Information Asymmetry and the Value of Cash*

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Abstract

This paper investigates the value of cash for a broad international sample consisting of 7,474 firms from 45 countries over the 1995 to 2005 period. In contrast to previous papers which mostly focus on the marginal value of cash with respect to different corporate governance regimes, we study the marginal value of cash in connection with firm-specific and time-varying information asymmetry. We test two contradictory hypotheses. According to the pecking order theory, asymmetric information leads to adverse selection and provides a value-increasing role for internal funds. However, the free cash flow theory predicts that abundant cash bundled with asymmetric information leads to moral hazard and consequently to a lower marginal value of cash. Our results indicate that information asymmetry decreases the marginal value of cash and thus strongly support the free cash flow theory. This evidence is further emphasized by splitting the data according to governance measures.

Keywords: Information asymmetry, cash holdings, value of cash, analysts' forecasts

JEL classification: G32

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1 Introduction

JP Morgan economists have calculated that savings by companies in rich countries increased by more than $1 trillion from 2000 to 2004 and measured against the last 40 years companies have never hoarded so much cash as they do today.[1]

By observing this corporate behavior, a natural question to ask is which factors lead firms to accumulate such enormous amounts of funds. Finding possible answers to this conundrum is especially enlightening as the benchmark textbook model would tell us that under the assumption of perfect capital markets, cash holdings are irrelevant to the firm. The reason is that in this idealized situation external finance can always be obtained at fair terms. However, by looking at figures from the corporate landscape, the irrelevancy of cash is not supported. For example, the U.S. software giant Microsoft presented in its 2004 annual report a cash position amounting to $60.6 billion. However, amid growing investor pressure, Microsoft announced in July 2004 that it would pay a one-time dividend of $32 billion in 2004 and buy back up to $30 billion of the company's stock over the next four years. Upon the arrival of that news, Microsoft's stock price rose by 5.7% in the after-trading which exemplifies that cash can by no means be regarded as irrelevant in investors' eyes.[2]

Hence, in order to depict the current business setting some of the assumptions of perfect capital markets have to be relaxed. First, if transaction costs are incorporated into the model, an optimal cash balance will be determined and the irrelevancy of cash does not hold anymore. Second, if information asymmetry (henceforth referred to as IA) is considered in the analysis, adverse selection and moral hazard problems result. Focusing on adverse selection, the underlying model dates back to Myers and Majluf (1984), who explicitly consider the role of cash holdings in the presence of IA. Adverse selection leads managers to abstain from raising external capital as they are not willing to issue undervalued securities. Therefore, a cash buffer can prevent the management from being forced to pass up positive NPV projects. However, there are two sides to everything. In this respect, Jensen (1986) analyzes the agency costs of

[1] JPMorgan Research: Corporates are driving the global saving glut, June 24, 2005.
[2] The Wall Street Journal, Microsoft to Dole Out its Cash Hoard, July 21, 2004, p. A.1.

free cash flow and hence focuses on the dark side of cash holdings. His framework is based on moral hazard. Instead of paying out free cash flow to the capital providers, managers waste the funds on inefficient investments or on their own pet projects.

From the preceding discussion, it becomes obvious that cash holdings and IA are interrelated. This means that studying corporate cash holdings with an emphasis on IA could provide valuable insights into the firms' motivation to hold cash. This is exactly the novel path that our study takes and contributes to the literature. The existing cash literature can loosely be divided into two different strands. The first category examines the determinants of cash holdings and whether there exists an optimal amount from the perspective of the shareholders. The second approach focuses on the impact of liquidity on firm performance and firm valuation. Importantly, the empirical study presented in this chapter belongs to the second category. Potentially, it would be interesting to follow the first path and analyze how a firm's cash reserve is influenced by the level of IA. Yet, it is virtually impossible to derive clear predictions and to unambiguously interpret the results from following this path: On the one hand, according to the pecking order theory a firm should hold more money when the level of IA is higher, because financial slack is valuable. On the other hand, this argument is especially important for firms with greater investment opportunities and according to the pecking order firms should use cash in the first place. Thus, depending on the stance one adopts completely opposite predictions for the influence of IA on the level of cash can be derived. The free cash flow problem leads to similar ambiguous predictions. One can argue that firms with a higher degree of IA hold more cash, because the management is very reluctant to distribute excess cash to shareholders. However, it also can be argued that IA results in lower cash holdings, because the management can easily dissipate cash. These difficulties of formulating clear predictions explain why we follow the second strand of literature and investigate the influence of IA on the value of cash and not on the level of the liquidity. Specifically, we study the value implications of cash holdings under consideration of firm-specific time-varying IA.

We consider this approach to be a novel path as we analyze the value implications of cash holdings from a different angle. Although in the past researchers have already investigated the value consequences of corporate cash holdings, they did so with respect to corporate governance issues and not with an emphasis on IA. In this strand of literature, most authors find that a low corporate governance regime has detrimental effects on the value of corporate liquidity holdings (see, for example, Dittmar et al., 2003; Pinkowitz et al., 2006; Dittmar and Mahrt-Smith, 2007). However, we think it is very illuminating to focus on IA as another channel where corporate cash holdings can have benefits in line with the Myers and Majluf (1984) argument (as external capital is costly) and/or also costs according to Jensen (1986) (as increased managerial discretion could lead managers to squander corporate liquidity resources). We empirically test the two hypotheses and investigate which effect outweighs the other. In this respect, our sample is very extensive encompassing 7,474 firms from 45 countries for the period 1995 to 2005, which is equal to 42,476 firm-year observations. We also employ different estimation methods. Specifically, the results are calculated via fixed effects estimation techniques and also with the Fama-MacBeth procedure. We derive our results for the actual cash ratio and also with the help of an estimated metric called 'excess cash'.

Considering the actual cash ratio, our results reveal that the marginal value of cash (without considering IA) is on average around one dollar. However, by incorporating IA (dispersion of analysts' earnings forecasts), the marginal value of cash incurs a substantial valuation discount and is significantly decreased. This evidence provides an initial corroboration of the free cash flow argument by Jensen (1986). For our data set it seems to hold that the agency costs due to moral hazard tend to outweigh the benefits due to the availability of internal funds. However, in order to distinguish more precisely between our two opposing hypotheses, we split the sample according to governance and financing constraints measures. In this respect, we find that the value of cash is higher if governance is stronger which further emphasizes the free cash flow argument. On the other hand, the results based on the financing constraints measures do not paint a clear picture and hence no clear-cut conclusions can be drawn. As a robustness test of the results using the actual cash-ratio we derive a measure for excess cash based on Opler et al. (1999). Importantly, the results remain qualitatively the same for this different metric.

Taken together, the results have important implications and question generally accepted principles of the capital structure and the cash literature. We find no evidence that financial slack is valuable as predicted by the pecking order theory. From this it follows that it is not in the shareholders' interest that firms hold cash reserves because of IA. Hence, the precautionary motive to hold cash appears to be questionable. However, our findings do not contradict the pecking order theory in general. We do not argue that firms should not use internal funds in the first place, but we argue that firms should not accumulate cash with the intention to avoid external finance in the future.

This chapter proceeds as follows: Section 2 introduces the theoretical background, puts forward our hypotheses and reviews the related literature. Section 3 describes the data as well as the methods we use in this study. Section 4 continues by reporting the results from our empirical investigation and provides various robustness tests. Finally, Section 5 provides the concluding remarks.

2 Theoretical Background, Hypotheses, and Related Literature

2.1 Theoretical Background and Hypotheses

According to the pecking order theory (Myers, 1984; Myers and Majluf, 1984), firms prefer internal to external financing. This theory is based on an information advantage of the management. Due to IA, firms could be forced to forgo positive NPV projects if internal funds are not sufficient to finance the project. If such a situation occurs, financial slack is valuable. According to Myers and Majluf (1984), the only opportunity to issue stock without any loss of market value occurs if IA is nonexistent or at least negligibly small. This idea describes the notion of time-varying adverse selection costs.[3] Based on this observation there are periods in which firms are not restricted in their access to external capital and periods in which external finance is prohibitively costly. In the latter events financial slack, i.e., liquidity reserves, is especially important and should have a higher value.

[3] The idea of varying IA is implemented in the models of Korajczyk et al. (1992) and Viswanath (1993). They show that it can indeed be optimal for a firm to deviate from a strict pecking order rule, i.e., to finance a new project with new equity even if there are other financial resources available.

This reasoning boils down to the following hypothesis:

Hypothesis 1: In periods with a higher degree of IA cash has *more* value for a firm than in periods where the degree of IA is lower.

However, based on Jensen's (1986) free cash flow theory the complete opposite could be expected. Internal funds allow the management to shield themselves away from the rigor of the capital market, hence they do not need the approval of the capital providers and they are free to decide according to their own discretion. As the management is very reluctant to pay out funds to capital providers, the executives have the incentive to invest even when there are no positive NPV projects available, hence financial slack can have major disadvantages. Yet, this is not the end of the story. Even if there is more room for the management to use funds for value-destroying and self-serving projects when cash reserves are high, there are some limitations due to corporate governance mechanisms (e.g., the markets for corporate control (Stulz, 1988)). Nevertheless, the higher the degree of IA, the more difficult it becomes to distinguish between value-destroying and optimal investments. Due to the information advantage of the management, shareholders, for example, cannot always judge whether an investment has a positive NPV or, as another example, whether high cash reserves are based on an optimal liquidity management or whether they are the result of managerial risk aversion (Fama and Jensen, 1983).

This reasoning results in the following hypothesis:

Hypothesis 2: In periods with a higher degree of IA cash has *less* value for a firm than in periods with a lower degree of IA.

Importantly, we acknowledge that empirically testing these two hypotheses involves three major difficulties:

(i) *How to disentangle the two supposed effects of the conflicting hypotheses?* The two hypotheses result in the direct opposite expectation concerning the influence of IA on the value of cash. If no relationship can be found, it cannot be ruled out that both effects are at work and cancel each other out. Even if a relationship can be detected, it still cannot be ruled out that the opposite effect is also existent, but to a lesser degree. Given that we are ultimately interested in the overall effect, this does not pose a real problem. Nevertheless, it can be attempted to disentangle these two effects to some extent by splitting the sample into subgroups. The first hypothesis is strongly related with the access to external financing. Firms that face tighter financial constraints can be expected to suffer more, especially if the degree of IA is high. By splitting up the sample according to the degree of financial constraints, it is expected that the value of cash in conjunction with IA is higher in the subgroup encompassing the constrained firms. This finding would support Hypothesis 1, regardless of the overall effect. For firms with a weaker corporate governance structure Hypothesis 2 should be more relevant. By splitting up the sample according to this criterion, it can be expected that the value of cash in combination with IA is lower in the subgroup with a weaker governance structure. This result would support Hypothesis 2, regardless of the overall effect.

(ii) *How to measure firm-specific time-varying IA?* To analyze the relation between the value of cash and IA, a proxy for the latter is required. We have to rely on proxies that were used in previous research and are meanwhile well established. Nevertheless, the use of such a measurement is a crucial matter. The proxy we use is discussed in detail in the data section (refer to Section 3.1.1).

(iii) *How to measure the value of cash?* While our study represents, to the best of our knowledge, the first that investigates the influence of IA on the value of cash, it is fortunately not the first study that analyzes the value of cash in some other settings. Fama and French (1998) study the impact of debt and dividends on firm value. Pinkowitz et al. (2006) modified the method of Fama and French (1998) to estimate the marginal value of cash. Dittmar and Mahrt-Smith (2007) also use such a modified version of the method of Fama and French (1998) to estimate the impact of cash on firm value. Dittmar and Mahrt-Smith (2007) are interested in the value of liquidity in relation to a firm's corporate governance system. This approach can easily be adapted to the questions analyzed in our study. For a comprehensive explanation of the methods employed in this chapter refer to Section 3.2.

2.2 Related Literature

There is a growing literature that investigates the value of a (marginal) dollar (Pinkowitz et al., 2006; Dittmar and Mahrt-Smith, 2007; Faulkeneder and Wang, 2006). These papers are related to our work as they also study the value of cash and provide interesting and important findings on this matter, however, their theoretical framework is different from ours. They do not analyze the relation between the value of cash and firm-specific, time-varying IA. Nevertheless, in the literature various empirical papers can be found that are related to our research question and further motivate our two hypotheses. In the following, we refer to a few studies that (i) find evidence for the pecking order theory with time-varying adverse selection costs (background of Hypothesis 1), or (ii) empirically test the free cash flow problem (background of Hypothesis 2), or (iii) examine a related question based on these two theoretical concepts.

Autore and Kovacs (2006) empirically show that firms prefer to access financial markets for issuing equity when the level of IA is lower. This evidence supports their hypothesis and they show that including time-varying adverse selection costs in the pecking order theory can explain violations of exactly that theory. Given this finding, it can be expected that in periods with a higher degree of IA, cash is more important for firms and should have a higher market value. In contrast, Leary and Roberts (2007) do not confirm the results of Autore and Kovacs (2006) and argue that the variation of IA cannot explain the violation of the pecking order theory. The use of different measures of IA could be an explanation for these contradictory findings. While Autore and Kovacs (2006) use a firm-specific and time-varying proxy, Leary and Roberts (2007) estimations are based on an aggregated proxy similar to the one used by Choe et al. (1993). At this point, we would like to emphasize that we consider it of crucial importance to measure IA on a firm-level basis because we do not believe that IA behaves in the same way over time for all firms.

With respect to evidence for the free cash flow hypothesis, Nohel and Tarhan (1998) investigate the consequences of share repurchases on operating performance. Their empirical findings reveal that operating performance improves after share repurchases, but only for firms that have low growth opportunities. Contrary to expectations, the reason for the augmented performance is not associated with better growth opportunities following share repurchases but results from the more efficient employment of assets. Accordingly, the authors argue that this evidence can best be explained by the free cash flow hypothesis. Moreover, Shin and Stulz (1998) empirically show that segments of a diversified firm depend on an internal capital market and that agency costs have an effect on the efficient use of the internal capital market access. More direct evidence on the agency costs of managerial discretion in connection with corporate cash holdings is provided by Dittmar et al. (2003). They study more than 11,000 firms from over 45 countries and find that firms in countries with low investor protection hold double the amount of cash when compared to their counterparts in countries with a high level of shareholder rights. Their results become even more pronounced when they control for the capital market development. They argue that their results are in line with the hypothesis that in countries with a low level of shareholder protection, shareholders simply lack the means for forcing managers to pay out cash to them. The authors interpret their results as confirming the free cash flow hypothesis. Similarly, Kalcheva and Lins (2006) find that firms with low corporate governance at the corporate level hold more cash and this effect becomes stronger for firms in low investor protection countries. Moreover, Pinkowitz and Williamson (2004) focus on the influence of country-level investor protection on the value of cash holdings and their findings reveal that cash is worth less in countries where minority rights are weaker. Taken together, poor protection of investor rights at the company level as well as at the country level make it easier for the executives to dissipate cash for their own ends.

The paper by Lundstrum (2003) is closely related to our study as it also focuses on IA. Specifically, Lundstrum (2003) tests whether the benefits from accessing an internal capital market in order to avoid selling underpriced securities outweigh the agency costs created by the availability of liquid resources. On the one hand, building on the Williamson (1986) information cost theory, he argues that internal capital markets have a positive effect on firm value for two reasons. First, firms do not have to sell undervalued securities if IA masks the true value of the shares and, second, internal capital markets allow managers to undergo investments that the capital market would be unwilling to finance. The reason is that IA hinders managers in conveying their informational advantage credibly to the market. On the other hand, the free cash flow theory predicts that more liquid funds at the managers' discretion lead to agency costs due to money squandering. The reason for this stems from the fact that an internal capital market increases liquid assets and hence amplifies those agency costs. His results reveal that although access to an internal capital market exerts a positive effect on firm value, this result only holds for firms with a low level of IA. In the case of high information problems, no gains from the availability of an internal capital market can be realized. This corroborates the free cash flow theory.

3 Data and Methods

Our regression specifications are primarily based on the method of Fama and French (1998). These authors investigate how firm value is related to dividends and debt. Pinkowitz and Williamson (2004), Pinkowitz et al. (2006), as well as Dittmar and Mahrt-Smith (2007) use a modified version of this approach to estimate the value of cash holdings. We also employ this modified version for calculating our results. For this reason, we require variables on firm characteristics. On the one hand, we need variables on firm value and cash holdings and, on the other hand, various control variables have to be collected. These variables are listed and described in Section 3.2, where the estimation models are explained in detail. For the sake of investigating the influence of IA on the value of cash, a measure for IA must be constructed. This metric is explained in Section 3.1.1. Furthermore, in Section 3.1.3 we present the splits that are used to test for the influence of financial constraints and the corporate governance structure on the value of cash in conjunction with IA.

3.1 Data

3.1.1 How to Measure IA?

To this date, numerous studies have been published that use different proxies for IA. Certainly, no perfect measure for the level of IA can be found, but at least scholars have put forward different reasonable proxies.

Announcement effects can be captured to measure the level of IA (e.g. Choe et al., 1993). The reason is that announcements reveal information to the market. On the one hand, a lower price reaction indicates that the market participants are less surprised by the news, i.e., the level of IA was relatively low. On the other hand, a lower reaction could indicate a less important signaling role of corporate actions, which also means that the level of IA was relatively low. The main disadvantage of this proxy is that it can only be measured discretely at the time of an announcement and not continuously on a firm-level basis. Therefore, it can only be used for aggregated estimations.

Many studies use size (e.g. Ozkan and Ozkan, 2004) or the market-to-book ratio (e.g. Frank and Goyal, 2003) as a proxy for IA. Large firms are better monitored and more information is available. Growth opportunities entail more discretion and uncertainty for the future. However, size and growth as proxies are useful in capturing variation in the cross-section rather than the time-series variation (Autore and Kovacs, 2005). Accordingly, the use of these variables as proxies for IA can nullify the advantages of having panel data.

But there are also other proxies that can capture the time-series variation. Krishnaswami and Subramaniam (1999) discuss five different proxies (errors in analysts' forecasts, standard deviation of forecasts, normalized forecast error, volatility of abnormal returns around earnings announcements, and volatility in daily stock return) that are often used in corporate finance studies. The use of the volatility of returns around earning announcements as proxy is not a feasible method to measure IA in a large cross-country study. If we used the volatility in stock return as proxy, we would not be able to distinguish between the effect of risk and the effect of IA. The errors in analysts' forecasts capture the difference between the mean analysts' forecasts and the actual earnings per share. By referring to a study by Elton et al. (1984), the authors argue that the errors in analysts' forecasts are an especially appropriate proxy for IA. Specifically, Elton et al. (1984) find that the main part of the forecast error in the last month of the fiscal year can be explained by misestimation of firm-specific factors rather than by misestimation of economy or industry factors. Therefore, we will use this measure as one of our proxies for IA. Since this variable can be influenced by risk, Krishnaswami and Subramaniam (1999) divide the errors in analysts' forecasts by the volatility of the firm's quarterly earnings which results in the normalized forecast error. However, we are unable to apply this correction for risk because we do not have quarterly data for most of the countries. Therefore, we use the errors in analysts' forecasts (without normalization) only in a robustness test. In our main specifications, the dispersion of analysts' forecasts is our proxy for IA. This variable measures the deviation of the forecasts of different analysts. Greater disagreement among analysts indicates a higher level of IA. Importantly, Diether et al. (2002) provide evidence that the dispersion in analysts' forecasts is not a proxy for risk.[4] Moreover, different studies have confirmed the relationship between the dispersion in the forecasts and the level of IA. Parkash et al. (1995) analyze the relationship between firm-specific attributes and analysts' uncertainty in predicting earnings. They show that the amount and quality of information available about a firm significantly influence the volatility of the earnings forecasts. D'Mello and Ferris (2000) present evidence in line with a stronger announcement effect for firms whose forecasts exhibit lower dispersion. Another important reason for using the dispersion as our proxy is that it is also used by Autore and Kovacs (2006)[5] who find evidence—as mentioned in the theoretical section—that firms avoid accessing financial markets in periods with a high degree of IA.[6]

[4] They argue that dispersion cannot be a proxy for risk, because they find a negative relation between dispersion and the future stock returns. We control for the influence of such a relation on our results in the robustness tests in Section 4.3.

[5] The proxy for IA used by Autore and Kovacs (2006) is also based on dispersion, but they compute the variable in a different way. They divide the dispersion in a given quarter by the average of the dispersion in the prior four quarters. This is done in order to explicitly consider the time-variation of dispersion and not the cross-sectional variation. Since we have no quarterly data for most of our firms, we do not divide dispersion by the average of the prior dispersion. If we used the values of the prior years instead of the prior quarters, we would lose too many observations. Nevertheless, our estimations are also based on the time-variation of IA, because we estimate with fixed effects (and not with OLS), and therefore we focus on the within dimension. In a robustness test Autore and Kovacs (2006) also use the unscaled dispersion and estimate with fixed effects. They find the same relationship for this variable as in their main specification.

[6] Krishnaswami and Subramaniam (1999) use in their analysis two additional measures for IA which are not used in our study. First, they look at the reaction to the announcement of quarterly earnings. However, due to data limitations we cannot use this variable. Second, they use the residual volatility in stock returns as a proxy. We are reluctant to use this proxy, as one cannot distinguish between the effect of risk and the effect of IA. Another variable that is sometimes used in corporate finance studies to proxy for IA is the number of analysts covering a firm (e.g. Lundstrum, 2003). We do not use this variable, because we consider it rather as a proxy for the size of the firm.

For the calculation of the dispersion in analysts' forecasts, we use the one-year consensus forecasts of the earnings per share provided by I/B/E/S. Firm observations are excluded if the standard deviation of the forecasts is not based on the estimates of at least three analysts. The dispersion of the forecasts (defined as the firm-level standard deviation of all forecasts of the various analysts) is not updated each month for every firm. Accordingly, if we took the data only for one specific month, we would loose all firm-year observations for which we would have no (updated) estimate for this particular month. Therefore, we calculate for every year the average of the monthly dispersions.[7] In order to make the measure comparable for different firms, the standard deviation of the forecasts needs to be scaled. This is usually done by either dividing the standard deviation by the stock price, by the absolute value of the mean, or by the median forecast. However, we abstain from using the stock price for scaling and use the median[8] instead because our dependent variable (firm value) is related to the stock price. We realize that if we were to scale by the stock price, an endogeneity problem could occur. By adding one to the measure and taking the natural logarithm, our measure approaches a normal distribution. Thus, the measure equals:[9]

$$dispM = \ln\left(1 + \frac{standard\,deviation\,of\,analysts'forecasts}{|median|}\right) \tag{1}$$

where the standard deviation is the mean of the standard deviations taken over the entire year. The descriptive statistics of this variable is provided in Table 2 (refer to Section 3.2.1).

7 Towards the end of the year, the dispersion usually decreases because there is less room for unexpected events and less uncertainty. Since we do not have the dispersion for each firm for every month, this average could underestimate the dispersion of firms for which we have no observations in the first month of the year. Thus, we tested another method to calculate the average. Specifically, we computed the average for only a few months. For January and February a forecast is only available for a small portion of our sample firms and the dispersion varies widely. Therefore, we decided to use the average of the dispersion in March, April and May. The results do not change qualitatively.

8 The results do not qualitatively change if the mean is used instead of the median.

9 A more detailed version of this formula is presented in the appendix.

3.1.2 The Sample

Our data set covers the period from 1995 to 2005. All firms from the different countries are included for which I/B/E/S provides analysts' forecasts[10] and for which we can retrieve company data from Worldscope. We use yearly data because for most countries quarterly data are not available. Furthermore, because of their specific business environment, financial firms and utilities are omitted from the sample. Additionally, in order to ensure comparative data, firms whose fiscal year does not end with the calendar year have to be excluded. Importantly, to reduce the impact of outliers, we trim all variables at the 1% and the 99% tails. Finally, we exclude countries with fewer than 30 firm-year observations. In the most basic specification, the (unbalanced) sample consists of 7,474 firms and 42,746 firm-year observations from 45 countries.

3.1.3 Variables Used to Divide the Sample into Subgroups

We divide the sample into subgroups in order to test whether this has an impact on the way IA influences the value of cash.

The following variables are used to split the sample into subgroups (using median-splits) to investigate the influence of corporate governance variables. Table 1 contains a list of the countries contained in the sample and the descriptive statistics of the variables (measured at the country level).

Rule of law index: This measurement is provided by the Worldbank. Among other things, it captures—for the different countries—the extent to which agents have confidence in the rules of society, the quality of contract enforcement and the courts. It is assumed that firms in countries with a lower rule of law index generally have a weaker corporate governance structure. We use the index for the year 2000 (the year in the middle of the sample period).

[10] If for a firm the variable *dispM* cannot be calculated for at least one year, the firm is excluded from the analysis.

Corruption index: This value is also provided by the Worldbank. It measures the extent to which public power is used for private gains in different countries. Generally, firms in countries with a higher extent of corruption have a weaker corporate governance structure. Again, we use the index for the year 2000.

Anti-director-rights index: This index is an aggregated measure for the level of shareholder rights in a country. The index is taken from the data provided by the website of Rafael La Porta.[11] A detailed description of the construction of this index can be found in La Porta et al. (1998). Again, we use the index for the year 2000.

Legal system: Countries can be classified broadly according to their different law traditions. While civil law is based on a series of written codes or laws, common law is developed by custom. Importantly, La Porta et al. (1998) find that in common law countries shareholders are better protected against expropriation by insiders compared to civil law countries.

Closely held shares: While the previous measurements are only available at the country level, we additionally use a variable that can be derived at the firm level. This item measures the percentage of shares held by insiders. For splits that are based on this variable, we do not use median splits but apply different cut-off levels that are described later. The numbers are taken from the Worldscope database which provides a time series for this measure.

The following variables are used to split the sample into subgroups to investigate the influence of financing constraints.

Stock market capitalization to GDP: It is computed as the ratio of the value of listed shares in a country to its GDP. We expect countries with a higher score to have a higher developed capital market. Accordingly, firms in these countries should have better access to capital, i.e., they are less constrained. This variable is provided on the website of Ross Levine.[12] We use the values for the year 2000.

[11] http://mba.tuck.dartmouth.edu/pages/faculty/rafael.laporta/publications.html.
[12] www.econ.brown.edu/fac/Ross_Levine/Publications.htm

Private bond market capitalization to GDP: It is equal to the ratio of a country's private domestic debt securities (issued by financial institutions and corporations) to its GDP. The same argument applies as for the employment of the variable above. The data is also provided on the website of Ross Levine. Again, we use the values for the year 2000.

Firm size: The previous two measurements are only available at the country level. By using firm size as a proxy for the extent of financial constraints, the sample can be analyzed at the firm level basis. According to Almeida et al. (2004) small firms are rather constrained. Firm size is measured by the firm's market capitalization and is derived as a time series from the Worldscope database.

Payout ratio: Additionally, we use the payout ratio to proxy for financial constraints. It is defined as the ratio of total dividends and share repurchases to operating income. Almeida et al. (2004) put forward that firms with a small payout ratio are rather constrained. We obtain the variable as a time series from the Worldscope database.

Admittedly, there is not always a clear-cut distinction between the variables that are used to divide the sample according to the governance structure and those that are used for splitting according to financial constraints. For instance, the legal system is used as a proxy for the strength of the governance structure. At the same time, civil law countries generally have smaller and narrower capital markets (La Porta et al., 1998), i.e., the legal system could also be associated with financial constraints. For a careful interpretation of the results, this caveat has to be kept in mind.

Table 1: Observations per country and index values

country	N method 1	N method 2	corrupt. index	rule of law index	anti-dir. right index	stock-gdp ratio	bond-gdp ratio	com. law	civil law
Argentina	151	141	-0.40	0.07	4	0.44	0.05	0	1
Belgium	428	370	1.32	1.53	0	0.81	0.46	0	1
Brazil	515	356	-0.01	-0.21	3	0.38	0.09	0	1

(continued)

Table 1: —*continued*

country	N method 1	N method 2	corrupt. index	rule of law index	anti-dir. right index	stock-gdp ratio	bond-gdp ratio	com. law	civil law
Canada	1551	1023	2.25	1.87	5	1.16	0.22	1	0
Chile	395	78	1.50	1.23	5	0.86	0.17	0	1
China	816	0	-0.38	-0.42	.	0.42	0.09	0	1
Colombia	42	0	-0.51	-0.73	3	0.13	0.00	0	1
Czech Republic	51	0	0.39	0.51	.	0.21	0.07	0	1
Denmark	452	69	2.31	1.87	2	0.68	1.03	0	1
Finland	671	608	2.49	2.02	3	2.70	0.24	0	1
France	2090	1842	1.41	1.36	3	1.13	0.40	0	1
Germany	2005	1727	1.67	1.84	1	0.73	0.62	0	1
Greece	694	168	0.84	0.66	2	1.42	0.00	0	1
Hong Kong	941	64	1.43	1.44	5	3.76	0.18	1	0
Hungary	101	0	0.71	0.77	.	0.31	0.02	0	1
India	121	0	-0.31	0.15	5	0.37	0.00	1	0
Indonesia	572	0	-1.05	-1.03	2	0.28	0.01	0	1
Ireland	217	208	1.50	1.71	4	0.80	0.08	1	0
Israel	153	83	1.11	0.96	3	0.56	.	1	0
Italy	891	786	0.79	0.88	1	0.70	0.33	0	1
Japan	846	0	1.28	1.66	4	0.82	0.47	0	1
Korea, South	2100	0	0.33	0.52	2	0.56	0.40	0	1
Malaysia	891	312	0.21	0.39	4	1.46	0.49	1	0
Mexico	628	177	-0.49	-0.45	1	0.24	0.02	0	1
Netherlands	1036	919	2.30	1.89	2	1.81	0.47	0	1
Norway	580	73	2.07	1.90	4	0.39	0.20	0	1
Pakistan	40	0	-0.94	-0.75	5	0.09	.	1	0
Peru	104	77	-0.16	-0.60	3	0.23	0.04	0	1
Philippines	268	0	-0.53	-0.55	3	0.66	0.00	0	1
Poland	217	63	0.48	0.54	.	0.18	.	0	1
Portugal	227	211	1.37	1.07	3	0.60	0.25	0	1
Russia	54	0	-1.04	-0.99	.	0.22	.	0	1
Singapore	750	578	2.44	1.91	4	1.93	0.18	1	0
South Africa	168	51	0.49	0.15	5	1.77	0.09	1	0
Spain	619	542	1.62	1.29	4	0.84	0.15	0	1
Sweden	964	93	2.43	1.87	3	1.47	0.43	0	1
Switzerland	871	796	2.17	2.11	2	3.03	0.43	0	1
Taiwan	2057	0	0.63	0.76	3	1.02	0.26	0	1

(continued)

Table 1: —*continued*

country	N method 1	N method 2	corrupt. index	rule of law index	anti-dir. right index	stock-gdp ratio	bond-gdp ratio	com. law	civil law
Thailand	888	0	-0.37	0.30	2	0.36	0.12	1	0
Turkey	265	227	-0.36	-0.07	2	0.46	.	0	1
United Kingdom	2571	2316	2.10	1.80	5	1.93	0.20	1	0
United States	13102	11270	1.73	1.79	5	1.64	1.02	1	0

This table shows the number of observations (N meth.1, N meth. 2) of the countries that are included in the two regression specifications and it presents the values of the indices that are used to split the firms into subgroups by country characteristics. The definitions of the indices are provided in Section 3.1.3. A point indicates that for a country the index value is not defined.

3.2 Methods

In the cash literature, three distinctly different approaches to estimate the value of cash are pursued. For a higher reliability of our results, we use not only one but two of these methods. We focus on the approach by Pinkowitz et al. (2006) as our main regression specification and consider the approach by Dittmar and Mahrt-Smith (2007) as our main robustness test.[13] The following sections describe these two methods in detail.

3.2.1 The Approach by Pinkowitz, Stulz and Williamson (2006)

This estimation method is based on the valuation regressions of Fama and French (1998). Whereas Fama and French (1998) study the influence of debt and dividends on firm value, Pinkowitz et al. (2006) modify their approach to estimate the value of cash. The basic regression specification of Fama and French (1998) is:

$$\begin{aligned}(V_t - A_t) = \alpha &+ \beta_1 E_t + \beta_2 dE_t + \beta_3 dE_{t+2} + \beta_4 dA_t + \beta_5 dA_{t+2} + \beta_6 RD_t \\ &+ \beta_7 dRD_t + \beta_8 dRD_{t+2} + \beta_9 I_t + \beta_{10} dI_t + \beta_{11} dI_{t+2} + \beta_{12} D_t \\ &+ \beta_{13} dD_t + \beta_{14} dD_{t+2} + \beta_{15} dV_{t+2} + \varepsilon_t\end{aligned} \tag{2}$$

with:

V_t: Total market value of the firm

[13] The approach that is not used in this study is the method of Faulkeneder and Wang (2006). They regress the cash ratio (levels and differences) on the excess stock return.

A_t:	Book value of total assets
E_t:	Earnings before interest and extraordinary items but after depreciation and taxes
RD_t:	R&D expenditures
I_t:	Interest expenses
D_t:	Total dividends paid
dX_t:	Past two-year change of the variable X, i.e., $X_{t-2} - X_t$
dX_{t+2}:	Future two-year change of the variable X, i.e $X_t - X_{t+2}$

All variables are scaled by total assets (A_t). The dependent variable is the spread of value over cost. The control variables (levels and differences) are included in the model to capture expectations about future earnings and other effects that could influence the value of the firm. To estimate the value of cash, Pinkowitz et al. (2006) modify this regression in some aspects. As a main difference, they split up the change in assets into its cash and non-cash component. Furthermore, they use V_t (scaled by A_t) as the dependent variable, so that the coefficient of the cash variable can be interpreted as the value of one dollar. Additionally, they use one-year differences instead of two-year differences with the consequence that fewer observations are lost. Taken together, Pinkowitz et al. (2006) use the following regression specification:

$$\begin{aligned} V_t = \alpha + \beta_1 E_t + \beta_2 dE_t + \beta_3 dE_{t+1} + \beta_4 dNA_t + \beta_5 dNA_{t+1} + \beta_6 RD_t \\ + \beta_7 dRD_t + \beta_8 dRD_{t+1} + \beta_9 I_t + \beta_{10} dI_t + \beta_{11} dI_{t+1} + \beta_{12} D_t + \beta_{13} dD_t \\ + \beta_{14} dD_{t+1} + \beta_{15} dV_{t+1} + \beta_{16} dC_t + \beta 17 dC_{t+1} + \varepsilon_t \end{aligned} \tag{3}$$

with:

NA_t:	Net assets (book value of total assets minus cash)
C_t:	Cash
dX_t:	Past one-year change of the variable X_t, i.e., $X_{t-1} - X_t$
dX_{t+1}:	Future one-year change of the variable X, i.e., $X_t - X_{t+1}$

The model of Fama and French (1998) includes the leads and lags as proxies for expectations. An increase in cash holdings may also change expectations about future growth. Therefore, Pinkowitz et al. (2006) additionally use another estimation approach where they include the level of cash instead of the differences:

$$\begin{aligned} V_t = \alpha &+ \beta_1 E_t + \beta_2 dE_t + \beta_3 dE_{t+1} + \beta_4 dNA_t + \beta_5 dNA_{t+1} + \beta_6 RD_t \\ &+ \beta_7 dRD_t + \beta_8 dRD_{t+1} + \beta_9 I_t + \beta_{10} dI_t + \beta_{11} dI_{t+1} + \beta_{12} D_t + \beta_{13} dD_t \\ &+ \beta_{14} dD_{t+1} + \beta_{15} dV_{t+1} + \beta_{16} C_t + \varepsilon_t \end{aligned} \tag{4}$$

Since we appreciate this argumentation, we use the second approach as our main regression specification. Nevertheless, we also employ the first method as a robustness check to our results. The descriptive statistics of the data are presented in Table 2 (Panel A).[14] The values are very similar to those presented in Pinkowitz and Williamson (2004).

Table 2: Descriptive statistics

	Panel A					
variable	N	p10	mean	p50	p90	sd
V	42,746	0.515	1.280	0.962	2.370	1.030
dV(t+1)	42,746	-0.399	0.163	0.045	0.806	0.892
RD	42,746	0.000	0.016	0.000	0.053	0.041
dRD(t)	42,746	-0.001	0.001	0.000	0.005	0.012
dRD(t+1)	42,746	-0.001	0.001	0.000	0.006	0.012
E	42,746	-0.035	0.056	0.062	0.155	0.101
dE(t)	42,746	-0.051	0.007	0.008	0.064	0.064
dE(t+1)	42,746	-0.053	0.010	0.008	0.075	0.069
dNA(t)	42,746	-0.115	0.064	0.054	0.283	0.184
dNA(t+1)	42,746	-0.120	0.095	0.047	0.344	0.255
D	42,746	0.000	0.018	0.009	0.049	0.027
dD(t)	42,746	-0.010	0.002	0.000	0.016	0.020

(continued)

[14] The dividend payments include share repurchases as this is done in Pinkowitz and Williamson (2004) but not in Pinkowitz et al. (2006) and in Fama and French (1998).

Table 2: —*continued*

	Panel B					
variable	N	p10	mean	p50	p90	sd
dD(t+1)	42,746	-0.011	0.003	0.000	0.020	0.023
I	42,746	0.002	0.020	0.016	0.043	0.019
dI(t)	42,746	-0.008	0.001	0.000	0.010	0.010
dI(t+1)	42,746	-0.008	0.001	0.000	0.011	0.011
C	42,746	0.009	0.125	0.073	0.310	0.147
dC(t)	42,519	-0.063	0.006	0.002	0.082	0.080
dC(t+1)	42,587	-0.063	0.012	0.002	0.090	0.093
dispM	29,963	0.023	0.193	0.109	0.458	0.249
V2	25,777	0.937	2.050	1.470	3.630	1.910
dV2(t+1)	25,777	-0.498	0.275	0.083	1.170	1.570
RD	25,777	0.000	0.031	0.000	0.091	0.089
dRD(t)	25,777	-0.001	0.002	0.000	0.009	0.023
dRD(t+1)	25,777	-0.001	0.003	0.000	0.009	0.024
E	25,777	-0.042	0.065	0.076	0.189	0.155
dE(t)	25,777	-0.059	0.010	0.010	0.080	0.102
dE(t+1)	25,777	-0.059	0.014	0.010	0.094	0.102
dNA(t)	25,777	-0.143	0.066	0.058	0.327	0.231
dNA(t+1)	25,777	-0.144	0.117	0.050	0.414	0.345
D	25,777	0.000	0.024	0.011	0.062	0.037
dD(t)	25,777	-0.013	0.003	0.000	0.020	0.028
dD(t+1)	25,777	-0.014	0.004	0.000	0.024	0.033
I	25,777	0.003	0.021	0.018	0.042	0.019
dI(t)	25,777	-0.008	0.001	0.000	0.010	0.011
dI(t+1)	25,777	-0.008	0.001	0.000	0.011	0.013
C	25,777	0.009	0.177	0.069	0.417	0.345
dC(t)	25,742	-0.071	0.009	0.002	0.098	0.135
dC(t+1)	25,754	-0.071	0.014	0.003	0.109	0.152

(continued)

Table 2: —*continued*

	Panel B					
variable	N	p10	mean	p50	p90	sd
dispM	20,089	0.019	0.173	0.088	0.426	0.241
errorF12	19,229	0.000	0.331	0.065	1.020	0.927
lnCash	25,777	-4.700	-2.730	-2.670	-0.875	1.490
realNA	25,777	10.900	13.200	13.000	15.600	1.750
FCF	25,777	-0.070	0.019	0.035	0.119	0.142
NWC	25,777	-0.154	0.059	0.054	0.298	0.191
vola12	25,777	0.054	0.124	0.105	0.219	0.072
RD/sales	25,777	0.000	0.031	0.000	0.083	0.115
MV	25,777	0.871	1.660	1.330	2.830	1.080
SALESg	25,777	-7.240	17.000	9.400	46.500	33.800
leverage	25,777	0.016	0.250	0.239	0.476	0.177
DIVDUM	25,777	0.000	0.714	1.000	1.000	0.452
Capex	25,777	0.017	0.075	0.055	0.155	0.068

The table shows summary statistics (number of observations, 10% and 90% percentile, mean, median, and the standard deviation) of the scaled variables over the 1995 to 2005 period included in our two regression specifications. The variables in Panel A are required for the regression approach by Pinkowitz et al. (2006). The variables in Panel B are required for the regression approach by Dittmar and Mahrt-Smith (2007). The definitions of these variables are provided in Section 3.2.2.

Ultimately, we are interested in the value of cash holdings in connection with IA. In order to proxy for this effect, an interaction term (INT) is included in the model. This variable is calculated by multiplying the cash level (C) with the dispersion variable ($dispM$). Additionally, the variable $dispM_{i,t}$ as such is used as an explanatory variable to control for a direct influence of IA on firm value. The model is estimated by running a fixed effects regression. The fixed effects estimator focuses on differences within firms (the within dimension of the data). This is exactly what we need in order to investigate how the value of cash in a firm changes when the degree of IA varies over time. To control for macroeconomic effects, time dummies are included in the model. The preceding argumentation results in the following final model:

$$
\begin{aligned}
V_{i,t} = \alpha &+ \beta_1 E_{i,t} + \beta_2 dE_{i,t} + \beta_3 dE_{i,t+1} + \beta_4 dNA_{i,t} + \beta_5 dNA_{i,t+1} \\
&+ \beta_6 RD_{i,t} + \beta_7 dRD_{i,t} + \beta_8 dRD_{i,t+1} + \beta_9 I_{i,t} + \beta_{10} dI_{i,t} + \beta_{11} dI_{i,t+1} \\
&+ \beta_{12} D_{i,t} + \beta_{13} dD_{i,t} + \beta_{14} dD_{i,t+1} + \beta_{15} dV_{i,t+1} + \beta_{16} C_{i,t} \\
&+ \beta_{17} (C \times dispM)_{i,t} + \beta_{18} dispM_{i,t} + \alpha_i + \mu_t + \varepsilon_{i,t}
\end{aligned}
\tag{5}
$$

The statistical inference is based on Driscoll and Kraay (1998) standard errors.[15] These standard errors are not only heteroscedasticity consistent but they are also robust to very general forms of cross-sectional and temporal dependence. Moreover, robustness to cross-sectional correlation of the error terms of the individual firms is often mentioned (e.g. Fama and French, 1998) as the main advantage of the estimation approach of Fama and MacBeth (1973). Although the Driscoll and Kraay (1998) standard errors are robust to cross-sectional dependence, we additionally estimate the model with the approach of Fama and MacBeth as this method is more commonly used in the literature. By using the Fama-MacBeth procedure, however, one cannot control for unobserved firm effects.

3.2.2 The Approach by Dittmar and Mahrt-Smith (2007)

This section describes our second approach used to measure the influence of cash on the value of the firm in the presence of IA. This approach serves as a robustness test to the previous method. It is not used as the main specification for two reasons. First, our Hypothesis 1 is based on the pecking order theory. In a pecking order world there is actually no cash optimum which, however, must be known to calculate the variable 'excess cash' that is used in this approach. Second, the calculation of 'excess cash' requires more variables that are not available for all firms in the sample and, therefore, more observations drop out of the sample reducing the sample size substantially.

The approach by Dittmar and Mahrt-Smith (2007) is similar to the first method as it also

[15] Höchle (2007) shows in a Monte Carlo simulation that the finite sample properties of Driscoll and Kraay's nonparametric covariance matrix estimator are significantly better than those of commonly used alternatives in the case that cross-sectional dependence is present.

uses the valuation regressions of Fama and French (1998). However, instead of including as the independent variable the actual cash level or the difference, excess cash is calculated beforehand. Specifically, the necessary calculations are laid out as a two-step approach where in the first step the normal level of cash is predicted based on the specification by Opler et al. (1999). The residuals from the prediction regression, i.e., the difference between the actual cash level and the predicted cash ratio, are defined as 'excess cash'. This name stems from the fact that this level of cash can neither be justified under the transaction cost motive nor under the precautionary motive. The former hypothesis puts forward that a certain level of cash is necessary in order to economize on transaction costs (Keynes, 1936; Miller and Orr, 1966). Transaction costs are determined by characteristics that either increase the probability and costs of cash shortfalls or increase the costs of raising funds. In order to control for this effect, Dittmar and Mahrt-Smith (2007), following Opler et al. (1999), include net assets (total assets minus cash), net working capital, and a proxy for cash flow volatility in their prediction regression.

Apart from the transactions cost motive, a second driving force for holding cash is called the precautionary motive. It is built on the premise that financial slack is valuable if investment opportunities are expected and external finance is prohibitively costly due to adverse selection costs (see, in particular, Myers and Majluf, 1984). This implies that one also has to control for investment opportunities (market-to-book ratio), cash flow, and also for the access to external capital as proxied by firm size (book value of assets in 2000 U.S. dollars). However, as Dittmar and Mahrt-Smith (2007) have postulated, there are endogeneity problems if the raw market-to-book ratio is used to predict the normal level of cash in order to calculate excess cash, and then the latter variable is again used to predict the market-to-book ratio. Dittmar and Mahrt-Smith (2007) picked up on this issue and instrumented the market-to-book ratio with past sales growth ($SALESg$) and then used this instrumented market-to-book ratio in order to predict cash. We endorse their approach and also instrument the market-to-book ratio by the average of last year's and this year's sales growth. However, as a modification to Dittmar and Mahrt-Smith (2007) we also include capital expenditures, leverage, and a dividend dummy into the analysis in order to fully adhere to the standard approach by Opler et al. (1999).[16] Furthermore, based on the latter authors we also estimate the prediction regression with the Fama-MacBeth estimation approach.

Therefore, following Opler et al. (1999) and Dittmar and Mahrt-Smith (2007), the regression specification for estimating the optimal level of cash is defined as follows:

$$\begin{aligned}\ln\left(\frac{C_t}{NA_t}\right) &= \alpha + \beta_1 \ln(realNA_t) + \beta_2 \frac{FCF_t}{NA_t} + \beta_3 \frac{NWC_t}{NA_t} + \beta_4 (Vola12)_t \\ &+ \beta_5 \frac{\hat{MV}_t}{TA_t} + \beta_6 \frac{RD_t}{Sales_t} + \beta_7 \frac{Capex_t}{NA_t} + \beta_8 \frac{Debt_t}{TA_t} \\ &+ \beta_9 DIVDUM_t + SECTDUM + \varepsilon_t\end{aligned} \tag{6}$$

with:

C_t:	Cash
NA_t:	Net assets (book value of total assets minus cash)
$realNA_t$:	Natural logarithm of net assets in dollar terms for the year 2000
FCF_t:	Operating income after interest and taxes
NWC_t:	Working capital minus cash
$Vola12_t$:	Standard deviation of a firm's monthly stock return over the prior 12 months
$\hat{MV}_t$:	Market value of the firm computed as shares outstanding times price plus total liabilities (instrumented with the average of last year's and this year's sales growth ($SALESg$))
RD_t:	R&D expenditures
$Capex_t$:	Capital expenditures
$Debt_t$:	Total debt (interest bearing)
$DIVDUM_t$:	Dividend dummy which is set equal to one if the firm paid dividends or engaged in share repurchases and it is set equal to zero in all the other cases
$SECTDUM$:	Sector dummies

16 The exception is that Opler et al. (1999) also include a regulation dummy; however, we include sector dummies. Furthermore, as volatility measure we cannot use an industry sigma due to multicollinearity. Hence, we use the standard deviation of the firm's stock price instead as our volatility measure. However, our results remain qualitatively the same if we calculate the volatility of the cash flows averaged over our sectors and instead do not include the sector dummies in the prediction regression.

Excess cash (*ExCash*) is then calculated as the difference between the actual cash ratio and the exponential of the predicted log cash ratio. The descriptive statistics of the data are presented in Table 2 (Panel B). The values are broadly in line with those reported in Dittmar and Mahrt-Smith (2007). Having in a first step determined excess cash, Dittmar and Mahrt-Smith (2007) continue by calculating the effects of this variable on the value of the firm. This is of particular interest as excess cash filters out the component of the actual cash ratio that cannot be directly related to operational needs or investment opportunities for the future. Therefore, excess cash is held for discretionary reasons. Consequently, it is especially prone to managerial squandering, as by their very nature liquid assets can more easily be siphoned off when compared to plant or equipment. This means that excess cash is directly related to the free cash flow hypothesis of Jensen (1986). Taken together, as the emphasis of this chapter is to study the value consequences of cash in the presence of IA, excess cash can provide valuable insights in this setting. Like Pinkowitz et al. (2006)[17], Dittmar and Mahrt-Smith (2007) also use the valuation regressions of Fama and French (1998):[18]

$$
\begin{aligned}
V_{i,t} = \alpha &+ \beta_1 E_{i,t} + \beta_2 dE_{i,t} + \beta_3 dE_{i,t+1} + \beta_4 dNA_{i,t} + \beta_5 dNA_{i,t+1} \\
&+ \beta_6 RD_{i,t} + \beta_7 dRD_{i,t} + \beta_8 dRD_{i,t+1} + \beta_9 I_{i,t} + \beta_{10} dI_{i,t} + \beta_{11} dI_{i,t+1} \\
&+ \beta_{12} D_{i,t} + \beta_{13} dD_{i,t} + \beta_{14} dD_{i,t+1} + \beta_{15} dV_{i,t+1} + \beta_{16} ExCash_{i,t} \\
&+ \beta_{17} (ExCash \times dispM)_{i,t} + \beta_{18} dispM_{i,t} + \alpha_i + \mu_t + \varepsilon_{i,t}
\end{aligned}
\tag{7}
$$

The variables have already been defined in Section 3.2.1 and the calculation of the variable *ExCash* is outlined above. Following Dittmar and Mahrt-Smith (2007) all variables are scaled by net assets and the valuation regression is only calculated for positive values of excess cash.

[17] Please refer to Section 3.2.1 for details on the valuation regressions of Fama and French (1998).

[18] Dittmar and Mahrt-Smith (2007) argue that they only use the level of excess cash and not the change. One of the most important arguments is that a change in excess cash can potentially come from two sources: either a change in the level of cash or in the prediction regression. Hence, it is difficult to interpret the actual meaning of a change in excess cash. For the full reasoning, please refer to Dittmar and Mahrt-Smith (2007).

4 Empirical Tests of the Hypotheses

4.1 Results from the Approach by Pinkowitz, Stulz, and Williamson (2006)

Table 3 presents the estimation results of the model without IA. It provides a basis for the comparison of the estimated coefficients with those in other studies that do not analyze the influence of IA. Pinkowitz and Williamson (2004) also include fixed effects and Fama-MacBeth estimations for the cash level and cash changes for the whole sample. Most of the coefficients have the expected signs and many are very similar to those in Pinkowitz and Williamson (2004). Nevertheless, there are also numbers that differ significantly. For instance, they present a positive coefficient for the earnings variable (E) in the Fama-MacBeth model compared to a negative one for the fixed effects specification. In contrast, we find in both specifications a positive value. Such differences between the two estimation approaches are somewhat surprising. It could be explained by the fact that the Fama-MacBeth approach cannot control for firm fixed effects. However, we also present a coefficient that gets the opposite sign in each of the two estimation methods. The past change in earnings (E_t) gets a negative sign by the estimation with fixed effects and a positive sign by using the Fama-MacBeth procedure. However, the coefficient with the negative sign is not statistically significant. Interestingly, Pinkowitz and Williamson (2004) also get mixed signs for the variable E_t. While one explanation of this outcome is based on the differences in the model assumptions, we potentially see another reason in the way the changes of the earnings are calculated. Fama and French (1998) include the earnings changes as proxy for the expected growth of profits using two-year changes. Our study is based on Pinkowitz and Williamson (2004) and uses one-year changes having the advantage of more observations but possibly leading to a noisier proxy. In Section 4.3 the model is estimated with two-year changes as a robustness test. Additionally, other aspects could also explain why we get some different coefficients if compared to Pinkowitz and Williamson (2004). We estimate with an international sample and not only with U.S. firms. Furthermore, we control for macroeconomic effects by including time dummies. While we so far highlighted differences between the estimation methods, it should be emphasized that the majority of the estimated coefficients are consistent across the two models.

Table 3: Estimated value of cash

	all firms				non-U.S. firms			
	FixEf.		FMBeth		FixEf.		FMBeth	
	level	diff.	level	diff.	level	diff.	level	diff.
E	2.884***	2.678***	1.785***	1.325***	2.277***	2.204***	1.958***	1.919***
	(27.54)	(15.88)	9.7	(7.92)	(12.10)	(10.11)	(7.13)	(6.63)
dE(t)	-0.082	-0.157***	0.802***	0.808***	-0.220**	-0.269**	0.023	-0.027
	(-1.19)	(-2.93)	(4.12)	(4.02)	(-2.09)	(-2.20)	(0.10)	(-0.12)
dE(t+1)	1.729***	1.499***	1.793***	1.444***	1.118***	1.007***	1.058***	0.971***
	(27.26)	(25.55)	(11.77)	(12.14)	(8.32)	(9.78)	(5.50)	(7.21)
dNA(t)	0.322***	0.302***	0.760***	0.661***	0.255***	0.232***	0.542***	0.452***
	(12.88)	(15.40)	(8.32)	(7.93)	(14.30)	(12.16)	(6.53)	(5.65)
dNA(t+1)	0.588***	0.647***	0.455***	0.544***	0.588***	0.612***	0.469***	0.509***
	(8.42)	(10.06)	(4.42)	(4.93)	(8.52)	(8.92)	(3.90)	(4.05)
RD	4.011***	3.645***	5.672***	7.392***	1.654**	1.659**	6.107***	6.904***
	(18.38)	(12.37)	(13.22)	(14.26)	(2.47)	(2.14)	(9.79)	(10.05)
dRD(t)	1.689***	1.561***	2.585**	2.584**	1.836***	1.578***	2.173	1.981
	(4.83)	(5.17)	(2.68)	(2.34)	(3.85)	(3.19)	(1.76)	(1.60)
dRD(t+1)	6.326***	5.385***	8.643***	9.266***	3.593***	3.369***	7.526***	8.090***
	(10.96)	(15.41)	(8.90)	(10.33)	(12.19)	(11.62)	(8.39)	(9.32)
I	-0.342	-0.848***	0.967	-1.952**	-1.294***	-1.714***	-0.074	-1.555**
	(-1.47)	(-3.28)	(1.39)	(-2.50)	(-3.59)	(-4.66)	(-0.10)	(-2.40)
dI(t)	-1.169***	-1.161***	-0.516	0.090	-0.022	0.058	0.607	1.239**
	(-3.07)	(-3.64)	(-0.49)	(0.13)	(-0.05)	(0.14)	(0.91)	(2.29)
dI(t+1)	-2.861***	-3.577***	-2.739**	-4.334***	-2.073***	-2.623***	-1.525*	-2.416***
	(-9.87)	(-13.88)	(-2.93)	(-4.72)	(-7.41)	(-10.20)	(-2.16)	(-3.85)
D	1.162***	2.032***	7.150***	7.873***	2.229***	2.830***	7.571***	8.156***
	(3.06)	(5.97)	(25.61)	(28.50)	(4.15)	(5.48)	(12.31)	(14.71)

(continued)

Table 3: *—continued*

	all firms				non-U.S. firms			
	FixEf.		FMBeth		FixEf.		FMBeth	
	level	diff.	level	diff.	level	diff.	level	diff.
dD(t)	-0.392** (-2.19)	-0.426** (-2.52)	-2.350*** (-5.32)	-1.887*** (-4.16)	-0.484** (-2.46)	-0.496*** (-2.59)	-1.930*** (-3.93)	-1.733*** (-3.55)
dD(t+1)	0.623*** (4.51)	0.970*** (8.62)	2.754*** (8.65)	3.507*** (10.00)	0.868*** (4.63)	1.124*** (6.88)	2.846*** (6.54)	3.305*** (7.47)
dV(t+1)	-0.247*** (-5.67)	-0.288*** (-6.04)	-0.127 (-1.33)	-0.172 (-1.63)	-0.263*** (-4.65)	-0.289*** (-4.89)	-0.170 (-1.37)	-0.202 (-1.58)
C	**0.696***** (5.99)		**1.868***** (10.36)		**0.466***** (6.30)		**1.104***** (7.94)	
dC(t)		**0.809***** (17.31)		**1.324***** (5.62)		**0.552***** (9.80)		**0.780***** (3.89)
dC(t+1)		0.997*** (7.91)		1.146*** (4.62)		0.785*** (7.98)		0.830*** (3.84)
Const.	0.812*** (30.94)	1.021*** (82.11)	0.552*** (39.85)	0.792*** (28.58)	0.787*** (27.88)	0.960*** (55.88)	0.571*** (41.52)	0.695*** (41.01)
R^2	0.289	0.321	0.397	0.375	0.272	0.291	0.375	0.374
N	42746	42392	42746	42392	29644	29515	29644	29515
Groups	7474	7433	10	10	4991	4981	10	10

This table shows estimation results without IA for fixed effects regressions (FixEf.) and Fama MacBeth regressions (FMBeth) for the cross-country sample over the 1995 to 2005 period. The dependent variable in all specifications is the total market value scaled by total assets. The definitions of all variables are provided in Section 3.1.2. Year dummies are included in all specifications, but are not presented. Statistical inference is based on Driscoll and Kraay (1998). *t*-values are presented in parentheses. The R^2 of the fixed effects regression represents the R^2 of the within dimension. The R^2 of the Fama MacBeth regression is the average value of the R^2 of the single years. ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

Importantly, the coefficients of interest are the one of cash (C) and that of the cash change (dC_t), respectively. By interpreting the results we focus on the fixed effect specification that includes the level of cash because we consider this method as the most appropriate one. The results of the other specifications are also presented whether the results are robust or not. Additionally, estimations are presented where all U.S. firms are excluded. This is done to check whether the findings are driven by the large fraction of U.S. firms in the sample. The coefficient of cash for the whole sample is 0.696 and it is strongly significant. This figure can be interpreted as the marginal value of one unit of money. The comparable coefficient in Pinkowitz and Williamson (2004) is equal to 1.05. As their sample is not laid out in an international setting, this value should rather be compared with that of Pinkowitz et al. (2006). Unfortunately, they do not present this coefficient for the whole sample but only for subgroups. In addition, they only use the Fama-MacBeth approach for deriving their calculations. Their estimated coefficient of C—depending on the subgroups (high versus low corruption)—ranges between 0.03 and 1.24. Hence, our coefficient lies in this range and is therefore a plausible outcome. Considering our results from other estimation methods included in Table 3, it becomes obvious that the coefficient of C and dC_t considerably varies with the model. However, by comparing the results of the sample that includes the U.S. firms and the sample without U.S. firms, it can be noticed that the differences between the coefficients based on the two samples are consistently found, i.e., the coefficient of cash (and the change of cash) for the sample with U.S. firms is higher in every specification. This corresponds to the results derived by splitting the sample in other subgroups. Therefore, we do not claim to estimate the effective marginal value of cash. We only claim to be able to roughly evaluate whether the value of cash differs in subgroups and whether the effect of IA on cash is positive or negative. The limitation of the interpretation of the isolated numbers becomes particularly apparent when the scaling of the variables is changed (e.g., net assets instead of total assets). When we change the scale we find qualitatively the same results, but the coefficients of C and dC_t considerably change in some specifications.

Table 4 presents the results of the models that include the dispersion of analysts' forecasts ($dispM$) and its interaction with cash. Again, the estimation is carried out for the whole sample as well as for the sample without U.S. firms. The observations for which *dispM* is not defined drop away. The numbers of groups stay the same because in a first step we exclude all firms for which *dispM* is not defined in at least one year. In all specifications we find a significantly negative coefficient for the interaction variable. Apparently, the results clearly support our Hypothesis 2 and not Hypothesis 1. That means that the value of cash is not higher when the degree of IA is higher—it is even lower. Thus, the free cash flow problem seems to be more relevant in relation to IA than the advantage of having a liquidity reserve when raising external funds is difficult. To see whether the negative effect of IA on liquidity is also economically significant, we calculate—despite our own reservations—the marginal value of cash and the influence of IA. By including an interaction term in the analysis, the marginal value of cash has to be calculated as follows:

$$\frac{V}{A} = \alpha + ... + \beta_c \frac{C}{A} + \beta_{INT} \left(\frac{C}{A} \times dispM \right) + \beta_{dispM} dispM \tag{8}$$

$$\frac{\partial \frac{V}{A}}{\partial \frac{C}{A}} = \frac{\partial V}{\partial C} = \beta_c + \beta_{INT} dispM \tag{9}$$

Table 4: Estimated value of cash in relation with IA

	all firms				non-U.S. firms			
	FixEf.		FMBeth		FixEf.		FMBeth	
	level	diff.	level	diff.	level	diff.	level	diff.
E	4.305***	3.983***	2.448***	1.872***	4.299***	4.206***	3.032***	3.106***
	(18.94)	(12.97)	(12.31)	(7.90)	(10.18)	(10.20)	(6.61)	(6.99)
dE(t)	-0.368***	-0.396***	0.789**	0.804**	-0.736***	-0.824***	-0.269	-0.399
	(-3.04)	(-2.94)	(3.15)	(3.07)	(-3.39)	(-3.62)	(-0.92)	(-1.41)
dE(t+1)	2.487***	2.164***	2.339***	1.771***	1.948***	1.736***	1.366***	1.126***
	(23.74)	(22.83)	(14.32)	(12.43)	(10.36)	(11.93)	(6.74)	(7.03)
dNA(t)	0.329***	0.312***	0.819***	0.712***	0.228***	0.228***	0.600***	0.497***
	(9.04)	(10.66)	(8.17)	(7.64)	(11.78)	(11.19)	(5.90)	(5.24)
dNA(t+1)	0.579***	0.646***	0.447***	0.558***	0.568***	0.583***	0.461***	0.510***
	(6.84)	(8.56)	(4.05)	(4.78)	(7.07)	(7.49)	(3.72)	(3.89)
RD	5.022***	4.280***	5.833***	7.660***	0.979	0.718	5.655***	6.602***
	(19.19)	(11.87)	(10.24)	(11.84)	(1.18)	(0.82)	(7.40)	(7.65)
dRD(t)	1.104**	1.296***	2.195**	2.496**	2.405***	2.281***	3.469**	3.015*
	(2.06)	(2.69)	(2.79)	(2.42)	(4.17)	(4.00)	(2.46)	(1.99)
dRD(t+1)	6.568***	5.454***	8.700***	9.454***	3.025***	2.736***	6.960***	7.736***
	(8.90)	(9.74)	(8.39)	(8.61)	(3.59)	(3.42)	(5.93)	(6.78)
I	-1.318**	-1.706***	0.738	-2.857***	-2.564***	-2.836***	-1.077	-2.992***
	(-2.44)	(-2.64)	(1.01)	(-4.26)	(-4.74)	(-5.58)	(-1.18)	(-3.98)
dI(t)	-0.728	-0.774	-0.590	0.422	1.284**	1.253***	1.719**	2.673***
	(-1.56)	(-1.53)	(-0.44)	(0.48)	(2.46)	(2.61)	(2.28)	(4.01)
dI(t+1)	-3.571***	-4.413***	-2.997**	-5.126***	-2.606***	-3.147***	-1.085	-2.237**
	(-9.35)	(-12.20)	(-2.97)	(-5.02)	(-5.82)	(-7.50)	(-1.02)	(-2.43)
D	0.088	1.152***	6.740***	7.470***	0.629	1.337***	7.197***	7.777***
	(0.20)	(3.13)	(20.94)	(20.69)	(1.25)	(2.93)	(12.06)	(15.53)

(continued)

Table 4: —*continued*

	all firms				non-U.S. firms			
	FixEf. (level/diff.)		FMBeth (level/diff.)		FixEf. (level/diff.)		FMBeth (level/diff.)	
dD(t)	-0.324 (-1.37)	-0.367* (-1.78)	-2.478*** (-5.13)	-1.853*** (-3.77)	-0.299 (-0.98)	-0.349 (-1.13)	-1.945*** (-4.82)	-1.673*** (-3.86)
dD(t+1)	0.102 (0.55)	0.571*** (3.04)	2.483*** (7.50)	3.393*** (8.65)	0.201 (0.62)	0.494 (1.63)	2.763*** (5.25)	3.263*** (6.12)
dV(t+1)	-0.272*** (-5.66)	-0.305*** (-6.09)	-0.142 (-1.44)	-0.178 (-1.62)	-0.280*** (-4.64)	-0.298*** (-4.86)	-0.186 (-1.35)	-0.209 (-1.46)
dispM	**0.009** (0.42)	**-0.062***** (-4.71)	**-0.033** (-1.00)	**-0.052** (-1.27)	**0.036** (1.28)	**-0.063***** (-3.21)	**0.179***** (3.77)	**0.160**** (3.01)
C	**0.782***** (4.50)		**2.118***** (10.84)		**0.391***** (4.53)		**1.308***** (6.48)	
dC(t)		**1.007***** (12.03)		**2.050***** (6.08)		**0.695***** (7.61)		**1.436***** (4.78)
dC(t+1)		1.009*** (6.88)		1.220*** (4.60)		0.803*** (6.87)		0.847*** (3.95)
C×dispM	**-0.594***** (-3.34)		**-0.326*** (-1.96)		**-1.041***** (-10.24)		**-0.512**** (-2.45)	
dC(t+1)×dispM		**-1.149***** (-5.99)		**-3.400***** (-6.12)		**-0.885***** (-6.52)		**-2.544***** (-4.30)
Const.	0.925*** (21.51)	1.016*** (45.24)	0.535*** (29.21)	0.815*** (36.81)	0.751*** (21.93)	0.945*** (36.47)	0.494*** (24.92)	0.629*** (27.21)
R^2	0.346	0.376	0.433	0.409	0.334	0.351	0.426	0.424
N	29963	29708	29963	29708	19661	19585	19661	19585
Groups	7474	7412	10	10	4991	4970	10	10

Estimation results with IA for fixed effects regressions (FixEf.) and Fama MacBeth regressions (FMBeth) over the 1995 to 2005 period. The dependent variable in all specifications is the total market value scaled by total assets. Definitions of all variables are provided in Section 3.1.2. Year dummies are included, but are not presented. Statistical inference is based on Driscoll and Kraay (1998). *t*-values are presented in parentheses. The R^2 of the fixed effects regression represents the R^2 of the within dimension. ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

Considering the results of the fixed effects estimation with the cash level, the coefficient of C is 0.782 and that of the interaction is -0.594. Based on the median value of *dispM* (0.109, see Table 2) the marginal value of cash is 0.717. An increase in the degree of IA of one standard deviation (0.249, see Table 2) results in a marginal value of cash that is 0.148 units of money lower, i.e., the marginal value amounts to 0.569. We conclude that the negative effect of IA on cash is substantial. To control for the direct influence of the dispersion on the firm value, we also included the variable *dispM* by itself. We did not formulate an explicit expectation on the coefficient of this variable. The results reveal that there is no clear relationship. In some specifications it is negative; in others it is positive. The negative relationship can be explained by the fact that IA in general is something unfavorable. Another explanation could be based on a possible correlation with a firm's risk. A possible reason for a positive result could be related to the model of Miller (1977). He argues that under certain assumptions a higher divergence of opinions among investors tends to increase the market value of securities as only the most optimistic investors engage in trading.[19]

In Table 5 we present the results of our more detailed analysis by splitting the sample according to firm characteristics. First, we examine splits by the firm size (measured with market capitalization) and by the payout ratio to test the impact of financial constraints. Second, the sample is split by the proportion of inside ownership (closely held shares) to test for an influence of the corporate governance structure. Considering the results of the fixed effects estimation, we can conclude that cash has a higher value for small firms (smaller than the median firm) than for large firms (larger than the median firm). This is consistent with the idea that large firms can more easily access financial markets, but the result is not robust. The estimation with the Fama-MacBeth method does not confirm this finding, but that does not pose a problem as we are primarily interested in the coefficient of the interaction term, for which we are able to present more robust results. The negative effect of IA on cash is less strong (or does not even exist) for small firms. Supposedly, the negative effect of IA on cash (as predicted by Hypothesis 2) is to some extent canceled out by an opposite effect, i.e., cash is more important in periods with higher IA (as predicted by Hypothesis 1). When the payout

[19] Diether et al. (2002) provide evidence for this model.

ratio is used as a proxy for the degree of financial constraints, we again find that cash is more valuable for firms that face financing constraints. The results for the interaction variable are mixed. Based on the split by the payout ratio we cannot conclude that there is an opposite effect as discussed before. The final split by firm characteristics results in three groups. In the choice of the cut-off levels (0–5%, 5–25%, and 25% or more) we follow Morck et al. (1988) (see also Opler et al., 1999, for these cut-off levels). Thus, we expect that cash has less value and that IA has a more negative impact for firms with inside ownership between 5% and 25% due to an entrenchment effect. Firms with such a high proportion of managerial ownership could suffer more from agency conflicts because the managers could fleece the shareholders more easily. Yet, in most specifications we find that cash has a higher value in the middle range, contrary to the prediction. Thus, the findings indicate that in the middle range an incentive effect is prevalent rather than an entrenchment effect and it is in line with the results of McConnell and Servaes (1990). They find a positive relationship between firm value and inside ownership up to a fraction of about 45%. The relationship between the coefficient of the interaction variable and the proportion of the closely held shares is not that clear. We can only detect a tendency that the negative influence of IA is most pronounced for firms featuring a low managerial shareholding.

Table 5: Estimated value of cash in different subgroups (firm characteristics)

		all firms		non-U.S. firms		U.S. firms	
		FixEf.	FMBeth	FixEf.	FMBeth	FixEf.	FMBeth
large firms	C	0.467*** (2.68)	2.249*** (8.47)	0.176 (1.63)	1.454*** (5.62)	1.114*** (3.35)	3.647*** (9.33)
	C×dispM	-1.018*** (-4.32)	-0.524 (-0.58)	-1.307*** (-4.38)	-1.539* (-2.04)	0.423 (1.10)	2.181* (2.04)
	N	14979	14979	10432	10432	4547	4547
	Groups	3761	10	2760	10	1007	10
small firms	C	0.844*** (4.08)	1.919*** (9.38)	0.335** (2.18)	1.088*** (6.32)	1.167*** (4.50)	2.117*** (9.88)
	C×dispM	-0.281 (-1.20)	-0.166 (-0.41)	-0.463*** (-3.49)	0.175 (0.54)	0.041 (0.13)	-0.033 (-0.08)
	N	14984	14984	9229	9229	5755	5755

(continued)

Table 5: *—continued*

		all firms		non-U.S. firms		U.S. firms	
		FixEf.	FMBeth	FixEf.	FMBeth	FixEf.	FMBeth
	Groups	4720	10	2799	10	1926	10
payout ratio high	C	0.241	0.820***	0.173	0.730***	0.219	1.016***
		(1.39)	(4.96)	(1.10)	(5.41)	(0.78)	(4.06)
	C×dispM	-0.250	-1.631**	-0.299*	-1.299**	0.904***	-1.353**
		(-0.79)	(-2.58)	(-1.73)	(-2.42)	(3.13)	(-2.72)
	N	14862	14862	11095	11095	3767	3767
	Groups	4434	10	3322	10	1114	10
payout ratio low	C	1.145***	2.780***	0.770***	1.969***	1.416***	3.016***
		(4.75)	(10.36)	(3.41)	(5.80)	(5.37)	(11.04)
	C×dispM	-0.658***	-1.036***	-1.367***	-1.280***	0.062	-0.350
		(-2.82)	(-5.93)	(-5.83)	(-4.73)	(0.24)	(-1.12)
	N	14867	14867	8372	8372	6495	6495
	Groups	5524	10	3374	10	2156	10
inside ownership	C	0.990***	2.247***	0.529*	1.078*	1.308***	2.669***
		(5.41)	(6.09)	(1.80)	(1.84)	(5.59)	(7.78)
0-5%	C×dispM	-1.251**	0.322	-3.038***	0.489	-1.212*	-0.369
		(-2.45)	(0.27)	(-5.21)	(0.25)	(-1.73)	(-0.33)
	N	3326	3326	966	966	2360	2360
	Groups	1144	10	410	10	734	10
inside ownership	C	1.042***	2.671***	-0.061	1.351**	1.463***	2.924***
		(4.26)	(9.79)	(-0.29)	(3.20)	(4.83)	(9.25)
5-25%	C×dispM	-0.501**	0.621	-1.899***	1.276	0.105	0.742
		(-2.28)	(1.15)	(-3.37)	(1.23)	(0.49)	(1.13)
	N	6559	6559	2809	2809	3750	3750
	Groups	2563	10	1175	10	1389	10
inside ownership	C	0.286***	1.974***	0.239**	1.092***	0.600	2.842***
		(2.61)	(11.40)	(2.15)	(7.63)	(1.53)	(9.57)
+25%	C×dispM	-0.284	-0.851***	-0.911***	-1.438***	0.436	-0.524
		(-1.14)	(-3.67)	(-4.20)	(-3.25)	(1.55)	(-1.33)
	N	14787	14787	10857	10857	3930	3930
	Groups	4793	10	3260	10	1537	10

This table shows estimation results without IA for fixed effects regressions (FixEf.) and Fama-MacBeth regressions (FMBeth) for different sub-samples over the 1995 to 2005 period. The dependent variable in all specifications is the total market value scaled by total assets. Year dummies and different variables on firm characteristics (as in Table 3 and 4) are included in all specifications, but are not presented for brevity reasons. The definitions of all variables are provided in Section 3.1.2. Statistical inference is based on Driscoll and Kraay (1998). *t*-values are presented in parentheses. . ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

We now turn to the estimation results included in Table 6 where we split the sample by proxies for the corporate governance and financing practices at the country level. The first three splits are based on three indices that were described in Section 3.1.3, i.e., the rule of law index, the anti-director-rights index and the corruption index. For each index, the sample is divided into two groups according to a higher (lower) index value than the median country. A higher index value indicates that a country has better corporate governance practices. With very few exceptions we find exactly what we expected. The coefficient of cash is higher (with one exception) for firms located in countries with a higher index value and the negative influence of IA on cash is stronger for firms in countries with a lower index value (also with one exception). This result supports the idea that IA is more problematic for firms operating in countries with lower corporate governance standards.

The next two splits are based on the financing practices of the countries. We use the stock market capitalization and that of the private bond market, respectively, divided by the gross domestic product as measurement for the financing practices. We expect that in countries with a lower level of those ratios, internal financing is more important and hence cash holdings play a major role. If we were to find a less negative coefficient of the interaction term or even a positive relationship between cash and IA, we would interpret this result as supporting our Hypothesis 1. Surprisingly, we find exactly the opposite. The coefficient of cash and the coefficient of the interaction term are generally smaller for firms in countries with a lower ratio. Therefore, we cannot corroborate our Hypothesis 1. We put forward two reasons for this finding. The first explanation is based on the correlation of a country's financing and its corporate governance practices. Common law countries are typically market-based countries and we can expect that these countries have a higher ratio of bond and stock capitalization to GDP than civil law countries. At the same time, investors generally are better protected in common law countries (La Porta et al., 2000). Our other explanation is based on the role of IA in capital markets and the role of financial intermediaries. Civil law countries are rather bank-based and, therefore, financial intermediaries play a decisive role. Financial intermediaries can be considered as a natural response to IA (Leland and Pyle, 1977). In contrast to shareholders and bondholders, banks know more about a company's prospects because banks have more information sources than the average market participant. Hence, the adverse selection problem is less important for banks than for other investors. Consequently, in market-based countries where firms typically access financial markets to raise funds, IA is more problematic. Thus, our Hypothesis 1 (cash has more value when IA is high) should be more important for common law countries and this could be reflected in the less negative interaction term, which is not even significant in most specifications.

Table 6: Estimated value of cash in different subgroups (country characteristics)

		all firms		non-U.S. firms	
		FixEf.	FMBeth	FixEf.	FMBeth
rule of law index high	C	0.883***	2.427***	0.426***	1.481***
		(4.92)	(11.10)	(4.97)	(5.56)
	C×dispM	-0.497**	-0.062	-0.998***	0.016
		(-2.54)	(-0.24)	(-6.93)	(0.05)
	N	23240	23240	12938	12938
	Groups	5470	10	2986	10
rule of law index low	C	0.374**	0.950***	0.374**	0.950***
		(2.34)	(5.34)	(2.34)	(5.34)
	C×dispM	-1.281***	-1.674***	-1.281***	-1.674***
		(-4.62)	(-3.50)	(-4.62)	(-3.50)
	N	6723	6723	6723	6723
	Groups	2011	10	2011	10
anti-director rights index high	C	1.028***	2.471***	0.533***	1.213***
		(4.99)	(10.82)	(6.12)	(5.18)
	C×dispM	-0.269	0.055	-0.996***	-0.008
		(-1.14)	(0.20)	(-3.66)	(-0.02)
	N	17246	17246	6944	6944
	Groups	4217	10	1726	10
anti-director rights index low	C	0.250**	1.353***	0.250**	1.353***
		(2.16)	(4.79)	(2.16)	(4.79)
	C×dispM	-0.985***	-0.721*	-0.985***	-0.721*
		(-5.26)	(-1.95)	(-5.26)	(-1.95)
	N	11966	11966	11966	11966
	Groups	3048	10	3048	10

(continued)

Table 6: *—continued*

		all firms		non-U.S. firms	
		FixEf.	FMBeth	FixEf.	FMBeth
corruption index high	C	0.883*** (4.92)	2.427*** (11.10)	0.426*** (4.97)	1.481*** (5.56)
	C×dispM	-0.497** (-2.54)	-0.062 (-0.24)	-0.998*** (-6.93)	0.016 (0.05)
	N	23240	23240	12938	12938
	Groups	5470	10	2986	10
corruption index low	C	0.374** (2.34)	0.950*** (5.34)	0.374** (2.34)	0.950*** (5.34)
	C×dispM	-1.281*** (-4.62)	-1.674*** (-3.50)	-1.281*** (-4.62)	-1.674*** (-3.50)
	N	6723	6723	6723	6723
	Groups	2011	10	2011	10
stock/gdp high	C	0.852*** (4.57)	2.357*** (10.95)	0.378*** (3.54)	1.452*** (5.62)
	C×dispM	-0.436** (-2.43)	-0.071 (-0.29)	-0.861*** (-7.40)	-0.017 (-0.06)
	N	24886	24886	14584	14584
	Groups	5943	10	3458	10
stock/gdp low	C	0.373*** (6.90)	1.034*** (10.15)	0.373*** (6.90)	1.034*** (10.15)
	C×dispM	-1.378*** (-5.59)	-1.338*** (-3.82)	-1.378*** (-5.59)	-1.338*** (-3.82)
	N	5077	5077	5077	5077
	Groups	1539	10	1539	10
bond/gdp high	C	0.814*** (3.88)	2.430*** (11.45)	0.097 (0.73)	1.418*** (4.87)
	C×dispM	-0.497** (-2.48)	-0.276 (-1.54)	-0.863*** (-5.01)	-0.179 (-0.50)
	N	22494	22494	12192	12192
	Groups	5528	10	3044	10
bond/gdp low	C	0.619*** (3.71)	1.032*** (5.36)	0.619*** (3.71)	1.032*** (5.36)
	C×dispM	-0.701*** (-2.67)	-1.206* (-2.12)	-0.701*** (-2.67)	-1.206* (-2.12)
	N	6995	6995	6995	6995

(continued)

Table 6: —*continued*

		all firms		non-U.S. firms	
		FixEf.	FMBeth	FixEf.	FMBeth
	Groups	1788	10	1788	10
common law	C	1.045***	2.491***	0.517***	1.164***
		(4.89)	(10.60)	(3.96)	(4.69)
	C×dispM	-0.215	0.078	-0.859***	-0.053
		(-0.91)	(0.27)	(-3.05)	(-0.13)
	N	16008	16008	5706	5706
	Groups	3981	10	1490	10
civil law	C	0.283***	1.345***	0.283***	1.345***
		(2.70)	(5.28)	(2.70)	(5.28)
	C×dispM	-1.048***	-0.618*	-1.048***	-0.618*
		(-6.94)	(-2.02)	(-6.94)	(-2.02)
	N	13955	13955	13955	13955
	Groups	3506	10	3506	10

This table shows estimation results without IA for fixed effects regressions (FixEf.) and Fama-MacBeth regressions (FMBeth) for different sub-samples over the 1995 to 2005 period. The dependent variable in all specifications is the total market value scaled by total assets. Year dummies and different variables on firm characteristics (as in Table 3 and 4) are included in all specifications, but are not presented for brevity reasons. The definitions of all variables are provided in Section 3.1.2. Statistical inference is based on Driscoll and Kraay (1998). *t*-values are presented in parentheses. . ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

4.2 Results from the Approach by Dittmar and Mahrt-Smith (2007)

In Table 7 we report the results from estimating the Fama and French (1998) valuation regression for firms that experience a positive value of excess cash (refer to Section 3.2.2). The results are estimated with fixed effects regressions (our standard model) and as a double check we also run Fama-MacBeth regressions. In order to control for a U.S. effect, the results are also shown without North American firms. The value for *ExCash* is statistically and economically significant. Specifically, the marginal value of excess cash is positive and significant at the one percent level for all specifications. Focusing on the results from the fixed effects estimator, the coefficient of *ExCash* amounts to 1.905 which means that one dollar put into excess cash increases the firm value by more than its par value. These results point to a value-enhancing role of excess cash and they are comparable to other studies in this field, e.g., Dittmar and Mahrt-Smith (2007) who find a value for excess cash of 2 to 3 dollars depending on the governance proxy used.[20]

However, as outlined above the emphasis of our study is placed on investigating the value consequences of cash in the presence of IA. Therefore, in Table 7 the models also include the dispersion of analysts' earnings forecasts (*dispM*) as our measure for IA. In order to study the combined effect of excess cash and IA, an interaction variable is also included in the model. Our results reveal that the coefficient on the interaction term is negative and significant in all but one specification. Importantly, we find that IA decreases the marginal benefit of holding excess cash. This means that the empirical evidence corroborates our Hypothesis 2. In order to illustrate the detrimental value effect of IA, we calculate the marginal value of excess cash with IA for the fixed effects calculations (see Section 4.1). In Table 7 the stand-alone coefficient on *ExCash* amounts to 1.905. However, if IA is taken into account, the marginal value of excess cash is reduced to a value of 1.863 (based on a median value of *dispM* of 0.088 according to Table 2 (Panel B).[21] And if we now increase the IA by one standard deviation [0.241, see Table 2 (Panel B)], the marginal value of excess cash decreases by 0.115 (6.2%) money units to a low level of 1.747.[22] Therefore, these results can be interpreted as a valuation discount placed on firms where IA constitutes a problem and the evidence clearly supports our Hypothesis 2. This means that the agency costs from the free-cash flow theory dominate any supposed cost savings from the availability of internal capital.

The empirical models presented thus far provided a first attempt to investigate whether IA impacts the value effect of cash holdings. However, for the sake of distinguishing more accurately between our two conflicting hypotheses, we split the sample into subgroups based on corporate governance (related to the free cash flow theory) and financing constraints (related

[20] Dittmar and Mahrt-Smith (2007) abstain from interpreting the stand-alone coefficient on excess cash as they argue that excess cash could still be afflicted with endogeneity and hence they only focus on the interpretation of their interaction term (excess cash times governance index).

[21] The calculation is done as follows: $1.905 + (-0.479) \times 0.088$. For more information on the calculation of the marginal value of cash, refer to Section 4.1.

[22] The calculation is done as follows: $1.905 + (-0.479) \times (0.088 + 0.241)$.

to Myers and Majluf (1984) adverse selection problem) (for details refer to 3.1.3).[23]

Table 7: Estimated value of excess cash in relation with IA

	all firms		non-U.S. firms	
	FixEf.	FMBeth	FixEf.	FMBeth
E	5.440***	2.337***	5.223***	3.207***
	(24.76)	(5.47)	(14.52)	(5.34)
dE(t)	-0.057	1.894***	-0.511*	0.17
	(-0.61)	(5.18)	(-1.68)	(0.39)
dE(t+1)	3.281***	2.681***	2.089***	0.858
	(12.91)	(8.26)	(4.58)	(1.42)
dNA(t)	0.351***	1.076***	0.176***	0.421***
	(2.74)	(8.05)	(3.49)	(4.62)
dNA(t+1)	0.697***	0.634***	0.484***	0.483**
	(6.13)	(4.18)	(3.70)	(2.37)
RD	10.748***	8.183***	8.268***	6.627***
	(6.56)	(11.57)	(3.52)	(5.90)
dRD(t)	-2.088	0.498	0.668	4.338
	(-1.46)	(0.28)	(0.59)	(1.54)
dRD(t+1)	8.260***	9.044***	4.227**	7.444***
	(9.89)	(4.80)	(2.15)	(5.47)
I	-0.775	-4.560***	-2.846	-5.307***
	(-0.73)	(-4.23)	(-1.21)	(-4.99)
dI(t)	0.586	-1.327	3.311***	3.233***
	(0.71)	(-0.65)	(2.83)	(3.51)
dI(t+1)	-2.381***	-8.829***	-1.663	-3.851*
	(-3.49)	(-6.51)	(-1.55)	(-2.09)
D	-2.130***	4.492***	0.511	4.868***
	(-5.12)	(10.51)	(0.94)	(7.14)
dD(t)	-0.215	-2.553**	-0.296	-1.787**
	(-0.76)	(-2.89)	(-0.71)	(-3.21)

(continued)

[23] The only difference to the classifications taken for the actual cash ratio is that in the case of excess cash we abstain from grouping firms along the dimension of size and the payout ratio as these two characteristics are endogenously related to the computation of excess cash and the ownership split is also omitted as the results have turned out to be not significant for the actual cash ratio.

Table 7: —*continued*

	all firms		non-U.S. firms	
	FixEf.	FMBeth	FixEf.	FMBeth
dD(t+1)	-1.169*** (-8.78)	0.781 (1.06)	0.159 (1.07)	1.294 (1.67)
dV(t+1)	-0.274*** (-4.09)	-0.136 (-1.26)	-0.154* (-1.78)	-0.048 (-0.29)
dispM	-0.007 (-0.16)	-0.034 (-0.29)	0.04 (0.66)	0.131 (1.29)
ExCash	1.905*** (8.84)	3.083*** (14.82)	1.299*** (7.41)	2.036*** (9.78)
ExCash×dispM	-0.479** (-2.23)	-0.42 (-0.49)	-0.776*** (-2.80)	-1.016** (-2.35)
Const.	1.182*** (14.83)	1.063*** (21.59)	0.948*** (19.28)	1.019*** (28.36)
R^2	0.444	0.589	0.362	0.617
N	10876	10876	6569	6569
Groups	3455	10	1895	10

Fixed effects regressions (with year dummies) and Fama-MacBeth regressions (1995 to 2005). The dependent variable is the total market value scaled by net assets. The explanatory variables are defined in Section 3.1.3. *T*-values (Driscoll and Kraay, 1998) are presented in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

The results are reported in Table 8. Accordingly, the first corporate governance grouping is based on the rule of law index (corporate governance variable at the country level). A first glimpse at the results reveals that they correspond to our expectations. The evidence for the interaction term further confirms our Hypothesis 2 as the interaction term is significantly more negative in low rule of law countries. This means that IA significantly decreases the value of cash and this effect is even more pronounced if the governance environment is weak. Moreover, this result is further emphasized by investigating the evidence for the anti-director-rights index, which is a further corporate governance split at the country level. In line with the previous discussion, the marginal value of excess cash is significantly decreased if the shareholder protection is weak. Accordingly, this result further enforces Jensen's (1986) free cash flow theory. The evidence for the corruption index also points in the same direction. The interaction term for high corruption countries (low corruption index) is negative and relatively higher in absolute terms (-2.563) than the interaction term if corruption is relatively low (-0.283). This means that a) IA decreases the value of cash and b) that this effect is even more pronounced if the external governance environment is weak. The last split of governance at the country-level (common law countries versus civil law countries) reveals that according to expectations the coefficient on *ExCash* is lower in civil law countries (0.934) versus common law countries. This confirms the results by La Porta et al. (1998) indicating that the governance environment in countries with a civil law tradition is weaker. This result is also confirmed by the interaction term, which is significantly negative in civil-law countries and not significant, albeit still negative, in common-law countries. Taken together, the splits according to corporate governance measures further emphasize that the free cash flow theory of Jensen (1986) is the common denominator between the results because the coefficient on *ExCash* is lower in a low governance environment as well as the interaction being more negative if the governance is weaker.

Table 8: Estimated value of cash in different subgroups (country characteristics)

		all firms		non-U.S. firms	
		FixEf.	FMBeth	FixEf.	FMBeth
rule of law index high	ExCash	1.952*** (6.59)	3.172*** (12.55)	1.165*** (5.82)	2.164*** (7.76)
	ExCash×dispM	-0.317* (-1.70)	0.194 (0.16)	-0.258 (-0.89)	-1.175* (-1.89)
	N	8513	8513	4206	4206
	Groups	2768	10	1207	10
rule of law index low	ExCash	1.403*** (5.68)	1.738*** (5.77)	1.403*** (5.68)	1.738*** (5.77)
	ExCash×dispM	-1.982*** (-5.28)	-0.112 (-0.10)	-1.982*** (-5.28)	-0.112 (-0.10)
	N	2363	2363	2363	2363
	Groups	688	10	688	10

(continued)

Table 8: *—continued*

		all firms		non-U.S. firms	
		FixEf.	FMBeth	FixEf.	FMBeth
anti-director rights index high	ExCash	2.155***	3.370***	1.948***	2.435***
		(6.17)	(13.27)	(6.76)	(6.29)
	ExCash×dispM	-0.26	0.051	-1.241	-0.552
		(-1.15)	(0.04)	(-1.51)	(-0.42)
	N	6578	6578	2271	2271
	Groups	2288	10	723	10
anti-director rights index low	ExCash	0.929***	1.884***	0.929***	1.884***
		(7.56)	(8.93)	(7.56)	(8.93)
	ExCash×dispM	-0.446**	-1.478**	-0.446**	-1.478**
		(-2.27)	(-2.71)	(-2.27)	(-2.71)
	N	4295	4295	4295	4295
	Groups	1170	10	1170	10
corruption index high	ExCash	1.929***	3.180***	0.977***	2.078***
		(6.34)	(12.71)	(5.70)	(8.28)
	ExCash×dispM	-0.283	0.193	-0.034	-0.941
		(-1.45)	(0.16)	(-0.11)	(-1.49)
	N	8442	8442	4135	4135
	Groups	2769	10	1208	10
corruption index low	ExCash	1.802***	1.895***	1.802***	1.895***
		(4.42)	(5.72)	(4.42)	(5.72)
	ExCash×dispM	-2.563***	-0.367	-2.563***	-0.367
		(-5.54)	(-0.36)	(-5.54)	(-0.36)
	N	2434	2434	2434	2434
	Groups	689	10	689	10
stock/gdp high	ExCash	1.948***	3.170***	1.041***	2.086***
		(7.48)	(13.26)	(9.35)	(12.44)
	ExCash×dispM	-0.329	0.115	-0.457	-0.181
		(-1.41)	(0.11)	(-1.51)	(-0.29)
	N	8738	8738	4431	4431
	Groups	2819	10	1258	10
stock/gdp low	ExCash	1.643***	1.975***	1.643***	1.975***
		(3.67)	(3.88)	(3.67)	(3.88)
	ExCash×dispM	-1.912**	-2.910*	-1.912**	-2.910*
		(-2.27)	(-2.11)	(-2.27)	(-2.11)
	N	2138	2138	2138	2138
	Groups	639	10	639	10

(continued)

Table 8: *—continued*

		all firms		non-U.S. firms	
		FixEf.	FMBeth	FixEf.	FMBeth
bond/gdp high	ExCash	1.861***	3.138***	0.748***	1.769***
		(6.71)	(13.84)	(8.19)	(8.67)
	ExCash×dispM	-0.325	-0.171	-0.291	-1.164*
		(-1.26)	(-0.18)	(-1.37)	(-2.05)
	N	8285	8285	3978	3978
	Groups	2623	10	1061	10
bond/gdp low	ExCash	1.847***	2.199***	1.847***	2.199***
		(5.80)	(5.84)	(5.80)	(5.84)
	ExCash×dispM	-1.194*	0.063	-1.194*	0.063
		(-1.67)	(0.06)	(-1.67)	(0.06)
	N	2454	2454	2454	2454
	Groups	787	10	787	10
common law	ExCash	2.157***	3.344***	1.934***	2.525***
		(6.00)	(13.11)	(6.11)	(6.24)
	ExCash×dispM	-0.197	0.155	-0.986	-1.251
		(-0.88)	(0.11)	(-1.11)	(-0.92)
	N	6256	6256	1949	1949
	Groups	2191	10	626	10
civil law	ExCash	0.934***	1.910***	0.934***	1.910***
		(7.79)	(8.95)	(7.79)	(8.95)
	ExCash×dispM	-0.492**	-1.476**	-0.492**	-1.476**
		(-2.55)	(-2.69)	(-2.55)	(-2.69)
	N	4620	4620	4620	4620
	Groups	1269	10	1269	10

This table shows estimation results without IA for fixed effects regressions (FixEf.) and Fama-MacBeth regressions (FMBeth) for different sub-samples over the 1995 to 2005 period. The dependent variable in all specifications is the total market value scaled by total assets. Year dummies and different variables on firm characteristics (as in Table 3 and 4) are included in all specifications, but are not presented for brevity reasons. The definitions of all variables are provided in Section 3.1.2. Statistical inference is based on Driscoll and Kraay (1998). *T*-values are presented in parentheses. . ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

Finally, the results for the splits according to financing constraints at the country-level (stock/gdp and bond/gdp) should proxy for the fact that in countries where the capital market is less developed, i.e., lower stock/gdp and/or lower bond/gdp, hoarding cash becomes more important as external finance is harder to obtain. This means that we expect that in countries where the capital market development is lower, the coefficient on *ExCash* is higher and the interaction term is relatively less negative. However, this prediction is not borne out by our data. For both measures of the capital market development (stock/gdp and bond/gdp) the coefficient on *ExCash* is lower for more constrained countries and the interaction term is only significantly negative in the same environment. One explanation of this result is that our proxy for the capital market development is imperfect as there is a high correlation between the country law tradition (civil law versus common law) and our capital market development measures. In effect, stock/gdp and bond/gdp are then actually proxies for the governance environment and hence, to a lesser extent, measures for the capital market development.

In a nutshell, the results provide an overwhelming view that IA decreases the value of cash, which is in line with Jensen's (1986) free cash flow argument and which corresponds to our Hypothesis 2. On the other hand, the results consequently do not confirm Myers and Majluf's (1984) argumentation for the value benefits of financial slack (our Hypothesis 1).

4.3 Robustness Tests

To further test the robustness of our main result, we alter the specification of our estimations as well as the definition of some variables. The coefficients of interest are presented in Table 9. For brevity, we only report (with one exception) the results of the fixed effects estimation with the level of cash. For the ease of comparison, Panel A of Table 9 shows again the coefficients of cash and the interaction variable as they were presented in the first column of Table 4. The other panels show the results of the robustness tests where we changed some parameters of the estimations as described subsequently:

- *Panel B:* As discussed above, the valuation regression used in this study is based on Fama and French (1998). While they use two-year changes for the calculation of those explanatory variables that capture differences, we followed in our main specification Pinkowitz et al. (2006) and Dittmar and Mahrt-Smith (2007) who only use one-year changes. By using two-year changes the sample becomes smaller, but we still find a clear negative influence of IA on the value of cash.

- *Panel C:* We estimate the regression without including time dummies. The coefficients and the statistical inference do not change considerably.

- *Panel D:* In this specification we estimated the model with ordinary least squares and cluster robust standard errors (Arellano (1987), Rogers (1993)). The coefficient of C changes considerably, that of the interaction variable changes to a lesser extent. The interaction remains significant but not anymore at the 1% significance level.

- *Panel E:* To control for a possible correlation between risk and IA we include two more variables. First, we add the volatility of the monthly stock returns over the year. Second, we include the interaction of the volatility and the cash ratio (C). We find a higher coefficient and a higher t-value for the interaction of cash and IA. Moreover, the estimation reveals that there is a positive interaction between cash and risk (at least for non-U.S. firms). This can be explained by the fact that cash is more important when the risk of the firm is higher. This test indicates that the influence of risk and of the IA runs in the opposite direction. Obviously, we can conclude that our results cannot be explained by a positive correlation between our measurement of IA and risk.

- *Panel F:* In Panel F, we change the proxy for IA. Instead of using the dispersion of analysts' forecasts, we employ the forecast error (see the discussion in Section 3.1.1). We calculate this variable as follows:

$$forecastError = \ln\left(1 + \frac{|eps_{forecast} - eps_{actual}|}{|median|}\right) \tag{10}$$

  where the forecast of the earnings per share is the average of all forecasts provided by the analysts in November and December. The difference of the actual and the forecasted earnings per share in absolute terms is scaled by the median of the earnings per share forecast. Similar to the calculation of *dispM*, we add one to this ratio and take the natural logarithm. Observations are excluded if the average of the forecasts is not at least based on the estimates of two analysts. The estimation indicates that our main finding is robust to a change of the measurement of IA.

Table 9: Robustness tests

		all firms	non-U.S. firms
Panel A (base case)	C	0.782*** (4.50)	0.391*** (4.53)
	C×dispM	**-0.594***** (-3.34)	**-1.041***** (-10.24)
	N	29963	19661
	Groups	7474	4991
Panel B (2-year lags)	C	0.512** (2.22)	0.296** (2.05)
	C×dispM	**-0.804***** (-4.15)	**-0.754***** (-9.51)
	N	22908	15182
	Groups	6072	4135
Panel C (no time dummies)	C	0.839*** (4.65)	0.566*** (6.54)
	C×dispM	**-0.587***** (-2.97)	**-1.163***** (-9.17)
	N	29963	19661
	Groups	7474	4991
Panel D (pooled OLS)	C	2.281*** (19.28)	1.501*** (10.79)
	C×dispM	**-0.610**** (-2.31)	**-0.479*** (-1.83)
	N	29963	19661
	Groups	7474	4991
Panel E (volatility)	C	0.567** (2.34)	0.215* (1.73)
	C×dispM	**-0.687***** (-3.72)	**-1.205***** (-14.97)
	Vola	-0.322** (1.98)	-0.129 (0.79)
	C×Vola	1.534 (1.58)	1.730** (2.00)
	N	29559	19441
	Groups	7408	4961

(continued)

Table 9: —*continued*

		all firms	non-U.S. firms
Panel F	C	0.797***	0.266**
(forecast error)		(4.85)	(2.54)
	C×forecastError	**-0.237****	**-0.266*****
		(-2.06)	(-2.43)
	N	31370	20452
	Groups	8016	5354

This table provides an overview of the estimation results of different robustness tests. The sample period corresponds to the period from 1995 to 2005. The regression specifications are explained in Section 4.3. The dependent variable in all specifications is the total market value scaled by total assets. The definitions of all variables are provided in Section 3.1.3 and Section 4.3, respectively. Statistical inference is based on Driscoll and Kraay (1998) (Panel A, B, C, E,F) and on White (1980) (Panel D). *t*-values are presented in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

5 Conclusions

This paper examines the value effects of corporate cash holdings. To date, the common practice in the cash holdings literature is to examine the valuation effects of cash holdings whereby the researcher discriminates according to corporate governance measures. However, we take a different perspective and focus on the valuation effects of cash in connection with information asymmetry. Specifically, we put forward two different hypotheses. First, focusing on Myers and Majluf (1984), cash in combination with information asymmetry should have a positive influence on the value of the firm because the adverse selection problem will be mitigated. Second, referring to Jensen (1986), the free cash flow argument coupled with information asymmetry leads to moral hazard and accordingly the value of cash should be lower.

For the sake of empirically contrasting these two hypotheses, we employ a large data set covering 7,474 firms from 45 countries. We use the Fama and French (1998) valuation regressions and derive our results from two different cash specifications. As the main approach we use the actual cash ratio in line with Pinkowitz et al. (2006) and as a robustness test we also calculate excess cash based on Opler et al. (1999) and Dittmar and Mahrt-Smith (2007).

The results for the actual cash ratio reveal that the value of one unit of cash without taking information asymmetry into account is on average around one. This result is consistent with previous papers in this field (see Pinkowitz and Williamson, 2004; Pinkowitz et al., 2006). However, if a firm faces a high level of information asymmetry, the value of its cash reserves is significantly and substantially reduced. This evidence indicates that the agency costs of the free cash flow argument outweigh the benefits from cash as internal capital. For being able to further distinguish between our two opposing hypotheses, we split the sample according to governance and financing constraints. Taken together, these splits further emphasize our results that agency costs due to moral hazard decrease the value of cash. Specifically, the value of cash is higher if the level of governance is stronger. According to the splits on the basis of financing constraints, the expectation that cash is valued relatively higher if the firms are financially constrained (either on the firm-level or because the markets are less developed) are only borne out partly by our data.

Our second approach which is based on the framework of Dittmar and Mahrt-Smith (2007) and the calculation of excess cash according to Opler et al. (1999) serves as a robustness test for the results above. If we use excess cash as our measure of cash holdings the results stay qualitatively the same compared to the results derived with the actual cash ratio. Accordingly, information asymmetry significantly decreases the value of excess cash. This evidence further confirms the free cash flow theory by Jensen (1986) and provides no empirical justification for the theoretical argument by Myers and Majluf (1984). When we consider the governance and financing constraints in our second approach, the results are also in line with what was found by the estimations with the actual cash ratio. Again the value of excess cash is higher if the level of governance is stronger; however, based on financing constraints no clear picture emerges.

Taken together, our comprehensive results—which survive extensive robustness tests—clearly indicate that the agency costs from the free cash flow theory outweigh the benefits from 'financial slack' in mitigating adverse selection.

Appendix

Detailed formula for measure of information asymmetry ($dispM_{i,t}$)

$$\ln\left(1+\frac{1}{M_{i,t}}\times\sqrt{\sum_{m_{i,t}=1}^{M_{i,t}}\left(\frac{\frac{1}{A_{m_{i,t}}-1}\times\sum_{a_{m_{i,t}}=1}^{A_{m_{i,t}}}(EPS_{a_{m_{i,t}}}-\frac{1}{A_{m_{i,t}}}\times\sum_{a_{m_{i,t}}=1}^{A_{m_{i,t}}}EPS_{a_{m_{i,t}}})^2}{Med_{m_{i,t}}}\right)}\right)$$

with:

$Med_{m_{i,t}}$: Absolute median earning per share forecast in month m in year t for firm i

$A_{m_{i,t}}$: Number of analysts that cover firm i in year t in month m

$M_{i,t}$: Number of months for which more than three analysts cover firm i in year t

$EPS_{a_{m_{i,t}}}$: Earnings per share estimate of analyst a for firm i in year t in month m

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