC4) in year *t* but that were not included in year *t-1*
#incumbents	Number of firms that appear in each industry (SIC4) in year *t* that were already included in year *t-1*
KZ index	Kaplan and Zingales (1997) index is computed as follows (excluding *Cash*): *KZ*=-1.002**Cash Flow*-39.362**Total Dividend* + 3.138**Leverage*+0.283**Market-to-Book*
WW index	Whited and Wu (2006) index is computed as follows: *WW*=-0.91**Cash Flow*-0.062**Dividend*+0.021**Leverage*-0.044**Size*-0.035**Sales Growth*, where *Dividend* is a dummy that equals one if *Total Dividend* is positive and zero otherwise
Δ*GDP*	Annual change in real GDP from the Federal Reserve Bank of St.Louis[38]
Δindustrial Production	Annual change in industrial production from the Federal Reserve Bank of St.Louis
UnexpectedGDP	Realized real GDP growth minus the median real GDP one-year forecasts from the Survey of Professional Forecasters (SPF)[39]
Δ*CPI*	Annual change in consumer price index from the Federal Reserve Bank of St.Louis
Δ*Unemployement*	Annual change in unemployment rate from the Federal Reserve Bank of St.Louis
Δ*Fed Funds*	Annual change in the Federal Reserve Funds Rate from the Federal Reserve Bank of St.Louis

[38] http://research.stlouisfed.org/fred2/
[39] http://www.phil.frb.org/econ/spf/index.html

1.7. Appendix B: Descriptive Statistics

This appendix reports summary statistics for the main variables used in the empirical analysis. The final sample has statistical properties that are very similar to those reported in comparable studies that use COMPUSTAT (see, for example, Campello (2006)). The sample period is 1973 through 2005. Included firms are from industries selected at the four-digit SIC level following Clarke (1989).

	#Obs	Mean	Median	Std.Dev	Pct. 25	Pct. 75
Cash	54346	0.186	0.092	0.218	0.030	0.265
Sales Growth	47424	0.136	0.098	0.331	-0.026	0.245
Assets ($Million)	54347	687	59	2289	16	280
Investment	53845	0.055	0.042	0.049	0.021	0.075
Selling Expenses	54059	0.354	0.248	0.500	0.138	0.400
Leverage	54809	0.139	0.100	0.146	0.007	0.226

1.8. Appendix C: Evolution through time

Bates et al. (2007) report that U.S. firms have significantly increased their cash holdings in recent decades. Consistent with the precautionary motive for holding liquid assets, they further argue that this upward trend is the result of increased business risk. If business has really become more risky and firms hoard cash to manage that risk, we should observe the effect of cash on business performance mirroring this trend. Here, I investigate this claim by analyzing the time evolution of the cash-performance sensitivity. I proceed in two steps; first, I estimate the base-line equation (1) for each year and gather the cash-market share sensitivity estimates (ϑ_t); second, I regress those estimates on a constant and a time trend. The first column of Table 1.10 presents the time trend estimate over the period 1970-2005. The 0.001 slope coefficient on time trend (*t*-stat of 4.82) establishes the growing importance of relative-to-rivals cash in driving product market performance.[40] The Durbin-Watson statistic indicates the absence of first-order autocorrelation in the cash-performance sensitivities.[41]

Figure 1.1 further provides descriptive evidence of a remarkably upward trend in the cash-market share sensitivity. To isolate secular from cyclical movements in these estimates, I use the Hodrick and Prescott (1980) decomposition. The cash-market share sensitivity turns out to be negative before 1978 and then drift upward until 2005. In terms of economic magnitude, the depicted results imply that a one-standard-deviation increase in relative-to-rivals cash by the end of 2003 leads to a 3.6 percent gain in market share over the 2004-2005 period. Overall, the estimated patterns show that the dependence of competitive performance on cash holdings has increased considerably over time. Unreported regressions indicate a parallel increase in the valuation of relative-to-rivals cash. These trends crucially underline the increasing need for cash reserves to sustain performance in the product market and the associated valuation premium. Bates et al. (2007) attribute the large buildups of cash mainly to the increase in firms'

[40] Note that I also estimate the base-line specification across subperiods of different length (3, 5 and 7 years) and consistently observe an increase in the estimated cash-performance sensitivities. Results are available upon request.
[41] I also look at higher-order autocorrelation but fail to find any significant coefficient.

cash-flow volatility. Complementarily, by emphasizing the increased importance of cash to performance in the product market, the results above provide a rationale for the hoarding phenomenon.

In addition to the observed upward trend, Figure 1 emphasizes a significant cyclical component in the cash-performance sensitivity, suggesting that the importance of cash to success in the product market depends on the stage of the business cycle. There are at least two possible explanations for such cyclicality. First, in economic downturns, consumer demand decreases. This translates into an overall change in the product market environment. Firms' reaction to the "new" conditions may be function of their own as well as rivals' financial strength. Second, when conditions worsen, it may be more difficult to obtain external financing; for example, Bernanke and Blinder (1992). As a result, cash-rich firms may take advantage of the tighter credit conditions to pursue more aggressive competitive strategies.

To explore the link between cash holdings, market shares, and macroeconomic conditions, I analyze how the cash-market share sensitivity responds to changes in the economic conditions. Importantly, to account for the fact that firms may set their war chests in anticipation of macroeconomic movements, I use *unexpected* shocks to aggregate demand as the conditioning variable. Hence, this setting provides me with a situation in which firms have to use their existing financial conditions to compete in an exogenously modified competitive environment. I gather data on real GDP forecasts and realized values from the Survey of Professional Forecasters (SPF) provided by the Federal Reserve Bank of Philadelphia. I define *Unexpected Shocks* for year *t* as the difference between the realized real GDP growth at the end of year *t* and the median real GDP growth forecasts for the end of year *t* made at the end of *t-1*. To gauge the impact of unforecast hocks on the cash-performance sensitivity, I regress the time-specific sensitivity estimates (ϑ_t) on a constant, a time trend, and *Unexpected Shocks*.[42] Column 2 of Table A reports the results of this two-step procedure. The response coefficient is significantly negative. The Durbin-Watson statistic shows that the inference is not driven by unspecified autocorrelation. As a result, following unanticipated negative shocks, the impact of cash on market share expansion turns out to be magnified.

[42] This two-step specification is very close to the one used by Campello (2003) and Almeida et al. (2004); the main difference is that I explicitly use GDP forecasts to compute innovations in aggregate activity.

Movements in aggregate activity often correlate with the evolution of other macroeconomic variables. This may potentially distort the inference. Following Campello (2003), I include changes in the consumer price index (CPI), changes in the unemployment rate, and changes in the Federal Reserve Funds Rate (Fed funds) as additional control variables. These variables are from the Federal Reserve Bank of St.Louis. Column 3 shows that the results are not altered by the inclusion of these additional controls.

Taken as a whole, the importance of cash for competitive performance is countercyclical. Rationalizing precautionary motives for stockpiling internal resources, cash-rich firms grow more than rivals in the aftermath of unexpected economic downturns. While several recent papers argue that firms hoard large amounts of cash to be in a better position to cope with adverse shocks; for example, Almeida et al. (2004) and Bates et al. (2007), these results indicate that, by allowing cash-rich firms to perform better in the product market, this precautionary motive is actually effective.

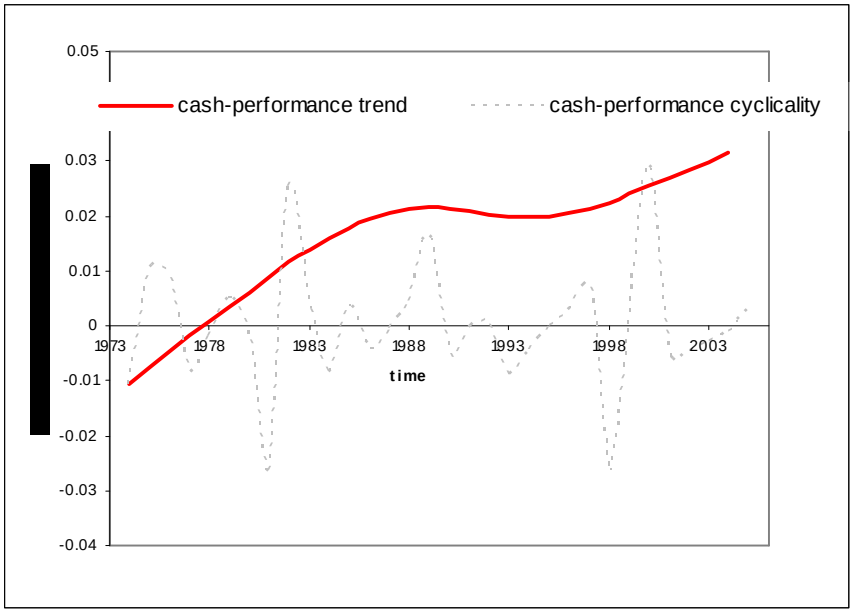
Table 1.10 The impact of cash on product market performance over time (trend and cyclicality)

The dependent variable is the year-by-year estimates of the cash-performance sensitivities (ϑ_t) [estimated via IV]. *Trend* is a time trend. *Unexpected shocks* are computed as the realized real GDP growth minus the median real GDP one-year forecast. *ΔCPI* is the annual change in the consumer price index. *ΔUnemployement* is the annual change in the unemployment rate. *ΔFed Funds* represents the annual change in the Fed funds rate. The sample period is 1973 through 2005. DW gives the Durbin-Watson statistics. *t*-statistics in brackets.

	(1)	(2)	(3)
Trend	0.001**	0.002**	0.002**
	[4.82]	[3.27]	[3.24]
Unexpected Shocks		-0.249**	-0.276**
		[4.20]	[4.95]
ΔCPI			-0.183*
			[1.92]
ΔUnemployement			-0.03
			[1.61]
ΔFed Funds			0.001
			[0.10]
DW Statistic	1.96	1.88	2.07

Figure 1.1 Trend and cyclical behavior of the cash-performance sensitivities

This figure displays the estimated year-by-year cash-performance sensitivities (ϑ_t). The sample period is 1973 through 2005 and includes only industrial firms (SIC codes 2000-3999). Cyclical and secular movements in ϑ_t are isolated using the Hodrick and Prescott (1980) decomposition.



Chapter 2: Corporate savings and Stock Price Informativeness

2.1. Introduction

Recent surveys of CFOs highlight that the most important driver of firms' financial choices is the desire to attain and preserve financial flexibility.[43] Concomitantly, an important research effort has been developed to understand how firms optimally maintain their ability to finance current and future growth opportunities at a low cost. In this context, researchers and practitioners have naturally paid a close attention to firms' cash policy since the management of internal resources constitutes a major element of firms' financial flexibility. Arguably, this growing focus has considerably broadened our understanding of the determinants of cash holdings and their consequences for firm valuation.[44] However, many dimensions of firms' cash management are not yet fully understood. In particular, prior work has paid relatively little attention to the process whereby firms accumulate their cash, i.e. their saving decisions.

This paper aims at shedding fresh light on this important question by concentrating on the role played by the information contained in stock prices in explaining firms' decision to save. Indeed, both economic intuition and previous work indicate that corporate savings are largely determined by managers' *expectations* about the value of future investment opportunities as well as their anticipations of future financing costs. In view of that, the nature and precision of available information about the firm's future prospects is likely to be a crucial ingredient of firms' savings choices. In this spirit, I argue that stock prices represent a relevant source of information that may guide managers and affect their decisions to allocate resources towards cash savings.

As a matter of fact, Dow and Gorton (1997) and Subrahmanyam and Titman (1999) suggest that by aggregating information from many different sources, stock prices may contain some information that

[43] See Graham and Harvey (2001) and Bancel and Mittoo (2004).
[44] See Bates, Kahle and Stulz (2008) for a comprehensive survey of the literature on corporate cash holdings.

is new to managers. This information, in turn, can guide them to make more efficient decisions. This "learning" hypothesis has recently received substantial empirical support. In particular, Durnev, Morck and Yeung (2004), Luo (2005) and Chen, Goldstein and Jiang (2007) report that managers integrate some information extracted from their stock price into their capital investment decisions.

To gauge whether managers infer new information by observing stock prices and whether they incorporate this incremental information into their savings decisions, I examine the relation between the amount of private information revealed by prices and the sensitivity of corporate savings to price. The logic of this approach follows closely that of Chen, Goldstein and Jiang (2007), and is based on the premise that firms' savings decisions are sensitive to shocks in their stock price. Indeed, Almeida, Campello and Weisbach (2004) and Riddick and Whited (2008) document that, on average, firms allocate more resources to their cash savings when the market foresees more valuable future prospects. On this ground, if managers glean valuable information from their market price and integrate it into their savings decisions, one would expect savings to be more responsive to stock price when the price encloses a larger content of private information.

Using firm-specific return variation – or price nonsynchronicity – to identify the quantity of private information incorporated into prices,[45] I report strong evidence that the sensitivity of savings to stock price is positively associated with price informativeness. More specifically, after controlling for size, cash flow, the stock of cash as well as firm- and time-specific effects, I find that the estimated savings-to-price sensitivity is magnified substantially when prices contain a large portion of private information. Noticeably, this result turns out to be economically significant. The estimates reveal that corporate savings become 60 percent more sensitive to stock price if one moves from the 25^{th} to the 75^{th} percentile of price informativeness. Various additional specifications confirm that this result is robust to different measures of price informativeness, to the potential effect of outliers in the measurement of firm-specific return variation as well as to several estimation methods.

[45] See Chen, Goldstein and Jiang (2007) for a detailed presentation of the papers supporting the use of firm-specific return variation to capture private information in prices.

To further strengthen my interpretation and rule out alternative explanations, I conduct various ancillary analyses. First, I reject the possibility that the documented positive association between stock price informativeness and savings originates from the fact that managers act on market mispricing to issue overvalued stocks and save part of the proceeds into their cash accounts. In particular, I report that while firms indeed funnel a significant fraction of their issuance proceeds into cash savings, the effect of price informativeness on the saving-to-price sensitivity remains equally strong when I control for firms issuance activity. In a similar vein, my conclusion is not altered by the inclusion of different proxies for market mispricing.

Next, I offer evidence that the effect of private information in prices on savings is not a by-product of binding financing constraints. Specifically, I conduct the analysis on various sub-samples where firms are classified according to their degree of financial constraints. Across different specifications, the regressions reveal that financially constrained firms exhibit larger saving-to-price sensitivities. Accordingly, firms that foresee binding financing constraints in the future increase their savings more intensively when their stock price point towards more valuable future growth options. However, the estimations reveal a positive and significant relation between the amount of private information in their prices and their saving-to-price sensitivity for *both* constrained and unconstrained firms. As a result, the effect of private information in prices contributes to explain saving behaviors systematically.

From a different perspective, I also evaluate the impact of different sources of information on the results. Indeed, one may argue that a positive relation between private information in prices and the sensitivity of savings to price reflects managerial learning only to the extent that the information gleaned from stock prices is new and valuable to managers. To address this point, I combine various sources of information and consider their joint effect on the estimated saving-to-price sensitivity. Specifically, I use the number of analysts following the firm to proxy for the prevalence of public information. Alternatively, I capture the private information that managers possess already by using the transactions by corporate insiders as well as earnings surprises. As expected, these additional information channels explain some of the observed variation in the savings-to-price sensitivity. Nevertheless, we continue to observe that

savings are more sensitive to price s when prices convey more private information that is really new to managers.

Lastly, to reinforce the interpretation of the results, I examine the combined effect of price informativeness and savings on future operating performance. Using different specifications, I show that precautionary savings enhance future return on assets. Furthermore, this valuable effect turns out to be exacerbated when firms' stock price includes a larger content of private information. This finding supports the view that private information revealed in stock prices enables managers to make more efficient savings decisions.

Overall, the mosaic of evidence suggests that managers use part of the private information embedded in stock prices when they decide on corporate savings. As such, this paper contributes in two distinct areas. First, the study adds to the literature on cash holdings, and more particularly to that focusing on corporate savings. Prior research looks at savings decisions mostly through the lens of their key role in counteracting costly or limited access to external financing. By documenting that savings are sensitive to stock price, the results in this paper confirm that precautionary savings are explained by the market anticipations about the firm's future investment prospects *and* financing costs. Importantly, the findings further stress that managers infer information from observing market expectations and incorporate part of it into their saving choices. Moreover, such a learning mechanism appears to be value-enhancing. From a different perspective, the analysis illustrates that both financially constrained and unconstrained firms increase systematically their savings when their stock price picks up more information about favorable future prospects. As such, my results substantiate the recent findings of Dasgupta, Noe and Wang (2008) who document that *all* firms optimally stage their response to positive shocks by delaying investment and building up cash savings. My analysis suggests that this inter-temporal mechanism depends on the amount and quality of information that managers have about their firm's future prospects and future financing costs.

Second, my findings offer new evidence on the role of price informativeness on corporate actions. The bulk of the empirical research in this area has revolved around analyzing the effect of stock prices on

investment decisions. Certainly, by establishing a link between the informational content of prices and corporate savings, my results point to an additional dimension of firms' decision process that is affected by stock prices. In that respect, the results confirm the intuition that prices contain a variety of information that can help managers in their decisions making. Alternatively, the results provide additional support for the idea that financial markets are not a side-show, and affect materially the real economy. In my analysis, this channel operates through the effect of prices on optimal savings' decisions.

Finally, the interpretation of my findings depends crucially on the measures of the amount of private information in prices. Clearly, it is possible that the estimates may be driven by unobservables that affect both the firm-specific return variation and render simultaneously corporate savings more sensitive to stock price. Nevertheless I believe that my use of alternative measures of price informativeness, together with extensive robustness tests mitigate substantially this concern.

In the next section, I review the related literature, discuss the theoretical background, and outline the main hypothesis. In section 2.3, I present the empirical methodology and describe the data. Section 2.4 reports the results. I draw the conclusions in section 2.5 and discuss some implications for future research.

2.2. Related literature and hypothesis development

The recent period has witnessed a growing number of studies dedicated to understand firms' cash policy. Importantly, this large research effort has considerably broadened our knowledge of why firms hold cash.[46] Yet, the existing literature has devoted little attention to the economic mechanisms whereby firms build up cash reserves, that is, why they save.

There are, however, few notable exceptions. In particular, Almeida, Campello and Weisbach (2004) formalize the idea of *precautionary* savings. Specifically, they show that when future projects are valuable and when future external financing is uncertain, corporate saving becomes a key element of a firm's financial choices. This is consistent with the general view that enhanced financial flexibility, in

[46] See Bates, Kahle and Stulz (2006) for an overview of the recent literature on corporate cash holdings.

other words, ensuring a firm's ability to finance present and future investment undertakings is the main goal of managers' financial decisions. On the empirical level, Almeida, Campello and Weisbach (2004) support their theory by documenting that firms save more intensively when they anticipate valuable future growth opportunities - when their market-to-book ratio is high – and when their access to external financing is limited. Khurana, Pereira and Martin (2006) obtain analogous results in an international context.

In a similar vein, Dasgupta, Noe and Wang (2008) provide further evidence in favor of an effective inter-temporal tradeoff between current savings and future capital investment. As a matter of fact, they show that all firms display a systematic propensity to save. In particular, they report that both financially constrained and unconstrained firms allocate a fraction of their cash flows into cash savings. Subsequently, firms draw down part of the accumulated cash reserves and increase simultaneously capital spending. They further document that this phenomenon is magnified for financially constrained firms. Notably, firms appear to save in a systematic way, and then deplete the cash to secure the financing of *future* valuable investment opportunities.[47]

Other papers provide ancillary support for such a dynamic tradeoff. Acharya, Almeida and Campello (2007) document that firms' propensity to save is magnified when they anticipate that valuable growth options are likely to appear in periods where operating cash flows are expected to be low. Alternatively, Gamba and Triantis (2007) and Riddick and Whited (2008) further indicate that income uncertainty and productivity shocks play key roles in generating the observed saving's patterns. Specifically, they show that firms save more aggressively when there is more uncertainty about the value of their future cash inflows.

Overall, the above studies provide supporting evidence that firms' savings decisions are driven by managers' expectations about the value of future investment opportunities as well as expected future financing costs, as reflected in their stock price (market-to-book ratio). In this paper, I build on this

[47] Note that these authors remain silent on the transmission mechanisms between cash savings in one period and investment in the next period. It could be that firms use directly the saved cash to finance investment. Alternatively, the cash can be used to increase external financing to finance investment.

regularity and study more closely the relation between stock prices and savings. To the extent that prices contain valuable information about a firm's fundamentals, it is legitimate to ask what type of information matters for savings and how managers process and incorporate market information in their optimal saving choices. In this spirit, I argue that stock prices may contain specific information that is new and valuable to managers. This information can take different forms. It can be about future investment opportunities, but also about the future demand for the firm's products, the strategic competition with other firms, the intrinsic uncertainty faced by the firm or its future financing costs. On this ground, I conjecture that managers' decision to save is partly guided by some private information they learn from stock prices.

This hypothesis is based on the view that managers can improve their decisions by observing stock price. As advocated by Dow and Gorton (1997), Subrahmanyam and Titman (1999) or Dye and Sridhar (2002), stock prices cumulate information from different market participants who cannot communicate with the firm other than via the trading process.[48] In this context, stock prices may enclose some information that the managers do not have. This fresh information, in turn, can lead them to allocate corporate resources more efficiently and hence contributes to enhance firm value.[49]

Several studies have taken this prediction to the data. In particular, Durnev, Morck and Yeung (2004) show that firms invest more efficiently when their stock price incorporate more private information.[50] Chen, Goldstein and Jiang (2007) report that investment is more sensitive to stock price when prices are more informative. They interpret their results as evidence that managers extract information from stock prices when they make investment decisions. Bakke and Whited (2008) reach a similar conclusion. Using a different approach, Luo (2005) finds that merger announcement returns predict deal completions, even after controlling for deal quality, thereby concluding that merging firms

[48] Put some additional reference of this literature (feedback effect).
[49] Stock prices can also affect corporate decisions through its effect on firms' access to capital. This mechanism is supported empirically by Baker, Stein and Wurgler (2003) and Campello and Graham (2007) who show that positive shocks to prices relax firm's financing constraints.
[50] They gauge the efficiency of corporate investment directly by estimating the deviation of Tobin's marginal q from its optimal level.

extract information from stock prices. From a different angle, Ferreira, Ferreira and Raposo (2008) provide evidence that private information in prices impinge on the structure of corporate boards.

By and large, all these pieces of evidence support the existence of a feedback from the informational content of stock prices to corporate decisions. However, it is fair to say that the vast majority of the research in this area concentrates on investigating the impact of price information on corporate investment. This unilateral focus appears surprising. As a matter of fact, both theory and economic intuition suggest the information revealed by prices may contain different components. Consequently, and to the extent that the information is new to managers, one may expect that the informational content of prices also guide managers in their savings strategy. On this ground, I hypothesize that corporate savings will be more sensitive to stock price when price embeds more private information. Below, I provide evidence that substantiates this claim.

2.3. Methodology and data

This section describes the econometric methodology, details how I construct proxies for the amount of private information embedded in stock prices and presents summary statistics.

2.3.1. Measuring the sensitivity of savings to price: econometric specification

To gauge whether managers incorporate the private information embedded in stock prices into their saving's decisions, I examine the relation between the amount of private information in stock prices and the sensitivity of savings to price. To do so, I follow and adapt the approach of Chen, Goldstein and Jiang (2007) who investigate whether price informativeness affects the sensitivity of corporate investment to stock price. Based on their argument, stock prices aggregate all public and private information about firms' fundamental value. Hence, when deciding upon the optimal level of savings, a value maximizing manager will consider all relevant and available information. This set includes both private information

that managers possess, and that is not yet integrated into the stock price, as well as the overall information embedded into the stock price.[51] If managers learn from prices and use this information into their savings decisions, we expect corporate savings to be more sensitive to stock price when the prices convey more private information that is new to managers.

To test this hypothesis, I draw from Almeida, Campello and Weisbach (2004) and specify the following model of corporate savings:

$$Savings_{i,t} = \alpha_i + \eta_t + \beta_1 Q_{i,t-1} + \beta_2 (Q_{i,t-1} \times \psi_{i,t-1}) + \varphi_1 Size_{i,t} + \varphi_2 CF_{i,t} + \varphi_3 \psi_{i,t-1} + \varphi_4 Cash_{i,t-1} + \varepsilon_{i,t}$$

where the subscripts *i* and *t* represent respectively the firm and the year. The dependent variable $Savings_{i,t}$ is the annual change in the holdings of cash and other liquid assets divided by lagged assets.[52] $Q_{i,t-1}$ is the normalized stock price, and is computed as the market value divided by the book value of assets. The variable of interest $\psi_{i,t-1}$ represents the firm-specific stock price and is used as a proxy for private investors' information. First proposed by Roll (1988), this measure relies on the correlation between a firm's stock return and the return of its corresponding industry and of the market. As explained and demonstrated by Durnev, Morck and Yeung (2004), in the absence of firm-specific information, a firm's stock return varies only because of exogenous s in industry and markets returns. In contrast, the presence of firm-specific information magnifies stock price, rendering the returns less correlated with market and industry returns. Hence, stock prices informativeness increases when the return on a stock becomes less correlated with the market and industry returns. A large amount of evidence supports the informational

[51] As noted in Chen, Goldstein and Jiang (2007), information that managers already had will move the price but not affect the savings decisions (as it already affected past savings) and thus will decrease the sensitivity of savings to price.

[52] The definition of all the variables is outlined in the Appendix A.

content captured by this measure, and particularly, the amount of private information about firms.[53] To compute this measure, I follow Durnev, Morck and Yeung (2004) and define firm-specific return variation for each year as $\psi_{i,t} = \ln((1 - R^2_{i,t}) / R^2_{i,t})$, where $R^2_{i,t}$ represents the R^2 from the regression of firm 's weekly returns on the value-weighted market and value weighted industry indices in year *t*. The market index and industry indices are value weighted and exclude the firm in question. This exclusion prevents spurious correlation between firm and industry returns in industries that contain few firms**.** Similarly to Durnev, Morck and Yeung (2004), I define industry at the three-digit SIC-code level. Note that I use weekly returns because CRSP daily returns data reports zero return when a stock is not traded in a given day.[54] The presence of zero (non-traded) returns could artificially decrease the explanatory power in the return regressions and therefore inflate mechanically the proxy for private information in prices. Although small stocks may not trade for a day or more, they generally trade at least once every few weeks. Weekly returns are thus less likely to suffer from "thin trading" problems.

To reliably estimate the combined effect of price and private information on corporate savings, I include control variables designed to capture a number of factors affecting savings decisions that may also correlate directly with stock price and its informativeness. First, I include $\psi_{i,t-1}$ separately to capture the possible effect of private information on corporate savings. I also include the natural logarithm of assets (*Size*) to neutralize the impact of size on the genuine need to save funds, as well as the potential effect of economies of scale in cash management. To accommodate the documented precautionary allocation of cash inflows into cash savings, I include cash flow (*CF*) as a control variable; see Almeida, Campello and Weisbach (2004) and Riddick and Whited (2008). Also, since a firm's decision to change its cash position depends likely on its available stock of cash, I include the beginning of period cash holdings (*Cash*). I account for time-invariant firm heterogeneity by including firm fixed effects (α_i). Also, to control for the effect of macro-economic variables that can affect firms' savings behaviors, I include time effects (η_t).

[53] See for instance Wurgler (2000), Durnev, Morck, Yeung and Zarowin (2003), Jin and Myers (2006). Chen, Goldstein and Jiang (2007) provide a detailed survey of the literature supporting the idea that high firm-specific return variation is a valid proxy for firm-specific information.

[54] My sample contains 4.5% of daily observations that are not traded (reporting zero return and zero volume).

Finally, I allow the error term in (1) to be serially correlated for the same firm. Hence, in all estimations, the standard errors are adjusted for heteroskedasticity and within firm-period clustering as defined in Petersen (2008). In estimating equation (1), my primary interest is on β_2 . Indeed, this coefficient measures how the association between saving and price is affected by the amount of private information contained in prices. If corporate savings decisions are guided by private information embedded in the stock price, one expects this coefficient to be significantly positive.

In an augmented version of (1), I further isolate the effect of stock prices on savings by including a number of sources and competing uses of funds. Indeed, because savings decisions are likely to be determined jointly with other financial choices, the estimates may be biased by the presence of omitted important variables. To address this concern, I follow Almeida, Campello and Weisbach (2004) and control for discretionary spending by including capital expenditure (*Capex*) and acquisitions (*Acquisitions*) because firms can draw down their cash reserves in order to pay for valuable growth opportunities. I add change in net working capital (*ΔNWC*) since working capital can be a substitute for cash (Opler, Pinkowitz, Stulz and Williamson (1999)) or it may compete for the available pool of resources. I include changes in short-term debt (*ΔShortDebt*) due to the substitutability between cash and debt, and because firms can use short-term debt financing to build up cash reserves. When I add these variables, I explicitly recognize the endogeneity of financing and spending decisions and use instrumental variables estimations. As recognized by Almeida, Campello and Weisbach (2004), finding appropriate instruments is not an obvious task. My approach strictly follows their and includes two lags of the level of fixed capital (property, plant and equipment over assets), lagged acquisitions, lagged net working capital, lagged short-term debt as well as industry dummies (two-digit SIC codes).

2.3.2. Sample and summary statistics

I obtain cash holdings and financial data from the annual Compustat industrial files. This data constitutes an unbalanced panel that covers the period 1970-2006. I exclude firm-year observations with

missing data. Next, I delete observations for which total assets, cash holdings, or sales are negative. I omit all firms in the financial (SIC code 6000-6999) and utility industries (SIC code 4900-4999). Stock price and return information are from CRSP. After merging the CRSP with the Compustat data and after deleting the top and bottom 1% of my regression variables, the sample comprises 88'501 firm-years observations with 11'937 firms. In robustness tests, I use additional data on analysts' coverage and insiders' transactions. Data on analysts' earnings forecasts are from I/B/E/S summary files and data on insiders' trading is from Trade and Quote (TAQ) database.[55] Appendix A defines the variables used in this study and describes their source.

Table 2.1 Descriptive statistics

This table reports the mean, median, standard deviation, number of observations as well as the 10^{th}, 25^{th}, 75^{th} and 90^{th} percentiles for the main variables used in the analysis. The variables are defined in the Appendix. The sample covers the period 1970 to 2006 and exclude firms from the financial (SIC 6000-6999) and the utility (4900-4999) industries.

Variables	Mean	Median	St.Dev	#Obs	10^{th}	25^{th}	75^{th}	90^{th}
Q	1.515	1.176	1.066	87145	0.779	0.924	1.684	2.58
Savings	0.012	0.001	0.113	88501	-0.075	-0.02	0.03	0.097
ψ	1.922	1.902	1.825	87612	0.082	0.886	2.982	4.092
R^2	0.212	0.131	0.227	88002	0.016	0.048	0.297	0.535
Assets	835.483	99.47	2445.221	88501	10.374	27.912	438.683	1927.249
Cash	0.114	0.059	0.142	87947	0.009	0.023	0.148	0.297
Cash Flow	0.054	0.083	0.142	88501	-0.07	0.038	0.122	0.161
Capex	0.068	0.05	0.065	88501	0.011	0.025	0.09	0.15
Acquisitions	0.015	0	0.041	88501	0	0	0.002	0.045
ΔNWC	0.063	0.048	1.607	88501	-0.866	-0.244	0.335	0.975
$\Delta ShortDebt$	0.781	-0.045	3.867	88501	-0.841	-0.433	0.447	2.007

Table 2.1 presents descriptive statistics. Noticeably, the average savings is 0.012 indicating that firms' saving rate is slightly more than 1% of total asset over the sample period. In dollar terms, this represents slightly more than $10 million per year. To put this number in perspective, I note that the average cash flow represents 5.4% of firm's assets. Hence, broadly speaking, firms save an amount that is

[55] We thank Wei Jiang for providing us with the insider trading data.

equal to one fifth of their annual operating revenues. Noteworthy, the mean of ψ is 1.92, corresponding to an average firm return-specific variation of 79% (1-R^2 in yearly firm-level return regressions). This number is in line with that displayed in Roll (1988), who first argued that a considerable part of stock price is driven by firm-specific information. The average firm in my sample has a size (total assets) of $835 million and cash-to-asset ratio of 11%. Its investment rate (capital expenditure over assets) is 6.8 % and its acquisition rate is (acquisitions over assets) is 1.4%. The mean net working capital represents 12.8% of firm's assets while the mean short-term debt accounts for 6%. Overall, these numbers are comparable to those found in closely related studies, such as Almeida, Campello and Weisbach (2004), Riddick and Whited (2008) and Chen, Goldstein and Jiang (2007).

2.4. Main results

2.4.1. The effect of price informativeness on the savings-to-price sensitivity

Before formally testing the hypothesis that I delineate in section 2, I start by documenting that corporate savings are sensitive to stock price . Specifically, column 1 of table 2.2 presents the results of a univariate regression of corporate savings on the stock price (*Q*). Notably, I observe a positive and significant association between *Savings* and *Q*, with a coefficient for *Q* estimated at 0.013, significant at less than the 1% level. The magnitude of this estimate is in line with Almeida, Campello and Weisbach (2004) and Riddick and Whited (2008) and confirms that savings are positively correlated with prices.[56] Firms appear to save more when they have higher valuation. This finding confirms the idea that, on average, firms allocate more resources to their cash savings when the market, i.e the marginal investor, foresees more valuable future prospects.

[56] Almeida, Campello and Weisbach (2004) do not report an estimate of the sensitivity of savings to price for their whole sample. Splitting their sample by the severity of financing constraints, they report estimates ranging between 0.0001 and 0.0029. Similarly, Riddick and Whited (2008) presents estimates between 0.006 and 0.045.

Column 2 displays the central finding of this paper. Indeed, I observe that the coefficient for $\psi \times Q$ is positive and statistically significant (0.002 with a t-stat of 4.48). Accordingly, corporate savings are more sensitive to stock price when prices contain a larger amount of private information. In other words, managers save more following a positive signal given by the market price when the signal contains a larger amount of private investors' information. To wit, this result corroborates the view that managers learn some information from their stock price and subsequently adjust their saving choices. This effect is also economically significant since the saving-to-price sensitivity increases by 60% when one moves from the 25th to the 75th percentile value of price informativeness (ψ).Controlling for other firm characteristics does not alter my central result. In column 3, I present estimates for a specification that includes the control variables described in equation (1). Importantly, the positive coefficient for $\psi \times Q$ remains highly significant (0.002 with a t-stat of 4.14). Note that the other estimates have the expected signs. In particular and consistent with Almeida, Campello and Weisbach (2004), cash flow contributes significantly to explain cash savings. In essence, this result confirms that the average firm has a positive propensity to save cash out of cash inflows. Also, *Size* displays a positive sign, indicating that larger firms tend to save more (or use less) cash.[57] As expected, a firm's stock of cash is negatively related to cash accumulation. A similar result is shown in Campello and Graham (2007). Finally, I observe that the coefficient on $\psi_{i,t-1}$ is not significant, thereby suggesting that price informativeness has no direct effect on corporate savings.

Column 4 reports the results I obtain by estimating the augmented specification using instrumental variables. Although slightly smaller, the coefficient for $\psi \times Q$ continues to be significantly positive. The decrease in estimated sensitivity is expected given that this specification controls for additional sources and use of funds. Again, most of the coefficients for the other regressors attract the expected signs.

Taken together, this first set of results supports the view that managers use part of the private information embedded in stock prices, as measured by firm-specific return variation, when they decide upon corporate savings.

[57] Maybe small firms actively use the cash to grow while large mature firms accumulate cash (due to lack of valuable investment opportunities).

Table 2.2 Price informativeness and the saving-to-price sensitivity: Baseline results

This table presents coefficient estimates of corporate savings on stock price and the amount of private information contained in price (specification (1)). The dependent variable is *Savings*, the annual change in cash holdings divided by lagged assets. *Q* is the normalized price, computed as the market value divided by the book value of assets. ψ is a proxy for the amount of private information in price and refers to firm-specific stock price variation. The set of control variables include *Cash flow*, *Size* and lagged *Cash*. In addition, in column (4), we also include *Capex*, *Acquisitions*, ΔNWC and $\Delta Shortdebt$ as additional control variables. All the variables are defined in the Appendix. The sample period is 1973 through 2006. IV estimations display diagnostic statistics for instrument overindentification restrictions (p-values for *J*-statistics reported). The estimations correct the error structure for heteroskedasticity and within-firm error clustering. *t*-statistics in brackets. ** and * denote statistical significance at the 1% and 5% level, respectively.

Variables	(1) OLS	(2) OLS	(3) OLS	(4) IV
Q_{t-1}	0.013**	0.010**	0.016**	0.017**
	[13.72]	[9.65]	[14.32]	[6.39]
$Q_{t-1} \times \psi_{t-1}$		0.002**	0.002**	0.001*
		[4.49]	[4.14]	[2.17]
ψ_{t-1}		0.000	0.000	-0.002
		[0.05]	[0.44]	[1.00]
$Cash\ Flow_t$			0.176**	0.206**
			[27.51]	[11.29]
$Size_t$			0.002	-0.020**
			[1.60]	[3.16]
$Cash_{t-1}$			-0.442**	-0.526**
			[51.58]	[17.34]
$Capex_t$				-0.809**
				[2.77]
$Acquisitions_t$				-0.697**
				[3.97]
ΔNWC_t				0.009
				[0.54]
$\Delta ShortDebt_t$				-0.003*
				[2.57]
Firm fixed effects	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes
#Obs.	88376	88376	88376	73213
R^2	0.23	0.24	0.34	0.22

2.4.2. Sensitivity Analysis

To give additional support for my findings, I extend the analysis in two dimensions. First, I use alternative definitions and measures of private information in prices. Second, I address the possibility that my inference is misstated by changing the model specification and the estimation procedure. I start by performing robustness checks with respect to the computation of firm-specific return variation (ψ). Table 2.3 presents the results. First, I use three complementary methods to compute firm-specific return variation using daily returns data instead of weekly data. Despite the advocated potential problem of "thin trading", column 1 of Table 2.3 reports the results of using daily returns to compute ψ. In column 2, I account for infrequent trading of daily frequency returns by cumulating the returns in days where no trading took place. This strategy mitigates the potential bias created by the zeros in returns series. In column 3, I add (one day) lagged market and industry returns to the regression estimating R^2 to control for some market and industry information that might find their way into prices with some delay. Although the magnitude of the estimates changes slightly across the three first columns of table 2.3, the effect of price informativeness on the sensitivity of savings to price is still positive and highly significant. Then, in column 4, I estimate firm-specific return variation by regressing weekly stock returns on the three factors from Fama and French.[58] Indeed, we might argue that those factors are part of the systematic variation in individual returns. Notably, the results remain unchanged.

Next, I replace firm-specific return variation by two alternative variables capturing price informativeness. In particular, I use the probability of information-based trading (*PIN*) developed by Easley, Kiefer and O'Hara (1996).[59] This measure is based on the estimation of a structural microstructure model, where trades may come from "noise traders" or "informed traders". Previous empirical work generally supports the use of *PIN* as a valid measure of price informativeness.[60]

[58] The daily Fama and French returns for small-minus-big (SMB) and high-minus-low (HML) factors are obtained from French's website: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html
[59] The data on PIN are available on Soeren Hvidkjaer's webpage for the period 1983-2001 (NYSE and AMEX).
[60] Vega (2006) reports that stock with high *PIN* have smaller reactions following an earnings announcement, which is in line with the idea that these stocks incorporate more private information. Chen, Goldstein and Jiang (2007) and Bakke and Whited (2008) document a positive association between PIN and the sensitivity of investment to stock

Table 2.3 Price informativeness and the saving-to-price sensitivity: Sensitivity analysis

This table presents coefficient estimates of corporate savings on stock price and the amount of private information contained in price (specification (1)). The dependent variable is *Savings*, the annual change in cash holdings divided by lagged assets. *Q* is the normalized price, computed as the market value divided by the book value of assets. ψ is a proxy for the amount of private information in price and refers to firm-specific stock price variation. The set of control variables include *Cash flow*, *Size* and lagged *Cash*. Columns (1) to (3) use daily returns to compute ψ. In column (2) ψ is computed using daily returns that are cumulated in no-trading days. In column (3), ψ is computed by including lagged market and industry returns in the returns regressions. In column (4) ψ is computed by including the Fama and French factors in the returns regressions. In column (5), *PIN* refers to the probability of informed trading from Easley, Kiefer and O'Hara (1996). In column (6), *ILLIQ* refers to the Amihud (2002) liquidity ratio. In column (7) and (8), firm-years observations for which ψ is above (below) 90th (10th) percentile, respectively above (below) 75th (25th) percentile are not included. In column (9) specification (1) is estimated using the Fama and MacBeth (1973) approach. All the variables are defined in the Appendix. The sample period is 1973 through 2006. The estimations correct the error structure for heteroskedasticity and within-firm error clustering. *t*-statistics in brackets. ** and * denote statistical significance at the 1% and 5% level, respectively.

Variables	(1) Daily	(2) Cumul	(3) Delay	(4) FF	(5) PIN	(6) ILLIQ	(7) 10th-90th	(8) 25th-75th	(9) FM
Q_{t-1}	0.015**	0.014**	0.012**	0.012**	0.003	0.019**	0.016**	0.014**	0.017**
	[12.29]	[13.08]	[7.52]	[6.79]	[0.81]	[19.13]	[12.15]	[8.54]	[14.04]
$Q_{t-1}\times\psi_{t-1}$	0.002**	0.002**	0.003**	0.003**			0.002**	0.003**	0.001**
	[5.82]	[5.81]	[5.65]	[5.50]			[4.50]	[4.61]	[2.84]
ψ_{t-1}	0.000	-0.000	-0.003	0.00			-0.001	-0.002	0.001*
	[0.54]	[0.94]	[1.43]	[0.09]			[0.84]	[1.92]	[2.34]
$Q_{t-1}\times PIN_{t-1}$					0.039				
					[1.94]				
PIN_{t-1}					-0.027				
					[0.97]				
$Q_{t-1}\times ILLIQ_{t-1}$						0.013			
						[1.52]			
$ILLIQ_{t-1}$						0.01			
						[0.97]			
Cash Flow$_t$	0.175**	0.175**	0.176**	0.175**	0.108**	0.174**	0.187**	0.201**	0.137**
	[27.36]	[27.46]	[27.34]	[27.62]	[8.35]	[27.28]	[24.85]	[20.67]	[16.65]
Size$_t$	0.003**	0.002	0.001	0.003**	0.000	0.001	0.001	0.001	0.001*
	[2.60]	[1.82]	[1.05]	[2.60]	[0.02]	[1.12]	[1.09]	[0.55]	[1.99]
Cash$_{t-1}$	-0.443**	-0.443**	-0.443**	-0.440**	-0.470**	-0.444**	-0.441**	-0.442**	-0.122**
	[51.41]	[51.40]	[51.42]	[51.37]	[22.70]	[51.71]	[45.69]	[35.09]	[14.65]
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
#Obs.	88010	87878	87299	88371	17885	88376	70292	44335	88376
R^2	0.34	0.34	0.34	0.34	0.32	0.34	0.37	0.44	0.08

prices, consistent with the idea that managers learn from the private information embedded into stock prices. Ferreira and Laux (2007) and Ferreira, Ferreira and Raposo (2008) report a positive relation between governance quality and PIN. However, Duarte and Young (2007) recently questions some interpretation of *PIN* as a measure of information.

Despite a sharp reduction in the sample size (due to the use of intraday data from TAQ to compute *PIN*), column 5 shows the results for the regression using *PIN* instead of ψ, I find that the estimated coefficient on $PIN \times Q$ is significantly positive (at 5.3% level).

Alternatively, I replace firm-specific return variation by the illiquidity ratio (*ILLIQ*) of Amihud (2002). This measure is computed as the annual average of the daily ratio between a stock's absolute return and its dollar volume (multiplied by 10^6). *ILLIQ* measures the absolute percentage price change per dollar of daily trading volume and is a proxy for the price impact of trades. As in Kyle (1985) and Ferreira, Ferreira and Raposo (2008), I conjecture that the magnitude of the price impact should be a positive function of the perceived amount of informed trading on a stock, and thus a proxy for the amount of private information embodied into prices.[61] Column 6 presents the estimates. $ILLIQ \times Q$ is positive and insignificant at any reasonable level of confidence. This supports the hypothesis that the savings-to-price sensitivity increases when there is more private information-based trading.

To further verify the validity of the inference, I reassess my base specification (1) following alternative estimation procedures. An important concern is that my results are driven by extreme observations in the information proxy. To reduce the potential impact of outliers, I first re-estimate specification (1) without firm-years observations for which ψ is above the 90th percentile and below the 10th percentile. Column 7 shows that this winsorizing does not alter my main findings. In column 8, I perform a similar test but trimming firm-years observations with ψ above (below) the 75th (25th) percentile and continue to observe a positive effect of price informativeness on the savings-to-price sensitivity.

Another possible issue is the presence of time and cross-sectional dependence in the sample. Despite the use of time and firm fixed effects and firm-clustered standard errors, it might be that my results stem from the misspecification of dependencies. To validate the inference, I use the Fama and MacBeth (1973) methodology. Specifically, I estimate specification (1) separately for each year and report the average of yearly estimated coefficients. Column 9 displays the Fama-MacBeth results. The

[61] Note however that this measure will also reflect the inventory costs associated with trading a given order size. Thus, it is a "noisy" measure for the private information content of prices.

estimates are qualitatively similar to those reported in Table 2.2. The coefficient for $\psi \times Q$ is 0.001 with a t-statistic of 2.84. The coefficients of the other firm characteristics are also consistent with the previous OLS regression estimates.

Overall, the conclusion remains robust to different definitions of price informativeness and different estimation techniques. Corporate savings are more responsive to stock price when market prices contain a larger fraction of private information.

2.4.3. Market mispricing

In this section, I examine the potential effect of mispricing on my findings. As argued by Baker and Wurgler (2002) and Baker, Stein and Wurgler (2003), overvalued firms may take advantage of irrationally low discount rates to issue securities at a cheaper price.[62] In this spirit, some recent papers provide evidence in favor of a "market mispricing" explanation for cash accumulation. In particular, Campello and Graham (2007) document that during the technology bubble (1995-1999), financially constrained non-technology firms issued equity in response to unjustified high stock prices, and subsequently saved a significant part of those funds. In an international context, Kim and Weisbach (2007) report that highly valued firms that issue equity via SEO tend to save a high fraction of the cash they raise.[63] On this ground, there is a possibility that the documented sensitivity of savings to prices reflects the fact managers act on mispricing by issuing overvalued stocks and channeling the proceeds into their cash savings, and not by optimally responding to changes in future prospects.

I address this possibility in different ways. First, I look at how issuance patterns affect the estimated saving-to-price sensitivity. Indeed, if stock prices influence corporate savings only through the hoarding of issuance proceeds, the positive saving-to-price sensitivity should vanish when I control for

[62] Bakke and Whited (2008) provide a comprehensive survey of this literature.
[63] In contrast, D'Angelo, D'Angelo and Stulz (2007) show that a large part of equity issuance cannot be explained by the timing of overvalued stock prices.

issuance activity. To test this claim, I define *Issuance* as the yearly change in equity[64] and introduce this additional variable into specification (1). Column 1 of table 2.4 displays the results. As expected, we observe that the coefficient on *Issuance* is significantly positive. Hence, firms that issue equities set aside part of the proceeds into their cash balances. Also, I note that the effect of prices on savings is reduced slightly when I control for issuance activity. These results corroborates Kim and Weisbach (2007) and Campello and Graham (2007) and indicate that part of the effect of prices on corporate savings materializes through "market timing". However, the estimated coefficient for $\psi \times Q$ remains largely significant, thereby supporting that the positive effect of private information in prices on the savings-to-price sensitivity is not an artifact of managers timing the market.

Alternatively, I use future abnormal returns ($EXRET_{t+3}$) to proxy directly for market mispricing. This approach follows Baker and Wurgler (2002) and Baker, Stein and Wurgler (2003) who use returns subsequent to the measurement of *Q* as a measure of mispricing. They argue that as mispricing is a transient phenomenon, firms with overvalued stocks ought to experience negative returns as the mispricing gets corrected. Hence, observing negative returns following the measurement of *Q* is suggestive that the stock was mispriced. I compute $EXRET_{t+3}$ as the value-weighted market adjusted three-year cumulative return, starting from the end of the saving year.[65] Consistent with a market mispricing argument, column 2 reveals that the estimate for $EXRET_{t+3}$ is negative and significant, indicating that firms save more intensively when their stock is *a priori* overvalued. Yet, the effect of price informativeness is not altered by the inclusion of future excess returns.

Finally, I control for firms' age. As documented in Bates, Kahle and Stulz (2008), firms that have recently gone public tend to accumulate more cash. This intensified saving behavior may originate in the hoarding of the IPO proceeds and/or because IPO firms often issue equity within a few years following their IPO. Alternatively, it could also be argued that young firms are genuinely more exposed to pricing

[64] More precisely, Issuance is computed as yearly change in equity plus the change in deferred taxes minus change in retained earnings divided by the beginning-of-year equity stock.
[65] As in Chen, Goldstein and Jiang (2007), for observations in the last two years of my sample period, two-year or one-year future returns are used.

errors because their valuation is more complex. For those reasons, in columns 4, 5 and 6, I report estimates of specification (1) when I eliminate firms that had their IPO within one, two and three years respectively. Although the effect of information in prices on the saving-to-price sensitivity decreases a little, it is still positive and largely significant.

Table 2.4 Price informativeness and the saving-to-price sensitivity: The effect of market mispricings

This table presents coefficient estimates of corporate savings on stock price and the amount of private information contained in price (specification (1)). The dependent variable is *Savings*, the annual change in cash holdings divided by lagged assets. *Q* is the normalized price, computed as the market value divided by the book value of assets. ψ is a proxy for the amount of private information in price and refers to firm-specific stock price variation. The set of control variables include *Cash flow*, *Size* and lagged *Cash*. *Issuance* is the Yearly change in equity plus the change in deferred taxes minus change in retained earnings divided by the beginning-of-year equity stock. $EXRET_{t+3}$ is the value-weighted market adjusted returns cumulated over three years. Columns (4) to (6) exclude firms-years that had their IPO less than one, two and respectively three years ago. All the variables are defined in the Appendix. The sample period is 1973 through 2006. The estimations correct the error structure for heteroskedasticity and within-firm error clustering. *t*-statistics in brackets. ** and * denote statistical significance at the 1% and 5% level, respectively.

Variables	(1)	(2)	(3)	(4) IPO<1yr	(5) IPO<2yrs	(6) IPO<3yrs
Q_{t-1}	0.011**	0.014**	0.009**	0.016**	0.016**	0.016**
	[10.84]	[10.76]	[8.00]	[14.35]	[12.95]	[12.03]
$Q_{t-1}\times\psi_{t-1}$	0.001**	0.002**	0.001*	0.002**	0.002**	0.001**
	[2.65]	[3.82]	[2.37]	[4.16]	[3.98]	[2.91]
ψ_{t-1}	0.00	0.00	0.00	0.00	0.00	0.00
	[0.12]	[0.61]	[0.10]	[0.51]	[0.75]	[0.14]
$Cash\ Flow_t$	0.199**	0.201**	0.226**	0.176**	0.171**	0.169**
	[32.97]	[23.25]	[27.10]	[27.60]	[26.28]	[24.32]
$Size_t$	0.001	0.001	0.001	0.002	0.002*	0.003**
	[1.28]	[0.49]	[0.68]	[1.40]	[2.09]	[2.58]
$Cash_{t-1}$	-0.408**	-0.445**	-0.404**	-0.442**	-0.432**	-0.433**
	[50.57]	[43.21]	[41.88]	[51.41]	[47.58]	[46.38]
$Issuance_t$	0.078**		0.089**			
	[29.55]		[26.10]			
$EXRET_{t+3}$		-0.006**	-0.003**			
		[7.53]	[3.85]			
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes	Yes
#Obs.	86275	66965	65571	88096	82777	76101
R^2	0.41	0.34	0.4	0.34	0.33	0.32

2.4.4. Financing constraints

In this section, I investigate whether the effect of price informativeness on the saving-to-price sensitivity is affected by a firm's financing conditions. In so doing, I address two related questions. First, are corporate savings more sensitive to change in prices when firms anticipate constraints in accessing external capital? Second, is there a difference in the effect of price informativeness on the estimated saving-to-price sensitivity between financially constrained and unconstrained firms?

To answer these questions, I partition the sample to obtain cross-sectional contrasts related to firms' access to external financing. Specifically, I split the sample according to five widely used measures of financing constraints. This strategy mirrors that of Almeida, Campello and Weisbach (2004) and Campello and Graham (2007). In particular, I use firm's size, the Kaplan and Zingales (1997) Index (KZ), the Whited and Wu (2006) index (WW), the payout ratio, and the existence of a bond rating to proxy for financing constraints.[66] I assign a firm in the "constrained" group if the book value of its assets lies below the 33rd percentile and in the "unconstrained" group otherwise. Concerning the KZ and WW indices as well as the payout ratio, I classify a firm in the constrained (unconstrained) group if it lies in the highest (lowest) tercile of each variable. Finally, I categorize a firm as constrained if it never had its public debt rated during the sample period. I then estimate specification (1) independently for each partition of constrained and unconstrained firms and present the results in table 2.5.

First, notice that the coefficients for *Q* are positive and significant across all specifications. These estimates confirm that stock price is a strong driver of corporate savings behavior for both financially constrained and unconstrained firms. All firms tend to accumulate more cash savings when their price reflects more valuable future prospects. These results mirrors those in Riddick and Whited (2008) and Dasgupta, Noe and Wang (2008) who find as well that both constrained and unconstrained firms have positive and significant saving-to-price sensitivities.

[66] These variables are defined in the appendix.

Table 2.5 Price informativeness and the saving-to-price sensitivity: The effect of financing constraints

This table presents coefficient estimates of corporate savings on stock price and the amount of private information contained in price (specification (1)). The dependent variable is *Savings*, the annual change in cash holdings divided by lagged assets. *Q* is the normalized price, computed as the market value divided by the book value of assets. ψ is a proxy for the amount of private information in price and refers to firm-specific stock price variation. The set of control variables include *Cash flow*, *Size* and lagged *Cash*. Firms-years are classified as financially constrained (C) and unconstrained (U). I use firm's size, the Kaplan and Zingales (1997) Index (KZ), the Whited and Wu (2006) index (WW), payout ratio, and the existence of a bond rating to proxy for financing constraints. I assign a firm in the "constrained" group if the book value of its assets lies below the 33rd percentile and in the "unconstrained" group if the book value of its asset lies above the 67th percentile. Concerning the KZ and WW indices as well as the payout ratio, I classify a firm in the constrained (unconstrained) group if it lies above (below) the 67th (33rd) percentile of each variable. Finally, I categorize a firm as constrained if it never had its public debt rated during the sample period. All the variables are defined in the Appendix. The sample period is 1973 through 2006. The estimations correct the error structure for heteroskedasticity and within-firm error clustering. *t*-statistics in brackets. ** and * denote statistical significance at the 1% and 5% level, respectively.

	Firm Size		**KZ Index**		**WW Index**		**Payout policy**		**Bond Rating**	
	C	U	C	U	C	U	C	U	C	U
Q_{t-1}	0.009**	0.008**	0.017**	0.010**	0.011**	0.007**	0.016**	0.006**	0.014**	0.005*
	[5.13]	[3.19]	[6.18]	[5.18]	[4.32]	[3.88]	[6.40]	[3.65]	[8.09]	[2.29]
$Q_{t-1}\times\psi_{t-1}$	0.002**	0.003**	0.001**	0.003**	0.002*	0.002**	0.001*	0.001*	0.002**	0.004*
	[3.44]	[4.08]	[2.71]	[4.81]	[2.66]	[3.12]	[1.97]	[2.41]	[4.13]	[2.67]
ψ_{t-1}	-0.003**	-0.002	0.000	-0.001	-0.002	-0.001	0.000	-0.001	-0.002*	-0.005*
	[2.72]	[1.57]	[0.02]	[1.09]	[1.47]	[1.16]	[0.28]	[0.66]	[2.39]	[2.43]
$Cash\ Flow_t$	0.186**	0.182**	0.123**	0.272**	0.195**	0.168**	0.197**	0.187**	0.177**	0.133**
	[21.61]	[12.57]	[12.16]	[22.60]	[22.31]	[10.73]	[21.72]	[11.85]	[26.79]	[6.28]
$Size_t$	0.007**	-0.004**	-0.003*	0.002	0.008**	-0.003*	0.002	-0.003	0.003*	-0.003
	[3.57]	[2.72]	[2.00]	[1.28]	[3.89]	[2.64]	[0.99]	[1.90]	[2.34]	[1.73]
$Cash_{t-1}$	-0.443**	-0.314**	-0.411**	-0.351**	-0.438**	-0.287**	-0.417**	-0.316**	-0.458**	-0.322**
	[38.13]	[23.74]	[28.17]	[32.06]	[36.53]	[20.97]	[33.39]	[25.95]	[49.85]	[14.22]
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
#Obs.	33319	37890	35359	35953	29717	33938	30913	35225	72913	15588
R^2	0.40	0.32	0.45	0.42	0.39	0.34	0.43	0.39	0.35	0.21

Notably, in the financially constrained groups, savings are on average two times more sensitive to stock price than in the financially unconstrained groups. These systematic differences suggest that firms that anticipate difficulties in accessing capital in the future tend to increase their saving rate more intensively when their stock price points to more valuable future growth options.

Strikingly, for each of the five classification schemes, we observe that the coefficients estimates for $\psi \times Q$ are positive and significant for both constrained and unconstrained firms, with estimates ranging from 0.001 in the payout ratio partition to 0.004 in the bond rating partition. This clear pattern reveals that the amount of private information embedded in prices turns out to be an important element of savings' decisions irrespective of firms' capital access. Interestingly, even managers of unconstrained firms seem to be sensitive to the informational content of their stock prices when deciding to allocate resources into cash savings. As such, these results substantiate the recent findings of Dasgupta, Noe and Wang (2008) who documents that *all* firms optimally stage their response to positive shocks by delaying investment and building up cash savings. The results of table 2.5 suggest that such an inter-temporal trade-off is magnified when stock prices are more informative about future prospects.

Table 2.5 also reveals that the effect of private information in prices on savings-to-price sensitivity is on average two times larger for firms that are less financially constrained. As pointed out by Chen, Goldstein and Jiang (2007), this result may translate the fact that firms can respond to market price signals more easily when they are less dependant on external funding.

In summary, the results in this section reveal that both private information in prices and financing constraints play a role in generating the positive sensitivity of savings to price. Importantly, my conclusion that managers learn from stock prices when they allocate funds into cash savings is not an artifact of unspecified financing constraints.

2.4.5. Other sources of information

So far, the results are consistent with the intuition that managers integrate some private information in prices into their savings' decisions. However, the documented association between

private information in prices and the savings-to-price sensitivity would only be reflective of managerial learning to the extent that the private information in prices is new to managers. In this section, I reinforce this interpretation by assessing the effect of other competing sources of information on the results. To do so, I follow Chen, Goldstein and Jiang (2007) and consider one measure of public information and two measures of managerial private information. Then, I test whether the results are robust to the insertion of additional information in the baseline specification (1) and assess their effect on the estimated saving-to-price sensitivity.

To gauge the quantity of public information, I rely on the number of analysts covering a firm. I define *Coverage* as the number of analysts that have issued an earnings forecast for the firm during the previous year. To the extent that analysts transfer information from managers to investors, the content of the information analysts release is unlikely to be new to managers.[67] Hence, one would expect less managerial learning, and consequently a lower savings-to-price sensitivity, when many analysts generate information about a firm's prospects.

Next, I use insiders' trading activities to capture the amount of private information that managers possess. I define *Insiders* as the total number of inside stock transactions for a given year divided by that year's total transactions. The intuition behind this measure lies in the fact that managers are more likely to trade if they possess more private information. I use equivalently buys and sells to compute this measure.[68] Because the computation of *Insiders* requires data from Trades and Quotes (TAQ) database, the sample is limited to the period 1993-2001. Alternatively, I consider earnings' surprise (*ERC*) as a second proxy for managerial private information. This variable is defined as the average of the absolute market-adjusted stock returns over the four quarterly earnings announcements periods (day-1 to day 1). I conjecture that a positive absolute earnings' surprise reveals that some information in earnings was not fully anticipated by the market and hence not impounded entirely into prices. Because managers know allegedly the accounting numbers before they are released to investors, *ERC* appears to be a reasonable measure of managerial private information.

[67] See for instance Agrawal, Chadha and Chen (2006) for evidence that a considerable fraction of information produced by analysts is obtained from managers.

[68] We thank Wei Jiang for providing us with the insider trading data.

Table 2.6 Price informativeness and the saving-to-price sensitivity: Other sources of information

This table presents coefficient estimates of corporate savings on stock price and the amount of private information contained in price (specification (1)). The dependent variable is *Savings*, the annual change in cash holdings divided by lagged assets. *Q* is the normalized price, computed as the market value divided by the book value of assets. ψ is a proxy for the amount of private information in price and refers to firm-specific stock price variation. The set of control variables include *Cash flow*, *Size* and lagged *Cash*. Coverage is the number of analysts that have issued earnings forecast during a year. *Insiders* is the number of transaction by insiders scaled by the total number of transactions during a year. *ERC* is the average of the absolute market-adjusted stock returns over the four quarterly earnings announcements periods (day-1 to day 1). All the variables are defined in the Appendix. The sample period is 1973 through 2006. The estimations correct the error structure for heteroskedasticity and within-firm error clustering. *t*-statistics in brackets. ** and * denote statistical significance at the 1% and 5% level, respectively.

	(1)	(2)	(3)
Q_{t-1}	0.018**	0.016**	0.016**
	[13.85]	[5.48]	[7.32]
$Q_{t-1} \times \psi_{t-1}$	0.001**	0.002**	0.002**
	[3.21]	[2.88]	[3.20]
ψ_{t-1}	0.000	0.000	0.000
	[0.07]	[0.14]	[0.11]
$Cash\ Flow_t$	0.175**	0.210**	0.194**
	[27.41]	[8.90]	[20.86]
$Size_t$	0.006**	0.022**	0.005*
	[5.21]	[3.90]	[2.42]
$Cash_{t-1}$	-0.443**	-0.677**	-0.464**
	[51.82]	[25.80]	[38.48]
$Q_{t-1} \times Coverage_{t-1}$	-0.000**		
	[4.09]		
$Coverage_{t-1}$	-0.001**		
	[5.99]		
$Q_{t-1} \times Insiders_{t-1}$		-0.001	
		[1.40]	
$Insiders_{t-1}$		0.000	
		[1.34]	
$Q_{t-1} \times ERC_{t-1}$			-0.015
			[1.35]
ERC_{t-1}			0.172**
			[2.72]
Firm fixed effects	Yes	Yes	Yes
Time effect	Yes	Yes	Yes
#Obs.	88376	13879	41514
R^2	0.35	0.51	0.38

Columns 2 and 3 of table 2.6 present the results when I include these two measures as well as their interaction with *Q* in specification (1). The first thing to notice is that when *Insiders* and *ERC* are included, the coefficient on $\psi \times Q$ remain virtually unchanged. This again corroborates the idea that some information embedded in stock prices is really new to managers. Noteworthy, both coefficients

on the interaction between *Q* and *Insiders* and *ERC* display the expected negative sign. Such a negative correlation is expected since managers that own superior private information are less likely to rely on information in stock prices for their savings decisions. These coefficients, however, are not statistically significant at conventional levels.

All in all, the results in this section lend additional support for my interpretation. Indeed, the results are not affected by the inclusion of measures of alternative sources of information. As such, they confirm that corporate savings are more sensitive to stock price when prices vehicle more private information new to managers.

2.4.6. Price informativeness, savings and future operating performance

Looking at the results I present so far, a natural question arises: Does the private information contained in prices really help managers to make *better* savings decisions? To shed some light on this question, I examine the relation between price informativeness, corporate savings and firms' future operating performance. I consider the one-year ahead return on asset (*ROA*), defined as operating income before depreciation divided by total assets as well as its industry adjusted value as measures of performance (*Excess ROA*).

Table 2.7 presents regressions results of future performance on firm-specific return variation (ψ). In the regressions, I control for size, the structure of the firm's assets using the ratio of property, plant and equipment to total assets (*PPE*) as well as past performance. Moreover, I include firm- and time-specific effect and adjust the estimates' standard errors for within-firm-period error clustering and heteroskedasticity. Columns 1 and 2 exhibit that future performance increases significantly in the amount of private information embedded in stock price (0.001 with a t-stat of 2.03 in the *ROA* estimation). These results largely mirrors those reported in Chen, Goldstein and Jiang (2007). All else being equal, firms with more informative stock price experience better future operating performance. Although this positive association is consistent with the view that private information in stock prices helps managers to allocate corporate resources more efficiently, the channels through which this enhancement operates remain unclear.

I continue by analyzing whether this superior future performance originates in more efficient savings decisions. To this end, I estimate the joint impact of savings and price informativeness on future performance and display the results in columns 2 and 4. First, we remark (column 2) that corporate savings are positively related to future operating performance (a coefficient of 0.087/0.071 with a *t*-stat close to 10). Thus, on average, savings seem to enhance future operating performance. This is in line with the traditional argument that firms save for precautionary reasons. The results suggest that, else being equal, such a precautionary behavior turns out to be effective. Of most interest is the estimated coefficient on the interaction between *Savings* and ψ.

Table 2.7 The impact of savings and price informativeness on future operating performance

This table presents results of regressions examining the effect savings and price informativeness on future operating performance. In columns (1) and (2), the dependent variable is return on assets (*ROA*). In columns (3) and (4), the dependent variable is the industry-adjusted return on assets (*Excess ROA*). The dependent variable is *Savings*, the annual change in cash holdings divided by lagged assets. *Q* is the normalized price, computed as the market value divided by the book value of assets. ψ is a proxy for the amount of private information in price and refers to firm-specific stock price variation. The set of control variables include *Size*, *PPE* and lagged *ROA* (respectively *Excess ROA*). All the variables are defined in the Appendix. The sample period is 1973 through 2006. The estimations correct the error structure for heteroskedasticity and within-firm error clustering. *t*-statistics in brackets. ** and * denote statistical significance at the 1% and 5% level, respectively.

	(1)	(2)	(3)	(4)
Variables	ROA_t	ROA_t	Excess ROA_t	Excess ROA_t
ψ_{t-1}	0.001*	0.000	0.001*	0.000
	[2.03]	[1.27]	[1.97]	[0.24]
$Savings_{t-1}$		0.087**		0.071**
		[10.95]		[9.25]
$\psi_{t-1} \times Savings_{t-1}$		0.006*		0.006**
		[2.42]		[2.59]
$Size_t$	0.014**	0.013**	0.014**	0.013**
	[13.36]	[12.61]	[13.96]	[13.28]
PPE_t	-0.108**	-0.083**	-0.093**	-0.071**
	[15.86]	[12.31]	[14.52]	[11.20]
ROA_{t-1}	0.169**	0.171**	0.156**	0.158**
	[19.53]	[19.99]	[18.93]	[19.36]
Firm fixed effects	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes
#Obs.	86175	86175	86175	86175
R2	0.49	0.5	0.41	0.42

In both specifications 3 and 4, I observe positive and significant estimates. For example, in column 3 the estimated coefficient on the interaction is 0.006 with a *t*-statistics of 2.42. Hence, corporate savings have a magnified effect on future performance when stock price contained a larger deal of private information. This result confirms the idea that private information in prices guide managers towards better savings decisions.

Overall, these findings are consistent with managers using part of the information contained in stock prices to efficiently allocate corporate resources into cash savings. From a different perspective, they also provide some validation in favor of ψ as a measure of price informativeness. Indeed, as noted by Chen, Goldstein and Jiang (2007), if this measure captures just noise or market mispricing, I should not expect it to be related to future operating performance.

2.5. Conclusions

This paper looks at the interplay between a firm's stock price and its decision to save cash. Remarkably, the analysis provides strong evidence that stock price, and more importantly the private information it contains plays a key role in explaining a firm's saving choices. Specifically, I start by documenting that corporate savings are highly sensitive to stock prices. This positive association suggests that firms tend to transfer more resources into their cash account when the market foresees valuable future prospects and concomitantly raise firms' valuation. Strikingly, the analysis reveals that such a precautionary mechanism turns out to be amplified when the market price encloses a larger content of private investors' information. Notably, extensive robustness checks indicate the significant effect of price informativeness on savings is not due to market mispricing or financing constraints. Moreover, the informational effect of prices remains markedly strong even when one controls for public and managerial private information.

In a nutshell, the analysis highlights that private information in prices matter for savings policy. As such, this paper provides at least two important insights. First, it confirms that corporate savings are driven by the nature and precision of managers' anticipations about their firm's future investment prospects and financing costs. Importantly, the findings stress that managers infer

information from observing market expectations and incorporate part of it into their savings choices. Second, by documenting a link between the informational content of prices and saving policy, the paper points to an additional of corporate decisions that is affected by stock prices. In that respect, the results corroborates the intuition that prices contain a variety of new information that can guide managers in their financial and operating decisions.

The findings in this paper ultimately raise more questions than they answer. In particular, what is the exact origin of the saved cash? Why a priori financially unconstrained firms tend to save cash? What is the inter-temporal link between savings and investment? Do firms save incrementally over many periods to finance large investment projects? I leave these issues for further research.

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2.6. Appendix : Definition of the main variables used in the analysis

Cash	Cash and short-term investment (Compustat item 1) scaled by *Total Assets*
Total Assets	Total assets (item 6) (in million USD)
Savings	Cash and short-term investment (item 1) minus one-year lagged Cash and short-term investment divided by one-year lagged *Total Assets*
Q	Market value of equity (item 24 multiplied by item 25) plus book value of assets minus book value of equity minus deferred taxes (item 6 – item 60 – item 74), scaled by *Total Assets*
ψ_t	Firm specific return variation computed as $\psi_{i,t} = \ln((1-R^2_{i,t})/R^2_{i,t})$, where $R^2_{i,t}$ represents the R^2 from the regression of firm *i* weekly returns on value-weighted market and value weighted industry indices in year *t*.
Size	Logarithm of *Total Assets* (item 6)
CF	Sum of net income before extraordinary items (item 18) and depreciation and amortization (item 14) scaled by *Total Assets*
Capex	Capital expenditures computed as capital expenditures (item 30) minus sales of property, plant, and equipment (item 107) divided by *Total Assets*
Acquisitions	Amount spent in acquisitions (cash) (item 129) scaled by *Total Assets*
NWC	Net working capital computed as current non-cash assets (item 4 minus item 1) minus current liability (item 5) divided by *Total Assets*
ΔNWC	Change in net working capital computed as NWC_t- NWC_{t-1}
ShortDebt	Short-term debt computed as short-term debt (item 34) divided by *Total Assets*
ΔShortDebt	Change in short-term debt computed as $ShortDebt_t$- $ShortDebt_{t-1}$
Capital stock	Gross property, plant, and equipment (item 7)
PIN	Probability of informed-based trading measure from Easley, Kiefer and O'Hara (available at http://www.smith.umd.edu/faculty/hvidkjaer/data.htm
ILLIQ	Average daily ratio of a stock's absolute return by the dollar volume (Amihud (2002)) $Illiq_{i,t} = \frac{1}{T}\sum_{\tau=t-T}^{t-1}\sqrt{\frac{\lvert Ret_{i,\tau}\rvert}{Vol_{i,\tau}}}$
Issuance	Yearly change in equity (item 60) plus the change in deferred taxes (item 74) minus change in retained earnings (item 36) divided by the beginning-of-year equity stock (item 60)
$EXRET_{t+3}$	Value-weighted market adjusted returns cumulated over three years

Payout	Sum of preferred (item 19) and common (item 21) dividends scaled by *Total Assets*
KZ index	Kaplan and Zingales (1997) index is computed as follows (excluding *Cash*): *KZ*=-1.002**CF*-39.362**Payout* + 3.138**Leverage* , where *Leverage* is long-term debt (item 9) scaled by *Total Assets*
WW index	Whited and Wu (2006) index is computed as follows: *WW*=-0.91**CF*-0.062**Dividend*+0.021**Leverage*-0.044**Size*-0.035**Sales Growth*, where *Dividend* is a dummy that equals one if *Payout*is positive and zero otherwise and *Sales Growth* is the yearly change in sales (item 12)
Bond Rating	A dummy variable that equals one if the firm has a public bond rated (item spdrc is non-zero and non-missing) and zero otherwise
Coverage	The number of analysts that have issued earnings forecast during a year. Earnings forecasts data are from the I/B/E/S summary files
Insiders	Number of transaction by insiders scaled by the total number of transactions during a year. Transactions data are from the Trades and Quotes (TAQ) database
ERC	Average of the absolute market-adjusted stock returns over the four quarterly earnings announcements periods (day-1 to day 1)
ROA	Ratio of operating income before depreciation and amortization expenses (item 13) to *Total Assets*

Chapter 3: The value of excess cash and corporate governance: Evidence from U.S. cross-listings

(In Collaboration with Carolina Salva)

3.1. Introduction

When shareholders anticipate that management will squander some of their money, they discount firm value. That is the main conclusion of the literature examining the interplay between firm value and corporate governance; see La Porta, Lopez-de-Silanes, Shleifer, and Vishny (2002) or Durnev and Kim (2005). Agency theories predict that the magnitude of the value shortfall depends not only on the existence and efficiency of mechanisms preventing managers from wasting corporate wealth, but also to a large extent on the availability of resources that can be easily diverted. Although many kinds of assets can be used in value-destroying ventures, Jensen (1986) and Myers and Rajan (1998) argue that cash reserves are especially at risk. Indeed, since the cash not committed to operations and investment—the *excess* cash—can be used as management chooses, it is a strong candidate for inefficient allocation, waste, and misuse.

In this spirit, recent research investigates the relationship between governance mechanisms, cash holdings, and firm value; see Pinkowitz, Stulz, and Williamson (2006), Dittmar and Mahrt-Smith (2006) and Kalcheva and Lins (2007). Consistent with the idea that cash reserves are particularly vulnerable in the hands of unconstrained managers, these cross-sectional studies reveal that when country-level shareholders' protection is weak or when managers are left widely unchecked, investors value cash holdings at a sizable discount. Consequently, a substantial source of value loss associated with weak governance materializes through investors' markdown of liquid assets. In this context, a fundamental question arises: what mechanisms can effectively restrain managers' misallocation of cash reserves and, in turn, help preserve firm value?

To shed some light on that question, this paper explores empirically whether investors perceive any change in the potential for value destruction embodied in large cash reserves when firms take actions that limit the risk of inefficiency. To do so, we focus on the consequences of firms' decision to cross-list in the United States. By listing shares in U.S. markets, foreign firms become subject to various additional governance layers that can restrain managers' misallocation of cash; see Coffee (1999) or Stulz (1999). Firms cross-listing on a U.S. exchange are exposed to enforcement procedures initiated by the SEC or to class actions lawsuits filed in U.S. courts, and are required to comply with demanding U.S. disclosure requirements. Foreign firms accessing U.S. capital markets through over-the-counter (OTC) listings or via private placements (Rule 144a) also face additional governance constraints. Although these firms are not tied directly to U.S. regulations, they may still benefit from the additional monitoring provided by U.S. intermediaries such as financial analysts or large U.S. institutional investors. As a result, the rigorous U.S. rules, coupled with the increased oversight that accompanies a U.S. listing, may reduce managers' ability to misuse of firms' liquid assets.

To assess whether and how a U.S. listing shrinks the potential for value destruction contained in large cash reserves, we look at investors' valuation of excess cash.[69] Using a sample of firms from more than 40 countries over the period 1989-2005, we find compelling evidence that the value investors place on excess cash is larger for firms that are cross-listed in the U.S. than for their domestic peers. The estimates reveal an economically important excess cash premium. On average, investors' valuation of excess cash is almost three times larger for cross-listed firms. Since investors' valuation is crucially determined by how they expect the cash to be used, the documented excess cash premium unequivocally suggests that investors view a U.S. listing as an efficient device to curb managers' inefficient allocation of cash reserves.

[69] Specifically, we follow Dittmar and Mahrt-Smith (2007) and define excess cash as cash reserves held in excess of those needed for operations and investment. Then, we estimate the value of this cash using the Fama and French (1998) model.

Next, to further characterize this important result, we look at the different avenues that firms have to access the U.S. markets. Specifically, we investigate whether the magnitude of the excess cash premium depends on the listing modality. We observe a strong premium for firms listed on a U.S. exchange. Notably, we also find a sizable excess cash premium for foreign firms listed OTC. However, the estimated premium, although significant, turns out to be smaller than for exchange-listed firms. In sharp contrast, the effect is negligible for firms conducting private placements. Importantly, since only exchange-listed firms are subject to the U.S. legal and disclosure provisions, the documented hierarchy clearly underlines the effect of the U.S. regulatory environment on managers' dissipation of cash reserves. A consequence is that by lessening investors' markdown of liquid assets, the U.S. rules reduce the value loss engendered by weak governance mechanisms. Nevertheless, given that OTC listings do not entail strong legal and disclosure consequences, our results suggest that investors also view cross-listing as a way to reduce the misallocation risk of excess cash holdings even when no legal rules, enforcement, or threat of litigation are at work. Reassuringly, numerous robustness checks offer persuasive evidence that our conclusions are not sensitive to model specifications, estimation procedure, or biases due to uncaptured growth options.

To reinforce the interpretation of the results, we exploit the temporal and cross-country dimension of our sample. In particular, we examine whether investors' valuation of excess cash changes around the cross-listing date. An event-time analysis shows that investors do raise the value they place on excess cash when firms access the U.S. markets through an exchange or OTC listing. Moreover, we document that this change in investors' valuation persists even several years after the cross-listing event and is still present. Accordingly, investors seem to see a U.S. listing as a commitment that guarantees the efficient use of corporate cash reserves in the long run. Second, additional tests reveal that the excess cash premium is larger for firms located in countries where shareholder protection is weak. Further, regardless of firms' country of incorporation, investors seem to equalize the value they attach to excess cash once firms access the U.S. financial environment. Hence, cross-listed firms truly appear to benefit from similar effective constraints on governance.

Finally, we explore in more detail what alternative mechanisms can explain the reduction of misallocation risk beyond the binding effect of U.S. legal rules. In particular, we examine whether part of the excess cash premium originates in the increased informal monitoring and scrutiny that accompanies a U.S. listing; see Stulz (1999). We start by focusing on the disciplinary role played by financial analysts. Strikingly, we find that investors' valuation of excess cash is magnified when a U.S. listing is accompanied by increased analysts' coverage. The effect of analysts' attention is pervasive across all three types of listings, suggesting that the additional scrutiny offered by financial analysts appears to markedly limit managers' inefficient actions. With analogous logic, we consider the monitoring pressure exerted by large and active shareholders. Mirroring the disciplining effect of financial analysts, we report compelling evidence that investors place a larger value on excess cash when firms' ownership structure tilts toward larger shareholders after the cross-listing event. Taken together, our findings provide clear-cut evidence that the more intense external monitoring that characterizes a U.S. listing substantially reduces the risk that managers will fritter away corporate cash reserves. Notably, our results suggest that both legal provisions and more intense monitoring complementarily help lessening investors' markdown of liquid assets and, in turn, safeguard investors' money.

Overall, this paper makes a contribution in two distinct areas. First, it adds to the burgeoning literature on corporate cash holdings. By documenting an excess cash premium for cross-listed firms, the analysis broadens our understanding of the value implications of corporate cash reserves. Prior research suggests that the conjunction of large cash holdings and poor governance leads to inefficient allocation and ultimately translates into value loss; see Pinkowitz, Stulz, and Williamson (2006), Dittmar and Marht-Smith (2007) or Kalcheva and Lins (2007). In this paper, we first confirm that investors' valuation of large cash holdings is largely determined by the existence of mechanisms putting boundaries on managerial actions. More importantly, by focusing on *changes* in legal protection and monitoring intensity that accompany a U.S. listing, our analysis highlights the notion that firms can take actions to acquire effective governance devices and hence prune a substantial source of value shortfall. We also provide valuable insights into *which* governance mechanisms enhance the value of corporate cash holdings. Our results suggest that increased investor protection

and transparency work hand in hand with better monitoring by market intermediaries to limit the potential misallocation of cash reserves. From a different point of view, our panel data allow us to focus on cross-sectional analysis but also to look at time series patterns. Interestingly, despite many recent governance reforms, our results indicate that investors' valuation of excess cash remains remarkably stable over time. Also, our analysis is in line with theoretical arguments and complements the important work of Dittmar and Mahrt-Smith (2007) by providing estimates of the value of excess cash mainly outside the United States.

Second, our analysis complements the evidence relating U.S. cross-listings and firm value. Indeed, several studies document that cross-listed firms trade at a premium to their domestic counterparts; see Karolyi (2006). Although many authors document that this "cross-listing premium" stems from the better governance practices prevailing in the United States, much less is known about how the U.S. governance standards affect firm value.[70] By concentrating on investors' valuation of excess cash holdings, we are able to demonstrate a direct channel by which the governance dimension of cross-listings operates. Indeed, through its effect in curbing the potential for value destruction embodied in cash holdings, a U.S. cross-listing clearly helps preserve investors' money. As such, our results suggest that the part of the valuation premium enjoyed by cross-listed firms can be attributed to a larger valuation of liquid assets. In a related perspective, our analysis also pins down indirect mechanisms through which a U.S. listing helps constrain managers. Stulz (1999) first argues that different U.S. financial intermediaries may play a critical role in monitoring cross-listed firms. Whereas this idea has been discussed frequently in the literature, the evidence remains relatively scarce. By highlighting the disciplining effects of greater analyst attention and larger investors, our work empirically supports the existence and efficacy of non-legal governance effects for all cross-listing types.

In the next section, we review the related literature, discuss the theoretical background, and outline our main hypothesis. In section 3.3, we present the empirical methodology and describe the

[70] The valuation premium of cross-listing firms has been related to an improvement in the information environment (Lang, Lins and Miller (2004)), to an expanded shareholder base (King and Segal (2007)), and to a reduction in private benefits (Doidge, Karolyi, Stulz (2004) and King and Segal (2007)). The channels through which firm value is enhanced have been less explored. An exception is Doidge, Karolyi, and Stulz (2004), who show that the reduction of private benefits translates into a higher value for growth options. Also Hail and Leuz (2006) propose that legal bonding may affect firm value through a lower cost of capital.

data. In section 3.4, we present the results and show that investors' valuation of excess cash increases with cross-listings. We present our conclusions in section 3.5 and discuss some implications for future research.

3.2. Related literature and hypothesis development

The benefits of holding cash reserves, namely mitigating risk and avoiding underinvestment, may be eroded if firms are poorly governed. This idea emanates from the extensive literature on agency costs initiated by Jensen and Meckling (1976). Accordingly, left on their own, managers may waste corporate resources, thereby destroying firm value. In such a context, firms' cash holdings are especially susceptible to being allocated to managers' private benefits or to being funneled into negative NPV projects.

Several recent studies examine how such a risk of misallocation of firms' cash reserves is reflected into investors' valuation.[71] In an international context, Pinkowitz, Stulz, and Williamson (2006) analyze how country-level legal protection affects investors' valuation of firms' liquid assets. Using several indices serving as proxies for the quality of the institutions protecting investors, they document that in countries where protection is weak, investors value firms' cash reserves at a large discount. By contrast, they find no discount in countries where investors are well protected. Hence, investors associate weak country-level shareholder protection with greater risk that firms' cash reserves will be used inefficiently and, in turn, discount their value. In a similar spirit but focusing on U.S. firms, Dittmar and Mahrt-Smith (2007) report that the presence of antitakeover provisions and low institutional blockholdings lead investors to discount the value they place on corporate cash holdings. Thus, when managers are left widely unchecked, investors' valuation of cash holdings is marked down considerably. From a very close perspective, Kalcheva and Lins (2007) use international data on managerial control rights to measure governance quality. They find that firms' values are

[71]Some papers look at how poor governance is linked to the level and use of corporate cash holdings. Harford (1999) shows that cash-rich firms are more likely to make value-decreasing acquisitions. Harford, Mansi and Maxwell (2008) report that firms with expected poor governance actually hold less cash, but that, for a given set of firms with high cash reserves, firms with worse governance spend their cash more quickly, primarily on acquisitions. Dittmar, Mahrt-Smith, and Servaes (2003) show that firms hold more cash in countries where investor protection is weak. Caprio, Faccio, and McConnell (2008) report that corporate cash holdings are negatively related to measures of political corruption. For a more general presentation of the determinants and consequences of corporate cash holdings, see Bates, Kahle, and Stulz (2007).

lower when entrenched managers hold more cash and country-level investors' protection is weak. Overall, these studies point out that investors recognize substantial potential for ineffective use of corporate cash reserves when institutional protection is feeble or when monitoring instruments are largely missing.

In this paper, we argue that cross-listing in the United States has several features that can reduce or even eliminate the discount that investors place on the value of liquid assets.[72] First, as suggested by Coffee (1999, 2002) and Stulz (1999), a U.S. cross-listing implies important legal consequences. Indeed, by listing on a U.S. stock exchange (NYSE, Nasdaq or AMEX), foreign firms become subject to U.S. disclosure requirements, SEC enforcement, and the threat of litigation by shareholders. In contrast, listing on the OTC market or conducting private placements (Rule 144A) allows substantial exemptions from these laws and regulations. Empirically, several papers provide support for the claim that U.S. cross-listings enhance investor protection. Reese and Weisbach (2002) show that foreign firms that cross-list on U.S. exchanges raise more equity capital after listing and that this effect is magnified for firms located in countries with weak investor protection. Doidge, Karolyi, and Stulz (2004, 2008) find that cross-listed firms have higher valuations than their home-country peers and, further, that the valuation differential is larger for firms located in countries with poor investor protection and for firms listed on U.S. major exchanges. Doidge (2004) reports that exchange-listed firms have voting premiums that are significantly lower than those of their home-country counterparts. Dyck and Zingales (2004) obtain similar results with control premiums. Doidge, Karolyi, Lins, Miller, and Stulz (2007) document that the presence of a large controlling shareholder reduces the likelihood of a U.S. listing. From a different angle, Lel and Miller (2007) estimate that foreign firms listed on a U.S exchange are more likely to replace underperforming CEOs. Finally, King and Segal (2008) provide evidence that both a larger shareholder base and lower consumption of private benefits explain the valuation premium for cross-listed firms.

Stulz (1999) observes that a U.S. cross-listing also brings to bear an important informal monitoring dimension. In addition to being subject to U.S. securities laws, cross-listed firms face extra

[72] A large literature has developed seeking to understand the motivations and benefits of the corporate decision to list shares on overseas exchanges. See Karolyi (1998, 2006) for a detailed survey of the literature.

scrutiny by large active U.S. institutional investors, journalists, and other financial-market intermediaries such as financial analysts, U.S. underwriters, and auditors. Baker, Nofsinger, and Weaver (2002) show that U.S. exchange listings are associated with greater analyst coverage and heightened media attention, and Lang, Lins, and Miller (2003) find that cross-listed firms receive more coverage by analysts and that forecasts for these firms are more accurate than those for firms that are not cross-listed. Moreover, Lang, Lins, and Miller (2004) show that this greater coverage contributes positively to firm value. Similarly, Bailey, Karolyi, and Salva (2006) show that cross-listing leads to an overall improvement in firms' informational environment.

By and large, all these pieces of evidence suggest that the better U.S. legal protection and disclosure practices together with the increased informal monitoring by U.S. watchdogs make it more difficult for managers to waste cash reserves. Accordingly, we first predict that the additional governance layers inherent in a U.S. listing help secure investors' money and so reduce their discounting of firms' cash reserves. More precisely, we conjecture that, other things being equal, the value investors place on the cash that is at risk of being wasted—the *excess* cash—is higher once a foreign firm cross-lists its shares in the United States.

Then, we take advantage of the rich specificities of the cross-listing event to further understand how different governance mechanisms affect investors' valuation of excess cash. First, Pinkowitz, Stulz, and Williamson (2006) and Kalcheva and Lins (2007) report that country-level legal protection is an important driver of investors' markdown of liquid assets. Accordingly, the potential for managers to use cash reserves inefficiently should generally be reduced for firms that benefit from the additional legal protection provided by U.S. institutions. Since only firms listed on a U.S. exchange become subject to the requirements of the U.S. federal securities laws (disclosure, threat of litigation, SEC supervision, and compliance), we hypothesize that investors' valuation of excess cash should be larger for exchange-listed firms than for listings that do not imply important changes in legal exposure (OTC, Rule 144A and London listings). Following this line of thinking, the influence of U.S. laws and monitoring devices on investors' confidence about the adequate allocation of cash reserves should depend on firms' home-country institutions. Indeed, for firms located in countries where legal protection is weak, the benefits from opting for U.S. protection and increased scrutiny should be

substantial. Consequently, we expect investors to perceive such larger benefits and conjecture that their valuation of excess cash should be magnified for cross-listed firms located in countries with poor investor protection.

From a related perspective, Dittmar and Mahrt-Smith (2007) emphasize that discounts are larger on the cash reserves of U.S. firms with limited monitoring exposure. When this result is taken to our cross-listing setting, the findings suggest that the potential management dissipation of cash may also be constrained by the additional scrutiny and informal monitoring that accompany a U.S. cross-listing. Hence, we infer that investor's discounting of excess cash will be reduced to a larger extent for firms that experience the largest increase in monitoring intensity regardless of the avenue through which they choose to cross-list.[73] Specifically, we conjecture that investors' valuation of excess cash should be larger for cross-listed firms that enjoy increased analyst coverage and that become subject to additional monitoring efforts by large investors subsequent to their U.S. listing.

3.3. Methodology and Data

3.3.1. Measuring investors' valuation of excess cash holdings

To assess the potential for value destruction contained in cash holdings and to gauge whether and how a U.S. cross-listing helps reduce the danger, we look at investors' valuation of firms' *excess* cash holdings. Following Dittmar and Mahrt-Smith (2007), we define excess cash as the cash that is not needed for firms' operations or investments. Specifically, we determine excess cash as the cash held above a predicted "normal" (or "optimal") level. To compute the normal level, we regress firms' total cash on variables that serve as proxies for genuine motives to hold cash such as hedging needs, growth options, or financing restrictions. Given that firms from different countries may have different reasons to hold cash, we estimate the normal cash specification independently for each country in our

[73] Bailey, Karolyi, and Salva (2006) point out that increased monitoring can sometimes be more important for OTC-listed firms that for exchange listings. That is, in addition to disclosure and legal implications attached to exchange listings, increased monitoring more tightly bounds on what managers can do with shareholder resources.

sample.[74] Then, we define *XCash* as the residual of these normal cash regressions. We further discuss in the appendix the details of the methodology and the technical motivations for using excess cash instead of total cash. Note, however, that the conclusions of the analysis below are robust to different ways of defining and computing excess cash.

To measure investors' valuation of excess cash, we draw from the model of Fama and French (1998). Specifically, we regress firm value on our measure of excess cash holdings as well as control variables capturing other sources of value within the firm. Then, to determine whether investors perceive a U.S. listing as a way to improve the efficient allocation of corporate cash reserves, we start by estimating whether their valuation of excess cash differs between cross-listed firms and their domestic peers. Our basic specification is as follows:

$$\begin{aligned} MV_{i,t} = {} & \alpha + \beta_1 Cross\text{-}list_{i,t} + \beta_2 XCash_{i,t} + \beta_3 (XCash_{i,t} \times Cross\text{-}list_{i,t}) + \delta_1 E_{i,t} + \delta_2 dE_{i,t} + \delta_3 dE_{i,t+2} \\ & + \delta_4 dNA_{i,t} + \delta_5 dNA_{i,t+2} + \delta_6 RD_{i,t} + \delta_7 dRD_{i,t} + \delta_8 dRD_{i,t+2} + \delta_9 I_{i,t} + \delta_{10} dI_{i,t} + \delta_{11} dI_{i,t+2} \\ & + \delta_{12} DIV_{i,t} + \delta_{13} dDIV_{i,t} + \delta_{14} dDIV_{i,t+2} + \delta_{15} dMV_{i,t+2} + \boldsymbol{\eta} + \boldsymbol{\omega} + \varepsilon_{i,t} \end{aligned} \quad (1)$$

where *MV*[75] is the market value of the firm, computed as the sum of the market value of equity and the book value of short-term and long-term debt. Our variable of interest, *XCash*, refers to cash held in excess, as defined above. *Cross-list* is a dummy variable that equals one if the firm is cross-listed in the U.S. and zero otherwise.[76] Following Fama and French (1998), we include variables that control for investors' expectations about other sources that determine firm value. Specifically, *E* is the net income plus all noncash charges or credits, extraordinary items, and interest. *NA* is net assets, computed as the book value of assets minus cash and marketable securities. *RD* refers to research and development expenses. When *RD* is missing, we set its value to zero. *I* is interest expenses and *DIV* is common dividend paid. We further control for firm's profitability, financial, and investment policies by including changes in those variables' level. The notation dX_t refers to the change in variable X_t from

[74] For instance, firms from riskier countries may hold more cash because they require a larger buffer to protect themselves against adverse events. Alternatively, cash holdings may be affected by country-level governance variables; see Dittmar, Mahrt-Smith, and Servaes (2003) or Caprio, Faccio, and McConnell (2008).
[75] For ease of notation, we drop the subscripts that refer to the firm *i* and respectively year *t*.
[76] In further analysis, we also consider the three different cross-listing avenues separately (Exchange, OTC and Rule 144A).

year *t-2* to year *t*. Likewise, dX_{t+2} represents the change in variable X_t from year *t* to year *t+2*.[77] To make firm attributes comparable, we normalize all firm-specific variables by the book value of total assets.

Importantly, the literature on cross-listings suggests that firms that cross-list in the U.S. may have better growth opportunities than domestic firms; see Doidge, Karolyi, and Stulz (2004). Hence, if the control variables used by Fama and French (1998) fail to capture completely the effect of growth options on firm value, our estimates of the value of excess cash for cross-listed firms (β_2 and β_3) may convey information about growth opportunities that are specific to cross-listed firms.[78] To mitigate this concern, we include two extra proxies for growth opportunities in our baseline regression (1): *Sales Growth* and *Global Industry q*.[79] *Sales Growth* is the percentage change in sales from *t-2* to period *t* and *Global Industry q* is the median market-to-book ratio of all firms that share the same SIC code.[80] Moreover, we control for differences in firms' value that stem from periods and countries' economic and institutional environments by including year ($\boldsymbol{\eta}$) and country ($\boldsymbol{\omega}$) fixed effects. Finally, since firm value may change with cross-listing for reasons other than the effect on excess cash and the control variables, we include a separate intercept for cross-listed firms (*Cross-list*).

Theory predicts that unchecked managers may waste free cash flow; see Jensen (1986). In this spirit, we follow Dittmar and Mahrt-Smith (2007) and focus only on firms that hold too much cash that is easily accessible to management. Accordingly, we estimate our value regression (1) for all firms with *positive* excess cash.[81] To the extent that the control variables effectively capture investors' expectations about future net cash flows and firms' growth options, the coefficient on *XCash* (β_2) measures investors' valuation of an additional unit of excess cash. In other words, this coefficient

[77] We aim to capture firm profitability and expected profitability growth given firm existing assets with a cash flow variable and two-year lead and lag changes in cash flows. We include past and future changes in net assets to capture another dimension of profitability that is a consequence of net investment. We add *RD*, and the corresponding lead and lag changes, to pick up additional information on expected profits not captured by the earnings or investment variables. *I, D* and its past and future changes aim to capture the firm's financing policy, which also affects the value of the firm.

[78] Note that this possibility is one benefit of using excess cash rather than total cash. Indeed, as discussed in Dittmar and Marht-Smith (2007) and in the appendix, when we estimate excess cash, we use instrumental variables to deal with the potential endogeneity between cash and growth options. Hence, our measure of excess cash is by construction orthogonal to investment opportunities.

[79] The use of these control variables for growth opportunities is motivated by studies such as Doidge, Karolyi, and Stulz (2004).

[80] In the following sections, we implement additional robustness checks and show that our conclusions are not driven by the effect of growth options that may be specific to cross-listing firms.

[81] Predictions about the role of incentive and governance mechanisms for firms having negative excess cash, i.e., a cash shortage, remain a theoretical issue and hence are difficult to establish.

reflects the magnitude of the potential for value destruction (or creation) perceived by investors. With a similar logic, the coefficient on the interaction between *XCash* and the cross-listing dummy (β_3) enables us to assess whether the value of excess cash differs between firms that are cross-listed in the United States and their domestic peers.

3.3.2. Data and descriptive statistics

The construction of our sample starts with all non-U.S. firms covered by Worldscope.[82] For each firm, we collect cash, market value, and variables that serve as proxies for firm profitability and financial and investment policy for the period 1989-2005. All variables are measured in local currency units. Then, we exclude financial firms (Standard Industrial Classification (SIC) codes between 6000 and 6999) and utilities (SIC codes between 9000 and 9999) because their businesses imply holding marketable securities and statutory capital requirements that may affect their investment choices. We also exclude firms for which information on cash and marketable securities, market value of equity, earnings before interests and taxes, interest expenses, or total assets is missing. To reduce the effect of outliers, we trim our sample at 1 percent in each tail of each variable.

Next, we classify firms as (a) firms cross-listing in the United States and (b) benchmark firms that have never cross-listed their shares in the United States. Because of the various avenues that foreign firms can take to access the U.S. market and the differences in their legal and regulatory consequences, we differentiate between exchange listings (NYSE, Nasdaq and AMEX), over-the-counter listings (OTC) and private placements under Rule 144A. We obtain cross-listing information (whether a firm has a foreign listing in the United States at the end of each year and the type of listing) from the Bank of New York, JP Morgan, Citibank, NYSE, Nasdaq, and the Center for Research on Security Prices (CRSP).[83] To mitigate the concern about survivorship bias, we keep track of both active and inactive listings using the data provided by Citibank and CRSP. We also trace the listing type upgrades or downgrades, from OTC to exchange listing, for instance, using the information

[82] We note that Worldscope tries to homogenize accounting data of firms subject to different accounting standards in a way that makes them more comparable. However, we remain conscious of the limitations of comparing accounting data for firms from different countries.

[83] See, for example, www.adrbny.com, www.adr.com. and www.citibank.com/adr.

provided by Citibank. We manually contrast and complete the cross-listing dates and types by searching on Lexis/Nexis.

To characterize the effects of cross-listings on the value of excess cash, we employ several proxies for governance quality and monitoring intensity. First, we use a number of country-level variables in our analysis. Specifically, we consider the anti-director rights index presented by La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998), which measures the quality of legal protection offered to minority investors. This index, based on laws prevailing in 1993, is available for 49 countries. From the same source, we take the accounting index to assess the effect of lack of transparency. In addition, we use two variables from Djankov, La Porta, Lopez-de-Silanes, and Shleifer (2006). First, we consider the revised anti-director rights index, which is compiled using laws prevailing in 2003, and second, the anti-self-dealing index, which focuses on the expropriation that minority shareholders may suffer from insiders (self-dealing). This latter index focuses more on the protection that shareholders receive in case of expropriation by corporate insiders and gives special attention to the level of disclosure. Investor protection tends to be highly correlated with measures of economic development. Hence, we also use the classification scheme of Standard and Poor's Emerging Market Database[84] to categorize countries as developed or emerging economies.

At the firm level, we use two variables as proxies for the intensity of outside monitoring. First, we use analyst following to capture external monitoring pressure; see Jensen and Meckling (1976), Lang, Lins, and Miller (2004), or Yu (2007). We collect information on analyst coverage for our sample firms from the I/B/E/S International Summary file. Specifically, we define *Coverage* as the average number of analysts issuing forecasts during a given year. Our second monitoring proxy captures the structure of a firm's ownership**.** Prior research indicates that large shareholders have enough capital at stake to have an incentive to monitor and influence managers' actions; see for instance Gillian and Starks (2000) or Gompers and Metrick (2001). To measure investor oversight, we use the data item reported as "Closely held shares" in Worldscope. Closely held shares *(CHS)* is

[84] The Standard and Poor's Emerging Market Database classifies a market as emerging if it meets at least one of two general criteria: (1) it is located in a low- or middle-income economy as defined by the World Bank, and (2) its investable market capitalization is low in relation to its most recent GNP figures. This yields a few situations in which newly rich countries (such as Taiwan and Korea) are categorized as emerging markets. The classification is based on 1998 data.

defined as the percentage of shares held by insiders, who include senior corporate officers and directors, and their immediate families; shares held in trusts; shares held by another corporation (except shares held in a fiduciary capacity by financial institutions); shares held by pension and benefit plans; and shares held by individuals who hold 5 percent or more of shares outstanding.[85] Hence these blockholdings can be considered a measure of how much oversight managers are subject to, with a larger percentage indicating more intense monitoring.

Finally, in further tests, we consider the extent to which firms raise external capital around the cross-listing event. For that purpose, we gather information about security issuance from the Securities Data Corporation (SDC). SDC contains the date and type of issue, the market (country) in which the security was issued, and the proceeds from each issue. Since we are interested in tracking issuance activity around the U.S. listing event, we follow Doidge, Karolyi, and Stulz (2008). comparing the issuance dates with the cross-listing dates and considering only issuance within three years of the listing. Further, we put together all capital-raising activity, that is, all public and private equity and debt issued at home and in the United States as well as in other markets.

Table 3.1, Panel A, describes the composition of our final sample for cross-listing firms and firms that never cross-list (the benchmark). The sample consists of 868 foreign firms (7,068 firm-years) listing shares in the United States. In terms of the repartition across the three cross-listing types, our sample comprises 337 firms (3,071 firm-years) listed on U.S. exchanges, 354 firms (2,999 firm-years) listed OTC and 177 firms (998 firm-years) listed through private placement under Rule 144A. The benchmark sample contains 11,554 firms, which represents 53,569 firm-years. The sample has considerable geographic dispersion. Firms are located in 44 countries, of which 22 are emerging markets, and spans 16 years. There are 533 cross-listing firms (7,648 benchmark firms) from developed markets and 335 cross-listing firms (3,906 benchmark firms) from emerging markets.

[85] In Japan, closely held shares represent the holdings of the ten largest shareholders. For firms with more than one class of shares, closely held shares for each class are added together. We recognize the limitations of this ownership measure, since it relies on information disclosed by firms and this disclosure is often voluntary and unmonitored.

Table 3.1 Descriptive statistics.

Panel A describes the number of non-U.S. firms cross-listing in the U.S. in our sample classified by the type of listing, the number of firm-years available for those cross-listing firms, and similar information for a benchmark sample of firms that do not list in the U.S. * denotes a country designated as an emerging market by Standard and Poor's Emerging Market Database. Panel B provides information on the composition of our sample classified by country-level measures of investor protection, by the degree of market development, and by the change in capital-raising activity around the cross-listing event. The country-level measures of investor protection are the anti-director-rights index and the accounting index from La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998), the anti-self-dealing index, and the revised anti-director-rights index from Djankov, La Porta, Lopez-de-Silanes, and Shleifer (2006). Panel C presents mean and median value for *Excess Cash*, *Cash* (cash plus marketable securities divided by total assets), *Market Value* (sum of the market value of equity, the book value of short- and long-term debt, divided by total assets), *Coverage* (number of analysts following the firm), *Closely held shares* (% of shares held by insiders including blockholders) and *Capital Raised* for the periods before and after a U.S. listing as well as for the benchmark sample. To test the differences between the groups before-after, before-benchmark, and after-benchmark, we compute two-sample Wilcoxon tests (W-test). For each group (before and after), below each grouping criterion, we compute Kruskal-Wallis tests (K-W test) to test whether there are significant differences across the grouping criteria. ** and * indicate statistical significance at the 1% and 5% test levels, respectively.

Panel A. By Country

	Number of Firms				Number of Firm-years			
Country	**Exchange**	**OTC**	**144A**	**Benchmark**	**Exchange**	**OTC**	**144A**	**Benchmark**
Argentina*	5	2	5	32	47	15	30	97
Australia	12	31	3	465	125	212	31	1,455
Austria	1	10	1	48	4	86	3	317
Belgium	1	2	-	76	13	26	-	524
Brazil*	15	21	2	127	64	95	7	379
Canada	64	-	-	475	538	-	-	2,132
Chile*	10	2	1	100	79	17	5	532
China*	7	5	4	406	29	25	26	931
Colombia*	-	-	2	17	-	-	5	83
Denmark	4	-	-	92	41	-	-	763
Finland	2	2	4	97	12	25	34	672
France	19	14	2	487	284	201	22	3,050
Germany	16	13	4	514	103	151	33	2,868
Greece*	1	-	3	75	4	-	12	175
Hong Kong	8	71	2	441	37	502	11	1,514
Hungary*	1	2	4	17	5	13	17	65
India*	3	-	46	301	15	-	222	1,157
Ireland	6	5	-	35	48	36	-	265
Israel	9	1	-	55	43	10	-	173
Italy	8	-	6	158	74	-	43	971
Japan	15	19	-	2,798	137	220	-	11,532
Korea*	2	-	4	569	4	-	18	.1,998
Luxemburg	1	-	1	16	1	-	2	82
Malaysia*	-	9	-	551	-	86	-	2,557
Mexico*	17	12	5	58	158	46	43	253
Netherlands	14	4	1	111	152	57	1	870
New Zealand	3	-	-	58	30	-	-	265
Norway	4	3	2	92	34	29	13	537
Pakistan*	-	-	1	90	-	-	2	515
Peru*	1	3	1	47	6	10	10	154
Philippines*	1	2	5	94	16	24	35	362
Poland*	-	1	5	44	-	4	15	157
Portugal*	2	1	3	36	18	9	21	188
Russia*	4	5	2	2	17	10	5	2
Singapore	3	17	-	342	9	105	-	1,411
South Africa*	6	20	4	172	64	137	28	720
Spain	3	2	1	82	70	13	1	607
Sweden	9	4	1	197	95	34	8	990
Switzerland	7	6	1	149	67	59	14	1,125
Taiwan*	5	-	42	804	44	-	246	2,057
Thailand*	-	11	2	257	-	82	19	1,462
Turkey*	-	1	6	84	-	3	13	176
UK	47	48	-	879	582	624	-	7,412
Venezuela*	1	5	1	4	2	33	3	14
Total	**337**	**354**	**177**	**11,554**	**3,071**	**2,999**	**998**	**53,569**

Panel B. By Investor Protection, Economic Development, and Capital-Raising Activity

	Number of Firms				Number of Firm-years			
	Exchange	**OTC**	**144A**	**Benchmark**	**Exchange**	**OTC**	**144A**	**Benchmark**
By Anti-Director-Rights Index								
High Protection	203	246	86	7,688	1,883	2,072	443	35,063
Low Protection	134	108	91	3,866	1,188	927	555	18,506
Total	337	354	177	11,554	3,071	2,999	998	53,569
By Accounting Index								
High Protection	224	266	83	8,907	2,174	2,346	509	40,564
Low Protection	113	88	94	2,647	897	653	489	13,005
Total	337	354	177	11,554	3,071	2,999	998	53,569
By Revised Anti-Director-Rights Index								
High Protection	240	288	97	9,091	2,087	2,325	490	41,384
Low Protection	97	66	80	2,463	984	674	508	12,185
Total	337	354	177	11,554	3,071	2,999	998	53,569
By Anti-Self-Dealing Index								
High Protection	207	251	127	8,627	1,834	2,121	666	37,608
Low Protection	130	103	50	2,927	1,237	878	332	15,961
Total	337	354	177	11,554	3,071	2,999	998	53,569
By Economic Development								
Developed	249	252	32	7,648	2,474	2,389	237	39,550
Emerging	88	102	145	3,906	597	610	761	14,019
Total	337	354	177	11,554	3,071	2,999	998	53,569
By Capital-Raising Activity								
Increase	154	80	18	-	1,599	885	555	-
No increase	183	274	159	-	1,472	2,114	443	-
Total	337	354	177	-	3,071	2,999	998	-

Panel B provides information on the composition of our sample classified by the various country-level measures of investor protection that we have introduced previously and by the change in capital-raising activity around the cross-listing event. Overall, our sample includes a broad cross-section of firm-years and firm characteristics suitable for our empirical investigation.

In Panel C, we present descriptive statistics for the main variables used in the subsequent analysis: excess cash, total cash, market value, analyst coverage, closely held shares and capital raised. For cross-listing firms, we present the statistics for both the period before and after the U.S. listing. We note a slight increase in the level of excess cash after foreign firms access the U.S. markets. In contrast, we note a significant difference in the level of excess cash between cross-listing firms and domestic firms. When we look at total cash, we observe no difference between cross-listing and benchmark firms. Those descriptive results are consistent with the view that cross-listing firms are the

ones that use additional cash and hence need to signal to investors that their money will be used efficiently; see Doidge, Karolyi, Lins, Miller, and Stulz (2007).[86]

Panel C. Summary Statistics

Variable	Before (1)			After (2)			Benchmark (3)			(1)-(2)	(1)-(3)	(2)-(3)
	Obs	Mean	Median	Obs	Mean	Median	Obs	Mean	Median	W-test	W-test	W-test
Excess cash												
All	1,249	0.027	0.008	5,819	0.029	0.085	53,569	-0.001	0.006	-2.06*	-1.43	-8.62**
Exchange	448	0.033	0.011	2,649	0.034	0.015				-0.28	-2.92**	-7.50**
OTC	693	0.024	0.007	2,285	0.024	0.015				-2.28*	0.54	-4.74**
144A	108	0.020	0.006	885	0.024	0.010				-0.35	-0.34	-2.12*
(K-W test)		5.20			6.59*							
Cash												
All	1,249	0.118	0.085	5,819	0.112	0.079	53,569	0.121	0.084	1.71	-0.71	2.13*
Exchange	448	0.115	0.076	2,649	0.116	0.097				-0.20	0.67	1.26
OTC	693	0.123	0.095	2,285	0.113	0.084				1.76	-2.22 *	-0.86
144A	108	0.096	0.063	885	0.098	0.068				-0.08	1.87	5.04**
(K-W test)		8.54*			27.78**							
Market Value												
All	1,249	1.181	0.881	5,819	0.990	0.705	53,569	0.766	0.503	7.78**	-20.00**	-25.06**
Exchange	448	1.216	0.890	2,649	1.179	0.834				1.27	-12.90**	-28.56**
OTC	693	1.175	0.895	2,285	0.820	0.594				9.81**	-15.17**	-8.46**
144A	108	1.076	0.735	885	0.857	0.567				2.41*	-3.66**	-2.77**
(K-W test)		4.09			259.04**							
Coverage												
All	1,142	15.5	14.0	5,219	17.6	17.0	35,172	6.8	4.0	-7.95**	-33.54**	-79.22**
Exchange	389	16.9	16.0	2,383	19.8	19.0				-6.31**	-21.26**	-63.53**
OTC	654	15.3	14.0	2,026	16.6	16.0				-3.61**	-25.16**	-46.48**
144A	99	10.7	10.0	810	13.4	13.0				-3.14**	-7.80**	-27.55**
(K-W test)		23.43**			263.98**							
Closely Held Shares												
All	965	34.01	33.70	4,551	33.18	31.86	40,055	46.27	46.60	3.72**	12.05**	34.14**
Exchange	311	29.96	30.03	2,055	27.99	24.58				4.23**	6.88**	32.06**
OTC	617	35.31	34.64	2,004	35.91	34.26				-0.20**	11.00**	18.58**
144A	37	46.23	36.62	492	43.76	43.57				3.33**	-2.74**	4.13**
(K-W test)		19.90**			159.99**							
Capital Raised												
All	183	130.9	106.2	1,606	226.0	155.4				-4.38**		
Exchange	55	152.9	130.0	949	255.4	189.0				-2.42**		
OTC	112	123.4	95.4	512	190.4	122.6				-2.98**		
144A	16	107.7	103.1	145	158.7	105.9				0.71		
(K-W test)		13.66**			55.85**							

Turning to firm value, we note several interesting points. First, consistent with Doidge, Karolyi, and Stulz (2004), the average and median firms' market values are larger for cross-listed firms than for benchmark firms. Moreover, we observe a pecking order in market values by type of listing. Indeed, the average and median market value of exchange-listed firms is larger than that of OTC firms, and finally than that of firms listing through Rule 144A. Also, in line with Doidge,

[86] Alternatively, it might indicate that cross-listing firms have a special need for cash that is absent from our "normal" cash specifications. However, this pattern remains even when we change the normal cash specification.

Karolyi, and Stulz (2008), we see that the market value is greater before a firm cross-lists than after. This result emphasizes the crucial need to control correctly for the effect of growth opportunities when measuring the effect of cross-listing on firm value, and more particularly on the value of excess cash. Consistent with the figures reported in Bailey, Karolyi, and Salva (2006) or Lang, Lins, and Miller (2004), we observe an increase in analyst following once foreign firms access the U.S. markets. Turning to ownership structure, we note a slight decrease in closely held shares for firms cross-listing on an exchange or OTC but a significant increase for firms choosing private placement. A Kruskal-Wallis test indicates that the ownership structure differs among the three types of listing both before and after the listing event. Finally, the last part of Panel C clearly shows that cross-listing firms increase their issuance activity after accessing U.S. markets. On average, they raise 70 percent more capital once listed in the United States.

3.4. Main Results

3.4.1. Comparison of cross-listed with non-cross-listed firms

To test the hypotheses that we delineate in section 3.2, we start by estimating investors' valuation of excess cash for the whole sample and report the results in table 3.2. The regression estimate uses pooled OLS, and the reported t-statistics are based on heteroskedasticity-corrected standards errors that are clustered at the firm level. Column 1 first shows that the marginal value of excess cash is 0.589 for our benchmark sample. The magnitude of this estimate is in line with Pinkowitz, Stulz. and Williamson (2006) and confirms that liquid assets are valued at a discount worldwide (outside the United States).[87] Next, we observe that the coefficient on *XCash* × *Cross-list* is positive and statistically significant. This central result indicates that investors value the excess cash of

[87] Pinkowitz, Stulz, and Williamson (2006) do not report an estimate of the value of cash for their whole sample. Splitting their sample by the degree of country investor protection, they report estimates of 0.39 for the low anti-director-rights index and 1.17 for the high anti-director-rights index. Moreover, they report estimates of the value of cash, whereas we present estimates of the value of *excess* cash.

cross-listed firms at a premium of 0.910 compared with their market peers.[88] This estimate reveals that on average investors' valuation of excess cash is almost three times larger for cross-listed firms. Hence, confirming our prediction, investors seem to view a U.S. cross-listing as an effective instrument for limiting managers' misallocation of corporate cash reserves, and thus increase the value they place on liquid assets.

Table 3.2 Investors' valuation of excess cash holdings: cross-listed versus non-cross-listed firms

This table reports cross-sectional pooled OLS regressions and coefficient estimates for the market value of excess cash. The dependent variable is the ratio of market value (sum of the market value of equity and the book value of short- and long-term debt) divided by total assets. The independent variables include excess cash holdings *XCash*, defined as the residual from regression (2) in the appendix. To identify firms' cross-listing status, we use different binary variables: *Cross-list* equals one for firms cross-listed in the U.S. regardless of the type of listing and zero otherwise. *Exchange* equals one for firms cross-listed on a U.S. exchange and zero otherwise. *OTC* equals one for over-the-counter cross-listed firms and zero otherwise. *144A* equals one for firms cross-listed through private placements and zero otherwise. To assess whether investors' valuation of excess cash varies with the different cross-listing types, we interact *XCash* with the cross-listing dummies. To control for investment opportunities we include *Sales Growth* (the percentage change in sales from *t-2* to period *t*) and *Global Industry q* (the median industry Tobin's q, defined as the median market-to-book ratio of all firms that share the same SIC code). All specifications also include a set of (unreported) firm-specific variables that serve as proxies for firm profitability and financial and investment policy as defined in the text. All estimations include year and country fixed effects. We report heteroskedasticity and serial correlation robust t-statistics in brackets. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Cross-list	0.066**				
	[3.61]				
Exchange		0.183**	0.182**		
		[6.72]	[6.69]		
OTC		-0,025		-0,036	
		[0.89]		[1.26]	
144A		0,034			0,024
		[0.79]			[0.55]
XCash	0.589**	0.589**	0.613**	0.636**	0.657**
	[12.18]	[12.18]	[12.94]	[13.45]	[14.01]
XCash × *Cross-list*	0.910**				
	[5.57]				
XCash × *Exchange*		1.023**	1.001**		
		[4.51]	[4.41]		
XCash × *OTC*		0.840**		0.792**	
		[3.16]		[2.97]	
XCash × *144A*		0,177			0,107
		[0.42]			[0.25]
Sales Growth	0.171**	0.173**	0.171**	0.166**	0.166**
	[11.44]	[11.52]	[11.42]	[11.06]	[11.01]
Global Industry q	1.337**	1.333**	1.329**	1.334**	1.330**
	[19.13]	[19.09]	[19.02]	[19.04]	[18.99]
Observations	32,155	32,155	32,155	32,155	32,155
Adjusted R^2	0.75	0.28	0.28	0.27	0.27

[88] A value of cash larger than one could reflect the cost of raising additional capital in the presence of profitable growth opportunities or differential corporate and individual taxes. See Pinkowitz, Stulz, and Williamson (2006), Falkender and Wang (2006,) and Dittmar and Mahrt-Smith (2007).

Next, to gain more insight into the mechanisms driving up investors' valuation, we distinguish between firms that list shares on U.S. exchanges, those that list in the OTC market, and those that access the U.S. market through Rule 144A. As recognized in the cross-listing literature[89], the avenues available for accessing U.S. markets differ mostly in legal constraints and disclosure requirements. Whereas an exchange listing implies full registration with the SEC, and makes firms liable to U.S. disclosure and legal rules, OTC listings and Rule 144A have much lower disclosure and legal implications. On this ground, if investors associate the three listing types with different intensity in the reduction of managers' risk of misallocation, they should value excess cash accordingly. To gauge this claim, we replace *Cross-list* by separate dummy variables representing each listing type and interact these dummies with *XCash*. Specifically, *Exchange* equals one if a foreign firm is listed on a U.S. exchange (levels 2 and 3) and zero otherwise. *OTC* equals one for firms listed over-the-counter (level 1) and zero otherwise and, by corollary, *144A* equals one for firms that are listed in the U.S. through private placements (Rule 144A).

Column 2 of table 3.2 clearly reveals that the magnitude of the excess cash premium differs across listing types. We observe the largest effect for exchange-listed firms, with a large, positive, and statistically significant coefficient of 1.023. Consistent with our hypothesis, investors seem to recognize the increased legal and disclosure requirements attached to a U.S. exchange listing and consequently place additional value on firms' excess cash reserves. Column 2 also displays a positive excess cash premium for foreign firms that have OTC listings. Even though the effect appears to be smaller than for exchange-listed firms, our estimates indicate that investors also consider OTC listings a tool to improve the efficiency of corporate cash allocation. Turning to Rule 144A, the coefficient is indistinguishable from zero. Accordingly, investors do not seem to perceive any reduction of misallocation risk for this type of listing. In columns 3 to 5, we redo a similar analysis but consider each cross-listing type separately. Reassuringly, these additional estimations continue to show a relative premium in investors' valuation of excess cash for both exchange- and OTC-listed firms.

Overall, the differences in investors' valuation of excess cash suppor the view that U.S. cross-listings have an important influence on managers' potential ability to use cash reserves inefficiently. In

[89] See for instance Doidge, Karolyi, and Stulz (2004, 2008) or Bailey, Karoyi, and Salva (2006).

particular, the strong excess cash premium we observe for exchange-listed firms corroborates recent findings that stringent laws and disclosure requirement put additional bounds on managers' actions and hence help reduce the risk of inefficient behavior. A consequence is that by lessening investors' markdown of liquid assets, a U.S. exchange listing reduces part of the value loss engendered by weak governance mechanisms. Interestingly, our results highlight that investors also perceive OTC listings as making it harder for managers to waste corporate liquid resources. Notably, since OTC listings have very few legal repercussions and do not comprise additional disclosure requirements, our findings suggest that investors associate OTC listings with other governance constraints.

3.4.2. Sensitivity analyses

Before exploring more in detail what explains the excess cash premium, and in particular why we observe such an important effect for OTC firms, we want to make sure that our inference is not misstated. For that, we extend our analysis in several dimensions. In this section, we examine whether our results are robust to changes in our model specification and estimation procedure. The outcome is reported on table 3.3. We start the first set of tests by changing our variable of interest. Following Pinkowitz, Stulz, and Williamson (2006), we reestimate our valuation model by using the level of cash and changes in cash instead of excess cash. Specifically, *Cash* is defined as cash and marketable securities over total assets, while $\Delta Cash_t$ refers to the yearly change in total cash.[90] In columns 1 and 2 of table 3.3, we note that our results are robust to this change. We observe that investors' valuation of cash is twice as large for exchange listings as for OTC listings, and, again, we find no premium for the less demanding cross-listing option.[91]

We continue by reestimating model 1 without firms from the U.K. and Japan. Given that those two countries comprise the greatest number of observations in our sample, a legitimate concern is that British and Japanese firms drive our results. As we notice in column 3, our results are virtually unchanged when we exclude the U.K. and Japan. In column 4, we extend our sample to include all

[90] From the univariate tests, we know that the level of cash decreases slightly subsequent to a U.S. listing. So, using changes in cash turns out to be robust to the potential effects of cash-level variations.
[91] All estimations presented in this paper for *XCash* are computed also for *Cash*. Results are available upon request.

firms and not only those with positive excess cash. Precisely, when a firm-year has negative excess cash we consider that the firm is operating at the optimal level (otherwise it could not operate) and set *XCash* equal to zero. We note that expanding our sample has no significant impact on our estimations. Next, we note that in our model the slope parameters on the profitability variables could be viewed as discount rates, which may be subject to change around cross-listing; see Karolyi (2006) and Hail and Leuz (2006).[92] If this is the case, imposing the same slopes on all variables, as we do in our basic specification, would be inadequate. To correct for that, in column 5 we interact all slope parameters on the control variables with the listing dummy *Cross-list* and alternatively, in unreported results, with each cross-listing type. This modification has no impact on our conclusions.[93]

Subsequently, we reassess our base model (1) following alternative estimation procedures. In column 6, we follow previous studies and reestimate the model using the Fama and Macbeth (1973) approach.[94] Although the magnitude of the estimates differs slightly, these changes have no bearing on our conclusions. Finally, in columns 7 and 8 we address concerns about the potential endogeneity of the cross-listing decision. Since firms choose to list in the United States, our sample of cross-listed firms may not be random. To mitigate this issue, we estimate self-selection Heckman-type models, where the first stage models a firm's decision to cross-list and the second stage refers to our baseline valuation specification (1). For the first-stage estimation, we follow prior studies in our choice of instruments and include size, leverage, sales growth, the industry median market-to-book ratio, the anti-director-rights index, and year fixed effects; see for instance Doidge, Karolyi, and Stulz (2004) or Bailey, Karolyi, and Salva (2006).

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[92] We note that the estimated change reported in the literature is rather modest. Doidge, Karolyi, and Stulz (2004) argue that "there is some support in the event study literature for the argument that listing in the U.S. reduces barriers to owning the stock and therefore decreases the listing firm's cost of capital, but this support is rather limited"." Recently, Hail and Leuz (2006) document that the reduction in the cost of capital explains only part of the valuation premium of cross-listed firms.

[93] A potential drawback with our model is that it does not account explicitly for differences in capitalization rates across firms. However, we note that the model has been shown to perform about asd well as a model that relates abnormal returns to changes in firm characteristics; see Dittmar and Mahrt-Smith (2007) and Faulkender and Wang (2006). In addition to letting the cost of capital change around cross-listing, we implement another test to see whether our specification poses a problem. We estimate regressions (where the variable of interest is the level of cash) separately for two groups of firms that are sorted to have more similar costs of capital. We sort by size (large versus small) and by firm-specific betas (high versus low). We observe that some of the slopes on control variables do differ across specifications, but the estimated responses of value to cash holdings are similar across groups and do not have any effect on our conclusions.

[94] See, for instance, Pinkowitz, Stulz, and Williamson (2006) and Pinkowitz and Williamson (2005). However, to the extent that our sample covers a short period (13 years) plus the fact that we have few observations for firms that hasve recently cross-listed, we think that pooled OLS is the appropriate estimation procedure.

Table 3.3 Investors' valuation of excess cash holdings: cross-listed versus non-cross-listed firms (robustness).

This table reports cross-sectional regressions and coefficient estimates for the market value of excess cash. The dependent variable is the ratio of market value (sum of the market value of equity and the book value of short- and long-term debt) divided by total assets. The independent variables include excess cash holdings *XCash* defined as the residual from regression (2) in the appendix. To identify firms' cross-listing status, we use different binary variables: *Exchange* equals one for firms cross-listed on a U.S. exchange and zero otherwise. *OTC* equals one for over-the-counter cross-listed firms and zero otherwise. *144A* equals one for firms cross-listed through private placements and zero otherwise. To assess whether investors' valuation of excess cash varies with the different cross-listing types, we interact *XCash* with the cross-listing dummies. To control for investment opportunities we include *Sales Growth* (the percentage change in sales from *t-2* to period *t*) and *Global Industry q* (the median industry Tobin's q, defined as the median market-to-book ratio of all firms that share the same SIC code). All specifications also include a set of (unreported) firm-specific variables that serve as proxies for firm profitability and financial and investment policy as defined in the text. In columns (1) and (2), we contrast our results with those oin the existing literature by replacing *XCash* by the level and changes in normal cash. Specifically, *Cash* is defined as cash plus marketable securities divided by total assets while *ΔCash* refers to the yearly change in *Cash*. In column (3), we exclude observations from the U.K. and Japan, which represent an important part of our sample and could be driving our results. In column (4), we include all observations and do not restrict ourselves to firm-years having positive *XCash*. More precisely, when a firm-year has a level of cash that is lower than the optimal level of cash, we set *XCash* equal to zero. In column (5), we interact all slope parameters on the control variables with the listing dummy *Cross-list* to control for the potential effect of changes in discount rates. In column (6), we use the Fama and MacBeth (1973) methodology to estimate the value of excess cash. In columns (7) and (8), we use the Heckman specification to further assess the potential effect of self-selection. In column (7) *Mills* refers to the inverse Mills ratio computed from the first step (unreported) probit estimation where the dependent variable equals one if a firm is cross-listed (irrespective of the cross-listing type) and zero otherwise. In column (8), $Mills_{Exchange}$, $Mills_{OTC}$ and $Mills_{A144}$ refer to the inverse Mills ratios independently computed from (unreported) probit estimations where the dependent variables are respectively *Exchange*, *OTC*, and *A144*. All estimations include year and country fixed effects. We report heteroskedasticity and serial correlation robust t-statistics in brackets. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

	Pooled OLS					FM	Heckman	
Variables	***Cash*** **(1)**	***ΔCash*** **(2)**	**Exclude UK/JPN (3)**	**Include *XCash<=0* (4)**	**Changing slope parameters (5)**	**(6)**	**(7)**	**(8)**
Exchange	0.063**	0.191**	0.178**	0.155**	0.176**	0.09	1.914**	4.692**
	[2.94]	[11.88]	[5.32]	[8.30]	[3.40]	[1.38]	[36.27]	[51.00]
OTC	-0,001	0,005	-0.123**	-0.041*	-0.149*	-0.042	1.844**	-0.147
	[0.04]	[0.29]	[3.74]	[2.25]	[2.61]	[1.83]	[33.09]	[1.23]
144A	0,006	0,013	0.018	0.048	-0.086	0.008	1.723**	0.119
	[0.20]	[0.52]	[0.40]	[1.75]	[1.62]	[0.22]	[28.12]	[1.15]
XCash			0.453**	0.611**	0.599**	0.616**	0.772**	0.768**
			[7.64]	[16.29]	[12.24]	[7.90]	[16.28]	[16.52]
XCash × Exchange			1.312**	0.953**	1.115**	1.13**	1.374**	1.657**
			[4.84]	[5.23]	[4.79]	[4.56]	[8.85]	[12.98]
XCash × OTC			1.120**	0.630**	0.599*	0.75**	1.087**	0.919**
			[3.76]	[2.97]	[2.21]	[4.23]	[6.47]	[3.57]
XCash × 144A			0.297	-0.158	0.058	0.307	0.562	-0.371
			[0.71]	[0.46]	[0.54]	[1.12]	[1.37]	[0.91]
Cash	0.842**							
	[35.07]							
Cash × Exchange	1.202**							
	[10.26]							
Cash × OTC	0.632**							
	[3.02]							
Cash × 144A	0,052							
	[0.24]							
ΔCash		0.644**						
		[21.57]						
ΔCash × Exchange		0.868**						
		[5.68]						
ΔCash × OTC		0.499**						
		[2.86]						
ΔCash × 144A		0,353						
		[1.20]						
Mills							-0.999**	
							[9.32]	
$Mills_{Exchange}$								-1.662**
								[5.50]
$Mills_{OTC}$								-0.568
								[7.12]
$Mills_{144A}$								0.422**
								[6.67]
Sales Growth	0.149**	0.138**	0.106**	0.142**	0.173**	0.100*	0.185**	0.202**
	[13.95]	[12.66]	[5.92]	[13.15]	[11.56]	[2.57]	[12.66]	[14.07]
Global Industry q	1.066**	1.137	1.062**	1.268**	1.321**	0.780**	1.291**	1.197**
	[21.37]	[22.49]	[12.10]	[24.36]	[18.96]	[3.25]	[18.93]	[17.86]
Observations	65,376	65,067	21,413	58,934	32,155	32,155	32,155	32,155
Adjusted R^2	0.25	0.23	0.25	0.26	0.28	0.32	0.31	0.34

Column 7 reports the second-stage regression results where *Cross-list* is the choice variable in the first stage. Alternatively, column 8 presents results where *Exchange*, *OTC*, and *144A* are the first-stage choice variables, respectively.[95] Although the significance of the estimated Mills ratios indicates the presence of a selection bias, we still observe that investors' value the excess cash of exchange and OTC listed firms at a premium.

Taken together, our conclusions remain robust to different measures of cash, different specifications, and different estimation techniques. Investors truly perceive U.S. exchange and OTC listings as effective devices to enhance the efficient use of cash holdings, and hence protect their investment.

3.4.3. Further tests to control for growth options

As we mention earlier, an important concern relates to the potential misleading effect of uncaptured growth options. It is plausible that we are associating a higher value of excess cash with a lower risk of misallocation of excessive cash balances when in fact our results could also be driven by increased growth options that are particular to cross-listing; see Faulkender and Wang (2006) and Pinkowitz and Williamson (2005). Recall that to mitigate this concern, we have already included explicit control variables (*Sales Growth* and *Global Industry q*) in our valuation regressions and we employ excess cash, an instrumental measure for growth opportunities. However, to truly rule out the possibility that uncaptured growth options contaminate our estimates of investors' valuations of excess cash, we perform two additional tests.

First, we draw from Faulkender and Wang (2006), who show that cash reserves are more valuable to financially constrained firms that face important growth opportunities. To address this possibility, we split cross-listed firms into two groups based on their capital-raising activity around the cross-listing event. In doing so, we presume that firms experiencing the largest expansion of their investment opportunity set and facing financing constraints are the ones that increase their capital-raising activity when accessing the U.S. markets. Hence, if our excess-cash estimates reflect

[95] Results from the first-stage probit estimations are available upon request.

uncaptured growth options, we should find a premium on the value of excess cash only for firms that increase their capital issuance activity. The results for the two partitions reported in columns 1 and 2 of table 3.4 contradict this claim. Indeed, while investors' valuation of excess cash turns out to be larger for firms that increase their capital-raising activity around the cross-listing date, column 2 reveals that the investors' valuation of excess cash continues to be larger for exchange- and OTC-listed firms even when they keep their issuance activity constant. These results indicate that increased growth options do seem to affect investors' valuation of excess cash, but they still highlight the importance of governance constraints imposed by the U.S. market environment. Notably, column 2 reveals that the estimated excess cash premium for exchange cross-listed firms is 0.54. Since it is purged from the effect of growth options, this estimate can be considered as a cleaner measure of the premium that investors really attach to excessive liquid assets.[96] Similarly, the premium for OTC listings is 0.40, but it is only marginally significant. This suggests that part of the effect uncovered for OTC listings could be attributable to growth options.

To further assess the potential effect of growth options on our conclusions, we compare investors' valuation of excess cash for cross-listed firms with that of a representative sample of U.S. firms that are available in Worldscope.[97] If expanded growth opportunities that are particular to cross-listed firms are really driving our results, the value of excess cash should be larger for cross-listed firms than for comparable U.S. firms. In column 3 of table 3.4, we compare the value of excess cash between cross-listed and U.S. firms. First, we observe that investors' valuation of excess cash for U.S. firms is around 2.34. This is consistent with the estimates of Dittmar and Mahrt-Smith (2007), who report coefficients larger than 2.00 for well-governed U.S. firms. The main result to notice is that, for the three cross-listing avenues, investors' valuation of excess cash never exceeds that of U.S. firms. This strong result provides confidence that our conclusions are robust to the effect of growth options that are not well captured by our original control variables.

[96] We thank the referee for suggesting us this interpretation.
[97] We are especially grateful to Christian Leuz for suggesting this test to us.

Table 3.4 Investors' valuation of excess cash holdings: the potential effect of growth options

This table reports cross-sectional regressions and coefficient estimates for the value of excess cash. The dependent variable is the ratio of market value (sum of the market value of equity and the book value of short- and long-term debt) divided by total assets. The independent variables include excess cash holdings *XCash* defined as the residual from regression (2) in the appendix. To identify firms' cross-listing status, we use different binary variables: *Exchange* equals one for firms cross-listing on a U.S. exchange and zero otherwise. *OTC* equals one for over-the-counter cross-listed firms and zero otherwise. *144A* equals one for firms that cross-list through private placements and zero otherwise. To assess whether investors' valuation of excess cash varies along with the different cross-listing types, we interact *XCash* with the cross-listing dummies. To control for investment opportunities we include *Sales Growth* (the percentage change in sales from *t-2* to period *t*) and *Global Industry q* (the median industry Tobin's q, defined as the median market-to-book ratio of all firms that share the same SIC code). In column (1) and (2), we separate cross-listed firms according to their capital raising activity. Column (1) includes firms that increase their capital-raising activity from the three years prior the cross-listing year to three years following the cross-listing year and column (2) includes firms that do not increase their capital-raising activity around the cross-listing event. For each group we also report the *p*-value of a Wald test for the difference between (1) and (2). The standard errors for the differences between (1) and (2) are computed with a SUR system that estimates both groups jointly. In column (3), we include in the sample only cross-listed and U.S firms. Thus we drop our benchmark sample of non-cross-listing foreign firms and include data for U.S. firms. The comparison is between U.S. firms and various types of cross-listings. The coefficient on *XCash* refers to the estimate of the market value of excess cash for U.S. firms. Similarly, *XCash* × *Exchange* refers to the incremental value of excess cash for exchange cross-listed firms in comparison with U.S. firms. A similar interpretation applies to the rest of the interactions. All specifications also include a set of (unreported) firm-specific variables that serve as proxies for firm profitability and financial and investment policy as defined in the text. All estimations only contain observations for which *XCash* is positive and include year and country fixed effects. We report heteroskedasticity and serial correlation robust t-statistics in brackets. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

	Changes in capital-raising activity			**Cross-listed versus U.S. firms**
Variables	**Yes (1)**	**No (2)**	**Wald test (1)-(2)**	**(3)**
Exchange	0.112*	0.197**	0.230	-0.113*
	[1.98]	[5.34]		[2.16]
OTC	-0.045	-0.043	0.974	-0.366**
	[0.66]	[1.30]		[6.75]
144A	-0.055	0.053	0.176	-0.357**
	[0.71]	[0.94]		[4.38]
XCash	0.665**	0.603**	0.124	2.340**
	[17.47]	[12.48]		[26.09]
XCash × *Exchange*	1.252**	0.544*	0.046*	-0.201
	[3.82]	[2.01]		[0.56]
XCash × *OTC*	0.902**	0.403	0.257	-0.925*
	[3.00]	[1.71]		[2.02]
XCash × *144A*	0.001	0.101	0.904	-1.637*
	[0.00]	[0.20]		[2.28]
Sales Growth	0.193**	0.176**	0.011*	0.369**
	[12.23]	[11.68]		[11.50]
Global Industry q	1.394**	1.309**	0.046*	0.983**
	[18.72]	[18.45]		[6.73]
Observations	29,879	30,684		18,002
Adjusted R^2	0.27	0.27		0.31

Interestingly, we note that the value of excess cash for exchange-listed foreign firms is virtually no different than that for U.S. firms, as the coefficient on *XCash*×*Exchange* is not statistically significant. However, investors appear to discount the value of liquid assets for OTC-listed firms. Regarding 144A cross-listings, those show the largest gap in the valuation of liquid assets with respect to U.S. firms. These results suggest that, while investors associate OTC cross-listing with *de facto*

improvement in the use of corporate cash resources, they still believe that managers of those firms enjoy larger discretion than the managers of comparable U.S. corporations.

All in all, our results are robust to various tests that attempt to mitigate concern about the effect uncaptured growth options may have on our estimated coefficients. In the following sections, we explore supplementary predictions of our hypothesis and extend our analysis to embrace dynamic features.

3.4.4. Change in the value of excess cash (pre- versus post-cross-listing)

So far, our results indicate that on average, investors place a larger value on the excess cash of foreign firms that have U.S. exchange or OTC listings than on that of domestic firms. In this section, we further characterize this result by examining the dynamics of the relation between U.S. cross-listings and investors' valuation of excess cash in event time. Looking at whether and how investors' change the way they expect cash to be used around the cross-listing event is important for at least two reasons. First, if investors really perceive U.S. rules, requirements, and other features as efficient tools for guaranteeing the adequate use of corporate cash resources, then the additional value they place on firms' excess cash should increase after the cross-listing date and be sustained in the long run. Second, looking at investors' valuation of excess cash mainly outside the window of years surrounding the listing event minimizes the concern that our estimates are contaminated by financing, investment, or operating events that occur contemporaneously with the cross-listing date.[98]

In table 3.5, we exploit the dynamic nature of our data set and examine how investors' valuation of excess cash *changes* over cross-listings. To do so, we start by creating "event time" dummy variables. In particular, *Before* equals one before a firm cross-lists in the United States and zero otherwise. Similarly, *After* takes a value of one once a firm is cross-listed in the United States and zero otherwise. Then to assess whether investors' valuation of excess cash increases over the cross-listing event, we reestimate our baseline model (1) but interact *XCash* with the listing-type dummies together with the

[98] We thank the referee for raising this important point.

two event-time dummies. Our specification now stacks firm-year observations of cross-listing firms before and after they access U.S. markets as well as those firms that never cross-list.

Column 1 presents the estimation results. We clearly observe that the coefficient on *XCash× Before* is not statistically different from zero.[99] Hence, in terms of risk of cash misallocation, investors do not seem to distinguish between firms that are going to cross-list and those that never cross-list. However, the positive and significant coefficient on *XCash×Exchange×After* and *XCash×OTC×After* indicate that investors do raise the value they place on excess cash once firms become listed on a U.S. exchange or over-the-counter.

Next, we further split the *After* variable into additional event-time dummies that better trace cross-listing patterns. Specifically, *After1* in column 2 equals one for cross-listed firms during the three years following their U.S. listing and zero otherwise. Similarly, *After2* equals one for firms that have been cross-listed for more than four years and zero otherwise. Column 2 presents the additional event-time results and contains several important findings. First, for each type of listing, there is a large increase in investors' valuation of excess cash in the years following the listing. The magnitude of the upsurge is especially large for OTC firms (1.366 with a t-statistic of 4.23). Second, the value of excess cash appears to decline in the years following the listing event. However, for exchange- and OTC-listed firms, the excess cash premium crucially remains positive and statistically significant even beyond three years after the listing. Further, F-tests confirm that this long-term effect is significant for both exchange- and OTC-listed firms.[100] In contrast, for Rule 144A listings, investors do not add a permanent premium on firms' free cash reserves. In column 3, we repeat a similar analysis but change the event-time pattern slightly. Specifically, *After1* in column 3 equals one for cross-listed firms during the two years following their U.S. listing and zero otherwise. Similarly, *After2* equals one for firms that have been cross-listed for more than three years and zero otherwise. We obtain virtually the same results.

[99] In unreported results, we also try to interact *XCash×Before* with each cross-listing type, but all the corresponding coefficients are not statistically different from zero.

[100] Specifically, we obtain the result that the coefficient *XCash× Before* is statistically different from *XCash×Exchange×After2* both in column (2) and in column (3).

Table 3.5 Investors' valuation of excess cash holdings: pre- versus post-cross-listing

This table reports cross-sectional regressions and coefficient estimates for the market value of excess cash in event time. The dependent variable is the ratio of market value (sum of the market value of equity and the book value of short- and long-term debt) divided by total assets. The independent variables include excess cash holdings *XCash* defined as the residual from regression (2) in the appendix. To identify firms' cross-listing status, we use different binary variables: *Exchange* equals one for firms cross-listing on a U.S. exchange and zero otherwise. *OTC* equals one for over-the-counter cross-listed firms and zero otherwise. *144A* equals one for firms that cross-list through private placements and zero otherwise. To assess whether investors' valuation of excess cash varies along with the different cross-listing types, we interact *XCash* with the cross-listing dummies. To control for investment opportunities we include *Sales Growth* (the percentage change in sales from *t-2* to period *t*) and *Global Industry q* (the median industry Tobin's q, defined as the median market-to-book ratio of all firms that share the same SIC code). To assess whether investors change their valuation of excess cash around the cross-listing event, we further interact *XCash* with the cross-listing type as well as with "event time" dummies. Specifically *Before* equals one before firms cross-list in the U.S. and zero otherwise while *After* equals one once firms have cross-listed in the U.S. and zero otherwise. In column (2) and (3), we further split *After* in two additional event-time dummies. Specifically, *After1* in column (2) (in column (3)) equals one during the three (two) years following the cross-listing year and zero otherwise while *After2* equals one for the period after and zero otherwise. All specifications also include a set of (unreported) firm-specific variables that serve as proxies for firm profitability and financial and investment policy as defined in the text. F-test # 1 tests the hypothesis that the coefficient on *XCash* × *Exchange* × *Before* is equal to the coefficient on *XCash* × *Exchange* × *After2 (×After in column (1))*. F-test # 2 tests the hypothesis that the coefficient on *XCash* × *OTC* × *Before* is equal to the coefficient on *XCash* × *OTC* × *After2 (×After in column (1))*. F-test # 3 tests the hypothesis that the coefficient on *XCash* × *A144* × *Before* is equal to the coefficient on *XCash* × *A144* × *After2 (×After in column (1))*. All estimations only contain observations for which *XCash* is positive and include year and country fixed effects. We report heteroskedasticity and serial correlation robust t-statistics in brackets. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

		Persistence of the effect	
	Before* vs *After	***Before* vs *After2***	
Variables	**(1)**	**(2)**	**(3)**
Before	0.116**	0.123**	0.123**
	[2.95]	[4.29]	[4.29]
Exchange ×After	0.187**	0.176**	0.175**
	[6.89]	[6.04]	[5.99]
OTC × After	-0.023	-0.033	-0.035
	[0.83]	[1.14]	[1.20]
144A × After	0.035	0.023	0.018
	[0.84]	[0.53]	[0.41]
XCash	0.584**	0.583**	0.583**
	[12.00]	[12.06]	[12.06]
XCash × Before	0.177	0.197	0.194
	[0.53]	[0.64]	[0.63]
XCash × Exchange × After	1.031**		
	[4.55]		
XCash × OTC × After	0.849**		
	[3.19]		
XCash × 144A × After	0.181		
	[0.43]		
XCash × Exchange × After1		1.105**	1.016**
		[3.75]	[3.09]
XCash × Exchange × After2		0.965**	1.030**
		[3.60]	[4.04]
XCash × OTC × After1		1.366**	0.909**
		[4.23]	[2.69]
XCash × OTC × After2		0.537*	0.632*
		[1.98]	[2.11]
XCash × 144A × After1		0.785	0.208
		[1.50]	[1.88]
XCash × 144A × After2		-0.294	-0.149
		[0.56]	[0.32]
Sales Growth	0.174**	0.174**	0.174**
	[11.63]	[11.63]	[11.63]
Global Industry q	1.329**	1.326**	1.326**
	[19.03]	[18.99]	[18.99]
Observations	32,155	32,155	32,155
Adjusted R^2	0.27	0.28	0.28
F-test # 1 (*p*-value)	0.007**	0.038*	0.022**
F-test # 2 (*p*-value)	0.034**	0.073	0.038**
F-test # 3 (*p*-value)	0.215	0.129	0.156

In summary, we find that investors do raise the value they place on cash reserves when firms choose to benefit from the U.S. market environment through exchange or OTC listings. Moreover, the change in investors' perception of the potential for misallocation contained in cash reserves remains substantial even several years following the cross-listing event. This suggests that investors envision that a U.S. listing constrains managers' wasteful actions in the long run and therefore really enhances the efficient use of cash.

3.4.5. Does the country of origin matter?

In this section, we examine whether and how firms' home-country institutional traits drive investors' perceptions of the governance benefits created through a U.S. cross-listing. Indeed, previous results show that the U.S. financial environment enhances overall investors' confidence about the adequate allocation of cash reserves. In this context, one might expect that the documented efficiency gains depend largely on the ability of home-market institutions to constrain managers' potential misuse of cash. To investigate this claim, we split our sample into subgroups by using proxies for home-country institutions' quality. Then, we estimate investors' valuation of excess cash separately for each subgroup. The first partition divides the sample into firms from countries where investor protection is weak, that is, the anti-director-rights index is below three (*Low*), and those from countries where the index is greater to or equal to three (*High*). Concerning the accounting, anti-self-dealing, and revised anti-director-rights indices, we assign firms to the *Low* protection groups if these indices are below their median. Likewise, we assign firms to the *High* protection groups if the respective indices are above their median values. Finally, we consider the difference between developed and emerging countries.

Table 3.6 Investors' valuation of excess cash: By home-country characteristics

This table reports cross-sectional regressions and coefficient estimates for the market value of excess cash. The dependent variable is the ratio of market value (sum of the market value of equity and the book value of short- and long-term debt) divided by total assets. The independent variables include excess cash holdings *XCash* defined as the residual from regression (2) in the appendix. To identify firms' cross-listing status, we use different binary variables: *Exchange* equals one for firms cross-listed on a U.S. exchange and zero otherwise. *OTC* equals one for over-the-counter cross-listed firms and zero otherwise. *144A* equals one for firms cross-listed through private placements and zero otherwise. To assess whether investors' valuation of excess cash varies with the different cross-listing types, we interact *XCash* with the cross-listing dummies. To control for investment opportunities we include *Sales Growth* (the percentage change in sales from *t-2* to period *t*) and *Global Industry q* (the median industry Tobin's q, defined as the median market-to-book ratio of all firms that share the same SIC code). All specifications also include a set of (unreported) firm-specific variables that serve as proxies for firm profitability, financial and investment policy as defined in the text. Countries with a low level of investor protection (Low) are countries with an index of investor protection (Anti-director rights and Accounting quality index [from la Porta et al. (1998)], Anti-self-dealing and revised Anti-director rights index [from Djankov et al. (2006)]) below the median and those with high levels (High) have indexes above the median. We use the Standard and Poor's Emerging Market Database to classify countries in emerging (Low) or developed (High). All estimations only contain observations for which *XCash* is positive and include year and country fixed effects. Below we also report the p-values of a two-sample Wald test. Specifically, Wald test #1 tests whether *XCash + XCash × Exchange* is significantly different between the Low and High groups. Similarly, Wald test #2 and Wald test #3test whether *XCash + XCash × OTC* and *XCash + XCash × 144A* , respectively, are significantly different between the Low and High groups. The standard errors for the two sample tests are computed with a SUR system that estimates both groups jointly. We report heteroskedasticity and serial correlation robust t-statistics in brackets. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

	Antidirector Rights		**Anti-Self-dealing**		**Revised Antidirector Rights**		**Accounting**		**Economic Development**	
	Low (1)	**High (2)**	**Low (3)**	**High (4)**	**Low (5)**	**High (6)**	**Low (7)**	**High (8)**	**Low (9)**	**High (10)**
Exchange	0.042	0.208**	0.01	0.230**	-0.063	0.207**	0.095	0.173**	0.143*	0.160**
	[0.92]	[5.69]	[0.20]	[6.34]	[1.11]	[6.17]	[1.87]	[5.02]	[2.30]	[4.95]
OTC	-0.205**	0.022	-0.209**	0.02	-0.330**	0.039	-0.106	-0.037	-0.016	-0.051
	[4.10]	[0.62]	[3.90]	[0.58]	[5.17]	[1.21]	[1.90]	[1.08]	[0.29]	[1.51]
144A	0.024	-0.05	-0.037	0	-0.078	-0.022	0.035	0.001	-0.016	0.07
	[0.41]	[0.74]	[0.50]	[0.00]	[1.24]	[0.35]	[0.57]	[0.02]	[0.31]	[0.89]
XCash	0.503**	0.700**	0.435**	0.733**	0.579**	0.722**	0.359**	0.697**	0.257**	0.723**
	[6.78]	[11.13]	[5.43]	[12.21]	[6.22]	[11.02]	[4.18]	[12.06]	[2.85]	[12.53]
XCash × Exchange	1.022**	0.897**	1.453**	0.595*	1.599**	0.884**	1.084**	0.875*	1.190**	0.755**
	[2.87]	[3.08]	[3.92]	[2.09]	[3.81]	[3.29]	[3.94]	[2.26]	[4.78]	[2.21]
XCash × OTC	0.734*	0.776	1.290*	0.503	1.250*	0.582*	1.029**	0.021	1.365**	0.659*
	[2.30]	[1.60]	[2.31]	[1.66]	[2.42]	[2.01]	[3.34]	[0.04]	[2.78]	[2.11]
XCash × 144A	0.555	0.177	0.597	0.337	0.454	0.486	0.607	-0.038	0.62	-0.325
	[1.08]	[0.26]	[1.04]	[0.55]	[0.89]	[0.67]	[0.75]	[0.08]	[1.17]	[0.51]
Sales Growth	0.135**	0.192**	0.158**	0.181**	0.102**	0.190**	0.185**	0.173**	0.029	0.203**
	[5.52]	[10.09]	[6.07]	[9.89]	[3.35]	[11.00]	[6.56]	[9.84]	[1.04]	[11.39]
Global Industry q	1.849**	1.068**	2.224**	0.928**	1.840**	1.184**	2.019**	1.098**	0.887**	1.296**
	[15.96]	[12.23]	[18.11]	[10.97]	[13.17]	[14.73]	[14.61]	[13.59]	[6.03]	[16.20]
Observations	11,592	20,563	10,052	22,103	7,976	24,179	8,177	23,978	8,568	23,199
Adjusted R^2	0.3	0.28	0.29	0.29	0.32	0.28	0.28	0.28	0.3	0.29
Wald test #1 (*p*-value)	0.91		0.40		0.32		0.37		0.04	
Wald test #2 (*p*-value)	0.78		0.40		0.13		0.01		0.77	
Wald test #3 (*p*-value)	0.83		0.93		0.93		0.79		0.53	

Table 3.6 reveals which firms seem to benefit more from the U.S. listing. Consistent with Pinkowitz, Stulz, and Williamson (2006), investors place a substantial discount on the value of excess cash for firms located in countries with weak institutional protection. However, unlike Pinkowitz, Stulz, and Williamson (2006), we note that the value of excess cash is discounted below its face value in countries with higher investor protection and transparency. This discrepancy might originate in the fact that we consider the investors' valuation of free cash flow, i.e., excess cash, while Pinkowitz, Stulz, and Williamson (2006) estimate the value of total and changes in cash

Turning to the effect of cross-listing, all specifications provide evidence that investors value the disciplining effect of a U.S. listing more if firms are incorporated in a country characterized by feeble institutions. More specifically, column 1 presents regression results for poor-protection countries according to the anti-director-rights index. For non-cross-listed firms, we estimate that the value of excess cash is 0.50, which is far below its face value. In sharp contrast, our estimates reveal that investors' valuation of excess cash is significantly larger for firms cross-listed in the United States. Again, we continue to observe the largest effect for exchange-listed firms but a significant effect for firms accessing U.S. markets through OTC listings. Columns 3, 5, 7, and 9 show similar patterns when we use the anti-self-dealing index, the revised anti-director-rights index, the accounting indices, and the level of economic development respectively. It is worth noting that the coefficients on *XCash* are at a discount across all specifications, but the importance of this discount differs slightly, depending on the measure of institutional quality that we use. Nonetheless, our results hold regardless of the index we consider.

When we consider the group of firms located in countries with strong institutions, columns 2, 4, 6, 8. and 10 offer a different picture. If we look at the estimates on *XCash*×*Exchange*, we see that investors also upgrade their valuation of excess cash for exchange-listed firms but to a lesser extent than for firms in the *Low* group. When we look at the estimates on *XCash*×*OTC*, the picture is not as clear-cut. Indeed, in some specifications the coefficient is only marginally significant, while it is still positive and significant in others.

Given that the value investors place on excess cash holdings appears to be related to the quality of the home-market institutions, a relevant question is whether cross-listing eliminates the pre-

existing differences. To examine whether the value of excess cash of all foreign firms cross-listing under the same modality is similar regardless of their country of incorporation, we perform two-sample tests. More precisely, we test whether *XCash* + *XCash*×*Exchange* is significantly different between the *Low* and *High* groups. A similar test is computed for OTC and 144A listings. We find that across the various cross-listing avenues there is no significant difference in investors' valuation of excess cash between the *Low* and *High* groups. This indicates that investors perceive the risk of misallocation of excessive corporate resources to be similar across cross-listed firms. regardless of the quality of their home-market institutions. In essence, cross-listed firms subject to the same U.S. requirements are viewed as having on average a similar level of governance constraints.

Our findings clearly confirm the view that the U.S. financial markets provide efficient mechanisms for limiingt the misallocation of investors' funds. Indeed, we report that the securing effect of cross-listing is magnified for firms located in poorly protected environments. From a different perspective, our results importantly highlight that country characteristics are important determinants of corporate governance. As a matter of fact, by pulling themselves out of their legal environment, cross-listed firms seem to partially sidestep their home-country institutions. Our analysis shows that investors associate this positive signal with a reduced risk of managers' wasteful actions. In this respect, we substantiate the study of Doidge, Karolyi, and Stulz (2007), who demonstrate that country characteristics explain much more variation in governance rating than observable firm characteristics.

3.4.6. What are the governance mechanisms at work?

Hitherto, we have found compelling evidence that investors associate U.S. exchange and OTC listings with a cutback in managers' unproductive allocation of cash resources. However, unlike those listing on exchanges, foreign firms opting for an OTC listing are not subject to U.S. disclosure requirements, SEC enforcement, or shareholders' litigation threat. Hence, our results indirectly suggest that governance mechanisms beyond legal protection effectively drive investors; perceptions.

To further strengthen this interpretation, we look at investors' valuation of excess cash when foreign firms are cross-listed in London. Listing shares on the London Stock Exchange does not subject firms to the U.K. legal rules and requires a weaker governance commitment than a U.S. exchange listing. In essence, a London listing can be compared with an OTC listing in terms of requirements, and hence enable us to further assess the effect of legal changes on managers' misuse of cash. We gather cross-listing information from the London Stock Exchange[101]. Some firms in our sample have both a London listing and some type of U.S. listing. Since U.S. listings are more restrictive, we consider only firms that are not simultaneously cross-listed in the U.S. We thus have 671 firm-year observations, representing 99 firms from 23 countries that meet our data requirements. We rerun model (1) for London cross-listings and the benchmark sample. Column 4 of table 3.7 shows the results of the estimation. As with OTC listings, we observe that investors value liquid assets of firms cross-listed in London at a premium compared with their home-country peers. As expected, the magnitude of the premium is much smaller than the one we obtain for U.S. exchange-listed firms, but it is still significant at the 10 percent level. This finding confirms that investors view cross-listing in larger and more liquid markets as an instrument for limiting management's wasteful actions, even when no legal rules and public enforcement are at work.

Overall, our results are in line with Stulz's (1999) argument that U.S. cross-listings might also discipline managers through the pressure of increased monitoring and scrutiny by various market participants. Accordingly, it might be that part of the documented premium investors place on excess cash stems from the increased monitoring and scrutiny that accompanies a U.S. listing. The cross-listing literature has suggested that mechanisms such as a stronger market for corporate control (Doidge, 2004), increased scrutiny by financial analysts and sophisticated investors (Baker, Nofsinger, and Weaver, 2002, Lang, Lins, and Miller, 2003), increased voluntary disclosure (Bailey, Karolyi, and Salva, 2006), or broader media coverage (Dyck and Zingales, 2004) might be at work. To further understand what factors induce investors to change their perception of misallocation risk with cross-listing, we focus on the potential monitoring role played by financial analysts and large institutional investors.

[101] The list of international firms listed in London is available at www.londonstockexchange.com

First, we use the change in analyst following around cross-listing to capture changes in external monitoring pressure. Indeed, as shown in Lang, Lins, and Miller (2004) and Yu (2007), by providing coverage and information, analysts play a significant role in disciplining management. In this spirit, we create the variable *ΔCoverag,e* defined as the difference between the three-year average coverage after the cross-listing event and before the cross-listing event.[102] Then, to assess whether investors' valuation of excess cash reflects the potential monitoring role of financial analysts, we reestimate our valuation regression by adding the interaction between *ΔCoverage*, *XCash* and our three cross-listing dummies. Column 1 of table 3.7 presents the results. Remarkably, the estimated coefficients on *XCash* interacted with all cross-listing types and *ΔCoverage* are significantly positive. These estimates essentially highlight that part of the reduction in the potential inadequate use of cash is triggered by the additional analyst coverage that characterizes a U.S. listing. Notably, the coefficient on *XCash*×*144A*× *ΔCoverage* is also significant. This surprising result indicates that, to the extent that a listing through Rule 144A comes with additional analyst coverage, investors react and increase the value they place on excess cash. This latter result provides unambiguous evidence that the enhanced analyst coverage helps increase investors' trust.

In column 2, we perform a similar analysis but consider the percentage of large shareholders as an alternative measure of monitoring. Prior research suggests that large shareholders have enough capital at stake to have strong incentives to monitor and discipline managers; see, for example, Gillian and Starks (2000) or Gompers and Metrick (2001). On this ground, if the ownership structure shifts toward larger and active shareholders when foreign firms cross-list in the United States, investors may feel that their money is better protected, even if no legal or institutional constraints tie managers' hands. We use closely held shares (*CHS*) as a proxy for large shareholders' oversight. Again, we consider changes in ownership structure by taking the difference between the three-year average pre- and post-listing to create *ΔCHS*. Column 2 displays positive and significant estimates for exchange- and OTC-listed firms. However, the interaction between *XCash*, *144A*, and *ΔCHS* is not distinguishable from zero. Overall, this specification confirms that part of the excess cash premium for

[102] Note that we also define this variable by considering only one and two years before and one and two years after the listing. Our results are not affected by how we define the change in analyst coverage.

exchange and OTC listings is explained by the change in ownership occurring around the cross-listing period.

In column 3, we introduce simultaneously our two measures for monitoring intensity because they may serve as proxies for different aspects of investor scrutiny as witnessed by their low correlation. This additional estimation clearly reinforces our previous conclusions. For exchange listings, we observe that part of the excess cash premium is explained by the increased number of analysts following the firm. Again, for OTC listings, our estimates reveal that the excess cash premium is partly explained by both dimensions of investor monitoring. Interestingly, investors seem to associate 144A listings with greater constraints on management only if they are able to draw additional attention from the analyst and investor community.

In columns 5 and 6, we perform a similar analysis for London listings, and in that case, we note that the premium investors place a premium on excess cash only if the listing comes along with an increased number of financial analysts following the firm. In all specifications the coefficients on *XCash*×*Exchange* remain positive and significant, suggesting that the stricter legal and disclosure environment provided by U.S. market unambiguously plays an important role in disciplining managers beyond the role played by more informal mechanisms. We also note that the coefficients on *XCash*×*OTC,* although lower, are also positive and significant. This could be because our proxies for monitoring intensity are not perfect or there are other mechanisms at work. As indicated in Bailey, Karolyi, and Salva (2006), many firms listing OTC voluntarily provide additional disclosures and implement governance improvements even if they are not required to do so. Another potential explanation for the unexplained premium for OTC firms could be the role of the market for corporate control in the United States.

The results in this section unequivocally suggest that the additional monitoring provided by analysts and large investors plays a substantial role in enhancing investors' confidence. In this respect, our analysis complements the evidence of Dittmar and Mahrt-Smith (2007). While these authors document that the value of excess cash of U.S. firms is positively related to firm-level governance proxies, we show that *changes* in monitoring intensity that characterize a U.S. cross-listing also help restrain the dissipation of cash and in turn preserve firm value. On a different level, our results indicate

that stricter legal protection for investors and more intense monitoring together enhance investors' confidence in management' actions, since investors update their valuation of excess cash holdings around the cross-listing event.

Table 3.7 Investors' valuation of excess cash: legal (formal) versus monitoring (informal) effects

This table reports cross-sectional regressions and coefficient estimates for the market value of excess cash. The dependent variable is the ratio of market value (sum of the market value of equity and the book value of short- and long-term debt) divided by total assets. The independent variables include excess cash holdings *XCash* defined as the residual from regression (2) in the appendix. To identify firms' cross-listing status, we use different binary variables: *Exchange* equals one for firms cross-listed on a U.S. exchange and zero otherwise. *OTC* equals one for over-the-counter cross-listed firms and zero otherwise. *144A* equals one for firms cross-listed through private placements and zero otherwise. *London* equals one if a firm has a London cross-listing and no U.S. exchange listing and zero otherwise. *ΔCoverage* is the difference between the three-year average number of analysts following the firm after the cross-listing event and prior the event. *ΔCHS* is similarly computed as the difference between the three-year average closely held shares post- and precross-listing. To assess whether investors' valuation of excess cash varies along with the different cross-listing types and with change in analyst following and ownership structure, we interact *XCash* with the cross-listing dummies, *ΔCoverage* and *ΔCHS*. To control for investment opportunities we include *Sales Growth* (the percentage change in sales from *t-2* to period *t*) and *Global Industry q* (the median industry Tobin's q, defined as the median market-to-book ratio of all firms that share the same SIC code). All specifications also include a set of (unreported) firm-specific variables that serve as proxies for firm profitability, financial and investment policy as defined in the text. All estimations only contain observations for which *XCash* is positive and include year and country fixed effects. We report heteroskedasticity and serial correlation robust t-statistics in brackets. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

	U.S. Listings				**London Listings**		
Variables	**(1)**	**(2)**	**(3)**	**Variables**	**(4)**	**(5)**	**(6)**
Exchange	0.161**	0.153**	0.156**	*London*	0.116	0.035	0.104
	[5.58]	[5.30]	[5.41]		[0.79]	[0.24]	[0.70]
OTC	-0.04	-0.056	-0.053				
	[1.39]	[1.92]	[1.84]				
144A	0.013	0.01	0.025				
	[0.30]	[0.24]	[0.56]				
XCash	0.589**	0.590**	0.589**	*XCash*	0.578**	0.583**	0.579**
	[12.21]	[12.22]	[12.22]		[11.41]	[11.51]	[11.42]
XCash×Exchange	0.894**	0.863**	0.838**	*XCash×London*	0.625	0.211	0.514
	[3.90]	[3.73]	[3.62]		[1.89]	[1.54]	[1.48]
XCash×OTC	0.746**	0.645*	0.576*				
	[2.80]	[2.39]	[2.13]				
XCash×144A	-0.245	0.238	-0.305				
	[0.54]	[0.56]	[0.67]				
XCash×Exchange×ΔCoverage	0.151**		0.105*	*XCash×London×ΔCoverage*		0.749**	
	[3.71]		[2.14]			[4.62]	
XCash×OTC×ΔCoverage	0.313**		0.283**				
	[5.23]		[4.70]				
XCash×144A×ΔCoverage	0.187**		0.250**				
	[2.68]		[3.28]				
XCash×Exchange×ΔCHS		1.735**	1.025	*XCash×London×ΔCHS*			0.022
		[3.54]	[1.74]				[1.08]
XCash×OTC×ΔCHS		2.382**	2.052**				
		[4.41]	[3.77]				
XCash×144A×ΔCHS		-0.051	-0.295				
		[0.70]	[0.89]				
Sales Growth	0.172**	0.173**	0.172**	*Sales Growth*	0.174**	0.174**	0.174**
	[11.51]	[11.55]	[11.54]		[10.66]	[10.64]	[10.66]
Global Industry q	1.337**	1.327**	1.333**	*Global Industry q*	1.318**	1.316**	1.316**
	[19.15]	[18.99]	[19.10]		[16.89]	[16.86]	[16.85]
Observations	32,155	32,155	32,155		24,666	24,666	24,666
Adjusted R^2	0.28	0.28	0.27		0.24	0.24	0.24

3.4.7. Is there still an effect today?

In recent years, new laws and regulations aimed at enhancing corporate governance have been introduced in many countries. Since 1998, some 30 codes or principles have been established in OECD countries.[103] Corporate governance reforms have also been a priority in many emerging markets. De Nicolo, Laeven, and Ueda (2006) show that this effort has translated into a real improvement in governance quality in many developed and emerging markets, although with varying intensity. In particular, they show that, in 2003, emerging-market corporate governance still ranked behind that of developed economies.

The efforts by governments to strengthen shareholder rights together with the pressure on business to improve governance practices may have led to an increase in investors' valuation of excess cash through time for non-cross-listed firms. Simultaneously, the Sarbanes-Oxley Act (SOX) of 2002 reinforced U.S. legal rules and disclosure and governance standards. Hence, if non-U.S. initiatives are economically more relevant than U.S. ones, we may observe a convergence of corporate governance practices and a reduction or elimination of the relative efficiency of U.S. cross-listing for securing investors' money. Actually, there is some evidence that convergence, as measured by the Corporate Governance Quality Index developed by De Nicolo, Laeven, and Ueda (2006), may have taken place. Yet, in a recent paper, Aggarwal, Erel, Stulz, and Williamson (2007) find that, on average, foreign firms have poorer governance than matching U.S. firms. These findings suggest that cross-listed firms, which benefit from the overall U.S. standards and environment, should still enjoy a higher valuation of their liquid assets.

Given the recent changes in international governance practices, a natural question is whether investors still perceive a U.S. listing as an efficient device to reduce the risk that managers will misuse corporate cash reserves. To shed some light on this question, we examine how the premium investors place on the excess cash of cross-listed firms varies across different subperiods. The first period ranges from 1991 to 1999, which coincides with an upward market. Then we consider the period 2000-2001, which corresponds to a bear market. The third period follows the SOX enactment, that is, 2002 and

[103] The "Survey of Corporate Governance Developments in OECD Countries" summarizes the codes and principles adopted by OECD countries that imply changes in law and regulation and that are designed to enhance corporate governance. See http://www.oecd.org/dataoecd/58/27/21755678.pdf

2003. The last period contains only 2003, which is the last year for which we can estimate our full model as specified in (1). Note that to estimate our model for 2003, we need data until 2005, because we are including two-year lead changes on earnings and investment variables as controls. However, in order to evaluate the recent period as thoroughly as we can, we also replace the two-year lead control variables by one-year leads. This enables us to include 2004 in our estimation window. Finally, for the most recent period, we split our sample into firms from developed and emerging markets, respectively.

Table 3.8 reports the results. If we look at the evolution of the coefficients on *XCash×Exchange*, we see that the premium that investors place on the excess cash of cross-listed firms is positive and significant even in the most recent period. The only exception is the estimated coefficient for the period 2000-2001.[104] During those years, investors did not seem to perceive cross-listing as an effective mechanism for tying tie insiders' hands. Interestingly, this period corresponds to the bursting of the Internet bubble and the rise in corporate scandals, when investors may have lost some trust in U.S. governance. However, when we consider the post-SOX period, we note that the excess cash of cross-listed firms is worth more than that of their domestic peers. If we look at columns 6 and 7, we observe that for the most recent period, this effect comes mostly from firms in emerging markets, while the value of the excess cash premium for developed markets firms is no longer statistically significant. In unreported tables, we obtain a similar outcome when we use any of the country-level indexes reported in table 3.6 to split the sample.

[104] A similar result is shown in Wojcik, Clark, and Bauer (2005). Following a different experiment, they observe that in 2003 U.S. cross-listed firms enjoyed a governance advantage over non-cross-listed peers, but this effect was weaker in 2000.

Table 3.8 Investors' valuation of excess cash holdings: temporal evolution

This table reports cross-sectional regressions and coefficient estimates for the market value of excess cash. The dependent variable is the ratio of market value (sum of the market value of equity and the book value of short- and long-term debt) divided by total assets. The independent variables include excess cash holdings *XCash* defined as the residual from regression (2) in the appendix. To identify firms' cross-listing status, we use different binary variables: *Exchange* equals one for firms cross-listed on a U.S. exchange and zero otherwise. *OTC* equals one for over-the-counter cross-listed firms and zero otherwise. *144A* equals one for firms cross-listed through private placements and zero otherwise. To assess whether investors' valuation of excess cash varies along with the different cross-listing types, we interact *XCash* with the cross-listing dummies. To control for investment opportunities we include *Sales Growth* (the percentage change in sales from *t-2* to period *t*) and *Global Industry q* (the median industry Tobin's q, defined as the median market-to-book ratio of all firms that share the same SIC code). All specifications also include a set of (unreported) firm-specific variables that serve as proxies for firm profitability, financial and investment policy as defined in the text. To assess the evolution of the marginal value of excess cash and whether there is still an effect today, we use different subperiods that correspond to distinct market periods. In column (1), the period 1991-1999 spans the phase preceding the bursting of the Internet bubble. In column (2), the period 2000-2001 corresponds to a bear market. In column (3), the period 2002-2003 maps the post SOX period but encompasses 2002 which still corresponds to a bear market episode. Column (4) considers only year 2003. That is the last year for which we can estimate our full model as specified in (1). Note that to estimate our model for 2003 we need data until 2005 because we are including two-year lead changes on earnings and investment variables as controls. To evaluate the recent period as much as we can we replace in columns (5), (6) and (7) the two-year lead control variables by only one-year leads. This enables us to expand our estimation window. Finally, in columns (6) and (7) we split our sample in firms from developed and emerging markets. respectively. All estimations only contain observations for which *XCash* is positive and include year and country fixed effects. We report heteroskedasticity and serial correlation robust t-statistics in brackets. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

	Full model				**One-year lead control variables**		
Variables	**1991-1999**	**2000-2001**	**2002-2003**	**2003**	**2003-2004**	**Developed 2003-2004**	**Emerging 2003-2004**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Exchange	0.025	0.513**	0.223**	0.188**	0.208**	0.318**	0.189**
	[0.59]	[9.23]	[4.27]	[2.68]	[6.58]	[6.22]	[2.82]
OTC	-0.08	0.047	-0.003	-0.001	-0.011	-0.018	-0.028
	[1.84]	[0.85]	[0.06]	[0.02]	[0.38]	[0.38]	[0.55]
144A	0.046	0.139	-0.05	-0.076	0.049	0.092	0.028
	[0.67]	[1.70]	[0.64]	[0.68]	[0.80]	[0.96]	[0.60]
XCash	0.583**	0.401**	0.495**	0.527**	0.555**	0.875**	0.318*
	[7.09]	[4.52]	[7.03]	[5.58]	[5.18]	[11.55]	[2.52]
XCash × *Exchange*	1.582**	0.601	0.881*	1.053*	0.913*	0.288	1.155**
	[4.59]	[1.47]	[2.24]	[2.15]	[2.21]	[1.55]	[3.12]
XCash × *OTC*	1.222**	0.101	0.574	0.508	0.497	0.302	0.588*
	[3.19]	[0.18]	[1.89]	[1.84]	[1.72]	[1.62]	[2.02]
XCash × *144A*	-0.144	-0.044	0.02	0.093	0.068	0.122	0.038
	[0.26]	[1.01]	[0.58]	[0.57]	[0.42]	[0.83]	[0.38]
Sales Growth	0.168**	1.151**	0.121**	0.098**	0.112**	0.182**	0.087*
	[6.42]	[5.34]	[5.86]	[3.51]	[4.02]	[6.45]	[2.32]
Global Industry q	1.235**	1.286**	0.576**	0.611**	0.667**	1.077**	0.388**
	[10.38]	[9.79]	[5.69]	[4.47]	[7.33]	[10.27]	[3.12]
Observations	13,810	7,411	10,934	5,747	12,742	9,423	3,049
Adjusted R^2	0.28	0.46	0.23	0.27	0.24	0.26	0.19

Our temporal analysis highlights several important facts. First, we illustrate that during the period comprising the bursting of the Internet bubble and the subsequent corporate scandals, such as those at Enron and WorldCom, investors downgraded their beliefs about the effectiveness of cross-listing to limit insiders' actions. This is consistent with the view that the scandals, which involved fraud and accounting irregularities, weakened investors' trust in the integrity of U.S. capital markets. In response, the U.S. Congress passed the Sarbanes-Oxley (SOX) Act of 2002, which aimed to offer enhanced transparency, accountability, and investor protection. If we look at the recent period, we see that investors again associate cross-listing with reduced risk of resource misallocation and consequently put a premium on the cash of firms that subject themselves to the U.S. financial system. This result is consistent with a recent study by Doidge, Karolyi, and Stulz (2008), who show that non-U.S. firms cross-listing on the New York Stock Exchange enjoy a valuation premium that is still present. Our contribution is to show that this valuation premium is partly explained by the efficacy of U.S. cross-listings in improving the efficient use of firms' liquid assets, especially for firms in emerging markets.

3.5. Conclusion

Recent research has shown that investors discount the value of corporate cash reserves when they are at high risk of being funneled into value destroying ventures. In this paper, we examine whether and how the stricter legal rules, the greater transparency, and the increased monitoring that accompany a U.S. cross-listing help mitigate this risk. Our analysis reveals that investors indeed perceive a U.S. listing as an efficient device to curb managers' misuse of cash reserves. In particular, we document that investors systematically place a valuation premium on the excess cash of foreign firms that cross-list on U.S. exchanges or over-the-counter compared with that of their domestic peers. Moreover, the excess cash premium turns out to be magnified for firms located in countries in which shareholder protection is weak. Also, despite many initiatives to improve governance practices worldwide, the valuation differential appears to be sustained in the long-run and is still present. Exploring more in more detail the origin of the reduction in misallocation risk, we find that two

complementary forces are at work. On the one hand, investors perceive the strength of U.S. legal enforcement and disclosure requirements as effective mechanisms for tying managers' hands. On the other hand, the additional scrutiny by financial analysts and large investors that accompanies a U.S. listing also enhances investors' confidence that cash reserves will be not be squandered.

In a nutshell, our results highlight that the potential for value destruction embodied in large corporate cash holdings is significantly lessened when foreign firms benefit from U.S. institutions and the U.S. monitoring environment. As such, this paper provides at least two important insights. First, we confirm that the value contained in cash holdings is largely determined by the existence and efficacy of mechanisms putting bounds on managerial actions. In this spirit, our results suggest that firms can take effective actions to acquire such mechanisms and hence cut back a substantial source of value loss. We provide evidence that a U.S. cross-listing turns out to be a valid option. Second, our analyses underline that legal constraints and external monitoring pressure operate hand in hand in securing the adequate use of cash reserves and, in turn, safeguarding firm value.

Yet our work leaves some questions unanswered. In particular and despite our best efforts, we are not able to fully explain the premium that investors place on the excess cash of firms that list over-the-counter. Although we document that part of the valuation premium is due to increased external monitoring, we believe that the unexplained portion could be attributed to additional disclosure and corporate governance rules that firms may voluntary choose to implement even if not required to do so. Also, our effort has been directed at understanding the impact of U.S. regulations and monitoring on the value of excess cash, but we note that those elements could also affect firm value positively or negatively through other channels. However, assessing the overall net impact on firm value is beyond the scope of this paper. Finally, our analysis does not address whether it would be better for certain firms, those with no investment opportunities, to unload their cash balances via dividends, stock repurchases, or paying off debt. These are important questions that we leave for future research.

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3.6. Appendix: Computing excess cash holdings

This appendix describes the methodology for computing excess cash holdings. We follow and adapt the approach of Dittmar and Mahrt-Smith (2007) and Opler, Pinkowitz, Stulz, and Williamson (1999). Specifically, for each country, we first estimate regressions to determine the normal level of cash holdings.[105] This choice is justified by the results in Dittmar, Mahrt-Smith, and Servaes (2003), who show that the level of cash depends crucially on country factors. We then define excess cash as the difference between actual cash and the predicted normal cash.

The excess cash measure that we use throughout the paper comes from the following specification:

$$\ln(Cash_{i,t}) = \beta_1 \ln(TA_{i,t}) + \beta_2 CF_{i,t} + \beta_3 NWC_{i,t} + \beta_4 \overline{MV_{i,t}} + \beta_5 Capex_{i,t} + \beta_6 Leverage_{i,t} + \beta_7 RD_{i,t} + \beta_8 DIV_{i,t} + \alpha_i + \phi + \eta_t + \upsilon_{i,t} \quad (2)$$

where *Cash*[106] is cash and marketable securities, *CF* is operating income minus interest and taxes. *NWC* is current assets minus current liabilities minus cash, and *MV* is the market value of the firm, computed as the sum of the market value of equity and the book value of short-term and long-term debt. This variable is further made instrumental using past sales growth; see below. *Capex* refers to capital expenditures. *Leverage* is the sum of short- and long-term debt. *RD* refers to research and development expenses. When *RD* is missing, we set its value to zero. *DIV* represents common dividend paid. All variables are scaled by total assets (*TA*). We also include firm (α_i), industry (ϕ). and time (η_t) fixed effects.

[105] Note that we also estimate one regression for all countries including country-fixed effects. This way of computing excess cash delivers similar results concerning the effects of cross-listing on the value of excess cash.
[106] For ease of notation, we drop the subscripts that refer to the firm *i* and respectively year *t.*

Several aspects of model (2) deserve additional comments. First, as noted in Dittmar and Mahrt-Smith (2007), the proxy for investment opportunities in (2), *MV*, presents a potential problem. Indeed, in the paper, we conjecture and provide evidence that excess cash affects firm value. Accordingly, it is problematic to also use this variable as a proxy for investment opportunities in regressions predicting cash levels. To address this concern, we follow Dittmar and Mahrt-Smith (2007) and employ an instrumental variable to control for investment opportunities. Specifically, we use two years lagged sales growth as an instrument for *MV*. As it is difficult to argue that current cash levels affect past sales growth, this measure is exogenous to cash decisions. As we show below, this instrument consistently identifies model (2) parameters.

Second, we include firm fixed effects in model (2), since some firms may genuinely hold larger cash balances than required for economic reasons.[107] Following the arguments of Dittmar and Mahrt-Smith (2007), we do not deduct the estimated specific firm effects when computing excess cash. Indeed, since firm fixed effects do not capture traditional determinants of cash holdings such as investment, hedging, and operational needs, they should be counted as excess cash.[108]

In Panel A of table 3.9, we present the estimation of model (2). First, columns 1 and 2 report pooled OLS coefficient estimates. In column 2, we replace *MV* by past sales growth to proxy for investment opportunities. In column 3–7, we apply an instrumental-variables approach to estimate model (2). Our estimates of excess cash throughout the paper are computed from the coefficients in column 3. These coefficients correspond to the mean coefficients of the country- specific regressions. The coefficient estimates are generally in line with previous related literature. We also report the results from the first-stage regression of the instrumental variable estimation in the last column. The strong positive association between past sales growth and market value supports of our instrument choice. We note that the results of the effect of cross-listing on the value of excess cash remain qualitatively the same if instead we use excess cash estimates based on coefficients in column 1 and 2.

[107] An F-test on the joint significance of firm-fixed effect confirms the need to account for firm-invariant effects (p-value equals to 0.001).
[108] See Dittmar and Mahrt-Smith (2007) for an illustrative example.

For robustness, we also estimate different alternative specifications of the normal cash regression where we include governance proxies as additional controls. Indeed, previous literature indicates a link between governance proxies and cash levels. In this spirit, we first follow the insights of Dittmar, Mahrt-Smith, and Servaes (2003), and include country-level governance variables. Specifically, we include the revised anti-director-rights index (column 4) as well as a dummy for the common-law legal origin (column 5). Since we cannot run country-by-country regressions when using country-level variables, we run a pooled estimation instead. Alternatively, we consider our two firm-level governance (monitoring) variables as predictors of cash level. In column 6, we include closely held shares and in column 7 we add analyst coverage. Our objective is to find a measure that represents the amount of cash that is at risk of being squandered by managers. Although governance quality affects firms' cash level, this channel is not justified for genuinely operational reasons. Accordingly, to have an accurate measure, we do not take into account the governance-variables estimates when computing the excess cash residuals. Reassuringly, those alternative specifications lead to the same conclusions on the interaction between cross-listing and cash and their effect on firm value presented in the body of the paper. Consistent with Dittmar and Mahrt-Smith (2007), the robustness of the results to different excess cash measures may be partly explained by the high correlation of the estimated excess cash across the different specifications and estimation techniques for the normal cash regression.

Panel B of table 3.9 displays the correlation coefficients between the seven specifications reported earlier. The magnitude of the correlation estimates ranges between 0.78 and 0.99. Finally, as we show in table 2 of the paper, using total cash and changes in cash instead of the excess-cash measure defined in this appendix also confirms the robustness of our value results.

Table 3.9 Predicting the normal level of cash

This table reports the regression results for the level of cash used to compute excess cash and the correlation between different measures of excess cash. In Panel A, the dependent variable is the natural logarithm of the ratio of cash divided by total assets. The regressors include: firm size (*Size*), EBIT to total assets (*CF*), net working capital to total assets (*NWC*), R&D to total assets (*RD*), market value to total assets (*MV*), capital expenditures to total assets (*Capex*), total debt to total assets (*Leverage*), total dividend paid (*Dividend*) and two-years lagged sales growth (*Sales Growth*). Column (1) and (2) report pooled OLS coefficient estimates. Column (2) replaces *MV* by past sales growth to proxy for investment opportunities. Columns (3)-(7) are estimated using an instrumental variables (IV) approach with past sales growth as an instrument for *MV*. The results of the first stage of the IV model (*MV* as dependent variable) are reported in the last column (8). The specifications in columns (4)-(7) are identical to (3) but include the following governance variables: *Revised Antidirector Rights* is an index measuring country-level investors' protection [from Djankov et al. (2006)]. *Common Law* is a dummy that equals one for Common law countries and zero otherwise [from la Porta et al. (1996)]. *CHS* represents the percentage ownership by large shareholders and insiders and *Coverage* is the number of analyst following the firm. All estimations include firm, industry and time fixed effects. Moreover specifications in (4) and (5) also include country fixed effects. We report heteroskedasticity and serial correlation robust t-statistics in brackets. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

Panel A : Regression results

	Pooled OLS		**Instrumental variables**					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**1st stage *MV* (8)**
Size	0.068**	0.063**	0.072**	0.099**	0.092**	0.102**	0.049**	-0.019
	[25.25]	[23.97]	[26.43]	[54.03]	[48.22]	[50.51]	[11.01]	[1.78]
CF	2.335**	2.351**	2.258**	2.372**	2.335**	2.411**	2.255**	2.266**
	[37.62]	[36.42]	[30.13]	[39.82]	[37.82]	[31.44]	[31.82]	[10.52]
NWC	-0.730**	-0.252**	-0.277**	-0.613**	-0.730**	-0.555**	-0.027*	-0.15*
	[10.72]	[4.48]	[4.14]	[8.99]	[10.70]	[5.87]	[2.32]	[2.03]
RD	0.038**	0.061**	0.023*	0.028**	0.023*	0.027	0.025	9.551**
	[3.79]	[5.98]	[2.29]	[2.56]	[2.09]	[1.65]	[1.61]	[3.06]
MV	0.048**		-0.048**	-0.050**	-0.058*	-0.101**	-0.066**	
	[8.53]		[3.10]	[3.16]	[2.50]	[3.73]	[2.80]	
Sales Growth		0.089**						0.277**
		[7.23]						[9.16]
Capex	-0.118**	-0.811**	-0.107**	-0.126**	-0.145**	-0.116**	-0.098**	
	[4.41]	[3.02]	[4.03]	[4.55]	[4.83]	[4.20]	[3.82]	
Dividend	-0.114**	-0.126**	-0.125**	-0.059**	-0.057**	-0.068**	-0.206**	
	[10.39]	[11.62]	[11.04]	[5.27]	[5.08]	[5.01]	[15.01]	
Leverage	-0.874**	-0.841**	-0.826**	-0.927**	-0.937**	-0.920**	-0.851**	
	[30.94]	[30.07]	[29.59]	[31.49]	[31.75]	[28.11]	[24.80]	
Revised Antidirector Rights				-0.292**				
				[9.08]				
Common Law					-0.210**			
					[20.64]			
CHS						-0.001**		
						[4.00]		
Coverage							0.007**	
							[7.86]	
By country estimation	yes	yes	yes	no	no	yes	yes	yes
Observations	59,072	60,406	60,406	58,462	57,983	44,484	40,980	60,406
Adjusted R^2	0.34	0.33	0.34	0.25	0.26	0.32	0.32	0.17
F-test: α_i=0 (*p*-value)	0	0	0	0	0	0	0	

Panel B : Correlations between the seven excess cash measures

Specifications	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1)	1						
(2)	0.8823	1					
(3)	0.8494	0.9579	1				
(4)	0.9955	0.8922	0.8441	1			
(5)	0.8128	0.8465	0.8756	0.8007	1		
(6)	0.8335	0.8547	0.9231	0.7886	0.9997	1	
(7)	0.8503	0.8999	0.8641	0.8528	0.9476	0.9135	1