Cash Holdings Around the World: Why do Listed Firms Hold More Cash?

By

Henk von Eije[1]

Version of January 12, 2012

Abstract

The main body of literature on firms' cash holdings focuses on listed firms. The aim of this paper is to compare the cash holdings of both listed and unlisted firms and to assess the causes for significant differences between these types of firms. The listing of a firm is likely to have three relevant effects for cash holdings. First, a listing improves the firm's access to financing and this may reduce the need for cash. Second, cash levels may increase because shareholders of listed firms have fewer incentives to monitor managers. As managers like the flexibility provided by cash, agency costs of cash may make cash ratios to become larger in listed firms than in unlisted firms. Third, the listing may increase the opportunity set for a firm. In that case listed firms may also hold more cash for inter alia transactions and precautionary motives. This paper finds that listed firms have cash ratios that are significantly higher than those of unlisted firms. The higher cash ratios in listed firms are, however, not primarily caused by increased agency costs of cash after the listing, because the marginal contribution of cash to earnings is higher in listed firms.

JEL codes: G34 G31 G15 L22 L6

---

[1] Henk von Eije (j.h.von.eije@rug.nl) is associate professor in Finance at the Faculty of Economics and Business of the University of Groningen (Duisenberg Building, 848, PO Box 9700AV, Groningen, The Netherlands, Tel. (31)503633838, Fax (31)503633756). He likes to thank participants of the University College of Dublin seminar for their comments on a previous version of the paper. The author alone is responsible for any errors or omissions.

1. Introduction

The main body of literature on a firm's cash holdings focuses on listed firms. It is, however, as relevant to know more about the cash ratios of unlisted firms, as these firms form the vast majority of firms in the world. The aim of this paper is to compare the cash ratios in listed to those in unlisted firms, to analyze the reasons for differences between both types of firm and to study major divergences in determinants for cash holdings in both types of firms.

The starting point is the trade-off theory of cash presented by Opler, Pinkowitz, Stulz, and Williamson (1999). In this theory, managers maximize the value of the firm to the shareholders by equalizing the marginal benefits of cash holdings to their marginal costs. Then I consider three hypotheses on why cash holdings for a listed firm may differ from those of an unlisted firm. First, a listing may improve the financing capabilities of a firm (Pagano, Panetta and Zingales, 1998; Chemmanur and Fulghieri, 1999) and reduce the constraints of a firm after the listing. In line with (Keynes, 1936) and (Almeida, Campello and Weisbach, 2004) financially constrained firms have larger cash holdings than unconstrained firms. This generates the hypothesis of "improved financial access", which suggests that value maximizing managers of listed firms hold less cash than value maximizing managers of unlisted firms. Second, a listing may generate an improved opportunity set (Pagano, Panetta and Zingales, 1998; Holmström and Tirole, 1993; Pagano and Röell, 1998). This may shift the marginal contribution of cash holdings positively because of transaction and precautionary motives (Keynes, 1936). The hypothesis of the "improved opportunity set" therefore suggests that value maximizing managers of listed firms will hold more cash than value maximizing shareholders in unlisted firms. Third, monitoring by the shareholders of a listed company is likely to be smaller than their monitoring of the unlisted firm (Alchian and Demsetz, 1972; Grossman and Hart, 1980). The low monitoring by shareholders of listed firms may increase agency costs (Jensen and Meckling, 1976; Jensen, 1986) and managers of listed firms may then hold cash ratios in excess of the cash ratios needed by comparable unlisted firms. The third hypothesis of "increased agency costs of cash" implies that the excess cash holdings will result in smaller marginal benefits of cash holdings in listed firms than in unlisted firms. This will in particular be the case in countries where the shareholders' protection is weak (Pinkowitz, Stulz, and Williamson, 2006).

To answer the question which of the three hypotheses holds, I apply several tests. The first test analyzes if there is a systematic difference between the cash ratios of listed and unlisted firms on a global scale. Second, systematic differences are analyzed by country. Third, differences between the cash ratios of never listed, delisted, recently and early listed firms are shown. Fourth, the question is answered whether cash ratios differ after having taken the characteristics of listed and unlisted firms into account. Such an analysis shows the determinants of the cash holdings, and if there are important differences in the determinants between listed and unlisted firms. Fifth, an analysis is made whether differences in cash holdings between listed and unlisted firms exist if they are headquartered in common and in non-common

law system countries. Finally, I study whether the marginal contribution of cash holdings to the firm's earnings is larger or smaller for listed firms than for unlisted firms.

The focus is on large listed and unlisted manufacturing firms worldwide. Within that sample listed firms hold more cash in relation to their assets than unlisted firms. In a country by country analysis this also holds for 23 of the 26 countries for which an adequate number of observations were available. On average the cash ratios of listed firms are 0.137 and those of unlisted firms 0.075. Listed firms remain to have higher cash ratios if one controls for economies of scale (Mulligan, 1997), leverage (Jensen, 1986), substitution by other short term assets (Bates, Kahle and Stulz, 2009), capital expenditures (Opler, Pinkowitz, Stulz, and Williamson, 1999), lines of credit (Almeida, Campello and Weisbach, 2004), cash flow proxies (Opler, Pinkowitz, Stulz, and Williamson, 1999; Bates, Kahle and Stulz, 2009), income risk (Bates, Kahle and Stulz, 2009), company age, a trend, and industry and country dummies. All these outcomes indicate that cash holdings in listed firms are larger than in unlisted firms. This implies that the first hypothesis has to be rejected: relatively easy access to financial resources of listed firms does not result in relatively lower cash holdings in such firms.

Furthermore, the cash ratios of firms that were never listed are 7.2%, while recently listed firms have cash ratios of 15.2%. After the IPO the cash ratios decline, but they remain higher than the cash ratios in never listed firms. Even cash ratios of delisted firms are still significantly higher than those of never listed firms. Listed firms also have a larger cash ratio in the IPO year in comparison to the years preceding the IPO. All these results imply that listed firms hold more cash than unlisted firms. These findings, again, refute the hypothesis of "improved financial access". The hypothesis of the "improved opportunity set" and the hypothesis of "increased agency costs of cash" may, however, still be relevant. Because the marginal contribution of cash to earnings in listed firms is larger than the marginal contribution of cash to earnings in unlisted firms, it is unlikely that increased agency costs of cash holdings after a listing are the major explanation for the higher cash ratios in listed firms. This leaves us with the conclusion that the hypothesis of the "improved opportunity set" is most likely.

The increased marginal contribution of cash to earnings in listed firms is in line with the findings of Harford, Mansi and Maxwell (2008) that managers of well governed firms do not have to spend cash holdings as quickly as managers of less well governed firms. This is in particular important in countries with good shareholder protection laws. It is thus not amazing that the difference between marginal contributions of cash holdings to earnings in listed firms in comparison to unlisted firms is more pronounced in common law countries. However, even in non-common law countries the difference in marginal contributions to earnings between listed and unlisted firms is positive. These findings suggest that "agency costs of cash" are not the main driver for higher cash holdings in listed firms and that the hypothesis of the "improved opportunity set" is most likely to hold.

However, the conclusion that the differences in cash holdings between listed and unlisted firms arise from a set of positive developments amongst listed firms does not necessarily mean that listed firms have lower agency costs than unlisted firms. Jain and Kini (1994), for example, find that listed firms

underperform unlisted firms and they attribute such underperformance to inter alia agency costs. Also in the current database the overall operating performance of listed firms is worse than of unlisted firms. The outcomes of this paper show that agency costs of cash are not a major determinant of the larger cash holdings in listed firms in comparison to unlisted firms. It is very likely that the liquid and very visible character of cash holdings (Myers and Rajan, 1998; Harford, Mansi and Maxwell, 2008) result in a different treatment of cash than of non-cash assets in the firm and that more transactions (Pagano, Panetta and Zingales, 1998; Holmström and Tirole, 1993; Pagano and Röell, 1998; Chemmanur, He and Nandy, 2010) and more international exposure (Foley, Hartzell, Titman, and Twite, 2007) of listed firms make cash to contribute relatively more to earnings in line with the transaction and precautionary motives of (Keynes, 1936).

The organization of the paper is as follows. Section 2 presents the literature, the tests and the methodology. Section 3 presents the data and the information on cash ratios in listed and unlisted firms in various countries in the world. Section 4 studies the impact of being listed on the firms' cash ratios and whether the cash ratios and their determinants differ significantly between listed and unlisted firms. Section 5 evaluates the marginal contribution of cash to firms' earnings. Section 6 provides robustness tests, while section 7 concludes the paper.

2. Literature, tests and methodology

The irrelevance propositions of Modigliani and Miller (1958, 1961) are in principle also relevant for the liquidity needs of firms under the assumptions of perfect markets and rational investors. In that case liquid cash holdings don't add value to the firm as any cash needed can be obtained without any costs. Irrelevance of cash holdings implies neither costs nor benefits of cash and firms do not trade-off marginal benefits and marginal costs of cash. In real markets, however, marginal benefits and marginal costs of cash holdings are not equal to zero. According to Opler, Pinkowitz, Stulz, and Williamson (1999) the costs of cash holdings are the opportunity costs of cash, arising from the fact that the cash holdings are not invested in high return illiquid assets. To these costs Opler, Pinkowitz, Stulz, and Williamson (1999) add the costs of double taxation of the interest revenues generated by the firm's liquid assets. Though the marginal costs may differ between countries, it is likely that the marginal costs are not influenced by the size of the cash holdings, and Opler, Pinkowitz, Stulz, and Williamson (1999) therefore assume that the graphical representation of the marginal costs is a horizontal line (see Figure 1). The marginal benefits of cash holdings are equal to the marginal costs of cash shortages. Opler, Pinkowitz, Stulz, and Williamson (1999) relate the marginal benefits to the motives for holding cash as indicated by (Keynes, 1936) and to the avoidance of the potential losses generated by underinvestment problems, costs of debt overhang, costs of dividend cuts, and the costs of the possibility to have to sell-off valuable assets at discount prices (Myers, 1977; Myers and Majluf, 1984). Managers can maximize firm value by setting the marginal costs

4

of cash shortages equal to the marginal costs of cash holdings. This approach is labeled by Opler, Pinkowitz, Stulz, and Williamson (1999) as the trade-off theory of cash holdings and it is used here as the starting point for the exposition of the possible consequences of being a listed firm instead of an unlisted firm. Three different curves for the marginal benefits of cash holdings are presented in Figure 1. These are indicated by the lines AA, BB, and CC.

Figure 1 Marginal costs and marginal benefits of holding cash
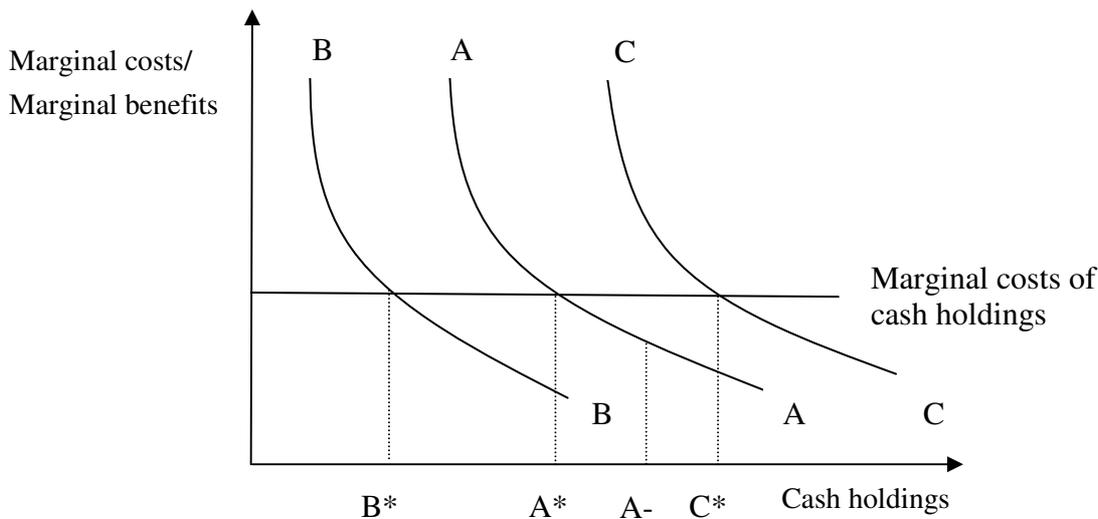
Starting from the trade-off theory of cash, an unlisted firm is assumed to have marginal benefits of cash holdings as indicated by the line AA. Managers who maximize firm value chose the level of cash holdings as represented by A*.

However, listed firms have different characteristics in comparison to unlisted firms. In this paper the comparative statics of three major differences between listed and unlisted firms are considered.[2] The first major reason for becoming a listed firm is the access to financing. (Pagano, Panetta and Zingales, 1998) indicate that going public helps overcoming borrowing constraints and increases the bargaining power with banks. Listed firms also have the benefits of lower costs of equity financing (Chemmanur and Fulghieri, 1999; Brav, 2009). These benefits enable listed firms to overcome cash shortages faster and cheaper than comparable unlisted firms. This means that the curve of marginal benefits of cash holdings shifts to the left from AA to BB. If the financing benefits of a listing dominate, and if financially less restrained firms need to hold less cash (Keynes, 1936), listed firms need less cash holdings than unlisted firms. In that case value maximizing managers of listed firms hold an optimum level of cash (B*) that is smaller than that of value maximizing managers of unlisted firms (A*). This is partly corroborated by

---

[2] In the exposition of the comparative statics I follow Opler, Pinkowitz, Stulz, and Williamson (1999) and assume that the marginal costs of cash holdings are not influenced by the question whether the firm is listed or unlisted, though it is allowed that such costs differ by country. The marginal benefits of cash holdings may differ between listed and unlisted firms and these benefits are also allowed to differ between industries.

(Almeida, Campello and Weisbach, 2004) and (Faulkender and Wang, 2006) who find -within the realm of listed firms- that constrained firms have higher marginal benefits of cash than unconstrained firms.[3] This reasoning is also in line with the theoretical and empirical results of (Kim, Mauer and Sherman, 1998), who find that there is a positive relation between the cost of external financing and corporate liquidity.

Even if listed firms have relatively easy access to external finance, managers may still prefer internal funds above debt and equity financing (Myers, 1984). Such preferences may be enhanced in listed firms, as a major reason for listing is the wish to improve the market position of the firm (Chemmanur, He and Nandy, 2010; Chod and Lyandres, 2010; De Jong, Huijgen, Marra, and Roosenboom, forthcoming). In that case, cash may increase after the listing if transactions and opportunities increase and transaction- and precautionary motives become more important (Keynes, 1936). This is in line with Kim, Mauer and Sherman (1998) who find that the cash holdings increase with the returns of future investment opportunities. The listing may also help to become renown on both a national and an international level and to increase (foreign) sales, which may result in additional needs for cash (Foley, Hartzell, Titman, and Twite, 2007). Moreover, the listing may improve monitoring and control. A listing improves control when the information embedded in public share prices allows managerial reward schemes to be tailored to the market performance of the firm (Holmström and Tirole, 1993). In addition, listed firms have to conform to listing- and disclosure requirements that do not exist for unlisted firms (Pagano, Panetta and Zingales, 1998; Campbell, 1979; Chemmanur and Fulghieri, 1999). These requirements strengthen the monitoring possibilities of outside investors. Furthermore, if private companies are owned by more than one investor and if large investments -like major acquisitions- are considered, company decisions may get stuck in conflicts of insights (or interests) between the owners. Loose, or even absent, control of investors participating in a publicly listed firm (Alchian and Demsetz, 1972; Grossman and Hart, 1980) allows managers to make value enhancing decisions on large investments, which might not be sanctioned by a majority owner who has other concerns (Pagano and Röell, 1998). Improved governance is indeed a determinant of higher cash holdings according to (Dittmar and Mahrt-Smith, 2007) and (Harford, Mansi and Maxwell, 2008), who find that well governed firms are indeed able to hold relatively large cash levels. For these reasons the level of cash of a newly listed firm may then increase above the level of cash allowed for by the owners of unlisted firms. If the cash effects of an "improved opportunity set" of a listed firm dominate the effects of "improved financial access" on cash holdings, the listing will shift the curve of marginal benefits to the right: from AA for an unlisted firm to CC for the listed firm.[4] [5]

---

[3] However, some of the marginal costs may be based on firm characteristics. (Tobin, 1956) considered it unlikely that a firm holds all liquidity as sheer cash and (Baumol, 1952) showed that brokerage costs then define an optimal level of cash withdrawals and generate economies of scale. Economies of scale are recently empirically confirmed by (Mulligan, 1997). (Miller and Orr, 1966) add risky cash flows to the equation of optimal cash balances and (Bates, Kahle and Stulz, 2009) confirm the empirical importance of firm risk in the explanation for cash holdings.

[4] Other possible reasons for a listing are that incumbent investors may benefit (Shah and Thakor, 1988) or that solvency may be improved (Pagano, Panetta and Zingales, 1998). These benefits are not further addressed here, as they may not be of direct relevance to a firm's cash holdings.

The third major difference between listed and unlisted firms is that listed firms are not necessarily better monitored by their shareholders than unlisted firms and the opposite of excess monitoring may occur. As already indicated, listed firms are generally owned by more investors than unlisted firms. This makes the shareholders less inclined to control the listed firm in comparison to the few investors that own an unlisted firm (Alchian and Demsetz, 1972). Shareholders of listed firms may become "free riders", as they hope that other shareholders will take care of efficient governance (Grossman and Hart, 1980). If every investor thinks similarly, managers of listed firms will hardly be monitored. As managers do not necessarily maximize firm value, deviations from the optimum level of cash holdings may arise from, inter alia, agency costs (Jensen and Meckling, 1976; Jensen, 1986). Agency costs of cash holdings arise if managers are allowed to follow their own preferences, without being forced to take care of efficient cash levels. As managers prefer to hold relatively much cash (Opler, Pinkowitz, Stulz, and Williamson, 1999; Pinkowitz, Stulz and Williamson, 2006) and liquid assets are an easy target for expropriation (Myers and Rajan, 1998; Dittmar and Mahrt-Smith, 2007), it is likely that the amount of cash in listed firms is increased to a level where the marginal benefits of cash are smaller than the marginal revenues of cash. In such a case listed firms may end in holding more cash than unlisted firms. In figure 1 this is represented by a shift from A* (for optimizing managers of unlisted firms) to A- (for managers that are not monitored adequately by listed shareholders).

Though Opler, Pinkowitz, Stulz, and Williamson (1999) do not find that agency costs are a strong explanation for holding cash, others start from the assumption that managers prefer more cash than would be beneficial for the shareholders. Pinkowitz, Stulz, and Williamson (2006) for example find that firms in countries with a low quality of investor protection hold significantly more cash than firms in common law systems and they conclude that agency costs of cash are relevant in civil law countries. If agency costs are smaller in countries with a common law system (Dittmar and Mahrt-Smith, 2007; Pinkowitz, Stulz and Williamson, 2006; Frésard and Salva, 2010; Doidge, Karolyi and Stulz, 2004; La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 2000) and if agency costs drive the difference in cash holdings between listed and unlisted firms, the shift from A* till A- should be smaller in common law countries.

The reasoning above results in three alternative hypotheses on cash ratios of listed firms in comparison to unlisted firms. These hypotheses are contrasted to the null hypothesis based on the assumption that there is no difference between cash ratios of listed and unlisted firms:

H0: Cash holdings of listed firms equal cash holdings of unlisted firms.

---

[5] There are also negative aspects of a listing, like the provision of valuable information to competitors (Campbell, 1979). Listed firms may therefore also have different characteristics than unlisted firms (Pagano, Panetta and Zingales, 1998)(Chemmanur, He and Nandy, 2010; Stoughton, Wong and Zechner, 2001).

If the null hypothesis is refuted, differences between cash ratios in listed and unlisted firms may be caused by the additional financing benefits available to the listed firm. This first alternative hypothesis of the dominance of "improved financial access" in listed firms suggests that value maximizing managers of firms will hold less cash (a shift from A* to B* in Figure 1).

HA1: Cash holdings will be smaller in listed firms in comparison to unlisted firms.

If the null hypothesis is rejected and the cash holdings of listed firms are smaller than those of unlisted firms, financing benefits will be the major driver for the difference in cash holdings between listed and unlisted firms. However, cash holdings may also be significantly larger in listed firms in comparison to those of unlisted firms. When this will be the case, hypotheses H0 and HA1 will be rejected, but the alternative hypotheses 2 and 3 may still hold. Alternative hypothesis 2 of the "improved opportunity set" implies that the listing improves the governance and/or the operating and/or the investment opportunities of the firm. In that case value maximizing managers will hold more cash in listed firms (C* in Figure 1) than in unlisted firms (A* in Figure 1). However, if the weaker monitoring combined with agency costs cause the increase in cash holdings (alternative hypothesis 3 of "increased agency costs of cash" in listed firms), the marginal contribution of cash in listed firms should be lower than the marginal contribution of cash in unlisted firms.

It is possible to distinguish the first alternative hypothesis from the second and third alternative hypotheses by the relative size of cash ratios in listed and unlisted firms. However, in case of larger cash ratios in listed firms one cannot distinguish whether "increased agency costs of cash" or "improved opportunity set" effects dominate. In order to differentiate alternative hypotheses 2 and 3 one should compare the marginal impact of the cash holdings on firm value for listed and unlisted firms in order to study if agency costs are a dominant phenomenon for additional cash holdings in listed firms. Because firm value of unlisted firms is not available, it will only be possible to distinguish the two alternative hypotheses by comparing the impact of cash holdings on firm value indirectly. This will be done here by considering that the second alternative hypothesis of the "improved opportunity set" also implies that cash holdings in listed firms will improve earnings more than in unlisted firms. For this reason I test whether the marginal contribution of cash holdings to earnings in listed firms will not be smaller than in unlisted firms. This gives the second alternative hypothesis:

HA2: The marginal contribution of cash holdings to earnings is not smaller in listed firms than in unlisted firms.

When the cash holdings in listed firms are larger than in unlisted firms and if the marginal contribution of cash holdings to a listed firm is at least equal to the marginal contribution of cash holdings to unlisted firms, the alternative hypothesis of the "improved opportunity set" holds. However, when cash holdings

are larger in listed firms but the marginal contribution of cash holdings to earnings is smaller in listed firms in comparison to unlisted firms, alternative hypothesis HA2 is rejected, and the third alternative hypothesis of "increased agency costs" is assumed to dominate:

HA3: The marginal contribution of cash holdings is smaller in listed firms than in unlisted firms.

One may note that the hypothesis HA2 allows the possibility that the marginal contribution of cash holdings to earnings in listed firms does not have to be equal to the marginal contribution of cash holdings in unlisted firms (as would be the case in figure1). The hypothesis HA2 allows the possibility that the marginal contribution of cash holdings to the earnings of a listed firm may be larger than that of unlisted firms. As it is assumed that the marginal costs of cash holdings are similar within a country, the managers of the listed firm do not maximize firm value if the marginal contribution of cash holdings to earnings is larger in listed firms in comparison to unlisted firms. In such a case even larger cash holdings in listed firms would be required to get the maximum value out of the firm. For now, it suffices to emphasize that hypothesis HA2 allows us to differentiate between the dominance of "increased agency costs" and its alternative of the "improved opportunity set". Table 1 summarizes the alternative hypotheses.

Table 1 about here
----

3. Data

Data from the Orbis database of Bureau Van Dijk are used. The Orbis database contains data on listed and unlisted firms and covers firms worldwide. From this database firms that are incorporated before 2011 are selected. I also require that the values of cash and cash equivalents, total assets, and earnings before interest and tax (EBIT) are available for the period 2006 until 2009. Because listed firms are relatively large, and because I intend to have as much as possible comparable firms, I require that total assets in the period 2006-2009 are each year larger than 100 million euro. For comparability reasons, I select only industrial firms (with a primary US SIC Rev. 2 code between 20 and 39). This means that not only financial firms and utilities are discarded with, but also agricultural, building and service firms. Firms are included only if there remain at least 10 listed and 10 unlisted firms in a country. This selection procedure provides 8633 firms, evenly distributed amongst unlisted (4309) and listed (4324) firms. For these firms data are retrieved for the period 2001-2009. Cash and cash equivalents for these firms are also downloaded from the Orbis database. In order to cope with the different currencies, I use the cash ratio as

the central measure. The cash ratio measures the amount of cash and cash equivalent divided by the amount of total assets. For the cash ratio there are 69900 firm year observations, of which 33598 for unlisted firms and 36302 for listed firms. Table 2 provides the number of firms by country and type (unlisted or listed) and the mean cash ratios for the types of firms as well as the t-values of a test on the equality of cash ratios for both types of firms.

`

Table 2 about here

Table 2 shows that most large manufacturing firms are found in Japan (1614), China (898), the United States (811) and in Europe (Italy, 628, United Kingdom: 567, Germany: 565 and France: 550). The table also shows how the cash ratios differ by country. If listed firms have a relatively high cash ratio in a country, unlisted firms have a high cash ratio too. On average the cash ratios in listed firms are 5.9 percentage points larger than in unlisted firms. For a large majority of countries (23 out of 26) the cash ratios for listed firms are larger than those for unlisted firms. The exceptions are Malaysia, Poland and the Ukraine. Moreover, in 19 out of 26 countries the difference in cash ratios between listed and unlisted firms is significantly different from zero and negative. In the Ukraine the mean cash ratios are the smallest of all the countries. Only in that country the mean cash ratio is significantly larger in unlisted firms than in listed firms. The cash ratios are largest In the United States of America, with China, Taiwan and Japan following. Table 2 also adds the same information for common and non-common law countries. Because law systems are quite often a combination of more than one law system, I classify the common law countries with a pure law system, namely Ireland, the United Kingdom and the United States, in one group and the other countries in the non-common law group. Table 2 shows that the mean cash ratio in the three common law countries is larger than in the non-common law countries. Moreover, the difference between the mean cash ratios of listed and unlisted firms is larger in common law countries than in non-common law countries. Finally, the listed firms in common law countries do have a larger cash ratio than the listed firms in non-common law countries. This is clearly different from the findings of Pinkowitz, Stulz, and Williamson (2006), and it may be caused by inter alia differences in observation periods, choice of common law countries, choice of firm industry, and database.

The literature suggests various determinants of cash ratios. The characteristics of listed firms may thus systematically bias the cash ratios of listed firms in the direction of a higher cash ratio in comparison to the cash ratios of unlisted firms.

Economies of scale result in a relatively smaller need for cash in large firms (Mulligan, 1997). As a measure for scale I use the natural log of total assets. According to agency theory, firms with a relatively larger debt ratio will have lower agency costs (Jensen and Meckling, 1976; Jensen, 1986). When managerial preferences increase the level of cash, an increase in leverage will reduce the possibility

to do so. Also option theory (Black and Scholes, 1973) implies a negative relation between leverage and cash ratios: when the company has long term debt, shareholders prefer risky assets above risk free (cash) investments (Faulkender and Wang, 2006). Agency and option theory thus imply a negative relationship between leverage and cash ratios. I measure leverage as the book value of long term debt divided by the book value of assets. Firms with a high market to book ratio are likely to hold more cash, because possible underinvestment problems (Myers, 1977) will be less if the firm can use its cash holdings for new valuable investments.

Growth options cannot be approached by the market to book value of unlisted firms. For that reason it is assumed that firms with large investments in the past are also likely to be wanting to invest in the future. According to the hierarchy theory of cash (Opler, Pinkowitz, Stulz, and Williamson, 1999) firms which made large investments in the past, are more cash constrained. For these reasons a negative relation between the relative change in assets and the level of cash holdings in both listed and unlisted firms is likely to arise.

(Bates, Kahle and Stulz, 2009) indicate that the non-cash component of liquidity may form substitutes for the amount of cash held in firms. The non-cash component of liquid assets is measured by dividing the sum of inventory and receivables by the firm's total assets. I thus assume that the impact of this measure will influence cash holdings negatively. (Bates, Kahle and Stulz, 2009) also indicate that the cash flows may be important measures for the access to future liquidity. The Orbis database does not give a comparable number of observations on operating cash flows. I therefore use net income instead of cash flows, as net income is found for both listed and unlisted firms in comparable proportions. It is assumed that an increase in the income variable will influence the cash ratios positively. Again, here a positive relationship arises from the hierarchy theory (Opler, Pinkowitz, Stulz, and Williamson, 1999; Bates, Kahle and Stulz, 2009) also include the cash flow risk in their analysis. Higher risk is likely to increase the cash holdings of firms. Again net income substitutes for the unavailable cash flows, and the standard deviation of the net income for the last two years and the current year is then used to measure risk. The three year variance reduces the number of observations in comparison to the other variables, but a risk variable should not be omitted. Both net income and the variance of the three years net income is scaled by total assets. I, finally, consider that firms may have avail to lines of credit or other short term bank loans. It is likely that lines of credit and short term debt reduce the need of firms of large cash holdings. It is impossible to measure potential credit of firms from unused lines of credit, and for that reason I use short term debt presented in the balance sheet as a measure of short term access to liquidity (Almeida, Campello and Weisbach, 2004) and the variable is scaled by the firms total assets.

The independent variables derived from the annual accounts are winsored at both sides at 0.5% for listed and unlisted firms separately. Finally, the dependent variable is similar to Opler, Pinkowitz, Stulz, and Williamson (1999) and other approaches in the literature, by using cash and including cash equivalents and then scaling the resulting value by total assets. This variable is not winsored, because it lies by definition between zero and one. Table 3 provides the most important determinants of cash ratios

and the concomitant characteristics of the unlisted and listed firms for the cleaned dataset (i.e. excluding firms with negative ages, listed firms that were in the database before the moment of appearing in the Datastream database, and after having winsored the variables except for the cash ratio and the year of incorporation.

Table 3 about here

Table 3 shows that the mean cash ratio (CATA) in listed firms is 0.138, which is larger than that of unlisted firms (0.074). The difference is significant at the 1% level according to a t-test with unequal variances assumed. Median cash ratios are 0.100 in listed firms and 0.029 in unlisted firms. The median cash ratio in listed firms is again significantly larger at the 1% level than the median cash ratio of unlisted according to the Mann-Whitney-Wilcoxon rank sum test.

For all variables the differences are significant at the 1% level according to both types of tests, except for the Mann-Whitney-Wilcoxon test for the relative change in fixed assets. Relatively large differences are found in mean and median firm size (LNTAW), the median long term debt ratio (LDTAW), the mean value of the relative change in fixed assets (DFAW), the mean and median of the non-cash short term assets ratio (OLTAW), the mean and median of the short term loans ratio (LOTAW), the mean and median turnover ratio (TUTAW), the mean turnover growth (DLNTUW), and the mean and median of company age (AGE). Listed firms are larger than unlisted firms. Mean net income of listed firms in relation to total assets is smaller in comparison to unlisted firms, but the median of that ratio is larger for listed firms. Mean and median measures of risk for listed firms are smaller than those for unlisted firms. Long term debt ratios (LDTAW), and in particular the median of the debt ratios, are larger in listed firms than in unlisted firms. The mean growth rate of unlisted firms (DFTAW) is almost twice as large as the mean growth rate of listed firms, though there is no significant difference between the relatively small median growth rates. While the cash ratio in listed firms (CATA) is larger than that in unlisted firms, the opposite is the case for the other short term assets (OLTAW). Moreover, listed firms do use much less short term debt (LOTAW) than unlisted firms. The mean and the median of firm age in listed firms are larger than in unlisted firms.

It may be noted that the performance of listed firms is according to various measures worse than that of unlisted firms: the mean net income to total assets (NITAW) is on average 3.6 percent in unlisted firms and 3.0 percent in listed firms. This difference is highly significant. Mean and median asset turnover (TUTAW) is also significantly higher in unlisted firms than in listed firms. Finally, sales growth (DLNTUW) is also larger in unlisted firms in comparison to listed firms for the full period. Except for the median net income, listed firms in the current sample indeed perform worse than unlisted firms. This also means that the relative performance of listed and unlisted firms in the current database is not materially

different from the relative performance of such firms measured in databases used by other researchers like Jain and Kini (1994).

Table 4 presents the developments of the variables over time. Because the period of time for which data are available is relatively short, there is no clear trend in the cash ratios, though the mean cash ratio is amongst the largest in listed and unlisted firms for the year 2009. An increase in cash ratios is also reported by Bates et al. (2009). The short term loan ratio (LOTAW) of unlisted firms is somewhat declining over time, but the other variables do not show a clear trend either. One, nevertheless, finds some cyclical developments. The net income ratio (NITAW) is smallest for listed and unlisted firms in well know crisis periods 2001/2002 and 2008/2009. While net income risk (S3TAW) cannot be measured for the first two years, the period 2008/2009 also shows the largest mean net income risk measurements. The period 2004-2006 has been a booming year for net investments in fixed assets (DFTAW) for unlisted firms and the middle of that period (2005) was also a major year for investments in listed firms. The other liquid asset ratio (OLTAW) is smallest for both listed and unlisted firms in 2009.

Table 4 about here

A final observation may be made on the relation between cash holdings and firm debt. Bates et al. (2009) indicate that the cash holdings in the listed firms in the US are nowadays large in comparison to previous cash holdings. In fact they find that the cash holdings of the average listed firm are able to retire all debt obligations. When I add the long term debt ratio and the short term loan ratio for all observation years, the outcome is (10.5% + 10.8% =) 21.3% for unlisted firms and (11.8% + 2.2% =) 14.0% for listed firms. The cash ratios of listed firms are on average 13.8%. These observations imply that, worldwide, listed firms would indeed almost have been able to use cash holdings to redeem all debt obligations in the period 2001-2009. For unlisted firms the cash ratios are on average 7.4%. This is 13.9 percentage points less than the sum of both debt ratios for unlisted firms. One may thus conclude that the unlisted firms are not able to use their cash holdings to retire their debt. [6]

---

[6] The possibility to retire all long term and short term debt for US listed firms holds in this database only for the years 2004 and 2005. On average the cash ratio for US listed firms (18.4%) is 1.3 percentage points smaller than the sum of both debt ratios (19.7%) in the period 2001-2009. For unlisted firms in the US the difference between the mean cash ratios and the sum of both debt ratios in the period 2001-2009 is 15.7 percentage points, which is larger than for all unlisted firms worldwide.

4. Cash ratios of listed and unlisted firms

Pagano and Röell (1998) find that managers of firms may like to get a listing when they want to use cash for future acquisitions. This means that the listing of a firm makes the cash ratios larger when the IPO adds cash to the firm, but that it may take some time before the cash can be given an appropriate destination. I therefore study whether the cash ratios of listed firms change over the duration of the listing. Table 4 presents the characteristics of the cash percentages over various types of listed and unlisted firms. Among the unlisted firms are firms that are delisted according to the Orbis database. For the listed firms I approach the moment of listing of a firm by the first occurrence of the return index in the Datastream database. One may then also distinguish between firms with a base year in 1980 (the starting year of Datastream) or earlier, firms that have a starting year after 1980 but before 2001 (the year for which the first observations were available in the Orbis database), and firms that appeared in the Datastream database during the period for which there were observations available in the Orbis database (2001-2009).

Table 5 about here

Table 5 indicates that there is a maximum of 77,697 firm year observations (9 years times 8633 firms). For these firm years there are 69,900 (90.0%) observations on the cash ratios. For all types of firms the percentage of cash ratio observations is higher than 80%, with a minimum percentage for the newly listed firms with a base year after 2000 (80.2%), and a maximum for the firms listed for the longest time period, namely in or before 1980 (99.4%). Amongst the listed firms, the firms with the most recent base year have the largest cash ratios, while the cash ratios decline if the base year lies further in the past. Amongst the unlisted firms, the previously listed firms have higher mean and median cash ratios than the firms that were never listed: the delisting does not result in a quick adaptation to the cash ratios of never listed firms.[7] In table 6 I relate the cash ratios of the listed firms to the duration of their appearance in the Datastream and Orbis databases.

Table 6 about here

---

[7] The mean cash ratio of delisted firms lies between the mean cash ratio of firms that were listed in or before 1980 and the mean cash ratio of firms that were listed after 1980 but before 2000. If the year of listing would be the only determinant of cash ratios, the average delisted firm would have gone public in the period 1980 – 2000.

For the firms with known base years, Table 6 shows the cash ratios observed in the years relative to the year of appearance in Datastream. Firms that are still far before the moment of appearance in Datastream have low cash ratios. For example, the 9 firm year observations for which the listing will take place after 8 years, have a mean cash ratio of only 2.2%. When firms come closer to the year of appearance they increase their cash ratios. In the year of appearance the cash ratios are largest (18.3%). After the year of appearance the cash ratios decline gradually over time. An exception on the latter form the 864 firms that already appear in Datastream in 1980 and that are still listed in 2009. These firms, with an appearance in Datastream of 29 years earlier, have on average a cash ratio of 12.7%, which is somewhat larger than the percentages for firms that appear 21-28 years in Datastream.

The gradual increase of cash ratios before the year of appearance in Datastream was quite unexpected. It might have been caused by the possibility that the appearance in Datastream for some firms is later than the moment of the listing of the firm. This would imply that the IPO-date would be earlier and that the additional cash generated during the IPO for the firms involved would be allocated earlier. The gradual increase in cash holdings would then be caused by IPOs that appear later in Datastream. However, the 4441 firm year observations from the Orbis database for which the listing date was available give comparable results. There is also a gradual increase in cash ratios before the IPO year and there the cash ratios are also largest in the IPO-year (19.8%). After the IPO year the cash ratios decline too and the firms with the longest number of observation years (12 years) after the IPO-year show cash ratios that are relatively large in comparison to those of the cash ratio observations 10 and 11 years after the IPO. These findings are not necessarily in conflict with the fact that one of the reasons for entering into the IPO-process is the need for additional cash. The run-up documented here, however, suggests that the IPO may not solely be focused on the need for cash, and that firms that strive for more cash are even able to accumulate cash before the IPO.

Still, firms that start an IPO process have relatively low cash ratios some years before the IPO. Until about four years before the IPO the future listed firms do not have cash ratios that differ systematically from the low cash ratios of unlisted firms as documented in Tables 1 and 2. Moreover, listed firms gradually reduce their cash ratios after their listing. However, even 29 years after the IPO, listed firms have mean cash ratios that are still much larger than the cash ratios of unlisted firms. Moreover, the cash ratios of the listed firms 29 years after the IPO are also larger than the cash ratios that the listed firms had 4 years (or more) before the IPO-year.

Table 7 presents the impact of being listed on cash ratios while taking various control variables into account. I define the cash ratio (CATA) as the sum of cash and cash equivalents divided by total assets. A listed firm is characterized by a dummy variable (LISTED), which takes the value of 1 if the firm is listed, and 0 otherwise. The other variables are control variables. First, I control for economies of scale in cash holdings (Mulligan, 1997). The natural logarithm of total assets (LNTA) is used as a measure of firm size and a negative relationship between firm size and the cash ratios is assumed. Then I include net income scaled by total assets (NITA). The net income is used as a proxy for the cash flows, which many

authors divide by total assets and then incorporate it as a major determinant for cash ratios (e.g. (Opler, Pinkowitz, Stulz, and Williamson, 1999; Bates, Kahle and Stulz, 2009). Because the Orbis database has too many missing values for cash flows of unlisted firms, I use net income instead of cash flows. The hierarchy theory of cash holdings Opler, Pinkowitz, Stulz, and Williamson (1999) suggests that increases in cash holdings may automatically arise from increased cash flows (or earnings). Only when net income has arisen, a firm may be able to use the money for e.g. debt reductions, investments, dividends or repurchases. This means that cash will be held some time before it will be given the appropriate use and a positive relation between net income and cash ratios is expected.

I also include long term debt, which is measured by the debt ratio (LDTA) defined as long term debt divided by total assets. The higher the debt ratio, the more likely it is that debt holders require collateral. As cash holdings can be captured with least costs, cash would be the best form of collateral available to debt holders. However, the drawback of cash holdings as collateral is that it offers managers flexibility in applying it in uses not foreseen and not preferred by debt holders. In that case fixed assets, which cannot easily be transformed by managers, may serve as better collateral (Myers and Rajan, 1998). Moreover, highly levered firms are less likely faced by agency costs (Jensen, 1986), and managers of highly levered firms may not be able to use the flexibility of cash as much as managers of firms with low leverage. It is therefore not amazing that authors find a negative sign of debt ratios on cash holdings (Opler, Pinkowitz, Stulz, and Williamson, 1999; Bates, Kahle and Stulz, 2009) and it is therefore expected that highly levered firms will hold less cash.

Capital expenditures are also able to influence cash ratios. In line with the hierarchy theory of cash (Opler, Pinkowitz, Stulz, and Williamson, 1999), capital expenditures are likely to reduce the amount of cash holdings, while selling off the firm's assets is likely to increase cash holdings. Capital expenditures and sell-offs are measured by the current change in assets divided by last year's assets (DFTA). Company age is also included. If the firm's age is higher, it is more likely that the firm will be better known and relations with banks and suppliers have been established. This makes it more likely that alternative possibilities exist to overcome temporary cash shortages by e.g. the use of commercial paper, lines of credit or trade credit. It is thus assumed that firms age (AGE) reduces the need for cash holdings. As (Bates, Kahle and Stulz, 2009) indicate that cash holdings increased, I include a trend (TREND) and assume that the sign of this control variable will be positive.

Besides the base equation, I consider the possibility that firms may substitute cash holdings for other types of firm liquidity. Non-cash components of working capital can be converted into cash holdings relatively quickly (Bates, Kahle and Stulz, 2009). For this reason, I include the sum of inventory and receivables and divide this sum by total assets. This gives the value for the ratio of other (non-cash) liquid assets (OLTA). The assumed substitution implies an expected negative sign for this variable in a regression on firms' cash holdings. I also assume that short term debt may act as a substitute for cash holdings, and calculate the ratio of short term debt to total assets (LOTA). Also this measure is assumed to influence cash the ratio of cash holdings negatively.

Managers may be able to retain cash during the current year, inter alia by refraining from repurchases (Brav, Graham, Harvey and Michaely, 2005), in order to be able to invest in envisioned future projects. Access to cash for future investments is also a major reason for firms to apply for a listing (Pagano and Röell, 1998). It is likely that managers already know in the current year to some extent whether such investments are envisioned. I therefore include a forward looking variable, which measures the relative change in total assets of next year (DFTAWF). The expected impact of this variable on cash holdings is positive. A drawback of using this variable is that it reduces the number of observations by one year at the end of the observation period. So the variable will only be included if the effect of the other variables has already been established.

Cash flow risk is also a major determinant for cash holdings (Bates, Kahle and Stulz, 2009). As there are more observations on net income than on cash flows for unlisted firms, the measure of risk will be based on net income. I use the standard deviation of net income to assets for the current and two preceding years as a measure of risk (S3TAW). It is expected that cash holdings are larger if company risk is higher. Again, the use of this variable reduces the number of observations, but now even for the first two years of the observation period, and therefore it is also a variable which will be included when the impact of all other variables has been assessed.

Finally, I incorporate industry and country dummies in the regression equations. Country dummies are primarily included, because the marginal costs of cash holdings (in particular the opportunity costs of cash and the corporate tax rates) may differ amongst countries. Country dummies take the value of 1, if the firm's headquarter is located in the relevant country, and 0 otherwise. Country dummies are provided for all countries reported in table 2, except for the United States, which serves as the base country from which the other countries differentiate. I include industry dummies, because the marginal benefits of cash holdings and the marginal benefits of being listed may be influenced by the industry in which the firm operates. Industry dummies are based on the first two digits of the firm's first NACE Rev. 2 codes. The industry dummies take the value of 1, if the NACE code is in the relevant industry, and 0 otherwise. Industry code 26 (manufacturing of computer, electronic and optical products) is taken as the base industry and excluded from the industry dummies, as this industry involved the largest number of firms. Incidentally, the mean of the cash ratios in this industry (0.186) proves to be the largest amongst the cash ratios of the industries. Neither the coefficients of the country dummies, nor the coefficients of the industry dummies will be presented.

Table 7 presents the base equation in column 1 and then the results of adding the successive other variables in columns 2-5. A major issue is that cash holdings may be influenced by the indicated variables, but that the causality may also go in the other direction. It is for example likely that net income increases add to the cash holdings, but that increased cash holdings also affect net income, because it can be invested in short term interest bearing instruments and because it allows profit generating transactions which might not be done without adequate cash levels. In order to cope with such endogeneity, I use lagged values of the independent variables as instrumental variables, except for AGE and TREND. The

lagged variables are represented by the L at the end of the mnemonic. I apply Tobit analysis, because the cash ratio is censored at 0 from below and at 1 from above. Because of the panel dataset I use panel regressions.

Table 7 about here

Table 7 shows in column 1 the results of the Tobit panel analysis for the base equation. In this equation all variables are highly significant with signs as expected. The dummy that represents the listed firms is also highly significant and shows that a listed firm has a cash ratio which is 0.039 larger than that of unlisted firms.

Column 2 of table 7 shows the results that include the possible substitution effects of non-cash liquid resources. The coefficient of this variable is highly significant and in line with the expectation that non-cash liquid assets are used as a substitute for cash holdings. Column 3 of table 7 adds the short term loans to the equation, and also here the coefficient is highly significant and -according to expectations- negative. Column 4 of table 7 incorporates the effect of future relative changes in assets. It shows a highly significant positive relation between future investment needs and the cash ratio. This means that the precautionary motive for holding cash for future investments is confirmed. Finally, also higher income risk is highly significant. The positive coefficient confirms that the cash ratios increase with higher income risk. In particular the inclusion of the latter three variables reduced the size of the effect of being a listed firm, but the effect is still highly significant and positive.

Tobit regressions provide the estimates for latent variables that may lie outside the attainable range of observed cash ratios (0,1). However, the economic effect of a listing within the relevant range of cash ratio observations may also be interesting. According to (Greene, 2008) a change in an independent variable has two effects. It changes, first, the conditional mean in the relevant part (0,1) of the distribution and, second, the probability that the observation will fall in that part of the distribution. The conditional mean of the cash ratios for the observed firms in the final equation (Column 5 of table 7) is 0.136. The marginal effect of a shift from being an unlisted firm on the conditional mean (0.019) is clearly smaller than the marginal effect measured for the latent cash ratio (0.030). Nevertheless, the marginal effect is still highly significant. Similar results apply to the marginal effects measured through the other four regressions of columns 1 till 4. Based on these results I conclude that the null hypothesis of no effect of a listing on cash holdings is rejected. Moreover, also the first alternative hypothesis of "improved financial access" which implies that there will be less cash holdings after the listing should be rejected.

18

5. The marginal impact of cash ratios on net income

As cash ratios of listed firms are larger than those of unlisted firms, a shift of the marginal benefits of cash to the left (from AA to BB in Figure 1) is refuted for listed firms. The question that still has to be answered is whether the combined effects of a listing of the firm shifts the marginal benefits of cash (from AA to CC in Figure 1), or whether it generates a shift along the marginal benefits curve AA from the optimum value A* to a suboptimum like A-. The latter would be the case if agency costs drive the increase in cash holdings of listed firms. For that reason it is relevant to test whether the marginal impact of the larger cash ratios in listed firms are smaller or larger than in unlisted firms. However, firm value of unlisted firms is not available. I therefore study the marginal effects of cash holdings on net income, by applying the following line of thought.

The marginal impact of cash holdings (C) on firm value (V) is $\partial V/\partial C = (\partial V/\partial NI * \partial NI/\partial C)$, where $\partial V/\partial NI$ is the marginal effect of net income on firm value and $\partial NI/\partial C$ the marginal effect of cash holdings on net income. It is likely that there is a positive relation between net income (NI) and firm value. When it is assumed that the marginal effect is similar for listed and unlisted firms in the same industry in the same country ($\partial V/\partial NI = \varphi$ and $\varphi > 0$), a positive effect of increases in cash holdings on net income implies that increased cash holdings improve firm value.[8] This means that the relative impact of cash holdings on net income ($\partial NI/\partial C$) for listed and unlisted firms also determines the relative impact of cash holdings on value for both types of firms. For this reason I test if the listing generated more agency costs or not, by comparing the marginal impact of cash holdings on net income for both listed and unlisted firms. In case the listing increased the agency costs of cash holdings, the marginal contribution of cash to net income should according to alternative hypothesis 3 be smaller in listed firms than in unlisted firms.[9]

In the regressions of table 7 lagged variables are used to measure the impact of the independent variables, amongst which the net income ratio, on the cash ratios. The lagged values of the determinants were introduced as instrumental variables for the current years' determinants in order to avoid endogeneity. Now I measure the inverse relationship, namely the effect of cash ratios on the net income ratios, but in first differences in order to measure the marginal effects. Change measures are, however,

---

[8] If net income growth as well as the payout ratio is stable, the Gordon and Shapiro (1956) model implies that φ equals $p/(r-g)$, where p is the payout ratio, r the relevant required rate of return and g the net income growth. The discount rate is generally based on systematic risk measures and evaluators normally derive systematic risks measures of the assets of an unlisted firm from the systematic risks of the delevered assets of a number of comparable listed firms (Koller, Goedhart and Wessels, 2010). When systematic risks of listed and of unlisted firms are comparable, the required rates of return are too. If one also assumes that the payout, the leverage and the growth ratios do not differ between listed and unlisted firms within an industry in a country, the value of φ does not differ between listed and unlisted firms.

[9] It would have been preferable to study the impact of cash holdings on free cash flows, but the database Orbis does not provide many observations for the operating cash flows of unlisted firms. Moreover, from the calculations of the marginal impact of cash holdings on net income, one cannot conclude whether additional cash also increases firm value by exactly (or more or less than 1), because it is impossible to measure the marginal impact of net income on firm market values (φ) for unlisted firms.

more volatile than level measures, and it may be inappropriate to assume that last years' changes in cash ratios are a good instrument for the current years' changes in cash ratios. For that reason I correct for endogeneity by using the Hausman and Taylor (1981) panel regression analysis. I retain the lagged measure for company size (LNTAWL) in order to cope with economies of scale. Data limitations for unlisted firms made it impossible to correct for other possible variables that influence company values, like the market to book value (Fama and French, 1992) or return momentum (Carhart, 1997). Moreover, short- and long-run effects on net income are taken care off by introducing a lagged dependent variable. Finally, country dummies and industry dummies are included. The inclusion of the country dummies controls for the possibility that the marginal costs of cash holdings may differ by country. The industry dummies control for the possibility that the marginal benefits of cash holdings may differ by industry. This results in the following specification for the regression line:

$$DNITAW_{it} = a_0 + a_1.DCATA_{it} + a_2. LNTAWL_{it} + a_3.DNITAWL_{it} + \Sigma_j \, a_j.CDUMi + \Sigma_k \, a_k.IDUMi + \varepsilon_{it} \qquad (1)$$

Where:

$DNITAW_{it}$	= the change in the winsored net profit ratio of firm i in year t,
$DCATA_{it}$	= the change in the cash ratio of firm i in year t,
$LNTAWL_{it}$	= the winsored natural logarithm of total assets of firm i in year t-1,
$DNITAWL_{it}$	= the change in the winsored net profit ratio of firm i in year t-1,
$CDUM_j$	= a dummy for the country, which takes the value of 1 if the firm is headquartered in country j, and 0 otherwise,
$IDUM_k$	= a dummy for the industry, which takes the value of 1 if the firm is headquartered in industry k, and 0 otherwise,
$a_0, \ldots, a_5, \, a_j, a_k$	= the coefficients of the regression equation,
ε_{it}	= the error term of the equation.

An increase in the cash ratio will result in a change of the net income ratio in the short run by a_1. In later years, the innovation in cash holdings may also affect income, and the long run equilibrium effect is captured by (a1/(1-a3)). The results for the Hausman-Taylor panel regression outcomes are presented for unlisted and listed firms in both common and non-common law countries. If the marginal benefits of cash holdings are smaller in listed firms than in unlisted firms, it is likely that increased agency costs are a major driver for the large cash holdings in listed firms. If the opposite proves to be true, I assume listings have as a dominant consequence that cash holdings are used for coping with the improved opportunities generated by the listing and by the possibilities of compiling the cash for future value enhancing investments. The Hausman-Taylor regression results are presented in table 10, panel A.

Table 8 about here

Table 8 shows that an increase in cash ratios increases net income in listed as well as in unlisted firms. This is the case for firms from common law countries as well as firms from non-common law countries. Moreover, all coefficients are at least significant at the 5% level, and the coefficients of the instantaneous impact of cash ratios on a firm's net income are all significant at the 1% level. The impact of cash holdings on net income in listed firms is larger than that of unlisted firms. Again this is also the case if one compares listed and unlisted firms in non-common law countries.

The findings of table 8 thus suggest that, while the listing of a firm results in larger cash holdings, the additional cash does not result in a decrease in the marginal effect of cash holdings on net income (and on presumed firm value). I therefore conclude that it is not likely that a listing resulted in additional agency costs of cash. It is even very likely that there are increased benefits of holding cash. If this would not be the case the increased amounts of cash holdings would –even without agency costs- result in a smaller contribution of cash holdings to firm value because of declining marginal returns. Because listed firms have larger cash holdings and also larger marginal contributions to net income than unlisted firms, it is very likely that the shift of becoming a listed company also shifted the marginal benefits of holding cash (in figure 1 from AA to CC). This means that the alternative hypothesis of

6. Robustness tests

Robustness tests for the larger cash holdings in listed firms are presented in table 9 by applying different measures for the cash ratios. The variables used are the winsored value of cash holdings divided by the turnover of the firm (CATW). The second alternative measurement is the natural log of this winsored variable (LNCATW). As a third alternative measure I use the natural logarithm of actual cash holdings measured in euros. The fourth measure analyzes the similar measure, but then calculated in dollars, and finally I use the amount of cash in dollars, without taking the natural logarithm. Table 9 shows that in all these equations cash holdings in listed firms are larger than cash holdings in unlisted firms.

Table 9 about here

The inclusion of country dummies in tables 7 and 9 prohibits to study whether the effect of being listed on cash ratios is different in common law countries in comparison to non-common law countries. It is,

however, likely that the law systems of countries influence cash holdings. Pinkowitz, Stulz, and Williamson (2006) find for listed firms that better protected shareholders (in common law countries) have lower cash ratios. Though the dataset has several countries that comprise a common law system, it is quite often also influenced by other law types, like Islamic law. I therefore restrict the analysis of the impact of common law to the countries with a pure common law system, namely the United States, Great Britain, and Ireland. For these countries a common law dummy (COM) is included in the final regression of table 7 (column 5) without the inclusion of country dummies. This dummy takes the value of 1 if the firm's headquarters is in one of these countries, and 0 otherwise. The coefficient of the COM allows us to study if the cash ratios in common law countries do differ from those in non-common law countries. Moreover, I interact the common law dummy with the listed dummy (COM*LISTED). This variable takes the value of 1 if a firm is listed in a common law country, and 0 otherwise. This variable is included in the regression equation to test whether listed firms in common law countries do hold more cash than listed firms in other law countries.

Column 1 of table 10 gives the Tobit panel regression results. The coefficient of the COM dummy is positive, but insignificant. This means that there is no overall systematic increase in cash ratios of firms in common law countries. The coefficient of the interaction variable is positive and differs significantly from zero. This finding differs from Pinkowitz, Stulz, and Williamson (2006). The difference between my findings and those of Pinkowitz, Stulz, and Williamson (2006) may be caused by inter alia differences in control variables, estimation periods, choice of industry, choice of common law countries, and database.

Table 10 about here

However, my results may also be explained by the possibility that the governance of listed firms generates more attention to cash holdings is the case in unlisted firms. With much attention for cash and when shareholders are well protected by the law system, managers will have no incentives to spend the money quickly on perks and empire building investments. Instead they will be allowed to retain the cash for future value enhancing investments. This is corroborated for cash holdings by Dittmar and Mahrt-Smith 2007) and Harford, Mansi and Maxwell (2008) who find that well governed firms in the United States are able to hold more cash than other firms. Better control of cash in listed firms in comparison to the governance of unlisted firms may then result in relatively large cash levels amongst listed firms not only in the United States but also in other common law countries. Column 2 of table 10 shows the results of the Tobit panel regression analysis for the firms in the three common law countries. The coefficient of the LISTED variable in the regressions is 0.067, while the marginal effect of becoming a listed firm is 0.042. It shows that the cash ratios of listed firms are indeed larger than those of unlisted firms when one corrects for all other determinants. If better governance on a country level increases cash ratios, it may

also occur on a firm level. In that case the relatively large cash holdings in listed firms would imply that cash in these firms is better governed than in unlisted firms.

I also apply the test to the firms headquartered in non-common law countries (column 3 of table 10). In these countries the listed firms have also larger cash ratios than unlisted firms. The coefficient of the LISTED variable is 0.045 and the marginal effect is 0.028. In comparison to the common law firms, the effect of being listed is (0.045 - 0.067 =) 0.022 smaller for the Tobit regression results and 0.017 for the marginal effects. When better country governance generates on average larger cash ratios, large cash ratios may not be a sign of agency costs.

I finally consider the possibility that the measurements of the marginal effects of cash holdings on net income may be dependent on the estimation technique used. Instead of the Hausman-Taylor technique I also use the technique of Arellano and Bond (1991). This technique uses lagged values of the independent variables as instruments to overcome endogeneity problems. The use of this technique does not allow the use of fixed dummy values for allocating countries and industries to firms. Though the use of lagged independent variables may be less desirable when applied to changes in cash ratios and net income, the results of the Arellano-Bond technique (Table 11) are fully in line with the results of the Hausman-Taylor technique. Again the coefficients are larger for listed firms, and again this is the case for firms in both common and non-common law countries. These results even hold if one does not control for country and industry dummies.

Table 11 about here

My results therefore indicate that even when listed firms perform worse than unlisted firms (see Table 3), the marginal contributions of cash holdings is higher in the listed firms. This suggests that cash holdings have a different position than non-cash assets. It is therefore likely that the liquid and very visible character of cash holdings (Myers and Rajan, 1998; Harford, Mansi and Maxwell, 2008) result in a different treatment of cash than of non-cash assets in the listed firm. Agency costs are at least not the most dominant feature of cash holdings in listed firms in comparison to unlisted firms. It is therefore likely that the relatively high cash holdings of listed firms are related to more transactions (Pagano, Panetta and Zingales, 1998; Holmström and Tirole, 1993; Pagano and Röell, 1998; Chemmanur, He and Nandy, 2010) and more international exposure (Foley, Hartzell, Titman, and Twite, 2007). This also makes cash to contribute relatively more to earnings in listed firms than in unlisted firms in line with the transaction and precautionary motives of (Keynes, 1936).

7. Conclusions

Using a database of 4309 large listed firms and 4324 large unlisted firms I examine the cash ratios of both types of firms in 26 countries all over the world. I start from the trade-off theory presented by Opler, Pinkowitz, Stulz, and Williamson (1999) and assume that managers may optimize firm value by equalizing marginal costs to marginal benefits of cash holdings. Then I consider three alternative hypotheses for possible differences in cash ratios between listed and unlisted firms.

First, the listing may have caused a shift in the curve of the marginal benefits of cash resulting from improved access to liquidity after the listing. This would result in lower cash ratios in listed firms in comparison to unlisted firms. Second, the listing may have caused a shift in the curve of marginal benefits of cash holdings originating from improved opportunities after the listing. This would result in larger cash ratios in listed firms in comparison to unlisted firms. Third, increased agency costs with listed firms would cause a shift along the marginal benefit curve. This would increase cash holdings, but the marginal benefits of cash holdings would be smaller in listed firms in comparison to unlisted firms.

I find in 23 of the 26 countries that the cash ratios of listed firms are larger than for unlisted firms. On average the cash ratios of listed firms are 0.137 and those of unlisted firms 0.075. Listed firms also have larger cash ratios if one controls for shifts of the marginal revenue curves caused by economies of scale, leverage, substitution by other short term assets, previous and future capital expenditures, short term credit, net income, net income risk, company age, a trend, industry dummies, and country dummies or a common law dummy. Furthermore, the cash ratios of firms that were never listed are 7.2%, while recently listed firms have cash ratios of 15.2%. After the IPO the cash ratios decline, but they remain higher than the cash ratios in never listed firms. Listed firms also have a larger cash ratio in the IPO year in comparison to the years preceding the IPO. All these results imply that managers of listed firms are allowed to hold more cash than managers of unlisted firms. These findings contradict the first hypothesis that the relatively easy access to financial resources of listed firms is a dominant explanation for different cash holdings between listed and unlisted firms.

Larger cash ratios may result from weaker governance and additional agency costs appearing after the listing. However, the marginal contribution of cash to earnings in listed firms is larger than the marginal contribution of cash to earnings in unlisted firms. I therefore conclude that increased agency costs of cash holdings after a listing are not the major explanation for the larger cash ratios in listed firms. This is in line with the findings of Opler, Pinkowitz, Stulz, and Williamson (1999) that agency costs are not a major determinant of cash holdings. It also suggests that corporate governance may be better in listed firms than in unlisted firms with respect to the cash holdings. This is supported by the fact that the cash ratios in listed firms in common law countries (with stronger shareholder protection) are larger than those of unlisted firms. It is also corroborated by the fact that the marginal contribution to the firm's net income is largest in listed firms in common law countries. My database does not confirm the quantitative results of Pinkowitz, Stulz, and Williamson (2006), because I do not find smaller cash ratios in listed

firms in common law countries as compared to listed firms in non-common law countries. Nevertheless, such findings are not in contradiction with the basic outcome of Pinkowitz, Stulz, and Williamson (2006) that better corporate governance in common law countries generates lower agency costs, because the marginal contribution of cash holdings to net income is higher in common law countries than in non-common law countries.

Having discarded the dominance of "improved financial access" and "increased agency costs", I conclude that the differences in cash holdings between listed and unlisted firms arise from a set of positive developments amongst listed firms. Improved incentives, lower conflicts of interest amongst major shareholders, and an improved opportunity set (Holmström and Tirole, 1993; Pagano and Röell, 1998; Pagano, Panetta, and Zingales, 1998) will have shifted the marginal contribution of cash holdings positively. Because the marginal benefit of cash holdings within non-common law countries is larger for listed firms than for unlisted firms, I also assume that the agency costs are not the major determinant in explaining the difference between listed and unlisted firms in non-common law countries. Also there the listing may have benefited firms: despite a larger cash ratio, the marginal contribution of cash to earnings improves.

References

Alchian, A. A., and H. Demsetz, 1972, Production, information costs, and economic organization, *The American Economic Review* 62, 777-795.

Almeida, H., M. Campello, and M. S. Weisbach, 2004, The cash flow sensitivity of cash, *The Journal of Finance* 59, 1777-1804.

Arellano, M., and S. Bond, 1991, Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations, *The Review of Economic Studies* 58, 277-297.

Bates, T. W., K. M. Kahle, and R. M. Stulz, 2009, Why do US firms hold so much more cash than they used to? *The Journal of Finance* 64, 1985-2021.

Baumol, W. J., 1952, The transactions demand for cash: An inventory theoretic approach, *The Quarterly Journal of Economics* 66, 545-556.

Black, F., and M. Scholes, 1973, The pricing of options and corporate liabilities, *The Journal of Political Economy* 81, 637-654.

Brav, A., J. R. Graham, C. R. Harvey, and R. Michaely, 2005, Payout policy in the 21st century, *Journal of Financial Economics* 77, 483-527.

Brav, O., 2009, Access to capital, capital structure, and the funding of the firm, *The Journal of Finance* 64, 263-308.

Campbell, T. S., 1979, Optimal Investment Financing Decisions and the Value of Confidentiality, *The Journal of Financial and Quantitative Analysis* 14, pp. 913-924.

Carhart, M. M., 1997, On Persistence in Mutual Fund Performance, *The Journal of Finance* 52, pp. 57-82.

Chemmanur, T. J., and P. Fulghieri, 1999, A theory of the going-public decision, *Review of Financial Studies* 12, 249-279.

Chemmanur, T. J., S. He, and D. K. Nandy, 2010, The going-public decision and the product market, *Review of Financial Studies* 23, 1855-1908.

Chod, J., and E. Lyandres, 2010, Strategic IPOs and product market competition, *Journal of Financial Economics* 100, 45-67.

De Jong, A., C. Huijgen, T. Marra, and P. Roosenboom, forthcoming, Why do firms go public: the role of the product market, *Journal of Business Finance and Accounting*.

Dittmar, A., and J. Mahrt-Smith, 2007, Corporate governance and the value of cash holdings, *Journal of Financial Economics* 83, 599-634.

Doidge, C., G. A. Karolyi, and R. M. Stulz, 2004, Why are foreign firms listed in the US worth more? *Journal of Financial Economics* 71, 205-238.

Fama, E. F., and K. R. French, 1992, The cross-section of expected stock returns, *The Journal of Finance* 47, 427-465.

Faulkender, M., and R. Wang, 2006, Corporate financial policy and the value of cash, *The Journal of Finance* 61, 1957-1990.

Frésard, L., and C. Salva, 2010, The value of excess cash and corporate governance: Evidence from US cross-listings, *Journal of Financial Economics* 98, 359-384.

Foley, F. C, J. C. Hartzell, S. Titman, and G. Twite, 2007, Why do firms hold so much cash? A tax-based explanation, *Journal of Financial Economics* 86, 579-607.

Greene, W.H., 2008, *Econometric Analysis, Upper Saddle River, New Jersey.*

Grossman, S. J., and O. D. Hart, 1980, Takeover bids, the free-rider problem, and the theory of the corporation, *The Bell Journal of Economics* 11, 42-64.

Harford, J., S. A. Mansi, and W. F. Maxwell, 2008, Corporate governance and firm cash holdings in the US, *Journal of Financial Economics* 87, 535-555.

Hausman, J. A., and W. E. Taylor, 1981, Panel Data and Unobservable Individual Effects, *Econometrica* 49, 1377-1398.

Holmström, B., and J. Tirole, 1993, Market liquidity and performance monitoring, *The Journal of Political Economy* 101, 678-709.

Jain, B. A., and O. Kini, 1994, The post-issue operating performance of IPO firms, *The Journal of Finance* 49, 1699-1726.

Jensen, M. C., and W. H. Meckling, 1976, Theory of the firm: Managerial behavior, agency costs and ownership structure, *Journal of Financial Economics* 3, 305-360.

Jensen, M. C., 1986, Agency costs of free cash flow, corporate finance, and takeovers, *The American Economic Review* 76, 323-329.

Keynes, J.M., 1936, *The General Theory of Interest, Employment and Money* (The Royal Economic Society, London, 1976 edition).

Kim, C. S., D. C. Mauer, and A. E. Sherman, 1998, The determinants of corporate liquidity: Theory and evidence, *Journal of Financial and Quantitative Analysis* 33, 335-359.

Koller, T., M. Goedhart, and D. Wessels, 2010, *Valuation: measuring and managing the value of companies* (John Wiley & Sons Inc).

La Porta, R., F. Lopez-de-Silanes, A. Shleifer, and R. Vishny, 2000, Investor protection and corporate governance, *Journal of Financial Economics* 58, 3-27.

Miller, M. H., and F. Modigliani, 1961, Dividend policy, growth, and the valuation of shares, *Journal of Business* 34, 411-433.

Miller, M. H., and D. Orr, 1966, A Model of the Demand for Money by Firms, *The Quarterly Journal of Economics* 80, 413-435.

Modigliani, F., and M. H. Miller, 1958, The cost of capital, corporation finance and the theory of investment, *The American Economic Review* 48, 261-297.

Mulligan, C. B., 1997, Scale economies, the value of time, and the demand for money: Longitudinal evidence from firms, *The Journal of Political Economy* 105, 1061-1079.

Myers, S. C., 1977, Determinants of corporate borrowing, *Journal of Financial Economics* 5, 147-175.

Myers, S. C., 1984, The capital structure puzzle, *The Journal of Finance* 39, No. 3, Papers and Proceedings, 575-592.

Myers, S. C., and N. S. Majluf, 1984, Corporate financing and investment decisions when firms have information that investors do not have, *Journal of Financial Economics* 13, 187-221.

Myers, S. C., and R. G. Rajan, 1998, The Paradox of Liquidity, *Quarterly Journal of Economics* 113, 733-771.

Opler, T., L. Pinkowitz, R. Stulz, and R. Williamson, 1999, The determinants and implications of corporate cash holdings, *Journal of Financial Economics* 52, 3-46.

Pagano, M., F. Panetta, and L. Zingales, 1998, Why do Companies Go Public? An Empirical Analysis, *Journal of Finance* 53*, 27-64*.

Pagano, M., and A. Röell, 1998, The Choice of Stock Ownership Structure: Agency Costs, Monitoring, and The Decision To Go Public, *Quarterly Journal of Economics* 113, 187-225.

Pinkowitz, L., R. Stulz, and R. Williamson, 2006, Does the Contribution of Corporate Cash Holdings and Dividends to Firm Value Depend on Governance? A Cross-country Analysis, *The Journal of Finance* 61, 2725-2751.

Shah, S., and A. V. Thakor, 1988, Private versus public ownership: Investment, ownership distribution, and optimality, *The Journal of Finance* 43, 41-59.

Stoughton, N. M., K. P. Wong, and J. Zechner, 2001, IPOs and product quality, *Journal of Business* 74, 375-408.

Tobin, J., 1956, The interest-elasticity of transactions demand for cash, *The Review of Economics and Statistics* 38, 241-247.

Table 1 The null hypothesis and three alternative hypotheses on the effects of a listing on cash holdings and their marginal benefits

Null hypothesis	There is no significant effect of a listing on the cash holdings nor on the marginal benefits of cash holdings
Alternative hypothesis 1 of "improved financial access" in listed firms	Financing benefits of a listing improve the external access to cash. When the "improved financial access" effects dominate after the listing, cash holdings are smaller in listed than in unlisted firms, and the marginal contribution of cash holdings to earnings do not necessarily differ between listed firms and unlisted firms.
Alternative hypothesis 2 of the "improved opportunity set" in listed firms	The improved opportunity set after the listing generates a concomitant need for additional cash. When the "improved opportunity set" effects dominate the "improved financial access" effects after the listing, cash holdings are larger in listed than in unlisted firms, and the marginal contribution of cash holdings to earnings in listed firms is at least equal to that of unlisted firms.
Alternative hypothesis 3 of "increased agency costs" in listed firms	Agency costs increase after the listing because managers benefit from weak monitoring. When the "increased agency costs" effects dominate after the listing, cash holdings will be larger in listed firms than in unlisted firms, and the marginal contribution of cash holdings to earnings is smaller in listed firms than in unlisted firms.

Table 2 The number of listed and unlisted firms and the concomitant mean cash ratios by country, for the period 2001-2009.

Cash ratios are defined by the amount of cash and cash equivalents divided by total assets. A firm is defined as listed or unlisted according to the Orbis version of April, 11, 2011. The t-value refers to the difference in cash ratios between unlisted and listed firms under the assumption of equal variances for the cash ratios of both types of firms.

Country	Number of firms			Mean cash ratios 2001-2009			
	Unlisted	Listed	Total	Unlisted	Listed	Total	t-value
Austria	14	26	40	0.035	0.096	0.080	-6.667
Belgium	179	34	213	0.085	0.099	0.087	-1.482
Brazil	119	62	181	0.084	0.109	0.097	-3.809
China	271	627	898	0.129	0.170	0.160	-12.118
Denmark	58	22	80	0.041	0.104	0.067	-7.130
Finland	55	31	86	0.054	0.073	0.061	-2.798
France	422	128	550	0.059	0.118	0.073	-13.735
Germany	432	133	565	0.063	0.099	0.073	-10.410
Greece	38	58	96	0.046	0.077	0.064	-4.987
Ireland	10	13	23	0.081	0.096	0.089	-0.726
Italy	553	75	628	0.045	0.117	0.053	-20.908
Japan	503	1111	1614	0.111	0.141	0.132	-15.380
Malaysia	25	81	106	0.121	0.118	0.119	0.334
Netherlands	140	33	173	0.082	0.106	0.087	-2.891
Norway	83	22	105	0.092	0.118	0.098	-2.242
Poland	90	17	107	0.069	0.058	0.067	1.077
Republic of Korea	184	298	482	0.068	0.068	0.068	-0.163
Russian Federation	119	109	228	0.030	0.062	0.044	-7.498
Spain	253	37	290	0.075	0.097	0.078	-3.264
Sweden	89	35	124	0.042	0.080	0.053	-6.527
Taiwan	40	359	399	0.109	0.157	0.154	-5.837
Thailand	85	46	131	0.070	0.080	0.073	-1.482
Turkey	21	56	77	0.067	0.098	0.092	-2.987
Ukraine	26	33	59	0.042	0.025	0.032	2.840
United Kingdom	444	123	567	0.077	0.105	0.083	-7.275
United States of America	56	755	811	0.161	0.183	0.182	-2.212
Common law countries	891	510	1401	.085	.171	.141	-26.359
Non common law countries	3799	3433	7232	.073	.128	.100	-59.187
Total	4309	4324	8633	0.075	0.137	0.107	-66.492

Table 3 Characteristics of unlisted and listed firms, 1991-2009

CATA indicates the ratio of cash to total assets. The variables that end on the letter "W" are winsored for both listed and unlisted firms at 0.5%. LNTA is the natural logarithm of total assets. NITA is net income divided by total assets. S3TA is the standard deviation of net income divided by total assets for the last three periods including the current period. LDTA is long term debt divided by total assets. DFA is the relative change in fixed assets. OLTA is the amount of non-cash liquid assets (debtors and stock) divided by total assets. LOTA is the amount of short term loans divided by total assets. TUTA is turnover divided by company assets. DLNTU is the change in the natural logarithm of turnover. AGE is the age of the firm.

Variable	Observations	Mean	Standard deviation	Median	Minimum	Maximum
			Unlisted firms			
CATA	33487	0.074 a)	0.115	0.029 b)	0.000	1
LNTAW	34129	12.436 a)	0.995	12.243 b)	8.670	16.172
NITAW	32507	0.036 a)	0.089	0.029 b)	-0.389	0.404
S3TAW	23856	0.040 a)	0.053	0.023 b)	0.000	0.394
LDTAW	32321	0.105 a)	0.165	0.017 b)	0.000	0.869
DFAW	29492	0.162 a)	0.971	0.002	-0.685	11.072
OLTAW	34040	0.352 a)	0.208	0.335 b)	0	0.919
LOTAW	33070	0.108 a)	0.156	0.038 b)	0	0.844
TUTAW	33903	1.225 a)	0.801	1.075 b)	0	5.267
DLNTUW	29198	0.063 a)	0.379	0.034 b)	-1.282	2.924
AGE	37542	31.568 a)	28.896	23 b)	0	324
			Listed firms			
CATA	34571	0.138 a)	0.131	0.100 b)	0.000	1
LNTAW	34590	13.221 a)	1.401	12.879 b)	10.726	17.944
NITAW	34587	0.030 a)	0.082	0.032 b)	-0.481	0.288
S3TAW	26971	0.035 a)	0.052	0.019 b)	0.001	0.400
LDTAW	34551	0.118 a)	0.124	0.086 b)	0	0.654
DFTAW	30216	0.082 a)	0.372	0.010	-0.552	3.034
OLTAW	34579	0.309 a)	0.143	0.303 b)	0.008	0.729
LOTAW	34327	0.022 a)	0.039	0.004 b)	0	0.265
TUTAW	34577	0.959 a)	0.490	0.880 b)	0.058	3.157
DLNTUW	30177	0.036 a)	0.242	0.027 b)	-0.931	1.141
AGE	35623	48.769 a)	40.081	41 b)	0	419

a) Indicates significant differences between listed and unlisted firms at a 1% level based on a t-test with unequal variances assumed.

b) Indicates significant differences at a 1% level based on Mann-Whitney-Wilcoxon rank sum test.

Table 4 The development of the main variables over time

CATA indicates the ratio of cash to total assets. The variables that end on the letter "W" are winsored at 0.5%. LNTA is the natural logarithm of total assets. NITA is net income divided by total assets. S3TA is the standard deviation of net income divided by total assets for the last three periods including the current period. LDTA is long term debt divided by total assets. DFTA is the relative change in fixed assets. OLTA is the amount of non-cash liquid assets (debtors and stock) divided by total assets. LOTA is the amount of short term loans divided by total assets.

				Unlisted firms				
Year	CATA	LNTAW	NITAW	S3TAW	LDTAW	DFTAW	OLTAW	LOTAW
2001	0.079	12.193	0.028	.	0.103	.	0.366	0.131
2002	0.078	12.166	0.030	.	0.109	0.148	0.356	0.119
2003	0.077	12.215	0.034	0.040	0.110	0.197	0.355	0.113
2004	0.075	12.304	0.043	0.040	0.103	0.239	0.358	0.108
2005	0.074	12.440	0.044	0.038	0.104	0.271	0.357	0.104
2006	0.073	12.538	0.047	0.037	0.107	0.198	0.358	0.101
2007	0.071	12.603	0.050	0.036	0.101	0.119	0.358	0.102
2008	0.069	12.623	0.027	0.042	0.103	0.110	0.344	0.110
2009	0.078	12.623	0.022	0.047	0.107	0.056	0.326	0.099
Total	0.074	12.436	0.036	0.040	0.105	0.162	0.352	0.108

				Listed firms				
Year	CATA	LNTAW	NITAW	S3TAW	LDTAW	DFTAW	OLTAW	LOTAW
2001	0.137	13.264	0.015	.	0.129	.	0.309	0.023
2002	0.139	13.122	0.018	.	0.123	-0.051	0.307	0.023
2003	0.141	13.057	0.030	0.034	0.121	-0.003	0.309	0.021
2004	0.138	13.076	0.041	0.033	0.114	0.086	0.312	0.022
2005	0.137	13.214	0.040	0.030	0.112	0.229	0.313	0.021
2006	0.133	13.238	0.046	0.030	0.112	0.087	0.317	0.021
2007	0.132	13.273	0.047	0.030	0.111	0.085	0.317	0.022
2008	0.132	13.329	0.012	0.042	0.123	0.133	0.307	0.025
2009	0.149	13.355	0.015	0.046	0.123	0.059	0.289	0.024
Total	0.138	13.221	0.030	0.035	0.118	0.082	0.309	0.022

Table 5 The number of observations and the characteristics of the cash ratio observations by type of unlisted and listed firm

The base year is based on the first year that the return index is available in Datastream

		Maximum number of observations	Cash ratios					
			Observations	Mean	Standard deviation	Median	Minimum	Maximum
Unlisted	Never listed	37476	32412	0.072	0.114	0.028	0.000	1
Unlisted	Delisted	1305	1186	0.132	0.157	0.081	0.000	0.974
Listed	Unknown base year	522	423	0.066	0.087	0.032	0.000	0.720
Listed	Base year 1980 or earlier	7776	7729	0.113	0.103	0.085	0.000	0.995
Listed	Base year after 1980 but before 2001	22383	21542	0.141	0.133	0.104	0.000	0.973
Listed	Base year after 2000 but before 2010	8235	6608	0.158	0.154	0.110	0.000	1
All firms		77697	69900	0.107	0.128	0.064	0.000	1

Table 6 The number of observations and the mean cash ratios by the number of years before (-) or after (+) the base year (year 0) during the period 2001-2009

Years before or after appearance (or listing)	Number of observations (Datastream)	Mean cash ratio	Number of observations (Orbis)	Mean cash ratio
IPO-year -10			3	0.053
IPO-year - 9			5	0.069
IPO-year -8	9	0.022	5	0.048
IPO-year -7	29	0.023	6	0.039
IPO-year -6	46	0.049	19	0.061
IPO-year -5	88	0.049	28	0.064
IPO-year -4	155	0.081	42	0.075
IPO-year -3	266	0.112	116	0.104
IPO-year -2	429	0.120	228	0.126
IPO-year -1	640	0.178	349	0.134
IPO-year 0	844	0.183	456	0.198
IPO-year +1	989	0.163	511	0.178
IPO-year +2	1093	0.161	527	0.159
IPO-year +3	1169	0.160	486	0.155
IPO-year +4	1261	0.159	416	0.158
IPO-year +5	1319	0.157	348	0.157
IPO-year +6	1412	0.151	252	0.156
IPO-year +7	1480	0.150	188	0.157
IPO-year +8	1498	0.149	167	0.149
IPO-year +9	1410	0.146	132	0.161
IPO-year +10	1327	0.146	85	0.110
IPO-year +11	1324	0.144	53	0.110
IPO-year +12	1290	0.144	19	0.152
IPO-year +13	1313	0.139		
IPO-year +14	1247	0.141		
IPO-year +15	1149	0.141		
IPO-year +16	1108	0.129		
IPO-year +17	1046	0.128		
IPO-year +18	985	0.128		
IPO-year +19	893	0.128		
IPO-year +20	744	0.127		
IPO-year +21	1448	0.118		
IPO-year +22	1169	0.113		
IPO-year +23	1117	0.116		
IPO-year +24	1049	0.118		
IPO-year +25	950	0.121		
IPO-year +26	931	0.114		
IPO-year +27	901	0.112		
IPO-year +28	887	0.111		
IPO-year +29	864	0.127		
Total	35879	0.138	4441	0.155

Table 7 The effect of listed firms on cash ratios, 2001-2009

The table shows Tobit panel regressions for the cash ratio, which is left censored at 0 and right censored at 1. The regressions include dummy variables for country and industry, for which the coefficients are not reported. "Coefficient" represents the coefficients of the independent variables. The coefficients are reported in the line where the variable is presented and p-values of the z-statistic are reported directly below the coefficients (between parentheses). The variables ending at WL are winsored and lagged. LISTED is a dummy variable which equals 1 if a firm is listed, 0 otherwise. OLTA is the amount of non-cash liquid assets (debtors and stock) divided by total assets. LOTA is the amount of short term loans divided by total assets. DFTAWF is the winsored value of the future relative change in assets. LNTA is the natural logarithm of total assets. NITA is net income divided by total assets. LDTA is long term debt divided by total assets. DFTA is the relative change in fixed assets. S3TA is the standard deviation of net income divided by total assets for the last three periods including the current period. AGE is the age of the firm. TREND is a variable that subtracts 2000 from the year of observation. The conditional mean presents the mean for the observed cash ratios conditioned on the independent variables. The marginal effect for a listed firm measures the impact of the shift of a firm from being unlisted to being listed on the conditional mean. * represents significance at 5% and ** significance at 1%.

	(1)	(2)	(3)	(4)	(5)
LISTED	0.039	0.038	0.034	0.030	0.030
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
LNTAWL	-0.008	-0.010	-0.009	-0.005	-0.005
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
NITAWL	0.023	0.029	0.022	0.040	0.043
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
LDTAWL	-0.038	-0.044	-0.053	-0.054	-0.055
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
DFTAWL	-0.003	-0.004	-0.004	-0.003	-0.003
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
AGE	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
TREND	0.001	0.001	0.001	-0.001	-0.001
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
OLTAWL		-0.076	-0.078	-0.078	-0.079
		(0.000)**	(0.000)**	(0.000)**	(0.000)**
LOTAWL			-0.050	-0.056	-0.056
			(0.000)**	(0.000)**	(0.000)**
DFTAWF				0.015	0.015
				(0.000)**	(0.000)**
S3TAWL					0.041
					(0.000)**
CONSTANT	0.315	0.360	0.355	0.308	0.304
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
COUNTRY DUMMIES	YES	YES	YES	YES	YES
INDUSTRY DUMMIES	YES	YES	YES	YES	YES
Observations	48450	48405	47864	39850	39740
Number of firms	8137	8136	8106	7963	7939
Wald-test	3025.67	3495.19	3631.11	4122.61	4152.90
P-value of the Wald-test	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Censored observations (left/right)	(0/3)	(0/3)	(0/1)	(0/0)	(0/0)
Conditional mean	0.140	0.139	0.139	0.136	0.136
Marginal effect for a listed firm	0.024	(0.024)	(0.021)	(0.019)	0.019
P-value for the marginal effect	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**

Table 8 The marginal effects of cash ratios on the return on assets of listed and unlisted firms in common and non-common law countries, period 2002-2009.

The table presents the Hausman-Taylor regression equations. The dependent variable is the change in the winsored ratio of net income divided by total assets. LNTAWL is the lagged value of the winsored values of the natural logarithm of total assets. DCATA is the change in the cash ratio. DNITAWL is the lagged value of the dependent variable. CONSTANT is the constant of the regression equation. The coefficients of the independent variables for unlisted (respectively listed) firms are presented in the columns. The p-values of the z-statistic are reported directly below the coefficients (between parentheses). DCATA is the endogenous variable and LNTAWL and DNITAW as a time varying exogenous variables. The Hausman-Taylor regressions include country dummies and industry dummies for which the coefficients are not reported. * represents significance at 5% and ** significance at 1%.

	Common law countries		Non-common law countries	
	Unlisted firms	Listed firms	Unlisted firms	Listed firms
DCATA	0.106	0.133	0.059	0.082
	(0.000)**	(0.000)**	(0.000)**	(0.000)**
LNTAWL	-0.004	-0.020	-0.006	-0.007
	(0.039)*	(0.000)**	(0.000)**	(0.000)**
DNITAWL	-0.405	-0.395	-0.346	-0.405
	(0.000)**	(0.000)**	(0.000)**	(0.000)**
CONSTANT	0.061	0.274	0.040	0.093
	(0.039)*	(0.000)**	(0.007)**	(0.093)
Number of observations	3170	5544	20185	20330
Number of firms	510	872	3600	3330
Wald-test	612.41	1013.16	2707.79	3760.97
P-value of the Wald-test	(0.189)	(0.000)**	(0.000)**	(0.000)**

Table 9 Robustness tests based on different approaches to cash holdings

The table shows random effects panel regressions with firm clustered standard errors. The coefficients are reported in the line where the variable is presented and p-values of the z-statistic are reported directly below the coefficients (between parentheses). The dependent variables are CATW (column 1), LNCATW (column 2), LNCA (columns 3 in euros and column 4 in dollars) and CA (column 5 in dollars). CATW is the winsored ratio of cash and cash equivalents divided by the turnover of the firm. LNCATW is the natural logarithm of CATW. LNCA is the natural logarithm of the amount of cash and cash equivalents in thousands (of euros or dollars), and CA is the amount of cash and cash equivalents in thousands of dollars. The variables ending at WL are winsored and lagged. LISTED is a dummy variable which equals 1 if a firm is listed, 0 otherwise. OLTA is the amount of non-cash liquid assets (debtors and stock) divided by total assets. LOTA is the amount of short term loans divided by total assets. DFTAWF is the winsored value of the future relative change in assets. LNTA is the natural logarithm of total assets. NITA is net income divided by total assets. LDTA is long term debt divided by total assets. DFTA is the relative change in fixed assets. S3TA is the standard deviation of net income divided by total assets for the last three periods including the current period. AGE is the age of the firm. TREND is a variable that subtracts 2000 from the year of observation. * represents significance at 5% and ** significance at 1%.

	(1)	(2)	(3)	(4)	(5)
	CATW	LNCATW	LNCA($€$)	LNCA($)	CA($)
LISTED	0.060	1.159	1.106	1.100	77,948
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.002)**
LNTAWL	-0.019	-0.053	0.813	0.819	261,283
	(0.000)**	(0.001)**	(0.000)**	(0.000)**	(0.000)**
NITAWL	-0.036	0.635	0.962	0.922	32,879
	(0.418)	(0.000)**	(0.000)**	(0.000)**	(0.403)
LDTAWL	-0.077	-0.105	-0.312	-0.297	-140,683
	(0.000)**	(0.302)	(0.004)**	(0.006)**	(0.000)**
DFTAWL	-0.005	-0.036	-0.062	-0.065	-22,745
	(0.124)	(0.004)**	(0.000)**	(0.000)**	(0.000)**
AGE	-0.001	0.001	0.002	0.002	992
	(0.000)**	(0.069)	(0.000)**	(0.000)**	(0.146)
TREND	0.000	-0.037	-0.040	-0.012	-7,082
	(0.865)	(0.000)**	(0.000)**	(0.012)*	(0.001)**
OLTAWL	-0.390	-1.522	-0.172	-0.170	-67,668
	(0.000)**	(0.000)**	(0.124)	(0.129)	(0.088)
LOTAWL	-0.094	-0.278	-0.499	-0.509	-83,172
	(0.000)**	(0.066)	(0.001)**	(0.001)**	(0.019)*
DFTAWF	0.025	0.070	0.057	0.065	42,340
	(0.000)**	(0.000)**	(0.005)**	(0.002)**	(0.000)**
S3TAWL	0.114	-0.096	-0.037	-0.037	-24,226
	(0.146)	(0.700)	(0.876)	(0.875)	(0.715)
CONSTANT	0.742	-1.575	-0.178	-0.133	-2912806
	(0.000)**	(0.000)**	(0.451)	(0.574)	(0.000)**
COUNTRY DUMMIES	YES	YES	YES	YES	YES
INDUSTRY DUMMIES	YES	YES	YES	YES	YES
Observations	32548	32548	32606	32606	32606
Number of firms	7586	7586	7596	7596	7596
Wald test	1146.19	4475.76	8796.98	8884.01	452.67
P-value of the Wald test	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
R^2 within	0.011	0.010	0.017	0.023	0.003
R^2 between	0.213	0.362	0.553	0.553	0.219
R^2 overall	0.181	0.321	0.513	0.513	0.204

Table 10 The effect of being a listed firm in common and non-common law countries

The table shows Tobit panel regressions for the cash ratio, which is left censored at 0 and right censored at 1. The regressions include dummy variables for country and industry, for which the coefficients are not reported. "Coefficient" represents the coefficients of the independent variables. The coefficients are reported in the line where the variable is presented and p-values of the z-statistic are reported directly below the coefficients (between parentheses). The variables ending at WL are winsored and lagged. LISTED is a dummy variable which equals 1 if a firm is listed, 0 otherwise. OLTA is the amount of non-cash liquid assets (debtors and stock) divided by total assets. LOTA is the amount of short term loans divided by total assets. DFTAWF is the winsored value of the future relative change in assets. LNTA is the natural logarithm of total assets. NITA is net income divided by total assets. LDTA is long term debt divided by total assets. DFTA is the relative change in fixed assets. S3TA is the standard deviation of net income divided by total assets for the last three periods including the current period. AGE is the age of the firm. TREND is a variable that subtracts 2000 from the year of observation. The conditional mean presents the mean for the observed cash ratios conditioned on the independent variables. The marginal effect for a listed firm measures the impact of the shift of a firm from being unlisted to being listed on the conditional mean. * represents significance at 5% and ** significance at 1%.

	(1) All firms	(2) Common law firms	(3) Non-common law firms
LISTED	0.045	0.067	0.045
	(0.000)**	(0.000)**	(0.000)**
LNTAWL	-0.006	-0.016	-0.003
	(0.000)**	(0.000)**	(0.000)**
NITAWL	0.033	0.009	0.059
	(0.000)**	(0.483)	(0.000)**
LDTAWL	-0.049	-0.048	-0.048
	(0.000)**	(0.000)**	(0.000)**
DFTAWL	-0.004	-0.005	-0.003
	(0.000)**	(0.001)**	(0.000)**
AGE	-0.000	-0.000	-0.000
	(0.000)**	(0.000)**	(0.973)
TREND	-0.000	-0.001	-0.000
	(0.071)	(0.121)	(0.202)
OLTAWL	-0.083	-0.162	-0.067
	(0.000)**	(0.000)**	(0.000)**
LOTAWL	-0.059	-0.098	-0.041
	(0.000)**	(0.000)**	(0.000)**
DFTAWF	0.015	0.034	0.010
	(0.000)**	(0.000)**	(0.000)**
S3TAWL	0.040	0.088	-0.008
	(0.000)**	(0.000)**	(0.456)
COM	0.009		
	(0.065)		
COM*LISTED	0.026		
	(0.000)**		
CONSTANT	0.255	0.477	0.194
	(0.000)**	(0.000)**	(0.000)**
INDUSTRY DUMMIES	YES	YES	YES
Observations	32606	5965	26641
Number of firms	7596	1321	6275
Wald-test	2998.09	1500.9	1716.15
P-value of the Wald-test	0.000	0.000	0.000
Censored observations (left/right)	(0/0)	(0/0)	(0/0)
Conditional mean	0.138	0.174	0.127
Marginal effect for a listed firm	0.027	0.042	0.028
P-value for the marginal effect	0.000	0.000	0.000

Table 11 Robustness test for the marginal effects of cash ratios on the return on assets of listed and unlisted firms in common and non-common law countries, period 2002-2009.

The table reports dynamic panel regression results based on Arellano-Bond estimates. The dependent variable is the change in the winsored ratio of net income divided by total assets. LNTAWL is the lagged value of the winsored values of the natural logarithm of total assets. DCATA is the change in the cash ratio. DNITAWL is the lagged value of the dependent variable. CONSTANT is the constant of the regression equation. The coefficients of the independent variables for unlisted (respectively listed) firms are presented in the columns. The p-values of the z-statistic are reported directly below the coefficients (between parentheses). The Arellano-Bond procedure does not support the use of country and industry dummies. * represents significance at 5% and ** significance at 1%.

	Common law countries		Non-common law countries	
	Unlisted firms	Listed firms	Unlisted firms	Listed firms
DCATA	0.086	0.121	0.059	0.076
	(0.003)**	(0.000)**	(0.000)**	(0.000)**
LNTAWL	-0.064	-0.111	-0.030	-0.036
	(0.000)**	(0.000)**	(0.000)**	(0.000)**
DNITAWL	-0.284	-0.230	-0.243	-0.269
	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Constant	0.817	1.528	0.367	0.472
	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Number of observations	2639	4666	16509	16977
Number of firms	510	845	3569	3247
Wald-test	240.97	396.44	972.57	1119.68
P-value of the Wald-test	(0.000)**	(0.000)**	(0.000)**	(0.000)**