Financial Strength and Product Market Behaviors: The Real Effects of Corporate Cash Holdings*

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Abstract

This paper empirically studies how corporate cash holdings affect product market decisions. Using U.S. intra-industry data from 1971 to 2005, the analysis reveals that larger relative-to-rivals cash reserves lead to systematic future market share gains that obtain at the expense of industry rivals. Noteworthy, this "competitive" effect of cash turns out to be magnified when rivals face tighter financing constraints and when firms intensively interact in their product market. Moreover, additional tests indicate that cash-rich firms partly gain market shares by drawing down their reserves to invest in fixed capital and R&D as well as to increase their labor force. From a different perspective, firms' cash policy also plays a significant pre-emptive role that distorts rivals' financial and real decisions. Specifically, consistent with a deterrence effect of deep pockets, incumbents' stock of cash significantly curbs the entry of potential competitors, and considerably hampers the expansion of rivals by constraining both their investment and acquisition policies. Overall, my results provide compelling evidence firm's cash policy encompasses a substantial and valuable strategic dimension

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1. Introduction

Contemplating the record amount of cash stockpiled by U.S. firms, the finance profession has started worrying about these large-scale cash hoards. In particular, observers have recently cast serious doubt on the rationale for such a cash-heavy status.[1] This growing concern has led to important research efforts intended to study the multifaceted dimensions of firms' cash policy. While 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 real effect on firms' day-to-day operations. This paper bridges part of this gap by examining whether and how cash reserves affect firms' product market decisions.

Following simple economic intuition, one may think of several reasons why cash holdings may influence a firm's product market choices and that of its competitors. Primarily, a cash-rich firm can actively use its war chest to finance competitive strategies. For instance, a firm can rely on a strong balance sheet to hurt rivals' bottom line and prospects through aggressive pricing; see Bolton and Scharfstein (1990). More generally, a firm may employ its cash reserves to fund a number of alternative competitive policies such as the location of stores or plants, efficient distribution networks, advertising targeted against rivals or even the staffing of more productive workers. From a different perspective, a firm's stock of cash can act as a signal about the possibility of aggressive behaviors, thereby distorting competitors' actions in the product market. Accordingly, one can view cash holdings as a pre-emptive 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 further understand the implications of corporate cash policy, this paper empirically explores the link between firms' cash holdings and their behavior in the product market. To this end, I start the analysis by arguing that irrespective of the mechanism at work, if cash holdings really matter in strategically influencing product market outcomes, we should observe cash-rich firms gaining market shares 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 shares expansion that obtains at the expense of industry rivals. More specifically, after controlling for relative size, fixed capital and R&D investment, selling expenses, leverage, labor productivity, past profitability as well as firm, time and industry specific effects, firms with markedly higher cash reserves expand market shares relatively more than their competitors in future years. The estimates reveal an economically

[1] "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.

important "cash" effect. Across all industries, a one standard deviation increase in relative-to-rivals cash holdings enables the average firm to gain 1.8% shares 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 impact of cash holdings on competitive performance depends on industry characteristics. In particular, I explore how rivals' financial statuses alter the competitive effect of cash holdings. Consistent with the idea that cash-richness 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 impacts. In particular, the effect of cash on market shares growth turns out to be two times larger in concentrated markets than in competitive markets. Moreover, the larger the fraction of growth options shared with rivals, the greater the effect of cash. In the same way, product market performance is more sensitive to cash in sectors where R&D efforts are crucial to reap market shares 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 be conditioned upon rivals' finance and related to industry characteristics.

To reinforce the interpretation of the results, I also explore the impact of relative-to-rivals 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 relative to their cash-poor rivals. This finding, which is robust to the inclusion of several control variables for investment opportunities suggest that the competitive effect of cash is value-enhancing.

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

Alternatively, I examine whether a firm's cash holdings play a pre-emptive role that distorts rivals' actions. In particular, I analyze whether incumbents' cash holdings influence the decision of firms 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 deterrence effect. Indeed, a one standard deviation increase in incumbents' cash reduces expected entries by 5%. Moreover, consistent with a curbing effect of incumbents' cash holdings, I further show that there is less entry in markets where deep-pocketed firms dominate the sales of their industry. With an analogous logic, I also look at capacity expansion decisions. Similarly to the effect on entry choices, cash reserves may alter rivals' expansion decisions. Using standard investment specifications, I find strong support for the claim that rivals' average cash reserves negatively impact expansion policy. Else being equal, firms competing against deep-pocketed rivals display investment rates that are 2 % 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 sub-optimally compared to what would be justified by growth opportunities. Taken together, these results unambiguously support the view that cash holdings play a strategic role that indirectly affect rivals' product market actions. Therefore, they suggest that the better performance of relative-to-rivals cash-rich firms is also partly due to the pre-emptive effect that large cash reserves have on competitors.

Overall, this paper contributes in two main areas. First, this study adds to the burgeoning literature on corporate cash holdings. By providing compelling evidence that cash policy encompasses a substantial product market dimension, this 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 efficiently take 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 significantly complete this line of research by showing that cash reserves bring real-side 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 its importance for product market success, the findings put in light one dimension for which the hoarding strategy turns out to be beneficial. On the other hand, the study also illustrates that a firm's cash reserves significantly affect rivals' actions. Noteworthy, this latter point suggests that cash policy might also encompass a precious signaling dimension.[2] Taken as a whole, the documented strategic effect of cash appears substantial. As such, it

[2] The idea that cash reserves serves a signalling purpose has recently been put forth by Servaes and Tufano (2007). In their international survey, they argue that cash holdings may play an important role in signalling firm quality to the stock market or to credit rating agencies.

needs to be taken into account when assessing the soundness of firms' levels of cash and to understand whether and how investors should be concerned.

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. Undeniably, 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 to an additional channel through which finance affect product market conduct. With this respect, the results highlight that the interactions between financial and real decisions clearly go beyond the association between debt financing and competitive strategies. In a related perspective, the analysis also pins down several direct and indirect mechanisms through which finance impact product market outcomes. In particular, by documenting that firms cash positions affect rivals' entry and expansion decisions, this study confirms that firms do not operate in isolation but incorporate rivals' financial status and competitive position into their decision process. This latter point calls our attention on the fact that firms' interactions need to be considered when investigating corporate financial decisions.

In the next section, I review the related literature and develop the main hypothesis. Section 3 describes the methodology and details the sample. Section 4 analyzes and characterises the impact of cash holdings on firms' product market performance. In section 5, I dissect the potential mechanisms through which cash reserves impinge on business performance. Section 6 concludes.

2. Related literature and hypothesis development

While much effort has recently been devoted to studying the determinants of firms' cash policy,[3] evidence on the implications of firms' cash reserves remains relatively scarce. There are, however few notable exceptions. Blanchard, Lopez-de-Silanes and Shleifer (1994), who study a small sample of firms that receive 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 put into light important facets of the

[3] 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).

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 on 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, a limited access to external funds can hinder a cash-poor firm's ability to fight competition 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 market shares building. In their model, firms directly decrease products' prices as a mean to secure long-term market shares 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 chest 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 indirectly influence other players' actions. Indeed, one can view cash reserves as a pre-emptive 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 behaviors 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 industries dynamics and hence, affect firms' competitive performance.[4] Similarly, cash holdings may act as a credible menace of competitive retaliation, i.e. a "second strike" capability against potential capacity expansion by industry rivals.[5] 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 product market mostly concentrates on linking firms' competitive performance to some measure

[4] In a recent paper, Hege and Henessy (2007) suggest another channel through which cash holding 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.

[5] 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.

of debt financing.[6] In view of that, deep pocketed firms are assumed to be those displaying low level of leverage. Specifically, due to their constrained 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 impacts of firm value and performance. This work draws attention on the fact that when external finance is costly, cash should not be considered as the negative of debt. In such a context, it is likely that cash and debt play distinct roles in influencing competitive outcomes.

Second, some recent works advocate that the supply of capital has important implications for corporate capital structure. In particular, Faulkender and Petersen (2006) show that, 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 might not necessarily indicate high debt capacity but might instead be a sign of saturated debt capacity. The same intuition also prevails in the work of Lemmon and Roberts (2006) and Sufi (2007). Under such circumstances, a low level of leverage might 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 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.[7] 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 upon their optimal amount of cash, firms take into account the risk that rivals might prey upon them. Considering three variables that proxy for predation risk[8], 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

[6] Noteworthy, while some studies report that high indebtedness leads to poor performance in the product market (e.g. 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 markets competition (e.g. Campello (2006), Lyandres (2006)).

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

[8] They consider industry concentration, similarity in firm's operation with its industry rivals and the extent to which a firm's growth opportunities co-vary through time with those of its industry rivals.

winning patent races in the U.S. pharmaceutical industry. To the extent that patents confer competitive advantages in the product market, their results confirm the idea that cash holdings are important drivers for product market success in this specific industry.

While those two papers provide primary evidence on a connection between cash and product market, whether and through which channels cash holdings affect a firm and its rivals' competitive behaviors remains an open question calling for more investigation. In this paper, I make a step towards that direction by empirically examining whether cash holdings encompass a strategic dimension. Also, I attempt to identify potential channels through which cash operate. To do so, I first hypothesize that if cash holdings matter in strategically influencing competitive outcomes, then one should ultimately observe, else being equal, cash-rich firms gaining market shares at the expense of industry rivals. In the following, I confirm this claim and provide compelling evidence on the mechanisms out of which cash policy affects competitive outcomes.

3. Methodology and data

3.1. Identifying the impact of cash on product market outcomes

As a first step to explore the interplay between cash holdings and product market outcomes, I investigate the link between cash and market shares 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 market. 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[9]:

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

where the subscripts *i* and *t* represents respectively the firm and the end of year. 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 proxies for market shares growth.[10] To reliably gauge the effects of cash holdings on market shares dynamics, I need to

[9] 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).

[10] In unreported tables, I re-do the analysis by modifying the dependent variables. Specifically I consider changes in a firm' percentage sales of its total industry sales to measure market shares growth. The results are virtually the same and are available upon request.

characterize a firm's cash position compared to 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% 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% cash deviation in an industry in which the standard deviation is 2% is likely to provide more strategic value than in an industry with a 15% 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 position. First, it is likely that cash holdings enable firms to fully invest 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 higher investment rate enables cash-rich firms to compete more successfully in the product market, one may expect that capital spending in one period translate into sales growth in the next period. Accordingly, the relationship between firms' market shares expansion and cash holdings should account for fixed investment (*Investment*). In a similar spirit, I also 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 firm's 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 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[11]. Since cash and debt are intimately related,[12] there is a possibility that a correlation between cash and market shares growth might just reflects the unspecified effect of capital structure. For that reason, I also include lagged *Leverage* in specification (1). Furthermore, I include past market shares development (*ΔMarketShares*) to capture the effect of other firms' characteristics that might 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.

[11] See Maksimovic (1995) for a survey.
[12] See for instance Acharya, Almeida and Campello (2007) or Gamba and Triantis (2007).

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 on the sensitivity of market shares' expansion to relative-to-rivals lagged cash holdings (ϑ). In other words, I focus on the statistical and economical significance of the residual correlation between cash and market shares 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.

3.2. Endogeneity of cash holdings

The literature on cash holdings raises two important concerns regarding the estimation of specification (1). First, Opler et al. (1999) and Bates et al. (2007), among others, document that cash holdings vary along 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 performance may be jointly affected by unobserved firm and industry factors. The second issue concerns the endogeneity of firms' cash policy. Indeed, knowing that cash holdings may help firms managing 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 a firm's cash policy.

Fortunately, the testing 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's 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 wiped out from the estimates. In a similar fashion, the inclusion of firm-fixed effect should capture unobservable firm effect and further limit potential spurious correlation.

A more important concern relates to the endogeneity of firms cash policy. As a matter of fact, 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 to relative-to-industry sales growth, aside through the cash channel itself. The literature on cash holdings provides guidance concerning possible identification strategies. While many variables have been documented to affect cash policy[13], I include in the set of instruments for cash two of its own lags, contemporaneous dividend payment as

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

well as contemporaneous asset tangibility. The lags of cash are used to capture differences in the levels of cash. Next, although payout policy correlates with cash, it may also contain information on a firm's access to capital (e.g. Fazzari, Hubbard and Petersen (1988)) and hence directly influences product market performance. However, the potential effects of finance constraints are unlikely to affect market shares' growth other than through their association either with cash or investment. Lastly, 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 asset should not influence its product market performance other than through the association with financial strength itself. To proxy for the tangible nature of a firm's asset, 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 identifying specification (1) parameters. Note also that in specification (1), I use one-year lag between the measurement of financial strength and the measurement of performance. This should further restrain the endogeneity bias.

As a result, I estimate the baseline 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 behaviors 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 shares' growth to relative-to-rivals cash. I adjust the estimates' standard errors for within firm-period error clustering and heteroskedasticity; see Petersen (2007).

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 when 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%. I classify product markets (industries) at the four-digit SIC level and restrict my focus on manufacturing firms (2000-3999 SIC's 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-year 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, while Appendix B presents the descriptive statistics.

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

4.1. Main findings

I start by estimating model (1) for firms in all industries where I use predetermined and z-scored cash to identify firms' financial strength. Table 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 shares' 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, everything else equal, a one standard deviation increase of relative-to-rivals' cash in year *t* leads to a 1.8% (significant at 1%) gain in market shares between years *t+1* and *t+2*. Noteworthy, the *p*-value associated with the tests of overidentifying restrictions (*J*-statistics) is well both above 10% (34%), confirming that the instruments over-identify the model's parameters.[14] 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 positively contribute to firms' market shares' 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 shares' 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.[15] These results are reassuring since they indicate that the effect of cash reserves on product market performance is not a by-product of that of capital structure. Noteworthy, the one-year lag R&D estimates 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 explain 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 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. Importantly for the rest of the analysis, while both estimations lead to similar qualitative conclusion, a Durbin-Hausman-Wu "endogeneity tests" strongly reject the null that OLS yields consistent estimates (*p*-values of 0.02). Hence, as expected, the endogeneity of cash

[14]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 shares expansion in the aftermath of unexpected economic downturn. This provide a natural way to investigate how firms use pre-existing financial conditions to react to new product market conditions. The results in appendix C confirms that cash help cash-rich firms to capture market shares to their rivals.

[15] 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. The results are available upon request.

significantly affects the OLS inference. Henceforth, I use instrumental variables estimations to consistently measure the cash-market shares sensitivities and use the same instrumental set to identify cash holdings. Note that in columns 3 and 4, I repeat this analysis by considering 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 shares via external growth. Column 1 of table 2 reveals that the competitive effect of cash is not altered by the inclusion of acquisition intensity (dollars spent in acquisitions scaled by assets). As expected, the one-year lag acquisition intensity positively contributes to market shares expansion, whereas the two-year lagged estimate exhibits 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. In column 2, I repeat this analysis by considering the sales contributions of acquisitions instead of the dollar amount spent in acquisitions. The results are virtually unchanged. I also take into account lagged cash flow to control for the residual effects of financial distress on sales growth not captured by past sales growth and investment. Column 3 reveals that this addition leads to similar results conclusions.

To further verify the validity of the inference, I estimate alternative versions of model (1). First, similarly to cash policy, fixed capital and R&D investment, selling efforts, debt levels and the firm's workforce 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-steps) GMM estimator. In addition to the variables used to instrument cash holdings, I follow Campello (2006) and instrument *Investment* using two lags of the capital stock and the others control variables with two of their own lags.[16] The results are presented in column 4. 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% level.

Another important concern relates to the use of z-scored cash to identify relative-to-rivals financial strength. Indeed, 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-years induces a skewed distribution of cash-to-asset ratios for each industry-year that might

[16] Campello (2006) argues that investment in a specific asset category should depend negatively on the initial stock of capital (*Capital Stock*).

twist the inference.[17] I address this concern in three different ways. First, in column 5, I restrict the sample to observations from industry-years with a minimum of 30 firms. In column 6, I avoid using standard deviation estimates and replace z-scored cash by its industry-adjusted value. Finally, following Campello (2006), I consider only observations from industry-years in which the skewness of cash-to-asset ratio is comprised between -1 and 1 and report the results in column 7. Although these estimations considerably lower the number of observations, 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 shares' expansion. In the following, I further characterize the nature of the competitive effect of cash.

4.2. Characterization: Inter-industry differences

As a first attempt to further dissect the nature of competitive effect of cash, I investigate how the effect of cash on market shares 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 amount of interactions between firms.

4.2.1 The effect of rivals finance

I start the inter-industry investigation by testing whether the impact of cash holdings on market shares gains is more pronounced in industries where rivals face more difficulty to obtain external funds. Indeed, we might expect the strategic effect of cash reserves to be larger when competitors are financially vulnerable. To examine this prediction, I use several proxies measuring the average industry rival's financial strength. 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 also consider industry *Net Leverage* to summarize rivals' balance sheet strength. In addition, I also use two indices of financial constraints encountered in the literature, namely the Kaplan and Zingales (1997) and the Whited and Wu (2006) index.[18]

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 into "Low" and respectively "High" industries. 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 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.

[17] Unreported figure displaying the distribution of the industry-year skewness confirms the need to address this issue.
[18] I define these two indices in appendix A.

Panel A of Table 3 reports which firms benefit more from large cash reserves to boost their market shares.[19] 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 shares growth to cash holdings is significantly larger in industries where rivals are relatively cash-poor. The coefficients decrease by 32% when moving 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 rivals translates into larger future competitive gains if average competitors have little internal resources.

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

Turning to the splitting based on the two financing constraints proxies, I obtain similar patterns. For both indices, a higher value indicates that firms face larger financing constraints. Noteworthy, the cash-market shares sensitivity is significantly larger in industries where the average competitor faces more financing constraints. In industry-year where the average rivals have difficulty accessing capital (large value of Kaplan and Zingales index), an extra unit of cash over competitors leads 2.4% market shares enhancement over rivals. Although significant at the 1% level, the effect is much smaller when competitors are relatively unconstrained.

Overall, the results I obtain when I split industry-year 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 upon competitors' financial status. In other words, this analysis provides supplementary evidence that the competitive impact of cash holdings is jointly determined 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-year where competitors turn out to be financially strong. This suggests that when facing financially tough competitors, building war chest enables a firm to perform better in the product market. Hence, cash holdings appear to play a systematic role in determining firms' performance in the product market

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 amount of strategic interactions between firms within an industry. Specifically, I examine whether and how the importance of cash reserves for product market

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

performance is related to competition risk, i.e. when it is more important to have available resources to fight competitors. Similarly to Haushalter et al. (2006), I assume that competition risk is positively related to the amount of strategic interactions between rivals firms. Hence, the higher interdependence between firms in a product market, the higher the costs of losing business shares. I use four different schemes to proxy for the risk of losing shares to rivals. The first measure I use as a proxy for the interdependence among firms 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.[20] The Census of Manufacturers reports these ratios every 5 years. Following the department of Justice's guidelines, I denoted as "concentrated" those industries for which the HHI index is greater than 1800, and as "competitive" those industries for which that index is less than 1000. In assigning firms into either concentrated or competitive markets, I use the timeliest information on their industries' HHI index within a five-year window from 1980 to 1999.[21]

As a second proxy for the competition risk, I follow Haushalter et al. (2006) and employ the co-variation 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).[22] Then I use the regression coefficient on the industry portfolio return to proxy for the interdependence of growth options. Acknowledging that such interdependence might change over time, I estimate this proxy using a 36 months rolling-regression approach.

The third proxy for the interdependence between firms is whether a firm operates at the technological core or fringe of its industry. 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.[23] 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 industry rivals and therefore, a higher risk of losing market shares.

The last proxy I use to characterize competition 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

[20] As noted in MacKay and Philips (2005), this measure of concentration provides us with an independent and reasonably timely measure of industry concentration.
[21] More precisely, I use the 1982 Census data for COMPUSTAT firm-fiscal years in the 1980-1984 period, the 1987 Census data for firms in the 1985-1989 period, the 1992 Census data for firms in the 1990-1994 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.
[22] Stock returns are from CRSP.
[23] Note that the industry year median is weighted by each firm's share of industry sales and excludes the firm itself.

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 conditionally on competition risk, I again split industries for each year and for each proxy into "Low" and "High" industries. Then, I estimate again equation (1) via a seemingly unrelated regression system combining the two industry subgroups based on the two years lagged rankings. I report the estimated cash-market shares (ϑ) sensitivities in panel B of Table 3.

Irrespective of the proxy, this table confirms that relative-to-rivals cash holdings have a differential impact depending on firms' exposure to competition risk. In particular, row 1 indicates that the importance of cash reserves to expand sales more than rivals is almost twice as large in concentrated markets than 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 using the correlation of a firm's stock returns with the stock returns of its industry to measure the interdependence between competitors. Noteworthy, 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 in R&D. Interestingly, this latter results substantiate 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 where R&D efforts are crucial to reap market shares.

While Haushalter et al. (2006) show that the average firm increases its holdings of cash when facing competition risk, the above analysis provides some evidence about 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 between rivals is important.

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 the competitive effects of cash affect firm value? To provide some evidence on the valuation consequences of the cash effects, I examine how measure 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 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 beside relative-to-rival cash, I include firm's *Size*, a dummy that equals one if the firm pays a dividend and zero otherwise, firm's *Cash Flow*,

Investment and *Leverage*. 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's value is significantly increasing in lagged *z-Cash* (0.061 with a *t*-stat of 7.18). All else equal, financially strong firms have higher valuation 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% increase at 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 4 is that a company with a lot of growth opportunities holds much larger cash balances than rivals. To further limit the potential effect of endogeneity inherent to the level of cash, I include four additional variables proxying for firms' growth options. Specifically, I introduce lagged relative-to-rivals R&D expenses, sales growth as well as lagged market-to-book ratio and ROA. In columns 2 and 4, although the magnitude of *z-Cash* coefficients slightly declines, they remain significantly positive.[24] In particular, with the additional control for growth options, a one standard deviation increase in cash relative to rivals breeds a 1.7% value premium over the average rival.

Overall, these findings are consistent with the hypothesis that financial strength positively contribute 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.

5. The origins of the competitive effect of cash

So far, the analysis has provided compelling evidence that cash-rich firms expand market shares relatively more than their industry rivals. While the above results 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 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 give a broad evaluation of some of

[24] Although I instrument cash 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.

these ideas by discriminating between direct and indirect effects of cash holdings on product market performance.

5.1. The use of war chest (direct effect)

To gain insights on the actual mechanisms driving the competitive effect of cash, I start by investigating whether and how cash-rich firms use their war chest to finance product market actions. Arguably, one can think of many channels through which a firm can strategically use its cash reserves. 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. To proxy for these potential channels, I consider five strategic ways to spend cash reserves: fixed capital investment, selling expense, R&D expenses, workforce growth and acquisitions.[25]

Table 5 shows how these spending patterns in year $t+1$ are related to relative-to-rivals cash holdings in year t. I restrict on firms that have positive relative-to-rivals cash holdings, that is, on 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 5 reveals that firms that are relatively richer than their rivals do spend an important fraction of their money. Indeed, we note that fixed capital investment, R&D expenses, selling expenses and workforce growth increase monotonically in relative-to-rivals cash for both high and low market-to-book firms. These patterns indicate that, else being equal, deep-pocketed firms invest a larger amount in strategies that can enhance their advantage in the product market. In contrast, we remark that spending on acquisitions does not increase with cash-richness since cash-rich firms with large growth opportunities spend less on acquisitions than firms with fewer internal resources. However, consistent with Harford (1999), last row of table 5 confirms that firms with low 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 to increase their workforce. To examine the whether these additional spending effectively provide a lead in the product market, I further investigate if the way cash-rich firms use their reserves explain their better performance in the product market. To do so, I hypothesize that if cash-rich firms use their war chest to finance successful competitive strategies, then the impact of past relative-to-rivals cash on market shares growth should be larger for firms that draw drawn their cash reserves and should depend on the way cash is spent. To

[25] 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.

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:

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

where the subscripts *i* and *t* represents respectively the firm and the end of year. 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 proxies 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) their cash holdings between year *t-2* and *t-1* and zero otherwise.[26] 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, workforce growth and acquisitions. Hence, in specification (2), the coefficient ϑ measures the effect of past relative-to-rivals cash holdings on market shares 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 firms fixed-effects (η_t and α_i).[27] 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 6. In column 1, we first remark that the coefficient on lagged *zCash* is of similar magnitude as in the baseline specification (1), confirming that cash-rich firms gain market shares 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 reserves 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 directly using their financial resources 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. 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 liquidity reserves and simultaneously increase capital spending are able to reap a larger fraction of the shares of

[26] Specifically, it equals one if $\Delta Cash_{t-1}$ is negative.
[27] The set of control variables comprises lagged: *Investment*, *R&DExpenses*, Δ*Labor*, *Leverage*, *Selling Expenses* and past Δ*MarketShares*.

their market in subsequent years. Similarly, columns 3 and 4 reveal alike effects when cash-rich firms use part of their war chest and boost R&D expenses (*ΔR&D*) or enlarge their workforce (*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 utilization 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 also to enlarge their workforce. On the other hand, the findings also demonstrate that firms' cash reserves affect their product market performance even when they do not directly employ their cash reserves. This latter observation suggests that a firm's cash holdings is likely to indirectly affect its' rivals product market decisions, thereby affecting competitive outcomes.

5.2. The pre-emptive effects (indirect effects)

5.2.1 Incumbents' cash and entry decisions

To examine whether a firm's cash reserves affect its rivals' decision, I first look at the effect of cash holdings on the dynamics of industry entries. Indeed, as put forth by Benoit (1984), the threat of aggressive behaviors by cash-rich incumbents may discourage potential entrants. Accordingly, if a firm's stock of cash strategically affects potential rivals' decisions, one can expect to see less entry in 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) on that year but not before.[29] Table 7 presents descriptive statistics for entrants and incumbents. Several interesting patterns emerge from this table. First, and as expected, entrants have markedly higher market-to-book ratio than incumbents, suggesting that firms 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 also note 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% 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, i.e. firms with sufficient internal funds and low leverage are more likely to enter product market. These findings support the view that only cash-rich firms can enter new product market and sustain the risk of tough competition.

[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 precisely determining the type of firm entry. For instance, I cannot distinguish between privately-held incumbents that go public and new firms that actually add productive capacity to their industry.

To expand on the informative findings of table 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' decision. To do so, I specify the following model of industry entry dynamics:

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

Where the subscripts *j* and *t* represent respectively the industry and the year. 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, I proxy for incumbents strength by using 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 equal, large cash holdings act as a credible threat and alter other players' behaviors 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 proxy for changes in industry demand conditions. Indeed, one can expect to see more entries in industry where business prospect 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 also 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 due to any potential misspecification I incorporate the lagged entry intensity. 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 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 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

[30] These series are taken from: http://research.stlouisfed.org/fred2/
[31] Alternatively, I estimate model (2) by OLS. This procedure yields similar results.

deterrence effect of incumbents' cash reserves and turns out to be economically important. Indeed, a one standard deviation increase in incumbents' cash reduces the expected entry intensity by 5%.[32] Turning to the control variables, the estimates roughly match with expectations. Indeed, the average size of incumbents is negatively associated to the number of entrants but industry average market-to-book, sales growth as well as changes in industrial production and GDP all positively predict entry decisions. 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 the entry of potential entrants.

To give additional support for 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. 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 cash-richest firms. This variable picks up information about the intensity with which cash-rich firms dominate their product market. 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 that the competitive position of cash-rich firms matters in strategically influencing entry decisions. In column 3, I refine the cash-richness criterion and classify firms as rich if they have larger cash reserves than the 75% of their industry-year rivals. Again, we notice less entry in product market dominated by cash-rich incumbents. Next, I include the average incumbents' cash holdings together with the market shares held by deep-pocketed incumbents. Worth noting, 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 above findings, I estimate alternative versions of model (3). First, I replace the average incumbents' cash holdings by its 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-

[32] Note that this represents the marginal effect evaluated at the mean values of the covariates.

[33] Note that in unreported table I also estimate model (2) by replacing the incumbents' average cash holdings by the average leverage ratio. Interestingly, all else 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.

to-asset 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 its median value. There is virtually no difference. Next, I change the proxy for industry entry by using the log(1+*#entry*) as dependent variable instead of entry intensity. Column 8 reports the estimates of the Tobit estimation. Confirming previous results, this modification does not bear any consequences.

5.2.2 Cash holdings and rivals' expansion

I continue the investigation of whether cash holdings influence rivals' actions by looking at expansion decisions. As a matter of fact, similarly to entry decisions, one may argue that large cash holdings can act as a credible threat of predatory retaliation, i.e. 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 baseline 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 respectively represent the firm, industry and fiscal year. 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 in the beginning of the year, divided by gross PP&E in the beginning of the year. I use this measure to proxy for 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's 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 report that firms' stock of cash is an important driver of corporate investment. Following their results, I also include lagged firm's 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

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

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

Table 9 displays the estimation results of the baseline investment specification (4). Noteworthy, column 1 reveals that the coefficient on the average rivals' cash holdings (χ) is significantly negative (-0.61) at the 1% 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%. In terms of magnitude, this represents a decrease of 2% (1.6%) of median (average) corporate investment. Notice that the signs of coefficients on the control variables display patterns that are consistent with previous research. Of particular interest is the coefficient on firm's own lagged cash holdings. Confirming economic intuition and the findings of Haushalter et al. (2006), firm's stock of cash allows flexibility over investment decisions and therefore positively predicts future investment spending. By and large, these estimates ascribe an important role for rivals' finance 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 year-to-year change in total asset (*AssetGrowth*). 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 sole expansion of capital assets. Similarly to the results obtained for fixed investment, column 2 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's acquisition intensity (*Acquisition*) in specification (4).[36] Noteworthy, column 3 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 carry on by examining how rivals' cash reserves modify the response of investment to proxy for investment opportunities. Indeed, if rivals' cash holdings really constrain a firm's expansion then we 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

[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, the coefficient of Tobin's q will be biased towards 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 using Erickson and Whited (2000) estimation procedure, 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.

[36] Note that this measure of acquisition prevents me to correctly identify 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 pre-emptive effect of cash, it also confers a strategic dimension to firms' cash holdings.

market-to-book ratio and my proxy for rivals' internal resources. Interestingly, columns 4 to 6 indicate that for the three measures of expansion, 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 sub-optimally compared to 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 lights 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).

5. 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 that obtain at the expense of industry rivals. Noteworthy, this "competitive" effect of cash turns out to be magnified when rivals face tighter financing constraints and when firms intensively interact 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 more in depth the origins of the positive effect of cash holdings on product market performance. Interestingly, cash-rich firms partly gain shares in their product market by drawing down their reserves to invest in fixed capital and R&D as well as to increase their labor force. From a different perspective, the analysis reveals that firms' cash policy also plays a significant pre-emptive role that distorts rivals' financial and real decisions. Specifically, consistent with a deterrence 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 lights 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. While this natural idea has recently emerged in diverse theoretical developments, it is fair to say that, so far, the empirical evidence remains patchy. All in all, I hope that the findings of this paper will encourage further research on the multifaceted interactions between firms, their rivals and their financial policies.

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Table 1. The impact of cash on market shares growth (Baseline Estimation)
This table displays results from the baseline specification (1). The dependent variable is Δ*MarketShares*, the annual market shares 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 asset. *Size* is the natural logarithm of assets. *Investment* is given by ($PPE_t - PPE_{t-1}$)/PPE_{t-1}. *R&D Expenses* is spending in 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 specifications include firm and time fixed effects. The sample period is 1973 through 2005. IV estimations display diagnostic statistics for instrument over-indentification 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 bracket. ** indicates statistical significance at 1% level; * indicate statistical significance at 5% level.

	(1) IV	(2) OLS	(3) IV	(4) OLS
$z\text{-}Cash_{t-2}$	0.018**	0.030**		
	[7.61]	[12.76]		
$z\text{-}Cash_{t-1}$			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]
$\Delta Labor_{t-1}$	0.078**	0.080**	0.082**	0.102**
	[8.88]	[9.66]	[9.75]	[12.16]
$\Delta Labor_{t-2}$	-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]
$\Delta MarketShares_{t-1}$	0.012*	0.012*	0.011	0.016**
	[1.99]	[2.08]**	[1.86]	[2.67]
$\Delta MarketShares_{t-2}$	-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	

Table 2. The impact of cash on market shares growth (Robustness)
This table displays additional results from the estimation of specification (1). The dependent variable is Δ*MarketShares*, the annual market shares 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 asset. All specifications include the same set of control variables as in table 1 [*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*. Furthermore, *Acquisitions* is the amount spent in acquisition over assets. *SalesAcquisitions* is the sales contributions of acquisitions. *Cash Flow* is net operating income divided by assets. All specifications include firm and time fixed effects. The sample period is 1973 through 2005. IV and GMM estimations display diagnostic statistics for instrument over-indentification 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 bracket. ** indicates statistical significance at 1% level; * indicate statistical significance at 5% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Additional Controls			GMM	#firms>30	Adj. Cash	Skewness
$z\text{-}Cash_{t-2}$	0.017**	0.015**	0.018**	0.020**	0.023**	0.155**	0.016**
	[7.13]	[5.51]	[7.64]	[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]					
$Cash\ Flow_{t-1}$			-0.066**				
			[3.83]				
$Cash\ Flow_{t-2}$			-0.023				
			[1.26]				
Control Variables from Specification (1)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# Obs	27347	21669	27792	29299	13671	29929	11734
R^2	0.26	0.28	0.26	0.18	0.33	0.22	0.34
J-statistic (*p*-value)	0.39	0.26	0.45	0.11	0.75	0.23	0.39

Table 3. Cross-industries impact of cash on market shares growth

This table reports the estimates for *z-Cash* (ϑ_t) from a series of IV estimations of model (1), The dependent variable is Δ*MarketShares*, the annual market shares growth given by industry adjusted sales growth at time *t* [($Sales_t - Sales_{t-1}$)/$Sales_{t-1}$]. I classify industries based on 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 1 [*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 a 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 1000 ("competitive industry") while *High*-concentration corresponds to an Herfindhal index above 1800 ("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 specifications include firm andtime fixed effects. The sample period is 1973 through 2005. The standards errors for the differences between High and Low are computed with a SUR system that estimates industry group jointly. *t*-statistics in bracket. ** indicates statistical significance at 1% level; * indicate statistical significance at 5% level.

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)	

Table 4. The impact of cash on firm value and operating performance

In columns (1) and (2), the dependent variable is (industry adjusted) *Market-to-book* ratio at time *t*. In columns (3) and (4), the dependent variable is (industry adjusted) return on assets (*ROA*) at time *t*. *Cash* is the ratio of cash and marketable securities divided by total asset. *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 is the firms pays dividend and zero otherwise. *R&D Expenses* is spending in 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 over-indentification restrictions (*p*-values for *J*-statistics reported).All specifications include 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 bracket. ** indicates statistical significance at 1% level; * indicate statistical significance at 5% level.

	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 5. Spending patterns based on market-to-book ratio and previous years cash holdings
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. 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 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]. ** indicates statistical significance at 1% level; * indicate statistical significance at 5% level.

	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] **	

Table 6. The impact of cash and the use of cash on market share gains (Direct effects)
This table displays additional results from the estimation of specification (1). The dependent variable is Δ*MarketShares*, the annual market shares 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 asset. All specifications include the same set of control variables as in table 1 [*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 decreased (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 specifications include firm and time fixed effects. The sample period is 1973 through 2005. IV estimations display diagnostic statistics for instrument over-indentification 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 bracket. ** indicates statistical significance at 1% level; * indicate statistical significance at 5% level.

	(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

Table 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 asset. *Leverage* is long-term debt over assets. *Market-to-Book* is the market value of equity plus the book value of assets minus book value of equity minus deferred taxes scaled by total assets. *Sales Growth* are 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

Table 8. The impact of cash on rivals' entry decisions (Tobit estimations)
This table displays the results of the Tobit estimations of the entry dynamics specification (2). 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 incumbents 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 baseline 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 replace the average as a proxy for financial strength and column (8) display the results when the dependent variable is *log(1+#entrants)*. All specifications include year and industry fixed effects. The sample period is 1973 through 2005. *t*-statistics in bracket. ** indicates statistical significance at 1% level; * indicate statistical significance at 5% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline			Additional Controls		z-scored	median	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

Table 9. The impact of cash on rivals' expansion decisions

This table displays the results of the estimation the effect of rivals' cash on 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 asset. *Market-to-Book* is the market value of equity plus the book value of assets minus 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 column (1), (2) and (5) the dependent variable is Investment, computed as $(PPE_t - PPE_{t-1})/PPE_{t-1}$. In column (3) the dependent variable is *Asset Growth* defined as $(Assets_t - Assets_{t-1})/Assets_{t-1}$. In column (4) the dependent variable is *Acquisitions* which represents the amount spent in acquisition over assets. All specifications include 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 bracket.

	(1)	(2)	(3)	(4)	(5)	(6)
	ΔPPE	Asset Growth	Acquisitions	ΔPPE	Asset Growth	Acquisitions
Rivals' Cash$_{t-1}$	-0.614**	-0.462**	-0.014**	-0.469**	-0.357**	-0.001
	[18.03]	[17.49]	[3.20]	[12.19]	[11.89]	[1.28]
Market-to-Book $_{t-1}$	0.041**	0.052**	0.001*	0.062**	0.066**	0.002**
	[30.65]	[48.66]	[2.58]	[21.23]	[29.98]	[6.03]
Cash Flow $_t$	0.329**	0.671**	-0.005**	0.327**	0.67**	-0.006**
	[29.93]	[55.55]	[4.14]	[29.79]	[27.43]	[4.25]
Size $_t$	0.018**	0.026**	0.007**	0.019**	0.026**	0.008**
	[8.68]	[45.68]	[27.79]	[8.84]	[15.81]	[27.89]
Cash $_{t-1}$	0.428**	0.061**	0.025**	0.425**	0.062**	0.024**
	[30.55]	[5.65]	[13.47]	[30.35]	[5.77]	[13.34]
Leverage $_{t-1}$	-0.3**	-0.26**	-0.019**	-0.302**	-0.258**	-0.019**
	[20.80]	[22.89]	[10.10]	[20.60]	[22.70]	[9.93]
Sales growth $_{t-1}$	0.14**	0.04**	0.001**	0.139**	0.039**	0.001
	[24.85]	[9.22]	[1.63]	[24.57]	[8.95]	[1.43]
Rivals'Cash $_{t-1}$ *x Market-to-Book* $_{t-1}$				-0.072**	-0.052**	-0.006**
				[8.06]	[7.28]	[5.46]
#obs	37973	38134	37676	37973	38134	37676
R^2	0.31	0.39	0.23	0.31	0.41	0.23

Appendix A : Definition of the main variables

Total Assets	Total assets (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}
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 1000
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
Asset Growth	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 gather in the Census of Manufacturers (editions 1982, 1987, 1992 and 1997)
#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: *W*W=-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

ΔGDP	Annual change in Real GDP from the Federal Reserve Bank of St.Louis[38]
Δindustrial Production	Annual change in the 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]
ΔCPI	Annual change in Consumer Price Index from the Federal Reserve Bank of St.Louis
ΔUnemployement	Annual change in unemployment rate from the Federal Reserve Bank of St.Louis
ΔFed Funds	Annual change in the Federal Reserve Fund 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

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, e.g. 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

Appendix C: Evolution through time

Bates et al. (2007) report that U.S. firms have significantly increased their cash holdings over the past 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 really business has become more risky and firms hoard cash to manage this risk, then we should observe that the effect of cash on business performance to mirror this trend. In this appendix, I investigate this claim by analyzing the time evolution of the cash-performance sensitivity. I proceed in two steps; first, I estimate the baseline equation (1) for each year and gather the cash-market shares sensitivity estimates (ϑ_t); second, I regress those estimates on a constant and a time trend. The first column of Table A presents the time trend estimate over the period 1970-2005. The 0.001 slope coefficient on time trend (*t*-stat of 4.82) establishes that the importance of relative-to-rivals cash in driving product market performance has been growing.[40] The Durbin-Watson statistic indicates the absence of first-order autocorrelation in the cash-performance sensitivities.[41]

Figure 1 further provides descriptive evidence of a remarkably upward trend in the cash-market shares sensitivity. To isolate secular from the cyclical movements in these estimates, I use the Hodrick and Prescott (1980) decomposition. The cash-market shares sensitivity turns out to be negative before 1978 and then drift upwards up to 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% gain in market shares over the 2004-2005 period. Overall, the estimated patterns show that the dependency of competitive performance on cash holdings has considerably increased over time. Noteworthy, unreported regressions indicate a parallel increase in the valuation of relative-to-rivals cash.[42] These trends crucially underline the increasing need of cash reserves to sustain performance in the product market and the associated valuation premium. Bates et al. (2007) mainly attribute the large build ups of cash to the increase in firms' cash-flow volatility. Complementarily, by emphasizing the increased importance of cash to perform in the product market, the above results provide a rationale for the evidenced 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 succeed in the product market depends on the stage of the business cycles. There are at least two reasons that may explain such cyclicality. First, in economic downturns, consumers' demand decreases. This translates into an overall change of 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 might be more difficult to obtain external financing; e.g. Bernanke and Blinder (1992). As a result,

[40] Note that I also estimate the baseline specification across sub-periods of different length (3, 5 and 7 years) and consistently observed 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.
[42] Full results are available upon request.

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 shares sensitivity responds to change in the economic conditions. Importantly, to account for the fact that firms may set their war chest in anticipation of macroeconomic movements, I use *unexpected* shocks to aggregate demand as conditioning variable. Hence, this setting provides me with a situation where 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.[43] 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 unforecasted shocks on the cash-performance sensitivity, I regress the time-specific sensitivity estimates (ϑ_t) on a constant, a time trend and *Unexpected Shocks*.[44]

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 non-anticipated negative shocks, the impact of cash on market share expansion turns out to be magnified. Movements in aggregate activity often correlate with the evolution of other macroeconomic variables. This may potentially distort the inference. According to Campello (2003), I include changes in the consumer price index (CPI), changes in the unemployment rate and changes in the Federal Reserve Fund Rate (Fed funds) as additional control variables. These variables are from the Federal Reserve Bank of St.Louis.[45] 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; e.g. 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.

[43] http://www.phil.frb.org/econ/spf/index.html
[44] 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.
[45] http://research.stlouisfed.org/fred2/

Table A. 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 Fed funds rate. The sample period is 1973 through 2005. DW gives the Durbin-Watson statistics. *t*-statistics in bracket.

	(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. 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 include only industrial firms (SIC code 2000-3999). Cyclical and secular movements in ϑ_t are isolated using the Hodrick and Prescott (1980) decomposition.