

Why Do Firms Hold Cash? Evidence from EMU Countries

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Abstract

This paper investigates the determinants of corporate cash holdings in EMU countries. Our results suggest that cash holdings are positively affected by the investment opportunity set and cash flows and negatively affected by asset's liquidity, leverage and size. Bank debt and cash holdings are negatively related, which supports that a close relationship with banks allows the firm to hold less cash for precautionary reasons. Firms in countries with superior investor protection and concentrated ownership hold less cash, supporting the role of managerial discretion agency costs in explaining cash levels. Capital markets development has a negative impact on cash levels, contrary to the agency view.

Keywords: *Cash holdings; liquidity; agency costs; corporate governance*

JEL classification: *G3, G32, G39*

1. Introduction

Corporations hold a significant amount of cash. EMU corporations, at the end of the year 2000 as listed in Datastream, held 15% of their total book value of assets in cash or cash equivalents, which amount to a total of €303 billion and to a firm average of €368 million. This work addresses the question of what are the determinants of corporate cash holdings.

There are three theoretical models that can help to explain which firm characteristics influence cash holdings decisions. First, the trade-off model postulates that firms identify their optimal level of cash holdings by weighting the marginal costs and

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marginal benefits of holding cash. The benefits related to cash holdings are the following: reduces the likelihood of financial distress, allows the pursuance of investment policy when financial constraints are met, and minimises the costs of raising external funds or liquidating existing assets. The main cost of holding cash is the opportunity cost of the capital invested in liquid assets.

Second, the pecking order theory of Myers (1984), supported by the theoretical foundation of Myers and Majluf (1984), states that to minimise asymmetric information costs and other financing costs, firms should finance investments first with retained earnings, then with safe debt and risky debt, and finally with equity. This theory suggests that firms do not have target cash levels, but cash is used as a buffer between retained earnings and investment needs.

Finally, the free cash flow theory of Jensen (1986) suggests that managers have an incentive to build up cash to increase the amount of assets under their control and to gain discretionary power over the firm investment decision. Cash reduces the pressure to perform well and allows managers to invest in projects that best suit their own interests, but may not be in the shareholders best interest.

The study of the determinants of corporate cash holdings has not been very appealing to researchers in the past, judging by the few papers available on this subject. However, recent empirical studies have made good progress in their attempt to find which factors explain the significant amounts of cash and equivalent assets held by firms.

Opler *et al.* (1999) examine the determinants and implications of cash holdings amongst publicly traded US firms in the 1971–94 period. They find that firms with strong growth opportunities, higher business risk, and smaller size hold more cash than other firms. Firms that have the greatest access to capital markets, such as large firms and those with credit ratings, as well as high-levered firms tend to hold less cash.

However, they also find evidence that successful firms tend to accumulate more cash than predicted by the static trade-off model with managers maximising shareholder wealth. Their attempt to find the motivation for this behaviour is supported by the precautionary motive for holding cash. Firms hold excess cash to ensure that they will be able to keep investing when cash flow is too low, relative to investment needs, and when outside funds are expensive. With respect to the agency theory, Opler *et al.* (1999) find little evidence of the managerial entrenchment hypothesis as an explanation for the level of cash holdings. Similar results are found using a sample of US small firms (Faulkender, 2002) and a sample of UK firms (Ozkan and Ozkan, 2002).

Mikkelson and Partch (2002) show that the operating performance of US firms with high cash levels is comparable to or even greater than the performance of firms with normal levels of cash matched by size and industry. This finding does not support the view that conservative financial policies serve the interests of managers rather than the interests of stockholders. In addition, proxies for managerial incentive problems, such as ownership and board characteristics, do not explain differences in cash levels. They also find that high cash holdings are accompanied by greater investment, particularly research and development expenditures, and by greater growth in assets.

The weak evidence on the role of corporate governance and agency costs in the determination of corporate cash holdings motivated subsequent work using international data. Using data from several countries allows for variation in legal environments, investor protection, ownership structure and capital markets development, which are related with different levels of agency costs.

Dittmar *et al.* (2003) suggest that agency costs of managerial discretion play an important role in explaining cash holdings. Using a sample of more than 11,000 firms from 45 countries, we find that corporations in countries where shareholders rights are not well protected hold up to twice as much cash as corporations in countries with good shareholder protection. Their evidence is consistent with the conjecture that investors in countries with poor shareholder protection cannot force managers to disgorge excessive cash balances.¹

In addition, when shareholder protection is weak, factors that generally drive the need for cash holdings, such as investment opportunities and asymmetric information actually become less important. These results are stronger after controlling for capital market development. Indeed, consistent with the importance of agency costs in explaining cash holdings, they find that firms hold larger cash balances when access to funds is easier. The use of international data increases the dispersion of managerial agency costs across countries, which seems to be more important in determining cash holdings than the variation across companies in a given country.

A different issue is the relationship between bank debt and cash holdings. Pinkowitz and Williamson (2001) examine the effect of bank power on the cash holdings of industrial firms from the USA, Germany and Japan. They find that Japanese firms have higher levels of cash balances due to higher power of banks and the absence of other monitor forces such as large non-bank block holders or an active market for corporate control. The explanation suggested for this finding is that banks encourage firms to maintain large cash balances in order to extract rents from firms or to lower their monitoring costs. In contrast, Ozkan and Ozkan (2002) found that bank-debt financing has a negative impact on cash levels for UK firms, consistent with banks having less power.

This paper contributes to the literature as it investigates the determinants of cash holdings in countries with corporate governance and financial structures different from Anglo-American countries, such as the UK and USA. Anglo-American firms are known to have lower debt levels than firms in other major economies such as France, Italy and Germany (see Borio, 1990). Furthermore, agency costs and indirect bankruptcy costs are known to be higher in Anglo-American countries due to the lack of long-term relationship between firms and creditors and of long-term objectives of business management (see Edward and Nibler, 2000).

Our main results are broadly consistent with the empirical work on US and UK firms and suggest that the level of cash holdings is positively affected by the investment opportunity set and cash flow and is negatively affected by the amount of liquid asset substitutes, size and leverage. Conversely, we find no evidence to support the view that dividend payments and debt maturity are important to the firm's policies concerning cash holdings.

We add to the existent evidence in two distinct dimensions. First, contrary to the evidence in Pinkowitz and Williamson (2001), we find a negative relationship between bank debt and cash holdings. This is consistent with the view that banks are in a better position to ascertain the firm's credit quality and to monitor and control the firm financial policies, cutting down the asymmetry and agency problems usually

¹ Recent work by Guney *et al.* (2003) also found similar evidence in a sample including firms from France, Germany, Japan and UK.

associated to other kinds of debt, which result in higher indirect financing costs and external financing constraints.

Second, our analysis suggests that firms in countries with superior investor protection mechanisms hold more cash. Our results are consistent with Dittmar *et al.* (2003) study and extend their analysis by including not only shareholders rights, but also the creditors' rights and the quality of law enforcement. However, we do not confirm the Dittmar *et al.* (2003) evidence that the level of capital markets development has a positive impact on cash holdings. In fact, EMU firms in countries with more developed capital markets tend to hold less cash, which is contrary to the agency costs view and consistent with firms building up cash for precautionary reasons.

The paper is organised as follows. Section 2 discusses the theory and develops the hypotheses. The sample and estimation methods are discussed in section 3. Section 4 analyses the empirical results. Section 5 concludes.

2. Theory and empirical hypotheses

This section discusses three theoretical models that can help identify which firm characteristics determine cash holdings decisions. It turns out that the way the firm characteristics influence cash holdings is not a consensual matter among these models. Next, we discuss country-specific characteristics, such as investor protection, legal environment, ownership structure and capital markets development that might determine the variation of cash levels across countries.

2.1. Trade-off model

The trade-off argument postulates that firms set their optimal level of cash holdings by weighting the marginal costs and marginal benefits of holding cash. There are several benefits related with holding cash. First, cash holdings reduce the likelihood of financial distress as it acts as a safety reserve to face unexpected losses or external fund raising constrains. Second, cash holdings allow the pursuance of the optimal investment policy even when financial constraints are met. Otherwise, external fund raising constrains would force the firm to forgo investment projects with positive net present value (NPV).² Finally, cash holdings contribute to minimise the costs of raising external funds or liquidating existing assets as it acts like a buffer between the firm sources and uses of funds. The traditional marginal cost of holding cash is the opportunity cost of the capital due to the low return on liquid assets. Below we provide a brief review of the firm characteristics that, according to trade-off theory, are relevant to firm cash holdings decisions.

Dividend payments. A firm that currently pays dividends can raise funds at low cost by reducing its dividend payments, in contrast to a firm that does not pay dividends,

² Almeida *et al.* (2002) propose a theory of corporate liquidity demand that is based on the assumption that choices regarding liquidity will depend on firms' access to capital markets and the importance of future investments to the firms. The model predicts that financially constrained firms will save a positive fraction of incremental cash flows, while unconstrained firms will not. Empirical evidence confirms that firms classified as financially constrained save a positive fraction of their cash flows, while firms classified as unconstrained do not.

which has to use the capital markets to raise funds. Thus, it is expected that firms that pay dividends hold less cash than firms that do not pay dividends.

Investment opportunity set. The cost of incurring in a cash shortage is higher for firms with a larger investment opportunity set due to the expected losses that result from giving up valuable investment opportunities. Therefore, it is expected a positive relation between investment opportunity and cash holdings. Theory also predicts that firms with better investment opportunities have greater financial distress costs because the positive NPV of these investments disappears (almost entirely) in case of bankruptcy. In this case, firms with better investment opportunities will keep higher levels of cash to avoid financial distress.

Liquid asset substitutes. To the extent that liquid assets other than cash can be liquidated in the event of a cash shortage, they can be seen as substitutes for cash holdings. Consequently, firms with more liquid asset substitutes are expected to hold less cash.

Leverage. It is generally accepted that leverage increases the probability of bankruptcy due to the pressure that rigid amortization plans put on the firm treasury management. To reduce the probability of experiencing financial distress, firms with higher leverage are expected to hold more cash. On the other hand, to the extent that leverage ratio acts as a proxy for the ability of the firms to issue debt it would be expected that firms with higher leverage (higher ability to raise debt) hold less cash. Thus, the predicted relationship between cash holdings and leverage is ambiguous.

Size. Miller and Orr (1966) model of demand for money by firms suggests that there are economies of scale in cash management. This would lead larger firms to hold less cash than smaller firms. Also, it is argued that the fees incurred in obtaining funds through borrowing are uncorrelated with the size of the loan, indicating that such fees are a fixed amount (see Peterson and Rajan, 2003). Thus, raising funds is relatively more expensive to smaller firms encouraging them to hold more cash than larger firms. Furthermore, it is generally accepted that larger firms, because of diversification, have lower probability of being in financial distress (see Rajan and Zingales, 1995). These arguments suggest a negative relation between size and cash holdings.

Cash flow. In the sense that cash flow provides a ready source of liquidity (see Kim *et al.* 1998) it can be seen as a cash substitute. Thus, we expect a negative relation between cash flow and cash holdings.

Cash flow uncertainty. Firms with more volatile cash flows face a higher probability of experiencing cash shortages due to unexpected cash flow deterioration. Thus, cash flow uncertainty should be positively related with cash holdings.

Debt maturity. The influence of debt maturity on cash holdings is not clear. Firms that rely on short-term debt must renegotiate periodically their credit terms, and are subject to the risk of experiencing financial distress if constraints are met to the renewal of credit lines. Thus, controlling for other variables, one would expect debt

maturity to be negatively related to cash holdings. However, Barclay and Smith (1995) provide evidence that firms with the highest and lowest credit risk issue more short-term debt while intermediate credit risk firms issue long-term debt. If we consider that firms with the highest credit rating have better access to borrowing, it is expected that these firms will hold less cash for precautionary reasons, which would cause debt maturity to be positively related to cash holdings.

2.2. *Pecking order theory*

The pecking order theory of Myers (1984) states that firms finance investments first with retained earnings, then with safe debt and risky debt, and finally with equity. The purpose of this order of financing is to minimise asymmetric information costs and other financing costs. This theory suggests that firms do not have target cash levels, but instead, cash is used as a buffer between retained earnings and investment needs. Thus, when current operational cash flows are enough to finance new investments, firms repay debt and accumulate cash. When retained earnings are not enough to finance current investments, firms use the accumulated cash holdings and, if needed, issue debt.

Investment opportunity set. A large investment opportunity set creates a demand for a large stock of cash, because cash shortfalls imply that unless a company engages in costly external financing it must forego profitable investment opportunities. Therefore, a positive relation between the investment opportunity set and cash holdings is expected.

Leverage. In a pecking order world, debt typically grows when investment exceeds retained earnings and falls when investment is less than retained earnings. Consequently, cash holdings follow an inverse pattern of evolution, i.e., cash holdings fall when investment exceeds retained earnings and grow when investment is less than retained earnings. This relationship between cash holdings, debt and investments suggests that there is a negative relation between leverage and cash holdings.

Size. Firms that are larger presumably have been more successful, and hence should have more cash, after controlling for investment (see Opler *et al.* 1999).

Cash flow. Controlling for other variables, it is expected that firms with high cash flow will have more cash.

2.3. *Free cash flow theory*

Jensen (1986) suggests that managers have an incentive to hoard cash to increase the amount of assets under their control and to gain discretionary power over the firm investment decision. Having cash available to invest, the manager does not need to raise external funds and to provide capital markets detailed information about the firm's investment projects. Hence, managers could undertake investments that have a negative impact on shareholders wealth.

Investment opportunity set. Managers of firms with poor investment opportunities are expected to hold more cash to ensure the availability of funds to invest in growth projects, even if the NPV of these projects is negative. This would lead to destruction of shareholder value and, even if the firm has a large investment programme, to a low market-to-book ratio. Thus, using the market-to-book ratio as a proxy, it is likely that the relation between investment opportunity set and cash holdings will be negative.

Leverage. Low leverage firms are less subject to monitoring, allowing for superior managerial discretion. Thus, we expect that less levered firms hold more cash.

Size. Larger firms tend to have larger shareholder dispersion, which gives rise to superior managerial discretion. Moreover, larger companies are not likely to be the target of a takeover due to the amount of financial resources needed by the bidder. Thus, it is expected that managers of large firms have more discretionary power over the firm investment and financial policies, leading to a greater amount of cash holdings.

Summary of model predictions

Variable	Trade-off Theory	Pecking Order Theory	Free Cash Flow Theory
Dividend payments	Negative		
Investment opportunity set	Positive	Positive	Negative
Liquid asset substitutes	Negative		
Leverage	Unknown	Negative	Negative
Real size	Negative	Positive	Positive
Cash flow uncertainty	Positive		
Cash flow	Negative	Positive	
Debt maturity	Unknown		

2.4. Investor protection and cash holdings

The protection of shareholders and creditors by the legal system is central to understanding corporate finance practices on different countries. The magnitude of managerial agency costs varies with the degree of protection to outside investors. In fact, when investor protection is low, managers will have an incentive to accumulate cash to gain discretionary power over the firm's investment decisions.

We investigate the impact of investor protection mechanisms and legal environment using several indicators developed by La Porta *et al.* (1998). First, the anti-director rights index is a summary measure of shareholder protection. This index ranges from zero to six and is formed by adding one when: the country allows shareholders to mail their proxy vote to the firm; shareholders are not required to deposit their shares prior to the general shareholders' meeting; cumulative voting or proportional representation of minorities in the board of directors is allowed; an oppressed minorities mechanism is in place; the minimum percentage of share capital that entitles a shareholder to call for an extraordinary shareholders' meeting is less than or equal to 10%

(the sample median); and shareholders have pre-emptive rights that can only be waived by a shareholders' vote.

Second, the creditor rights index is a summary measure of creditor protection. This index ranges from zero to four and is formed by adding one when: the country imposes restrictions, such as creditors' consent or minimum dividends to file for reorganisation; secured creditors are able to gain possession of their security once the reorganisation petition has been approved (no automatic stay); secured creditors are ranked first in the distribution of the proceeds that result from the disposition of the assets of a bankrupt firm; the debtor does not retain the administration of its property pending the resolution of the reorganisation.

Third, the rule of law index is an assessment of the law and order tradition in the country produced by the country risk rating agency International Country Risk (ICR). Scale from 0 to 10, with lower scores for less tradition for law and order. Table 1 presents the values of these variables for each EMU country.

La Porta *et al.* (1998, 1999) also find that corporate ownership structures tend to be more concentrated in countries with poorer shareholder protection. Ownership concentration is a substitute for legal protection. When the country's legal protections to shareholders is weak, then only large shareholders can effectively monitor managers and mitigate managerial agency costs. Thus, we control for ownership structure when studying the impact of investor protection on cash levels. The Ownership Concentration indicator is measured as the median percentage of common shares owned by the largest three shareholders in the ten largest privately owned non-financial firms (La Porta *et al.* 1998). We expect to find a negative relation between cash and ownership concentration because managers will have more difficulty in accumulating cash due to monitoring by large shareholders. Table 1 presents the values of ownership concentration for each EMU country.

Table 1

Investor protection and ownership concentration by country.

Anti-director rights is a summary measure of shareholder protection. Ranges from 0 to 6. Creditor rights is a summary measure of creditor protection. Ranges from 0 to 4. Rule of Law is an assessment of the law and order tradition in the country produced by International Country Risk (ICR). Scale from 0 to 10. Ownership concentration is the median percentage of common shares owned by the largest three shareholders in the ten largest privately owned non-financial firms. All variables are taken from La Porta *et al.* (1998).

Country	Anti-director Rights	Creditor Rights	Rule of Law	Ownership Concentration
Germany	1	3	9.23	0.50
Austria	2	3	10.00	0.51
France	3	0	8.98	0.24
Greece	2	1	6.18	0.68
Italy	1	2	8.33	0.60
Netherlands	2	2	10.00	0.31
Portugal	3	1	8.68	0.59
Spain	4	2	7.80	0.50
Belgium	0	2	10.00	0.62
Ireland	4	1	7.80	0.36
Finland	3	1	10.00	0.34
Luxemburg	NA	NA	NA	NA

La Porta *et al.* (1997) also show that countries with poorer investor protection mechanisms have less developed capital markets. In fact, less developed capital market will limit the firm access to external finance due to higher transaction costs of raising additional funds and, consequently, firms tend to accumulate more cash.

3. Data description

For our empirical investigation we use a sample of publicly traded firms from the EMU countries from 1987 to 2000, obtained from Datastream.³ The EMU includes the following countries: Germany, France, Netherlands, Italy, Spain, Finland, Belgium, Austria, Ireland, Luxemburg, Greece and Portugal. Our sample includes survivors and non-survivors that appeared on Datastream at any time during the sample period. Firms operating in the financial sector were excluded. We also exclude missing firm-year observations for any variable in the model. These criteria have provided us with a total 6,387 firm-year observations.

3.1. Cash holdings

We define the cash ratio as the ratio of cash and cash equivalents to net assets, where net assets are computed as book value of assets less cash and equivalents (Opler *et al.* 1999).

Table 2 shows the number of firm-year and cash holdings descriptive statistics by country. Although most countries show similar cash-to-assets ratio averages, there appears to be significant differences in some countries. These differences can be a consequence of different accounting standards among EMU countries as well as different institutional environment, namely bankruptcy laws, the state of development of capital markets, and patterns of corporate governance. The overall mean is 14.8%, but some countries have mean cash ratio above 20%. Italy and Ireland have cash to net assets of 21.9% and 21.6%, respectively. Countries with low cash ratio are Portugal and Spain with mean ratio below 10%, respectively, 5.1% and 8.9%. The major EMU economies present cash ratios close to the mean and similar to the level of the USA reported in Opler *et al.* (1999).

Fig. 1 plots the evolution of the average cash-to-assets ratio throughout 1987–2000 in our sample. During this period it is not possible to identify any clear trend.

3.2. Exogenous variables

To estimate the effects of dividend payments we construct a dummy variable that is set to one if the firm paid dividends in each year and set to zero if it did not.

We employ the market-to-book ratio as a proxy for the firm's investment opportunity set. The firm's balance sheet does not include intangible assets like growth options. Thus, more growth options increase the firm's market value in relation to its book value (Smith and Watts, 1992). We estimate the market value of the firm's assets as the book value of assets minus the book value of equity plus the market value of equity. The market-to-book ratio is given by the market value of assets divided by the book value of assets.

³ Appendix A contains a list of the variable identifier in Datastream used in our work.

Table 2

Cash ratio by country.

Descriptive statistics on the cash ratio by country for our sample of firm years from the 1987–2000 Datastream sample of EMU publicly traded firms. Cash ratio is measured as cash and cash equivalents divided by net assets, where net assets is total assets minus cash and equivalents. N is the number of observations in the sample for each variable.

Country	Mean	25th Percentile	Median	75th Percentile	Standard deviation	N
Germany	0.148	0.035	0.091	0.194	0.211	1,587
France	0.159	0.050	0.107	0.204	0.176	1,583
Netherlands	0.129	0.027	0.076	0.179	0.158	698
Italy	0.219	0.067	0.175	0.334	0.182	614
Spain	0.089	0.016	0.048	0.114	0.114	571
Finland	0.151	0.050	0.106	0.213	0.132	355
Belgium	0.123	0.042	0.079	0.171	0.114	306
Austria	0.144	0.029	0.083	0.184	0.178	245
Portugal	0.051	0.016	0.030	0.049	0.082	189
Ireland	0.216	0.047	0.121	0.297	0.250	141
Greece	0.145	0.028	0.061	0.160	0.235	93
Luxemburg	0.074	0.059	0.069	0.093	0.019	5
EMU	0.148	0.036	0.091	0.198	0.179	6,387

We use the net working capital to assets ratio as a proxy for liquid asset substitutes as these assets can be seen as substitutes for cash holdings. We measure net working capital to assets ratio as net current assets minus total cash and equivalent divided by total assets (book value of assets) minus total cash and equivalent.

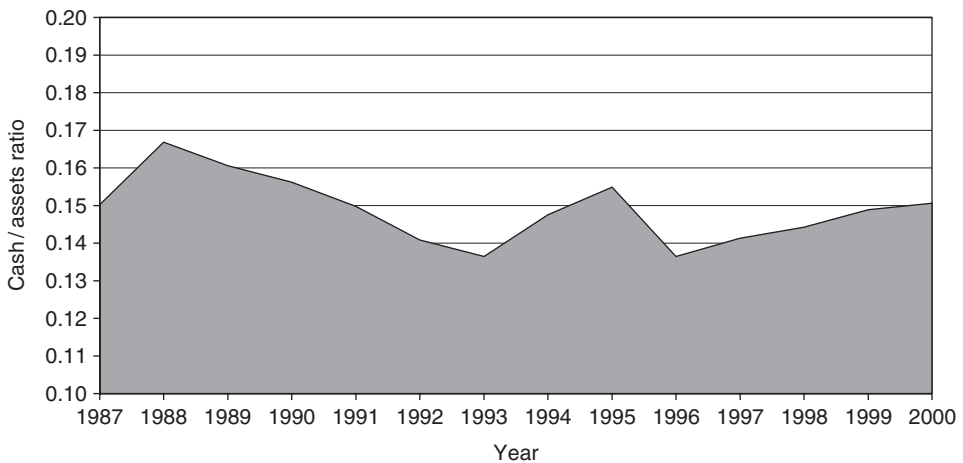


Fig. 1. Average cash ratio, 1987–2000.

Average cash ratio for our sample of firm years from the 1987 to 2000 of EMU publicly traded firms. Firms that have missing year observations were excluded. Cash ratio is measured as cash and cash equivalents divided by net assets, where net assets is total assets minus cash and equivalents.

Leverage is measured as the ratio of total debt divided by total assets less cash and equivalents (Opler *et al.* 1999).

We use the natural logarithm of total assets in constant year 2000 euros as a proxy for the real size of firms. We used Consumer Price Index for all countries in the sample, transformed to shift the base year to 2000.

We measure cash flow uncertainty using the standard deviation of industry cash flow computed using the procedure suggested in Opler *et al.* (1999). For each firm we compute the cash ratio standard deviation for the 14 years of the sample (at least 6 years if data are missing). We then take the average across the Datastream industry classification (50 categories), excluding the maximum and minimum observation.

We use the ratio cash flow to net assets (total assets minus cash and equivalents) to measure cash flow magnitude. Cash flow is defined as published after tax profit plus depreciation. Opler *et al.* (1999) assess cash flow as earnings after interest, dividends and taxes plus depreciation. Our cash flow measure is not so sophisticated due to insufficient data on our sample.

Debt maturity is measured as total debt less debt repayable in less than one year divided by total debt (Opler *et al.* 1999). We use the ratio of bank borrowings to total debt as a measure of bank debt magnitude (Ozkan and Ozkan, 2002).

Table 3 shows summary statistics for the exogenous variables used in our analysis. Table 4 exhibits the country averages of our exogenous variables. The overall mean market-to-book ratio is 1.1 with Germany, France, Netherlands, Spain and Greece presenting values above the mean. Greece has a market-to-book ratio much higher than all other countries. The leverage (debt divided by net assets) overall mean is

Table 3
Description of exogenous variables.

Descriptive statistics on variables for our sample of firm years from the 1987–2000 Datastream sample of EMU publicly traded firms. Assets in the denominators are calculated as total assets less total cash and equivalents. Dividend dummy is a variable set to one if the firm paid a dividend in the year, and set to 0 otherwise. The market-to-book ratio is measured as the book value of assets, less the book value of equity plus the market value of equity, divided by book value of assets. Net working capital is calculated as net current assets minus cash. Real size is defined as the natural logarithm of total assets in euros deflated to 2000 prices. Industry sigma is a measure of the volatility of an industry's cash flow during the sample period. Cash flow is defined as published after tax profit plus depreciation. Debt maturity is debt repayable in more than one year to total debt. Bank debt is defined as bank borrowings to total debt. Bank debt is the ratio bank borrowings to total debt. N is the number of observations in the sample for each variable.

Variable	Mean	25th Percentile	Median	75th Percentile	Standard deviation	N
Dividend dummy	0.861	1.000	1.000	1.000	0.346	6387
Market-to-book ratio	1.710	1.051	1.279	1.722	1.917	6387
Net working capital/assets	0.035	-0.077	0.038	0.160	0.333	6387
Debt/assets	0.248	0.118	0.235	0.354	0.161	6387
Real size	17.930	16.868	18.130	19.306	2.237	6387
Industry sigma	0.045	0.036	0.039	0.044	0.055	6387
Cash flow/assets	0.105	0.065	0.099	0.137	0.191	6387
Debt maturity	0.580	0.397	0.612	0.792	0.268	6387
Bank debt	0.661	0.438	0.740	0.970	0.326	1950

Table 4

Exogenous variables averages by country.

Averages of variables by country for our sample of firm years from the 1987–2000 Datastream sample of EMU publicly traded firms. Assets in the denominators are calculated as total assets less total cash and equivalent. Dividend dummy is a variable set to one if the firm paid a dividend in the year, and set to 0 otherwise. The market-to-book ratio is measured as the book value of assets, less the book value of equity plus the market value of equity, divided by book value of assets. Net working capital is calculated as net current assets minus cash. Real size is defined as the natural logarithm of total assets in euros deflated to 2000 prices. Industry sigma is a measure of the volatility of an industry's cash flow during the sample period. Cash flow is defined as published after tax profit plus depreciation. Debt maturity is debt repayable in more than one year to total debt. Bank debt is defined as bank borrowings to total debt.

Country	Dividend dummy	Market-to-book ratio	Net working capital/assets	Debt/assets	Real size	Industry sigma	Cash flow/assets	Debt Maturity
Germany	0.858	1.789	0.131	0.175	18.163	0.048	0.104	0.541
France	0.903	1.800	-0.001	0.266	17.959	0.046	0.104	0.589
Netherlands	0.895	1.891	0.029	0.235	17.809	0.043	0.132	0.618
Italy	0.832	1.354	-0.066	0.308	18.829	0.039	0.081	0.517
Spain	0.757	1.745	0.001	0.235	17.518	0.042	0.096	0.530
Finland	0.921	1.331	0.044	0.334	17.987	0.044	0.102	0.788
Belgium	0.928	1.622	-0.002	0.288	18.030	0.039	0.108	0.625
Austria	0.751	1.367	0.011	0.274	17.216	0.044	0.116	0.609
Portugal	0.820	1.331	0.038	0.264	16.913	0.040	0.113	0.530
Ireland	0.809	1.536	0.023	0.349	16.768	0.097	0.061	0.696
Greece	0.742	3.358	0.095	0.224	16.020	0.045	0.201	0.445
Luxemburg	1.000	0.945	0.031	0.230	19.971	0.054	0.093	0.620
EMU	0.861	1.710	0.035	0.248	17.930	0.045	0.105	0.580

24.8% with only one country below 20% (Germany) and three countries above 30% (Italy, Finland and Ireland). In all countries except Greece, long-term debt (maturity over one year) is the major source of financing.

4. Empirical results

4.1. Univariate tests

Table 5 shows the characteristics of the firms that stand on each cash/assets quartile. The quartiles are constructed each year, which explains why ranges of the cash-to-assets ratio overlap across quartiles. The t-statistics test the hypothesis that the fourth quartile firms differ significantly from the first quartile firms. We find that all firm characteristics, except real size and industry sigma, are significantly different at the 5% level between the first and fourth cash-to-assets quartiles. However, some firm characteristics do not change monotonically across cash-to-assets ratio quartiles, so that comparing the firms in the first and fourth quartiles is not sufficient to describe the relation between cash holdings and firm characteristics.

Market-to-book ratio and cash flow show an undoubtedly monotonic relationship with cash holdings. As predicted by trade-off and pecking order theories and contrary

Table 5
Firm characteristics by cash/assets quartiles.

Univariate comparison of means and medians of measures of firm characteristics for our sample of firm years from the 1987–2000 Datastream sample of EMU publicly traded firms. Quartiles for cash to assets are determined each year. The t-statistic is for a difference of means test from the first to the fourth quartile. Median values are bracketed. Assets in the denominators are calculated as total assets less total cash and equivalent. Dividend dummy is a variable set to one if the firm paid a dividend in the year, and set to 0 otherwise. The market-to-book ratio is measured as the book value of assets, less the book value of equity plus the market value of equity, divided by book value of assets. Net working capital is calculated as net current assets minus cash. Real size is defined as the natural logarithm of total assets in euros deflated to 2000 prices. Industry sigma is a measure of the volatility of an industry's cash flow during the sample period. Cash flow is defined as published after tax profit plus depreciation. Debt maturity is debt repayable in more than one year to total debt.

Variable	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	t-statistic (p-value)
Cash/assets range	0 to 0.05	0.03 to 0.12	0.07 to 0.23	0.17 to 3.52	
Cash/assets	0.019 [0.018]	0.064 [0.062]	0.141 [0.137]	0.378 [0.315]	−62.55 (0.0000)
Dividend dummy	0.826 [1.000]	0.864 [1.000]	0.883 [1.000]	0.882 [1.000]	−4.35 (0.0000)
Market-to-book ratio	1.535 [1.244]	1.558 [1.255]	1.603 [1.265]	2.091 [1.373]	−7.67 (0.0000)
Net working capital/assets	0.048 [0.056]	0.059 [0.052]	0.048 [0.039]	−0.019 [−0.012]	4.21 (0.0000)
Debt/assets	0.276 [0.282]	0.244 [0.231]	0.252 [0.238]	0.217 [0.166]	9.53 (0.0000)
Real size	17.775 [17.946]	18.155 [18.343]	18.168 [18.363]	17.866 [18.182]	−1.14 (0.2561)
Industry sigma	0.047 [0.036]	0.044 [0.038]	0.042 [0.038]	0.045 [0.038]	1.12 (0.2608)
Cash flow/assets	0.085 [0.085]	0.091 [0.092]	0.107 [0.100]	0.133 [0.120]	−14.68 (0.0000)
Debt maturity	0.586 [0.634]	0.586 [0.616]	0.597 [0.622]	0.566 [0.590]	1.96 (0.0502)

to the free cash flow theory, firms with a better investment opportunity set have larger cash holdings. Conversely, firms with higher cash flow-to-assets ratio show larger cash holdings which is inconsistent with the trade-off argument but supports the pecking order theory.

4.2. Regression tests

We study the determinants of cash holdings using a regression of cash holdings on the exogenous variables described in section 3. We use three different regression

methodologies. First, we use the Fama and MacBeth (1973) methodology: each year we run cross-sectional regressions and use the time series of regression coefficients to make our inferences.⁴ Second, we run a pooled time-series cross-sectional regression in order to use all the available information. To control for any macroeconomic events we include unreported yearly dummies. Since there are significant differences in the average cash holdings across countries, we also include country dummies. In addition, industry dummies are included to stand for industry specific factors that affect cash holdings and are not captured by the remaining variables in our model. Finally, we run a cross-sectional regression using means of variables for each firm across time. Firms with less than 8 year-observations are excluded from this regression, which restricts our sample to 400 firms. Regression models estimates are presented in Table 6.

We find that the three methodologies support that firms with higher leverage have less cash holdings, which is consistent with pecking order and free cash flow theories. According to the pecking order theory high levels of debt and little cash holdings occur simultaneously when firms' investment exceeds retained earnings. The argument that high-levered firms have less cash holdings is also supported by the free cash flow theory, but the main reason is because high leverage firms are more subject to monitoring by capital markets preventing superior managerial discretion. The trade-off model is not clear about the predicted sign for this relationship, but the argument that firms with higher leverage need more cash holdings to prevent bankruptcy is clearly not supported.

The market-to-book ratio coefficient is significant at the 5% level (except in the cross-sectional regression), consistent with the trade-off and pecking order theories predictions, firms with a better investment opportunity set have larger cash holdings. This evidence does not support the free cash flow theory that states that managers of firms with poor investment opportunities (low market to book ratios) will hold more cash to ensure the availability of funds to invest in growth projects, eventually with negative NPV. This way they avoid raising external funds, which would require capital markets to be provided of detailed information about the investment projects. The negative coefficient on the working capital to assets ratio is consistent with the trade-off model, which argues that liquid assets act as cash substitutes.

Real size, cash flow and industry sigma are significant at the 5% level in the pooled time-series cross-sectional regression, while the coefficients obtained for dividend dummy and debt maturity are not significant across all methodologies. Nevertheless, the sign of the cash flow to assets coefficient is positive, which contradicts the trade-off argument but supports the pecking order theory.

These findings are mainly consistent with the empirical studies on the determinants of cash holdings of US firms (see Opler *et al.*, 1999) and UK firms (see Ozkan and Ozkan, 2002).

Contrary to our expectations and previous empirical evidence,⁵ the sign on the industry sigma coefficient is negative which means that firms with higher cash flow volatility have less cash. High cash flow volatility is usually associated with high cost of capital (and high agency costs), which may explain this negative relation. Firms with high cost of capital could avoid having cash because the income generated by

⁴ This methodology avoids the issue of serial correlation in the residuals that could arise in a time-series cross sectional regression.

⁵ Both Opler *et al.* (1999) and Ozkan and Ozkan (2002) find a positive cash flow volatility coefficient, though it is not significant in the latter study.

Table 6
Regression of cash holdings on firm characteristics.

Regressions of the dependent variable cash to assets ratio on firm characteristics for our sample of firm years from the 1987–2000 Datastream Sample of EMU publicly traded firms. Assets in the denominators are calculated as total assets less total cash and equivalent. Dividend dummy is a variable set to one if the firm paid a dividend in the year, and set to 0 otherwise. The market-to-book ratio is measured as the book value of assets, less the book value of equity plus the market value of equity, divided by book value of assets. Net working capital is calculated as net current assets minus cash. Real size is defined as the natural logarithm of total assets in euros deflated to 2000 prices. Industry sigma is a measure of the volatility of an industry's cash flow during the sample period. Cash flow is defined as published after tax profit plus depreciation. Debt maturity is debt repayable in more than one year to total debt. Fama-MacBeth model gives the average of the time series of coefficients from annual cross-sectional regressions. The year dummy regressions are run with a dummy variable for each year from 1987 to 2000. The country dummy variables include one variable for each EMU country. Industry dummy variables are constructed for each Datastream industry classification. The cross sectional regression uses means of variables for each firm. White (1980) heteroskedasticity robust t-statistics are in parentheses.

Independent variable	Fama-MacBeth model	Regressions using dummy variables for:			Cross-sectional regression
		Year	Year and country	Year, country and industry	
Constant	0.1083 (3.288)	N.A.	N.A.	N.A.	0.0294 (0.416)
Dividend dummy	-0.0110 (-1.796)	-0.0002 (-0.026)	-0.0034 (-0.438)	-0.0002 (-0.022)	-0.0026 (-0.087)
Market-to-book ratio	0.0098 (3.274)	0.0188 (3.049)	0.0189 (3.006)	0.0171 (2.670)	0.0148 (1.350)
Net working capital/assets	-0.1587 (-6.077)	-0.0403 (-1.072)	-0.0363 (-1.002)	-0.0404 (-0.992)	-0.1241 (-2.804)
Debt/assets	-0.0676 (-3.177)	-0.0812 (-3.647)	-0.1136 (-5.433)	-0.1215 (-5.524)	-0.1341 (-2.681)
Real size	0.0002 (0.147)	-0.0014 (-0.713)	-0.0054 (-2.719)	-0.0028 (-1.309)	0.0053 (1.538)
Industry sigma	0.0180 (0.349)	-0.0614 (-2.015)	-0.1143 (-3.599)	-0.1456 (-4.425)	-0.0648 (-1.167)
Cash flow/assets	0.4126 (4.312)	0.0539 (1.205)	0.0586 (1.208)	0.0592 (1.209)	0.2664 (1.612)
Debt Maturity	0.0081 (0.956)	0.0062 (0.608)	0.0080 (0.777)	0.0144 (1.231)	0.0115 (0.336)
N	14	6387	6387	6387	417
Adjusted R ²	0.1490	0.0610	0.1098	0.1377	0.1050
Italy dummy	N.A.	N.A.	0.3351 (7.193)	0.2965 (6.345)	N.A.
Ireland dummy	N.A.	N.A.	0.3343 (6.798)	0.2908 (5.858)	N.A.

Table 6
Continued.

Independent variable	Fama-MacBeth model	Regressions using dummy variables for:			
		Year	Year and country	Year, country and industry	Cross-sectional regression
Finland dummy	N.A.	N.A.	0.2666 (5.668)	0.2123 (4.509)	N.A.
Austria dummy	N.A.	N.A.	0.2479 (5.541)	0.2104 (4.669)	N.A.
France dummy	N.A.	N.A.	0.2573 (5.425)	0.2017 (4.225)	N.A.
Luxemburg dummy	N.A.	N.A.	0.2099 (4.341)	0.2054 (4.082)	N.A.
Germany dummy	N.A.	N.A.	0.2412 (4.968)	0.1962 (4.041)	N.A.
Belgium dummy	N.A.	N.A.	0.2237 (4.793)	0.1782 (3.797)	N.A.
Netherlands dummy	N.A.	N.A.	0.2199 (4.649)	0.1674 (3.531)	N.A.
Greece dummy	N.A.	N.A.	0.2024 (3.566)	0.1606 (2.793)	N.A.
Spain dummy	N.A.	N.A.	0.1852 (4.072)	0.1499 (3.255)	N.A.
Portugal dummy	N.A.	N.A.	0.1534 (3.505)	0.1151 (2.577)	N.A.

that cash is lower than its cost. Consequently, for those firms with high cost of capital is very expensive to build up cash for precautionary reasons.⁶

Table 6 also reports the coefficients obtained on the country dummies we use in the pooled time-series cross-sectional regressions. Our findings suggest, while firms in countries like Italy and Ireland have higher levels of cash holdings, on the other hand firms in Spain and Portugal hold less cash.

The differences between cash holdings on these countries can result from two reasons. First, EMU accounting practices are not uniform across countries, namely the rules to report consolidated balance sheets and the assets valuation criteria's (at historical cost or current value). For instance, it is generally believed that German accounting standards place greater emphasis on 'conservatism' while the revaluation is compulsory for French companies (see Nobes and Parker, 1991). Second, the institutional environment in these countries also exhibits some differences, namely bankruptcy laws, the state of development of capital markets, and patterns of corporate governance. We explore these differences in sub-section 4.5.

⁶ Nevertheless, this result should be taken cautiously because the cash flow volatility measure is based on just 14 years of data, which is insufficient to compute a precise measure of cash flow dispersion.

4.3. *Reduced-form regressions*

It is reasonable to accept the argument that the firm's decisions about leverage, cash holdings and investment policy are determined simultaneously. This joint determination would make our estimates inconsistent. To test the robustness of our results we estimated a reduced form of the regressions of Table 6 omitting the dividend dummy and the debt-to-assets variable. The results are reported in Table 7. The coefficient signs and level of significance were unchanged so we conclude that the problem of the joint determination of leverage, cash holdings and investment policy does not affect our findings.

Table 7
Regression of cash holdings on firm characteristics.

Regressions of the dependent variable cash to assets ratio on firm characteristics for our sample of firm years from the 1987–2000 Datastream sample of EMU publicly traded firms. Assets in the denominators are calculated as total assets less total cash and equivalent. The market-to-book ratio is measured as the book value of assets, less the book value of equity plus the market value of equity, divided by book value of assets. Net working capital is calculated as net current assets minus cash. Real size is defined as the natural logarithm of total assets in euros deflated to 2000 prices. Industry sigma is a measure of the volatility of an industry's cash flow during the sample period. Cash flow is defined as published after tax profit plus depreciation. Debt maturity is debt repayable in more than one year to total debt. Fama-MacBeth model gives the average of the time series of coefficients from annual cross-sectional regressions. The year dummy regressions are run with a dummy variable for each year from 1987 to 2000. The country dummy variables include one variable for each EMU country. Industry dummy variables are constructed for each Datastream industry classification. The cross sectional regression uses means of variables for each firm. White (1980) heteroskedasticity robust t-statistics are in parentheses.

Independent variable	Fama-MacBeth model	Regressions using dummy variables for:			
		Year	Year and country	Year, country and industry	Cross-sectional regression
Constant	0.0947 (2.895)	N.A.	N.A.	N.A.	-0.0066 (-0.097)
Market-to-book ratio	0.0112 (3.847)	0.0196 (3.130)	0.0198 (3.090)	0.0179 (2.736)	0.0208 (1.810)
Net working capital/assets	-0.1510 (-5.891)	-0.0350 (-1.014)	-0.0314 (-0.923)	-0.0347 (-0.921)	-0.1096 (-2.595)
Real size	-0.0005 (-0.292)	-0.0020 (-1.001)	-0.0066 (-3.169)	-0.0041 (-1.847)	0.0052 (1.518)
Industry sigma	0.0461 (0.767)	-0.0489 (-1.592)	-0.0950 (-2.940)	-0.1316 (-3.906)	-0.0282 (-0.576)
Cash flow/assets	0.4249 (4.333)	0.0606 (1.248)	0.0669 (1.250)	0.0681 (1.248)	0.2967 (1.715)
Debt maturity	0.0002 (0.028)	-0.0031 (-0.307)	-0.0026 (-0.257)	0.0030 (0.266)	-0.0070 (-0.214)
N	14	6387	6387	6387	417
Adjusted R ²	0.1436	0.0565	0.1016	0.1289	0.0886

4.4. *Bank debt*

It is known that, in opposition to Anglo-Saxon firms, EMU firms have a closer relationship with banks. In fact, in EMU countries, banks own a significant proportion of firms' stock. We address the question of how does bank close relationship affect firm cash holdings.

It is generally accepted that banks are in a better position to evaluate the firm's credit quality and to monitor and control the firm financial policies. Thus, it is expected that firms that rely in bank loans as major source of financing are less likely to experience agency and asymmetric information problems associated with other kinds of debt. Because agency and asymmetric information problems are a source of significant indirect financing costs, which may impose constraints in the access to capital markets, one would expect that firms with a greater proportion of bank debt, have less cash holdings for precautionary motives. However, Pinkowitz and Williamson (2001) find evidence that Japanese firms have higher levels of cash balances due to higher power of banks and the absence of other monitor forces such as large nonblank block holders or an active market for corporate control. They suggest that banks encourage firms to maintain large cash balances in order to extract rents from firms or to lower their costs of monitoring. Thus, the relationship between bank debt and cash holdings is not a clear cut.

To analyse the impact of bank close relationship on cash holdings we re-estimate the regression replacing debt maturity by bank debt to total debt ratio (see Ozkan and Ozkan, 2002). The little availability of information about bank debt on our sample reduces our data to 1950 firm-year observations and, consequently, we only report pooled time-series cross-sectional regression results in Table 8.⁷

The evidence shows that firms using more bank debt hold less cash. This supports the view that the bank close relationship provides firms treasury management some cushion allowing for lower levels of cash holdings. Moreover, the negative relation between cash and bank debt also supports the view banks are in a better position to assess the firm's credit quality and to monitor and control the firm financial policies, cutting down the asymmetry and agency problems usually associated to other kinds of debt. Our results go in the opposite direction of the Pinkowitz and Williamson (2001) evidence for Japanese firms, which can be explained by the lower bank power in EMU countries relative to Japan.

4.5. *Cash holdings and investor protection*

Our sample includes firms from several EMU countries that show evidence of different corporate finance policies. The degree of protection of shareholders and creditors by the legal system is central to understanding corporate finance practices on different countries.

To capture the effects of the different EMU countries financial and legal systems in the firms cash holdings decisions we run the regression including a set of variables that measure how well the laws in these countries protect outside investors in addition to firm characteristics. We include the anti-director rights, creditor rights and rule of law as well as ownership concentration (see La Porta *et al.* 1998) as regressors.

⁷ Fama-MacBeth and cross-sectional regression results, not reported here, do not change our main conclusions.

Table 8

Regression of cash holdings on firm characteristics including bank debt ratio.

Regressions of the dependent variable cash to assets ratio on firm characteristics for our sample of firm years from the 1987–2000 Datastream sample of EMU publicly traded firms. Assets in the denominators are calculated as total assets less total cash and equivalent. Dividend dummy is a variable set to one if the firm paid a dividend in the year, and set to 0 otherwise. The market-to-book ratio is measured as the book value of assets, less the book value of equity plus the market value of equity, divided by book value of assets. Net working capital is calculated as net current assets minus cash. Real size is defined as the natural logarithm of total assets in euros deflated to 2000 prices. Stock price volatility is a measure of share price fluctuation during the previous 12 months. Industry sigma is a measure of the volatility of an industry's cash flow during the sample period. Cash flow is defined as published after tax profit plus depreciation. Bank debt is the ratio bank borrowings to total debt. Year dummy variables were built for each year from 1987 to 2000. The country dummy variables include one variable for each EMU country. Industry dummy variables are constructed for each Datastream industry classification. White (1980) heteroskedasticity robust t-statistics are in parentheses.

Independent variable	Regressions using dummy variables for:		
	Year	Year and country	Year, country and industry
Constant	N.A.	N.A.	N.A.
Dividend dummy	0.0281 (2.812)	0.0338 (3.464)	0.0357 (3.425)
Market-to-book ratio	0.0116 (1.628)	0.0134 (2.013)	0.0105 (1.550)
Net working capital/assets	-0.2187 (-3.930)	-0.2097 (-3.667)	-0.2219 (-3.325)
Debt/assets	-0.0340 (-1.072)	-0.0780 (-2.801)	-0.0623 (-2.071)
Real size	-0.0078 (-2.202)	-0.0143 (-4.261)	-0.0041 (-1.136)
Industry sigma	-0.0934 (-1.452)	-0.2111 (-3.044)	-0.2101 (-2.931)
Cash flow/assets	0.0262 (0.895)	0.0258 (0.857)	0.0244 (0.887)
Bank debt	-0.0279 (-2.199)	-0.0426 (-3.024)	-0.0366 (-2.559)
N	1950	1950	1950
Adjusted R ²	0.0827	0.1840	0.2737

Table 9 shows the results of our regressions. All variables included are significant at a 5% level.⁸ Our previous findings about the firm characteristics that determine cash holdings are unchanged. We find that firms in countries with better investor protection, as measured by the anti-director rights, creditor rights and rule of law, hold less

⁸ Except the rule of law and ownership concentration variables in the cross sectional regression.

Table 9

Regression of cash holdings on firm characteristics, investor protection and ownership concentration.

Regressions of the dependent variable cash to assets ratio on firm characteristics for our sample of firm years from the 1987–2000 Datastream sample of EMU publicly traded firms. Assets in the denominators are calculated as total assets less total cash and equivalent. Dividend dummy is a variable set to one if the firm paid a dividend in the year, and set to 0 otherwise. The market-to-book ratio is measured as the book value of assets, less the book value of equity plus the market value of equity, divided by book value of assets. Net working capital is calculated as net current assets minus cash. Real size is defined as the natural logarithm of total assets in euros deflated to 2000 prices. Industry sigma is a measure of the volatility of an industry's cash flow during the sample period. Cash flow is defined as published after tax profit plus depreciation. Debt maturity is debt repayable in more than one year to total debt. Anti-director rights is a summary measure of country shareholder protection. Creditor rights is a summary measure of country creditor protection. Rule of law is an assessment of the law and order tradition in the country produced by International Country Risk (ICR). Ownership concentration is the median percentage of common shares owned by the largest three shareholders in the ten largest privately owned non-financial firms. Fama-MacBeth model gives the average of the time series of coefficients from annual cross-sectional regressions. The year dummy regressions are run with a dummy variable for each year from 1987 to 2000. Industry dummy variables are constructed for each Datastream industry classification. The cross sectional regression uses means of variables for each firm. White (1980) heteroskedasticity robust t-statistics are in parentheses.

Independent variable	Regressions using dummy variables for:			
	Fama-MacBeth model	Year	Year and industry	Cross-sectional regression
Constant	0.6512 (5.597)	N.A.	N.A.	0.0402 (0.255)
Dividend dummy	-0.0184 (-3.674)	-0.0034 (-0.443)	-0.0011 (-0.134)	-0.0103 (-0.325)
Market-to-book ratio	0.0069 (2.079)	0.0177 (2.941)	0.0158 (2.601)	0.0173 (1.362)
Net working capital/assets	-0.1643 (-6.459)	-0.0415 (-1.078)	-0.0473 (-1.064)	-0.0949 (-2.033)
Debt/assets	-0.0561 (-2.407)	-0.0802 (-3.702)	-0.0883 (-3.820)	-0.1260 (-2.328)
Real size	-0.0030 (-1.846)	-0.0034 (-1.700)	-0.0017 (-0.819)	0.0054 (1.491)
Industry sigma	-0.0075 (-0.184)	-0.0685 (-2.239)	-0.0851 (-2.701)	-0.0863 (-1.625)
Cash flow/assets	0.4038 (4.358)	0.0539 (1.249)	0.0547 (1.270)	0.2407 (1.646)
Debt maturity	0.0154 (1.975)	0.0143 (1.389)	0.0192 (1.652)	0.0249 (0.689)
Antidirector rights	-0.0366 (-5.363)	-0.0299 (-9.720)	-0.0275 (-8.860)	-0.0249 (-3.744)

Table 9
Continued.

Independent variable	Fama-MacBeth model	Regressions using dummy variables for:		
		Year	Year and industry	Cross-sectional regression
Creditor rights	-0.0011 (-0.364)	-0.0090 (-2.544)	-0.0091 (-2.544)	-0.0292 (-2.661)
Rule of law	-0.0354 (-4.457)	-0.0242 (-5.517)	-0.0244 (-5.311)	0.0034 (0.267)
Ownership concentration	-0.1867 (-3.704)	-0.1321 (-4.364)	-0.0870 (-2.819)	0.1319 (1.460)
N	14	6382	6382	417
Adjusted R ²	0.1698	0.0743	0.0995	0.1027

cash, which supports the agency motive for having cash. Moreover, as expected, we find a negative significant relation between cash and ownership concentration, which is also consistent with the agency view for holding cash.

Our results support the free cash flow theory of Jensen (1986), which assumes that if investors have less control over the firm, managers will have an incentive to accumulate cash to gain discretionary power over the firm investment decisions. Thus, firms in countries with superior investor protection, better law enforcement and more concentrated ownership are expected to hold less cash. This evidence is broadly consistent with the results in Dittmar *et al.* (2003).⁹

However, La Porta *et al.* (1997) show that countries with superior investment protections, measured by both the character of legal rules and the quality of law enforcement, have more developed capital markets. Thus, the fact that firms with superior investor protection hold less cash can be due to better access to capital markets, and not because of the agency problems suggested by Jensen (1986) free cash flow theory. To test this hypothesis, we run the regressions adding two variables that measure the capital market development of the firm's country of origin.

The first measure is defined as the ratio of external capital to GNP where external capital is the country stock market capitalisation held by minority shareholders. This measure is a proxy for the degree of development of the equity market and is discussed in more detail in La Porta *et al.* (1997). The second measure is the ratio of private credit by deposit money banks and other financial institutions to GDP. This measures the total amount of debt finance to private firms by all financial institutions and it is obtained from Levine *et al.* (2000). This variable captures the degree of development and size of the credit market.

⁹ Recent work by Guney *et al.* (2003) also found similar evidence in France, Germany, Japan and UK, with exception of the creditor rights, which presents a significantly positive relation with cash. This result might be explained by a stronger creditor protection might be explained by a stronger creditor protection increase the likelihood of bankruptcy in case of financial distress. However, this finding should be taken cautiously because it is based on only four countries.

Table 10

Regression of cash holdings on firm characteristics, investor protection and capital markets development.

Regressions of the dependent variable cash to assets ratio on firm characteristics for our sample of firm years from the 1987–2000 Datastream sample of EMU publicly traded firms. Assets in the denominators are calculated as total assets less total cash and equivalent. Dividend dummy is a variable set to one if the firm paid a dividend in the year, and set to 0 otherwise. The market-to-book ratio is measured as the book value of assets, less the book value of equity plus the market value of equity, divided by book value of assets. Net working capital is calculated as net current assets minus cash. Real size is defined as the natural logarithm of total assets in euros deflated to 2000 prices. Industry sigma is a measure of the volatility of an industry's cash flow during the sample period. Cash flow is defined as published after tax profit plus depreciation. Debt maturity is debt repayable in more than one year to total debt. Anti-director rights is a summary measure of country shareholder protection. Creditor rights is a summary measure of country creditor protection. Equity market development is defined as the ratio of external capital to GNP where external capital is the country stock market capitalization held by minority shareholders. Credit market development is the ratio of private credit by deposit money banks and other financial institutions to GDP (total amount of debt finance to private firms by all financial institutions). Fama-MacBeth model gives the average of the time series of coefficients from annual cross-sectional regressions. The year dummy regressions are run with a dummy variable for each year from 1987 to 2000. Industry dummy variables are constructed for each Datastream industry classification. The cross sectional regression uses means of variables for each firm. White (1980) heteroskedasticity robust t-statistics are in parentheses.

Independent variable	Regressions using dummy variables for:			
	Fama-MacBeth model	Year	Year and industry	Cross-sectional regression
Constant	0.1961 (6.428)	N.A.	N.A.	0.1435 (1.859)
Dividend dummy	-0.0167 (-3.402)	-0.0035 (-0.453)	-0.0019 (-0.232)	-0.0153 (-0.521)
Market-to-book ratio	0.0083 (2.486)	0.0183 (2.995)	0.0163 (2.641)	0.0138 (1.255)
Net working capital/assets	-0.1671 (-6.317)	-0.0404 (-1.062)	-0.0467 (-1.056)	-0.1271 (-2.681)
Debt/assets	-0.0586 (-2.580)	-0.0852 (-3.921)	-0.0933 (-4.028)	-0.1397 (-2.836)
Real size	-0.0019 (-1.215)	-0.0028 (-1.395)	-0.0009 (-0.434)	0.0041 (1.190)
Industry sigma	0.0290 (0.478)	-0.0570 (-1.846)	-0.0749 (-2.360)	-0.0764 (-1.372)
Cash flow/assets	0.4286 (4.460)	0.0546 (1.218)	0.0553 (1.232)	0.2767 (1.665)
Debt maturity	0.0147 (1.861)	0.0116 (1.093)	0.0155 (1.302)	0.0178 (0.524)
Antidirector rights	-0.0196 (-6.847)	-0.0191 (-8.156)	-0.0166 (-6.948)	-0.0227 (-3.943)

Table 10
Continued.

Independent variable	Fama-MacBeth model	Regressions using dummy variables for:		
		Year	Year and industry	Cross-sectional regression
Creditor rights	-0.0148 (-5.060)	-0.0186 (-6.912)	-0.0145 (-5.072)	-0.0180 (-2.936)
Equity market development	-0.1319 (-10.909)	-0.0762 (-3.881)	-0.0836 (-4.213)	-0.0489 (-1.121)
Debt market development	0.0630 (4.853)	0.0302 (1.671)	0.0049 (0.272)	0.0085 (0.198)
N	14	6382	6382	417
Adjusted R ²	0.1657	0.0718	0.0976	0.1294

The results are reported in Table 10, which shows that after controlling for capital markets development we continue to find evidence of the importance of the investor protection variables in explaining cash holdings.¹⁰ However, in contrast with Dittmar *et al.* (2003), the coefficient obtained for the equity market development is negative and significant at the 5% level, which does not support the agency cost view. In fact, EMU firms in countries with more developed equity markets tend to hold less cash, which it is supportive of the precautionary motive for holding cash. In addition, there is weak evidence that the debt market degree of development, measured by private credit to GDP, has a positive impact on cash holdings.

5. Conclusion

This paper investigates the determinants of cash balances for firms in EMU countries, using panel data for the period 1987–2000. We model the cash-to-assets ratio as a function of firm and country characteristics. Similarly to previous findings in Opler *et al.* (1999) and Ozkan and Ozkan (2002) about the determinants of cash holdings, our results indicate that the amount of cash held by firms is positively affected by the investment opportunity set and negatively affected by the amount of liquid asset substitutes and leverage. These findings are consistent with the trade-off model that postulates that firms identify their optimal level of cash holdings by weighting the marginal costs and marginal benefits of holding cash. Pecking order considerations are also consistent with these results. However, this evidence contradicts free cash flow theory as it predicts a negative relationship between investment opportunity set and cash holdings, which suggests that agency conflicts between managers and shareholders do not play a determinant role in the determination of cash holdings. The negative relationship found between cash holdings and size provides support to

¹⁰The ownership concentration and rule of law variables are no longer statically significant when we include capital market development indicators as regressors.

the trade-off argument and contradicts the pecking order theory. However, the positive impact of cash flow on cash holdings is predicted by the pecking order theory and it is in conflict with the trade-off argument. Overall, we conclude that both trade-off and pecking order theories play an important role to explain the determinants of firms' cash holdings.

We also provide evidence of a significant negative relationship between bank debt and cash holdings. This is consistent with the view that banks are in a better position to ascertain the firm's credit quality and to monitor and control the firm financial policies, cutting down the asymmetry and agency problems usually associated to other kinds of debt, which result in higher indirect financing costs and external financing constraints.

Finally, our analysis suggests that firms in countries with superior investment protections, measured by both the character of legal rules and the quality of law enforcement, hold more cash. The level of capital markets development is negatively related with cash holdings, which is contrary to the agency costs view, but supportive of firms holding cash for precautionary motives.

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Appendix A

Variable identifier in Datastream

Variable	Database	[Datatype]/Item
Bank borrowings	Company accounts	# 275 plus # 387
Book value of assets	Company accounts	# 392
Book value of equity	Company accounts	# 305
Debt repayable in less than one year	Company accounts	# 309
Depreciation	Company accounts	# 136
Dividends	Equities	[DPS]
Market value of equity	Equities	[MV]
Net current assets	Company accounts	# 390
Published after tax profit	Company accounts	# 623
Total cash and equivalent.	Company accounts	# 375
Total debt	Company accounts	# 1301

