Corporate cash holdings: financial determinants and corporate governance*

Nicolas Couderc§

Comments welcome.

Abstract

This paper investigates the determinants and consequences of the corporate cash holdings. We use firm-level data of 4,515 firms in Canada, France, Germany, Great-Britain and the USA over the period 1989-2002. We show that financial factors, as well as institutional factors, influence the corporate cash holdings determinants. Moreover, implementing a dynamic panel data estimation, we find empirical support for the hypothesis of implicit cash targets. The second key point of the paper is to investigate the consequences of "excessive" cash holdings. To do so, we implement a bivariate probit model to take into account the fact that cash balances levels and the future performance of these firms are probably jointly determined. We conclude that excessive cash holdings lead to poor firm performances.

Keywords: Corporate cash holdings, corporate governance, dynamic panel data, bivariate probit model.

JEL Classification: C33, G32.

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§TEAM-CNRS. University of Paris 1 Panthéon-Sorbonne, 106-112 boulevard de l'Hôpital, F-75647 Paris Cedex 13, France. Mail : couderc@univ-paris1.fr

"And what about the cash, my existence jewel?"

Ch. Dickens, *Nicholas Nickelby*, ch. 17

Introduction

It's a well-known fact that nearly all firms hold cash reserves, which are often large: in our panel, the median US firm holds more than 13% of its total assets as cash and marketable securities[1] over the 1989-2002 period.

If capital markets were perfect, a firm would not have incentives or needs to hold substantial cash reserves: when firms decide to invest, or face a cash shortage[2], they can find the needed funds on the market at a cost which is function of the anticipated risk and profitability of their projects. The gap between the reality and the prediction of the model with perfect markets is wide. Since Opler *et al.* (1999), the determinants of corporate cash holdings have been regularly studied, in order to try to fill this gap. Under the imperfection of capital markets hypothesis[3], internal and external funds are no longer perfect substitutes and many theoretical factors, firm-specific (financial) as well as institutional, have been put forward to enlighten the motives for corporate cash holdings.

On the one hand, a firm with cash holdings will not have to forego some positive net present value projects because of market imperfections, asymmetric information or transaction costs. This firm is also less likely to face financial distress. On the other hand, from a corporate governance point of view, large cash holdings can be suspected of weakening market discipline and can increase the entrenched CEO autonomy. The manager can potentially use these cash holdings to finance investments which will not enhance firm value. The question is about the relative part of cash holdings which can be explained by precautionary or optimal financial planning motives and by managerial opportunism. If the managerial opportunism seems to be prominent, do these cash holdings allow the firm to underperform?

We first study the cash holdings determinants, using Osiris[4] and Datastream data for 4,515 firms of five countries (Canada, France, Germany, Great-Britain and USA). The choice of these countries allows us to focus on the consequences on cash holdings of the differences in institutional and legal frameworks, following for instance Dittmar *et al.* (2003), in addition to traditional financial determinants. We provide static panel data estimations. To cap it all, we also implement a dynamic panel data estimation, to check whether firms act as if they had an implicit target for their cash holdings or not. With a GMM-derived

[1] 7% in Canada, 16% in Germany, 18% in France and 14% in Great-Britain.

[2] As long as the firm is not in financial distress.

[3] At least understood as a limited capacity of the market to finance firms and projects and to discriminate between them.

[4] Osiris is a Bureau Van Dijk's publication. Osiris provides standardized and as reported financial accounts for the world's publicly quoted companies (more than 24,000), up to 15 years on approximately.

method, we can focus on the dynamic nature of cash holding decisions, allowing for delays or imperfections in the adjustment of cash holdings.

Our second goal is to emphasize the consequences of what we call "excessive" cash holdings: do these "too large" cash holdings allow firms to underperform? We propose a bivariate probit model to estimate the consequences of these "excessive" cash holdings. The existing literature on excess cash spending, to our knowledge, has never dealt with the fact that past cash balances levels and present performance of firms are probably jointly determined. The bivariate probit model with recursive equations allows us to take this fact into account.

Our paper is organized as follows. In section 1, we review the theoretical reasons for which a firm can decide to hold cash. We present our data in section 2. We study the static and dynamic determinants of cash holdings in section 3 and then we investigate the consequences of "excessive" cash holdings for the firms in section 4.

1 Why do firms hold cash?

1.1 Transaction costs and trade-off theory

In the trade-off theory framework, a value-maximizing firm evaluates the marginal costs and marginal benefits of cash holdings to determine its optimal cash ratio[5]. Tobin (1956) or Miller and Orr (1966) for example emphasize the transaction motive for corporate cash holdings. The underlying hypothesis is the existence of scale economies for raising external funds, encouraging firms to hold cash to avoid frequent and repetitive fund raising. Another point is that cash holdings reduce the likelihood of financial distress, allow investment even when some financial constraints are binding, and suppress the costs of raising external funds or switching from non-liquid assets to cash. The cost of holding cash is the liquidity premium, defined as the opportunity cost for holding liquid assets.

The second generation of papers about the trade-off theory is more focused on empirical issues. John (1993) studies the link between liquidity and financial distress costs. Beltz and Frank (1996) test the trade-off theory and find that empirical results strongly support the theoretical predictions of the trade-off theory. Deloof (1999) finds strong evidence of cash holdings for transaction motives, but none for precaution. D'Mello *et al.* (2004) confirm these results, adding new evidence about cash holdings and financial factors: cash holdings are decreasing in the ease of raising cash from internal sources and increasing in growth opportunities and variability of cash flow. Kim *et al.* (1998) study the optimal investment in liquidity of a firm. Following them, cash holdings are increasing in the cost of external funds, the variance of future cash flow, and the profitability on future investment, while it decreases with the opportunity cost of holding liquid assets.

[5] The cash ratio is defined as cash and marketable securities on total assets.

1.2 Asymmetric information and cash holdings

In the transaction cost model, there are incentives for firms to hold cash, without the assumption of asymmetric information or agency problem. Introducing such a possibility intensifies the incentives for corporate cash holdings. The pecking order theory (Myers (1984) and Myers and Majluf (1984)) emphasizes on asymmetric information costs associated to external financing. To minimize these costs, firms should finance investment with internal funds first, then with external funds (debt first and finally equity)[6]. Following them, firms have to stockpile cash when they are able to in order to finance future investment without (or with less) external funds.

In this theoretical framework, Opler *et al.* (1999) investigate the determinants and consequences of cash holdings of US firms. They find that cash holdings are positively correlated with small size, investment opportunities, risk and low access to external funds (high leverage...)[7].

Another informational cost which can affect cash holdings is between banks and firms. Theoretically, one can suggest that the more a firm is linked to a bank, the less cash the firm holds, because a strong relationship between a firm and a bank is supposed to relax the constraint upon raising funds, so the firm is less likely to be constrained, which lowers the cash holdings for precautionary motives. Against the intuition, Pinkowitz and Williamson (2001) find that Japanese firms have higher levels of cash balances than US and German ones. They explain this fact by the higher power of Japanese banks and the lack of checks and balances system, such as large block shareholders. Banks are likely to encourage firms to hold large cash balances to lower their monitoring costs.

1.3 Entrenched managers and cash holdings

Another theoretical body must be evoked to understand reasons for which a firm can hold cash: the agency theory. The very basic idea of the agency theory is that managers may have their own objectives that do not necessarily coincide with those of shareholders. In this framework, to protect themselves, investors ration capital to firms (Stulz (1990) and Hart and Moore (1998)). Jensen (1986) follows the same logic and argues that managers have incentives to increase the free cash flow[8] of their firm, because it's probably the only one asset they can freely control. The manager's incentives to hold cash are mainly to lower the probability of a future financial distress and to allow investment in projects that suit his interest but may not be in the interest of the shareholders (*cf.* Shleifer and Vishny (1997) for in-deep review of the reasons for which a manager can decide to engage additional investment on projects that they prefer even though such investment is not in the interests of shareholders).

[6] See Smith (1993) for evidence of costly external finance.

[7] Same results are found on US firms by Kim *et al.* (1998) and Schnure (1998), on US small firms by Faulkender (2002) and on UK firms by Ozkan and Ozkan (2004).

[8] The free cash flow is the net income of the firm plus depreciation minus capital expenditures. Free cash flow represents the cash that is really available for a firm to spend after financing everything (investment, changes in working capital, interest, taxes...).

Empirically studying this point, Kusnadi (2003) established that board size is positively related and outside block-holder ownership is negatively related to the ratio of cash to net assets in Singapore. These findings support the agency cost model: shareholders of firms with large boards and low non-management block-holder ownership do not have much power in forcing the managers to give back the cash in excess to the shareholders.

The takeover market is often viewed as a way for dealing with the agency problems of corporate free cash flow (external control of the managers by the market). Recent empirical evidence is mixed on this subject. Harford (1999) and Pinkowitz (2002) both find a negative correlation between the likelihood of becoming a target of a takeover and the cash balances levels. This counterintuitive result can be explained by enhanced ability of a target to defend itself (because of its cash reserves...) against the bidder, by repurchasing its stock, acquiring a competitor of the bidder... On the other side, Faleye (2004) investigates the proxy contests[9] as a control mechanism for addressing the agency problems of excessive corporate liquidity, and finds a positive relationship between proxy fights and high cash balances.

Some recent papers are interested in the influence of legal and institutional factors on the decision to hold cash, because of the correlation between these factors and the level of agency costs. The basic idea of these papers is that the agency costs vary among countries, according to the degree of protection the outside investors receive. The more the outside investor are protected, the more they are ready to finance firms at low cost and the less firms have to hold cash. La Porta *et al.* (1997) and La Porta *et al.* (1998) have provided some proxies for characterizing institutional and legal systems across countries. Using these proxies, Dittmar *et al.* (2003) show that cash or marketable securities holdings are higher in countries with a lower value of the anti-director rights index. This variable is a proxy for legal rights of minority shareholders[10]. They assess that shareholders in countries with poor shareholders protection are not in position to enforce managers to give back excessive cash to themselves. This result supports the agency costs of managerial discretion hypothesis for high cash holdings. These results are supported by additional evidence on EMU countries (Ferreira and Vilela (2004)). Pinkowitz *et al.* (2004) follow the same path, extending the evidence on the importance of the link between institutional factors viewed as proxies for corporate governance practices and cash holdings (see also Kalcheva and Lins (2003)). A contradictory result is obtained by Harford *et al.* (2004), who find that US firms with weaker shareholder rights have small cash reserves. The explanation they give for this striking result is that US entrenched managers spend their cash reserves more quickly than do non-entrenched managers.

[9] A proxy contest occurs when the bidder attempts to convince shareholders of the target to use their proxy votes to fire the managers and replace them by new ones who are in favor of the takeover.

[10] High value if laws protect minority shareholders better.

1.4 Theoretical predictions

The relationship between cash flow and cash holdings is ambiguous, because on the one hand, when internal funds are abundant, the firm can finance valuable investment opportunities with no problem and is not likely to face financial distress, so cash holdings are not really needed for such a firm (transaction cost theory). On the other hand, when a firms generates abundant cash flow, the less dependent is the firm from external capital markets, and the less the shareholders are able to control the manager, so the manager can decide to stockpile cash (managerial opportunism theory). The relationship between Tobin'q and cash holding is somewhat ambiguous, too: a high Tobin's q firm is a firm which invest more than the average firm, with more growth opportunities, and is more valuated by the market. According to the transaction cost theory, this firm must have low cash balances, since its resources are used to invest and grow. But the managerial theory suppose that these firms are also, all else being equal, less likely to face financial distress and are managed by more autonomous managers. These managers can try to augment cash holdings.

Following the transaction cost theory, cash holdings are correlated with the variability of cash flow because the more cash flow are volatile, the more probable is the existence of a liquidity constraint in a near future, and the more the firm wants to avoid the expected costs of this liquidity constraint. The indebtedness is expected to be correlated with low cash holdings (debt can be viewed as a more costly substitute for cash holdings). Following the same logic, an inverse relationship is expected to be found between the interest rate and cash holdings (a higher interest rate is the sign of higher transaction costs and/or higher risk premium). Conversely, a highly liquid balance sheet is supposed to lower cash holdings, because many assets can be sold when the firm faces a cash shortage. The dividend variable is likely to be negatively correlated with cash holdings, since a firm can cut its dividend when cash is needed. Last, capital expenditures must be negatively correlated with cash holdings: when a firm decide to invest, it is not likely to keep high cash balances. We can also expect a negative relationship between the financial sector effectiveness and corporate cash holdings, because the deeper, the larger and the more efficient the financial sector is, the lower the transaction costs would be (this negative relationship means a positive coefficient, since the lower the index is, the more efficient the financial markets are).

Turning to institutional factors, one can say that, following the managerial opportunism theory, the more the managers are under the control of the shareholders the less cash the firm will hold. This control and its effectiveness can be approximated by the legal rights given to the shareholders, the existence of a major shareholder, ... For instance, we define the power of shareholders in two different ways. First, shareholders are powerful when the institutional system is designed to defend shareholders. Second, one can think that the presence of a major shareholder improves the monitoring of the manager's decisions. A major shareholder can monitor the firm with more precision, because his cost/benefits analysis of monitoring is much more in favor of monitoring

than the cost-benefits analysis of a small shareholder. Moreover, he is likely to have more information about the firm, because of his weight. One can expect a negative relationship between these two proxies and cash holdings. The more powerful are the shareholders, the more they can effectively control the manager and the more they are able to control cash balances.

To sum up the theoretical predictions about the signs of the variables on cash holdings, one can say that it's very hard to distinguish between the transaction cost and the pecking order theory, because the theoretical predictions are essentially the same. The pecking order theory only gives a strong basis for the existence of transaction costs. But the theoretical predictions about cash holdings are quite divergent between the transaction cost theory and the managerial opportunism theory (also called the free cash flow hypothesis) ; see table 1. The aim our our empirical research is to determine which determinants are significant to explain cash holdings, and to test these theoretical predictions.

Table 1: Theoretical predictions

Variable	**Transaction cost th.**	**Manag. opp.**
Cash flow	−	+
Anticipated variation of cash flow	+	.
Indebtedness rate	−	.
Portion of long-term debt	+	.
Size of the firm	−	+
Liquidity of its balance sheet	−	.
Dividend	−	.
Investment	−	.
Market valuation of the firm	−	+
Interest rate	−	.
Power of the shareholders	.	−
Financial sector effectiveness	−	.

2 Sample and descriptive statistics

2.1 Sample design

To build our panel, we use the Osiris and Datastream databases. We started with an initial sample of 7,994 companies[11] from Osiris[12]. We then merge this database with some additional data types (historical market data) from Datastream database. The usual checking for coherence of both sources of data en-

[11] Criteria for selecting these firms: at least 10 employees, publicly listed, data available (at least 4 years in a row of data), country, standardized account presentation and absence of major event in the firm life (bankruptcy, merger...).

[12] Osiris is a Bureau Van Dijk's publication. Osiris provides standardized and as reported financial accounts for the world's publicly quoted companies (more than 24,000), up to 15 years on approximately. We use the Osiris DVD version, October 2003.

courages us to delete 1,881 firms[13]. After matching, we obtain data from both sources for 6,113 firms.

Firms under the direct or indirect control from the government, banks, insurance companies and other financial companies (sectors 45 to 48[14]) and firms with non reported industry code are set aside from our sample (1552 firms). To ensure the reliability of the data, we exclude 46 firms which are reporting non-credible values such as negative debt, negative total assets, *etc*.

Finally, we obtain a sample of 4,515 listed firms from five countries: USA, Canada, France, Germany and Great-Britain. The sample period is from 1989 to 2002. For each of them we have its annual balance sheet and current account, with some additional variables (number of employees, PER, number of shares...).

2.2 Descriptive statistics

The left-hand side variable, $CASH$[15], is the ratio of total cash and marketable securities to total assets.

We define the financial variables listed on Table 1. $CASH\_FLOW$ is the ratio of pre-tax profit plus depreciation on total assets. VAR_CF is the three-year average variation in % of $CASH\_FLOW$ on total asset. $TOTDEBT$ is the ratio of long term debt bearing interest plus short term debt on total assets. $LTDEBT$ is the ratio of long-term debt on $TOTDEBT$. $SIZE$ is the log of total revenue. $CAPEX$ is the ratio of capital expenditures to total assets. TOB_Q is the Tobin's q, the ratio of the total market value of the firm divided by the replacement costs of assets, estimated as the book value of fixed assets. INT_RATE is a fictive interest rate, calculated as the ratio of interest expenses to $TOTDEBT$ and DIV is a dummy, equal one when the firm had given a dividend to its shareholders.

We winsorize the data, VAR_CF between -20 and 20, TOB_Q between 0 and 15 and INT_RATE between 0 and 1.

The power of the shareholders is a quite difficult variable to appreciate. To do so, following La Porta *et al.* (1997), we consider four alternative proxies: $RULE\_LAW$, which is an index of the law and order tradition in the country. The index is comprised between 0 and 10, a lower score means less tradition of law and order. $CREDITOR\_RIGHT$ is an index which ranges from 0 to 4, it's an indicator of the creditors' rights. The higher the index is, the better creditors are protected[16]. $ANTIDIR\_RIGHT$[17] is an index, which ranges from 0 to 5. The higher the index is, the stronger are the shareholders' rights to control the

[13] Data types included in both databases from Osiris and from Datastream are used to control the merging and must be similar (number of shares and market price of common shares in particular).

[14] About the Fama and French sector classification, see details in appendix C.

[15] See Appendix A for more details about the calculation of these variables.

[16] This index focuses on the decisions the debtors can veto or impose when the firm faces financial difficulties.

[17] Another variable from La Porta *et al.* (1997).

managers[18]. The fourth one, a firm-specific dummy MAJ, is equal to one if the presence of a major shareholder is denoted. We generate this dummy with the Osiris "Independence Indicator". This variable indicates the presence of no recorded shareholder with a direct or indirect ownership over 25%, of no recorded shareholder with an ownership over 50% but at least a shareholder with an ownership over 25%, of a shareholder with an ownership over 50%. We define a major shareholder as a shareholder who holds more than 25% of the capital of the firm.

In order to obtain a proxy of the financial sector effectiveness, we use an index built by Couderc and Jestaz (2004), FIN_EFFECT. This index is a composite of many indicators of the size, the depth, and the liquidity of a national financial market (stock market as well as debt market)[19]. A higher value of this index means a deeper, more efficient and larger financial market. This index is a proxy for the transaction costs firms support when they want to raise funds. The higher this index is, the more developed is the financial sector.

Tables 2 and 3 report the descriptive statistics for the variables used in the estimations[20].

Table 2: Descriptive statistics

Variable	Mean	Std. Dev.	Median	Min.	Max.	N
$CASH$	0.221	0.219	0.140	0	1	52917
$CASH\_FLOW$	0.106	0.107	0.091	0	1	52773
VAR_CF	0.018	1.202	0.009	-20	20	39883
$TOTDEBT$	0.294	0.232	0.253	0	1	53000
$LTDEBT$	0.429	0.333	0.447	0	1	51360
$SIZE$	18.451	2.571	18.512	6.908	26.169	54761
$LIQUIDITY$	0.093	0.131	0.016	0	0.979	52124
DIV	0.487	0.5	0	0	1	48297
$CAPEX$	0.106	0.128	0.062	0	1	31314
TOB_Q	3.921	4.476	1.981	0	15	42025
INT_RATE	0.155	0.24	0.083	0	1	42262

3 The determinants of cash holdings: an international comparison

3.1 The financial and institutional determinants of cash holdings

F-tests are performed on the null hypothesis that the coefficients for each variable in the regression equation are the same for each year. The null hypothesis

[18] In particular, the rights of the minority stock-holders and the existence of some vote-facilitating mechanisms are addressed.

[19] For example: private bond market capitalization to GDP, stock market capitalization to GDP, stock market turnover ratio, profits of listed firms to profit of all firms... See appendix F for details.

[20] Summary statistics by country are presented in appendix B.

Table 3: Institutional characteristics

Variable	Canada	France	Germany	Great-Britain	USA
$RULE\_LAW$	10	1.22	1.57	1.59	10
$CREDITOR\_RIGHT$	1	0	3	4	1
$ANTIDIR\_RIGHT$	4	2	1	4	5
MAJ (freq.)	33.23	73.30	65.38	19.05	27.08
FIN_EFFECT	1	0	0.80	3.3	6.5

of equal coefficients is rejected (even at 10%), therefore we can not pool the data. The stationarity of $CASH$[21] allows us to perform the usual static panel estimation. Results are reported in tables 4 and 5.

On the whole panel, the main factors are significant, and except for LT_DEBT, the random- and fixed-effect models give the same results for the coefficients. Small firms with higher cash-flow, high cash flow volatility and high Tobin's q are likely to have more cash. On the contrary, firms with high debt, liquid assets, or high investment rate have lower cash balances. Firms which are paying high interest rate have lower cash balances too. Now turning to institutional factors[22], all the dummies are significant, institutional characteristics influence firms decisions about cash holdings.

Following the transaction cost model, firms with liquid assets or paying a dividend can easily turn these assets into cash, so they don't need high cash balances, which is confirmed by the signs of the two variables ($LIQUIDITY$ and $CASH$). Conversely, firms with high uncertainty of future cash flow level (estimated in our regression by the variable VAR_CF) and small firms ($SIZE$) are expected to have high cash balances. In the same model, firms with higher capital expenditures (with more profitable investment opportunities) are expected to have lower cash balances (the internal resources are spent to finance these investments), which once again is supported by the sign of the variable $CAPEX$. Our results, convergent with the findings of Opler *et al.* (1999) strongly support the transaction cost model. Last, the correlation between cash holdings and low financial sector effectiveness (FIN_EFFECT) is confirmed: the coefficient is negative, say cash holdings are increasing when financial sector effectiveness is lower (*ie.* transaction costs are higher): when firms are convinced that the financial markets are able to finance easily projects, they tend to lower their cash

[21] Confirmed by the Levin-Lin-Chu test at 1% ($t^* = -92.22$) and by the Im-Pesaran test at 1% ($W(\bar{t}) = -1.901$). H_0 for both tests: the variable is non-stationary. These tests were performed on a sub-panel of 2064 firms, because these tests need a balanced panel.

[22] Since the proxies for institutional characteristics are time- and country-invariant (except MAJ), it's not possible anymore to run fixed-effects regressions anymore. We must swap to the random-effect model. In order to address the heterogeneity of firms, we had in each regression year, country and sector dummies (following the Fama and French (1997) classification).

balances[23]. The only contradiction between the theoretical predictions and our results deals with the sign of the TOB_Q variable. In our sample, we observe that the highest the TOB_Q is (the more valuated the firm is), the more cash it holds.

Some results can also be convoked in favor of the asymmetric information paradigm, since the only consequence of the informational imperfections are that external funds are harder to raise. The interesting point with the asymmetric information theory is that this theory gives a solid reason for explaining the costs associated with external funds, and insisting on informational costs about the cost of raising external funds.

Our results are also in favor of the influence of managerial opportunism in cash holdings: firms with low debt have more cash. Because of their low indebtedness, these firms are less subject to financial monitoring by the capital markets or banks, and managers can more easily be autonomous in their decisions. The presence of a major shareholder (MAJ) is correlated with a firm which holds less cash. The better the creditor rights are established and enforced ($CREDITOR\_RIGHT$), and the better the shareholders are protected against managerial decisions ($ANTIDIR\_RIGHT$) the lower the cash balances are. In fact, in countries with high creditors' protection, a firm can borrow cash on the securities market without having high internal liquid funds, because creditors aren't so much afraid of firm's bankruptcy than they would be in a country with low creditors' rights. The same logic can be applied to the $RULE\_LAW$ variable: the higher the tradition and respect of law is, the lower are the cash levels needed, because a firm doesn't have to convince the shareholders or creditors of its financial health. Shareholders are also less reluctant to finance firms when their rights are high; we find that the more powerful the shareholders are, the lower the cash balances are. When they can (because of no powerful shareholder or lack of anti-director rights), managers do stockpile cash, which is a clue of a potential discretional use of this cash, and is in favor a the free cash flow hypothesis.

Since the country dummies are highly significant, we also run separate regressions by countries[24]. In the five countries studied, the influence of many variables on corporate cash holdings are the same across countries. Four variables don't influence the cash holdings in the same way in these countries: $CASH\_FLOW$ (not significant in Great-Britain, negative in France), VAR_CF (not significant in Great-Britain and Canada), LT_DEBT (only significant in Germany and Canada) and DIV (only significant in Great-Britain). These differences will be investigated more deeply in the next section.

As a conclusion, the financial and institutional factors support the two testable

[23] Alternative proxies for financial sector effectiveness have been considered, for instance the number of IPO in a country as a ratio to its population... The same explanation applies: the more common IPO are, the more liquid the financial market is, facilitating the external funds raising by firms, which is in favor of lower cash balances. Moreover, the more frequent the IPO are, the less autonomous the managers are. More precisely, managers know that if the firm they manage holds too much cash, it can become a target for an IPO. Results available upon request.

[24] See appendix E for estimation results.

models, the transaction cost model and the managerial opportunism theory, one can consider these two cash holdings motives as complementary rather than opposite. The consequences of cash holdings on firm performance will be investigated in section 4.

Table 4: Financial factors

	All panel (fixed effects)		**All panel (random effects)**	
Variable	**Coefficient**	**(Std. Err.)**	**Coefficient**	**(Std. Err.)**
$CASH\_FLOW$	0.055***	(0.009)	0.022***	(0.008)
VAR_CF	0.003***	(0.001)	0.003***	(0.001)
$TOTDEBT$	-0.149***	(0.005)	-0.160***	(0.005)
LT_DEBT	0.012***	(0.004)	-0.001	(0.003)
$SIZE$	-0.015***	(0.001)	-0.014***	(0.001)
$LIQUIDITY$	-0.493***	(0.009)	-0.480***	(0.008)
DIV	-0.013***	(0.002)	-0.018***	(0.002)
$CAPEX$	-0.157***	(0.005)	-0.157***	(0.005)
TOB_Q	0.013***	(0.001)	0.015***	(0.001)
INT_RATE	-0.058***	(0.003)	-0.070***	(0.003)
$INTERCEPT$	0.533***	(0.017)	0.444***	(0.027)
N	26532		26532	
R^2	0.409		0.506	
ρ	0.730		.606	

Notes: Significance levels : $*$: 10% $**$: 5% $***$: 1%.

Random-effect model estimated with year, sector and country dummies.

ρ is the fraction of variance due to firm-specific residual.

Table 5: Institutional factors.

Variable	Coefficient	(Std. Err.)	Coefficient	(Std. Err.)	Coefficient	(Std. Err.)	Coefficient	(Std. Err.)	Coefficient	(Std. Err.)
$CASH\_FLOW$	0.023***	(0.008)	0.023***	(0.008)	0.023***	(0.008)	0.023***	(0.008)	0.023***	(0.008)
VAR_CF	0.003***	(0.001)	0.003***	(0.001)	0.003***	(0.001)	0.003***	(0.001)	0.003***	(0.001)
$TOTDEBT$	-0.160***	(0.005)	-0.160***	(0.005)	-0.160***	(0.005)	-0.160***	(0.005)	-0.160***	(0.005)
LT_DEBT	-0.001	(0.003)	-0.001	(0.003)	-0.001	(0.003)	-0.001	(0.003)	-0.001	(0.003)
$SIZE$	-0.014***	(0.001)	-0.014***	(0.001)	-0.014***	(0.001)	-0.014***	(0.001)	-0.014***	(0.001)
$LIQUIDITY$	-0.480***	(0.008)	-0.480***	(0.008)	-0.480***	(0.008)	-0.479***	(0.008)	-0.480***	(0.008)
DIV	-0.018***	(0.002)	-0.018***	(0.002)	-0.018***	(0.002)	-0.018***	(0.002)	-0.018***	(0.002)
$CAPEX$	-0.157***	(0.005)	-0.157***	(0.005)	-0.157***	(0.005)	-0.157***	(0.005)	-0.157***	(0.005)
TOB_Q	0.015***	(0.000)	0.015***	(0.000)	0.015***	(0.000)	0.015***	(0.000)	0.015***	(0.000)
INT_RATE	-0.070***	(0.003)	-0.070***	(0.003)	-0.070***	(0.003)	-0.070***	(0.003)	-0.070***	(0.003)
$RULE\_LAW$	-0.003***	(0.000)	–	–	–	–	–	–	–	–
$ANTIDIR\_RIGHT$	–	–	-0.005***	(0.001)	–	–	–	–	–	–
$CREDITOR\_RIGHT$	–	–	–	–	-0.007***	(0.002)	–	–	–	–
INT_RATE	–	–	–	–	–	–	-0.012***	(0.004)	–	–
MAJ	–	–	–	–	–	–	–	–	-0.004***	(0.001)
$INTERCEPT$	0.476***	(0.027)	0.469***	(0.028)	0.451***	(0.027)	0.455***	(0.027)	0.472***	(0.028)
N	26532		26532		26532		26532		26532	
R^2	0.506		0.506		0.506		0.506		0.506	
ρ	0.606		0.606		0.606		0.606		0.606	

Notes: Significance levels : $*$: 10% $**$: 5% $***$: 1%.
Random-effect model estimated with year, sector and country dummies.
ρ is the fraction of variance due to firm-specific residual.

3.2 The hypothesis of a target cash holding level

Many authors (e.g. Opler *et al.* (1999)) emphasize on the "persistence of cash holdings" and the existence of implicit target cash levels (*i.e.* cash balances are mean-reverting). It seems that firms have an implicit and unobservable cash holdings target, but the adjustment of real cash holdings to targeted cash holdings is only partial. In other terms, a delay can exist in the adjustment process because of positive costs of adjustment. Even if firms have cash holdings targets, the right-hand variables used in the static estimations have to be taken into account. To deal with the potential dynamic nature of cash holdings, we fit a dynamic panel data model. The key idea of this technique is to add a lag of the left-hand side variable as a right-hand variable. Some methodological issues compel us to use the Arellano and Bond (1991) and Arellano and Bover (1995) estimators[25].

We implement different tests in order to evaluate the relevance of our econometric estimation. We first provide the Arellano and Bond tests for first and second order serial autocorrelation of residuals. If $\varepsilon_{i,t}$ is not serially correlated, the difference residuals should be characterized by a negative first-order serial correlation and the absence of a second-order serial correlation. The Hansen/Sargan test for the validity of over-identifying restrictions and the quality of instruments is implemented for each regression. It conducts test for the null hypothesis that the remaining theoretical orthogonality restrictions are equal to zero (Sargan (1958) and Hansen (1982)). Failure to reject the null hypothesis indicates that the instruments are valid. It supports the validity of the model specification.

$L.CASH$[26] is significantly positive and under 1. The significance of this coefficient confirms the dynamic nature of cash holdings and, by the way, the merits of a dynamic estimation[27]. We can conclude that firms make a trade-off between the positive costs of cash holdings adjustments and the costs of being far from the fixed target. The persistence of cash holdings is quite low, because nearly 2/3 of the gap between the actual cash level and the desired cash level is filled each year.

One can not compare the signs and significance levels of these estimations and the static estimations provided in tables 4 and 5. In fact, due to the dynamic nature of the regression, the entire history of the right-hand side variables is included in the lagged term. In other terms, the measured influence of right-hand side variables in this equation is conditioned on this history, and is only the consequence of the effects of new information (that is, a change in the value of the variable). The results of the two estimators (two-step difference GMM and two-step system GMM) are convergent. Among the variables, one can note that total debt has a negative influence on cash holdings, such as size, liquidity and capital expenditures, and Tobin's q has a positive influence on cash hold-

[25] For details about the methodology, see appendix D.

[26] The first lag.

[27] When separate regressions are ran by country, the differences between these coefficients are not significant.

ings. These results confirm our previous (static) results, but moreover it seems that firms do have an implicit cash holdings target, and they partially adjust their current cash holdings to the target.

Table 6: Dynamic panel data estimation

Variable	Two-step difference GMM results Coefficient	(Std. Err.)	Two-step system GMM results Coefficient	(Std. Err.)
$L.CASH$	0.328***	(0.037)	0.493***	(0.023)
$CASH\_FLOW$	0.038	(0.090)	-0.042	(0.077)
VAR_CF	-0.001	(0.011)	0.005	(0.011)
$TOTDEBT$	-0.322***	(0.093)	-0.177**	(0.072)
LT_DEBT	-0.014	(0.055)	-0.039	(0.045)
$SIZE$	-0.016**	(0.007)	-0.003	(0.004)
$LIQUIDITY$	-0.345***	(0.124)	-0.337***	(0.086)
DIV	-0.013	(0.030)	-0.016	(0.017)
$CAPEX$	-0.341***	(0.052)	-0.397***	(0.041)
TOB_Q	0.005***	(0.002)	0.006***	(0.002)
INT_RATE	-0.037	(0.041)	-0.037	(0.035)
$INTERCEPT$	–	–	0.270***	(0.078)
N	22149		26526	
$AR-1$ test	$z=-12.94$	$Pr>z=0.000$	$z=-19.70$	$Pr>z=0.000$
$AR-2$ test	$z=0.32$	$Pr>z=0.748$	$z=1.59$	$Pr>z=0.112$
Sargan-Hansen test	189.03	$Pr>\chi^2=0.192$	213.64	$Pr>\chi^2=0.343$

Notes: Significance levels : $*$: 10% $**$: 5% $***$: 1%.

Windmeijer finite-sample correction applied in order to obtain robust two-step GMM estimators.

Arellano and Bond (1991) residual tests are performed on the null hypothesis of zero auto-covariance in residual (of order 1 and 2).

Instruments validity is checked using the Sargan-Hansen test for over-identifying restrictions.

4 Why do some firms stockpile "too much" cash ?

4.1 Methodological issues

Since some firms hold large amounts of cash, we investigate the consequences of these holdings, in terms of firm performances. Do firms with large cash holdings perform differently from other firms? Testing the correlation between firm performance and cash holdings is a roundabout way to verify which explanation (transaction costs or managerial opportunism) is the more pertinent to understand the motives for cash holdings. According to the free cash flow theory, one can expect that the cash-rich firms performance is below the average performance, since their managers have less incentives to do well. On the contrary (in transaction costs framework), a cash-rich firm faces less transaction costs, can finance investment at a lower cost and is not likely to be forced to forego valuable investments, so cash-rich firms, all else being equal, are likely to perform better than other firms.

Some studies focus on excess cash (firms which hold more cash than the average cash holdings of comparable firms), but the evidence on the subject is mixed. Harford (1999) is focused on firms that have excess cash holdings at a particular point in time. He finds that firms with excess cash holdings are more likely than other firms to attempt acquisitions or overdiversify and by the way to destruct value. Same conclusions of the destroying value comportment for cash-rich firms are reached by Blanchard *et al.* (1994), who study firms that receives cash windfalls from lawsuits. Harford and Haushalter (2003)[28] find that expenditures of cash windfalls are influenced by managerial ownership stakes[29]. On a German sample of firms, Schwetzler and Reimund (2004) do find a significant operating under-performance of German firms that previously held excess cash over a three-year period. These studies support strongly the findings of Jensen (1986) and the fact that large cash holdings lead to poor performance and strategic managerial behavior.

In contrast, Mikkelson and Partch (2003) examine the operating performance of firms that held more than 25% of their assets in cash. They focus on firms which have a "sustained and deliberate policy of retaining large holdings of cash", since they consider cash balances over a five-year period to build the group of firms which own "large cash reserves". Following them, the operational performance of firms is not correlated to the size of cash balances. They confirm the early results of Opler *et al.* (1999), who don't find the proof of non-efficient cash-spending in cash-rich firms.

These divergent results are probably the consequences of many factors: differences in the sample, in the methodology, in the definitions of excess cash and inefficient spending of cash... Another problematic issue is that a correlation between performance and the amount of cash hold by the firms probably exists. More precisely, these two variables are probably jointly influenced by the same observable and unobservable factors. Furthermore, the excessive holdings of

[28] They use the Persian Gulf crisis of 1991 as a natural experiment.
[29] Another paper with the same conclusion is Lang *et al.* (1991)

cash will appear as a right-hand side variable in the performance equation, so the two equations (cash holdings and performance) are correlated.

We address this issue with a framework for estimating such a model of recursive bivariate probit model. The bivariate probit model belongs to the general class of simultaneous equation models with continuous and discrete variables. This model is similar to the simple bivariate probit model, except the left-hand side variable of the second equation appears as an independent variable in the first equation. The bivariate model is useful when two left-hand variables are interdependent or may depend on a common set of explanatory variables. Greene (2003) demonstrates that the endogenous nature of one of the left-hand side variable can be ignored when we maximize the log-likehood function.

A strong hypothesis is needed implementing this model. One can not estimate this model with fixed effects. We are constrained to suppose the orthogonality of firms-specific effects and left-hand side variables. Robust variance estimates have been produced across individual observations.

Before estimating such a model, we do have to define first what is "too much" cash. We can not precisely observe how much cash in excess a particular firm have. We can only observe if a firm, in a particular period of time, has more cash than the predicted amount of cash. We define the predicted cash holdings with the static model presented in table 4. We suppose that cash holdings larger than the predicted cash holdings plus one standard deviation are excessive. The dummy $EXCESS\_CASH$ is in this case equal to the unity, and zero otherwise.

Following the same logic, since we can not define precisely what is a good or bad performance for a firm, we suppose that a firm have good performance when it does better than the median firm, for the year and the sector considered. Conversely, a firm presents bad performance ($BAD\_PERF = 1$) when its profitability rate is under the median profitability rate less a standard deviation.

4.2 Results

The presence of cash in excess is positively correlated with the probability of bad performance for firms. Even with all these contemporaneous control variables, the negative influence of the cash in excess on firm's performance is significant at 1%[30]. This result strongly supports the managerial opportunism thesis. All else being equal, firms with high cash balances are likely to underperform. A Wald test confirms at 1% the existence of a dependence between the two equations. The same regressions run without the cluster option provides

[30] This influence exists for all countries, when separate regressions are run. Alternative specifications of bad results and excess cash holdings were tested, without notable changes in the results : predicted cash holdings plus two standard deviations, predicted cash calculated as the average cash holdings of firms of same sector, size, and year... The excess cash is always correlated with future under average performance of firms. Results available upon request.

the same coefficients, since this clustering option modifies only the standard errors (the standard errors are smaller for the cluster estimates).

Table 7: Firm performance and firm cash holdings

Variable	**Coefficient**	**(Std. Err.)**
Equation 1 : BAD		
$L.EXCESS\_CASH$	0.956***	(0.110)
LT_DEBT	-0.117	(0.072)
DIV	-0.747***	(0.044)
$SIZE$	-0.167***	(0.010)
$VARIAB\_CF$	-0.056***	(0.017)
TOB_Q	0.021***	(0.005)
TX_INT	0.349***	(0.069)
$TOTDEBT$	0.515***	(0.092)
$LIQUIDITY$	-2.141***	(0.205)
$CAPEX$	-1.711***	(0.241)
$INTERCEPT$	1.821***	(0.200)
Equation 2 : $L.EXCESS\_CASH$		
$L.CASH\_FLOW$	-2.897***	(0.373)
$L.VARIAB\_CF$	0.006	(0.025)
$L.TOTDEBT$	-0.908***	(0.154)
$L.LT\_DEBT$	-0.406***	(0.113)
$L.SIZE$	0.020	(0.013)
$L.LIQUIDITY$	-3.767***	(0.375)
$L.DIV$	-0.153**	(0.062)
$L.CAPEX$	-1.702***	(0.202)
$L.TOB\_Q$	0.091***	(0.006)
$L.TX\_INT$	-0.514***	(0.115)
$INTERCEPT$	-1.065***	(0.241)
N	22154	
Log L	-8090.17	
Pseudo R^2	0.609	
ρ	-0.450	(0.045)
Wald test of $\rho = 0$	71.778	

Notes: Significance levels : $*$: 10% $**$: 5% $***$: 1%

Standard errors adjusted for clustering on $IDFIRM$.

Clustering allows for correlated errors within firms, but none across firms.

Two concurrent explanations can be given. First, managers who are free to stockpile cash are not really under the control of the shareholders (because of the absence of a major shareholder, of a "good" managerial entrenchment...). These managers have no incentives to manage their firm in the shareholders' interests, and they can allow the firm they manage to underperform without risk for their jobs and compensations. The other explanation is that the cash in excess is an assurance for the risk-averse managers against potential future

bad performances. But this cash in excess reduce the ability of the firm to invest and increase the incentives for the managers to spend this cash, even in absence of profitable projects. Whatever the good explanation may be, there is a correlation between "excessive" cash holdings and bad performance of firms. And this correlation is a significative clue in favor of the free cash flow hypothesis (Jensen (1986)).

Conclusion

This paper investigate the corporate cash holdings determinants and consequences on the firms' profitability from 1989 to 2002, by using firm-level data from Canada, France, Germany, Great-Britain and the USA.

We find that, *ceteris paribus*, cash holdings are increasing on firm's size, cash flow level, cash flow variability, and Tobin's q, and decreasing on indebtedness, investment rate, liquidity of the balance sheet. The institutional determinants of cash holdings are significant and support the hypothesis of an influence of the legal system on cash holdings decisions: cash balances are lower in the institutional frameworks which are more in favor of the shareholders rights. Both financial and institutional factors which are significant can not rule out the free cash flow hypothesis.

We also run a dynamic estimation of corporate cash holdings, using the appropriate GMM framework. This model is probably a better way to estimate the cash holdings determinants, since the usual tests support the hypothesis of an implicit cash holdings target.

Last, we focus on the link between cash holdings and firms' profitability, by implementing a bivariate probit model. A negative correlation is drawn between these two variables, a firm with more cash is likely to perform worst than other firms. This finding strongly support the managerial opportunism thesis, according to Jensen (1986). This result is in contradiction with the findings of Opler *et al.* (1999) or Mikkelson and Partch (2003). One potential explanation for this striking result is that, in our empirical framework, we consider that cash balances levels and the future performance of these firms are probably jointly determined.

Static determinants of cash holdings as well as the link between cash holdings and firm performance are in favor of the free cash flow hypothesis. As a consequence, a consequent amount of cash in the balance sheet of a firm is probably a clue in favor of the presence of entrenched managers.

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A Description of the variables

The item references indicates the source: Osiris (OS_000) or Datastream (DS_000)[31].

$$\text{Total debt} = \text{Long term interest bearing debt } (OS\_D14016) + \text{Loans (current liabilities) } (OS\_D21010) + \text{Other LT int. bearing debt } (OS\_D21115)$$

$$\text{CASH} = \frac{\text{Total Cash and Short term Investment } (OS\_20070)}{\text{Total assets } (OS\_13077)}$$

$$\text{CASH\_FLOW} = \frac{\text{Earnings after tax } (OS\_13037) + \text{Depreciation } (OS\_13039)}{\text{Total assets } (OS\_13077)}$$

$$\text{VAR\_CF} = \frac{\sum_{i=t-2}^{t} \left| \frac{\text{CASH\_FLOW}_i - \text{CASH\_FLOW}_{i-1}}{\text{CASH\_FLOW}_{i-1}} \right|}{3}$$

$$\text{TOTDEBT} = \frac{\text{Total debt}}{\text{Total debt } + \text{Total Shareholders Equity} (OS\_14041)}$$

$$\text{LT\_DEBT} = \frac{\text{Long term interest bearing debt } (OS\_D14016)}{\text{Total Debt}}$$

$$\text{SIZE} = \ln\left(\text{Total Revenues } (OS\_13004)\right)$$

$$\text{CAPEX} = \frac{\text{Fixed Assets}_t (OS\_D20085) - \text{Fixed Assets}_{t-1} (OS\_D20085)}{\text{Total assets } (OS\_13077)}$$

$$\text{INT\_RATE} = \frac{\text{Interest expenses } (OS\_D13026)}{\text{Total debt}}$$

$$\text{TOB\_Q} = \frac{\text{Market value } (DS\_MV)}{\text{Fixed assets } (OS\_D20085)}$$

$$\text{LIQUIDITY} = \frac{\text{Tot. curr. assets } (OS\_13061) - \text{Tot. curr. liab. } (OS\_14011)}{\text{Total assets } (OS\_13077)} - \frac{\text{CASH}}{\text{Total assets } (OS\_13077)}$$

[31] For more details about accounting principles, see van Dijk (2003).

B Summary statistics by country

Table 8: Summary statistics by country

	USA					
Variable	**Mean**	**Std. Dev.**	**Median**	**Min.**	**Max.**	**N**
$CASH$	0.226	0.23	0.134	0	1	34883
$CASH\_FLOW$	0.101	0.111	0.082	0	1	34739
VAR_CF	0.021	1.28	0.008	-20	20	25287
$TOTDEBT$	0.307	0.254	0.260	0	1	34940
LT_DEBT	0.458	0.344	0.511	0	1	33437
$SIZE$	18.26	2.583	18.314	6.908	26.169	37010
$LIQUIDITY$	0.105	0.138	0.035	0	0.972	34090
DIV	0.317	0.465	0	0	1	28554
$CAPEX$	0.071	0.118	0.025	0	1	31282
TOB_Q	4.331	4.713	2.270	0	15	26402
INT_RATE	0.15	0.233	0.083	0	1	27500

Table 9: Summary statistics by country (continued)

	Canada						France					
Variable	**Mean**	**Std. Dev.**	**Median**	**Min.**	**Max.**	**N**	**Mean**	**Std. Dev.**	**Median**	**Min.**	**Max.**	**N**
CASH	0.172	0.221	0.077	0	1	2836	0.213	0.142	0.180	0.003	0.994	2738
CASH_FLOW	0.093	0.103	0.076	0	1	2836	0.116	0.079	0.104	0	1	2738
VAR_CF	0.034	2.45	0.009	-20	20	2208	0.021	0.604	0.008	-3.167	20	2289
TOTDEBT	0.314	0.205	0.310	0	1	2836	0.334	0.166	0.322	0	1	2741
LT_DEBT	0.407	0.314	0.439	0	1	2821	0.41	0.252	0.410	0	1	2736
SIZE	18.743	3.175	19.318	6.908	24.236	2663	19.881	2.256	19.892	6.908	25.465	2721
LIQUIDITY	0.066	0.105	0.001	0	0.979	2836	0.061	0.101	0	0	0.642	2738
DIV	0.427	0.495	0	0	1	3718	0.833	0.373	1	0	1	2690
CAPEX	0.085	0.128	0.035	0	0.912	2475	0.055	0.082	0.026	0	0.902	2474
TOB_Q	2.592	3.897	1.034	0	15	2526	2.87	3.599	1.460	0.043	15	2355
INT_RATE	0.122	0.182	0.083	0	1	2195	0.108	0.171	0.061	0	1	2579
	Germany						**Great-Britain**					
Variable	**Mean**	**Std. Dev.**	**Median**	**Min.**	**Max.**	**N**	**Mean**	**Std. Dev.**	**Median**	**Min.**	**Max.**	**N**
CASH	0.222	0.185	0.164	0.001	0.979	3300	0.217	0.206	0.146	0	1	9160
CASH_FLOW	0.117	0.096	0.103	0	0.799	3300	0.122	0.099	0.113	0	1	9160
VAR_CF	0.004	0.211	0.006	-3.013	4.181	2548	0.008	0.509	0.011	-20	20	7551
TOTDEBT	0.208	0.151	0.175	0	1	3306	0.255	0.172	0.236	0	1	9177
LT_DEBT	0.399	0.314	0.417	0	1	3294	0.343	0.307	0.293	0	1	9072
SIZE	19.411	2.325	19.277	7.601	25.819	3300	18.369	2.26	18.353	6.908	25.916	9067
LIQUIDITY	0.109	0.132	0.050	0	0.719	3300	0.062	0.11	0	0	0.930	9160
DIV	0.725	0.447	1	0	1	3041	0.821	0.384	1	0	1	10294
CAPEX	0.061	0.105	0.021	0	0.925	2940	0.068	0.113	0.023	0	0.996	8340
TOB_Q	2.791	3.613	1.439	0.006	15	2481	3.657	4.103	1.973	0	15	8261
INT_RATE	0.171	0.249	0.087	0	1	2614	0.197	0.288	0.086	0	1	7374

C The Fama and French (1997) sector classification

Sector number	Sector	SIC codes
1	Agriculture	100-799, 2048
2	Foods products	2000-46, 2050-63, 2070-9, 2090-5, 2098-9
3	Candy and sodas	2064-8, 2086-7, 2096-7
4	Alcoholic beverages	2080-5
5	Tobacco products	2100-99
6	Recreational products	900-99, 3650-2, 3732, 3940-49
7	Entertainment	7800-41, 7900-99
8	Printing and publishing	2700-49, 2770-99
9	Consumer goods	2047, 2391-2, 2510-2519, 2590-9, 2840-4, 3160-99, 3229-31, 3260, 3262-3, 3269, 3630-9, 3750-1, 3800, 3860-79, 3910-9, 3960-1, 3991, 3995
10	Apparel	2300-90, 3020-1, 3100-11, 3130-59, 3965
11	Healthcare	8000-99
12	Medical equipment	3693, 3840-51
13	Pharmaceutical products	2830-6
14	Chemicals	2800-29, 2850-99
15	Rubber and plastic products	3000, 3021, 3050-99
16	Textiles	2200-95, 2297-9, 2393-5, 2397-9
17	Construction materials	800-99, 2400-39, 2450-9, 2490-9, 2950-2, 3200-19, 3240-59, 3261, 3264, 3270-99, 3420-42, 3446-52, 3490-9, 3996
18	Construction	1500-49, 1600-799
19	Steel work	3300-69, 3390-9
20	Fabricated products	3400, 3443-4, 3460-79
21	Machinery	3510-36, 3540-69, 3580-99
22	Electrical equipment	3600-21, 3623-29, 3640-46, 3648-9, 3660, 3691-2, 3699

23	Miscellaneous	3900, 3990, 3999, 9900, 9999, n.a.
24	Automobiles and trucks	2296, 2396, 3010-1, 3537, 3647, 3694, 3700-16, 3790-2, 3799
25	Aircraft	3720-9
26	Shipbuilding	3730-1, 3740-3
27	Defense	3480-9, 3760-9, 3795
28	Precious metals	1040-9
29	Non-metallic mining	1000-39, 1060-99, 1400-99
30	Coal	1200-99
31	Petroleum and natural gas	1310-89, 2900-11, 2990-9
32	Utilities	4900-99
33	Telecommunications	4800-99
34	Personal services	7020-1, 7030-9, 7200-12, 7215-99, 7395, 7500, 7520-49, 7600-99, 8100-499, 8600-99, 8800-99
35	Business services	2750-9, 3993, 7300-72, 7374-94, 7397, 7399, 7510-9, 8700-48, 8900-99
36	Computers	3570-9, 3680-9, 3695, 7373
37	Electronic equipment	3622, 3661-79, 3810, 3812
38	Measuring and control equipment	3811, 3820-30
39	Business supplies	2520-49, 2600-39, 2670-99, 2760-1, 3950-5
40	Shipping containers	2440-9, 2640-59, 3210-21, 3410-2
41	Transportation	4000-299, 4400-799
42	Wholesale	5000-199
43	Retail	5200-736, 5900-99
44	Restaurants, hotels,motels	5800-13, 5890, 7000-19, 7040-9, 7213
45	Banking	6000-199
46	Insurance	6300-411
47	Real Estate	6500-53
48	Trading	6200-99, 6700-99

D Dynamic panel data estimators

Consider the following model:

$$CASH_{i,t} = \alpha CASH_{i,t-1} + \beta' \mathbf{X}_{i,t} + \nu_i + \varepsilon_{i,t} \tag{1}$$

where $i = 1, ..., N$, and $t = 1, ..., T$. α and the $(K \times 1)$ vector β are $K+1$ parameters to be estimated. $\mathbf{X}_{i,t}$ is a $(K \times 1)$ vector of strictly exogenous variables. ν_i are the random effects that are independent and identically distributed (i.i.d.) over the firms and the disturbances $\varepsilon_{i,t}$ are i.i.d. over the whole sample.

It is well known that the standard estimators are inefficient and inconsistent in dynamic panel data models since including lags induce a correlation between the error term and the lagged dependent variable[32]. Moreover, if the error terms $\varepsilon_{i,t}$ are serially uncorrelated, the errors in first differences may well exhibit AR(1) autocorrelation.

An usual technique for dealing with this difficulty is to use an instrumental variable approach. Many consistent estimators are available: GMM estimators (Arellano and Bond (1991)), IV estimators (Anderson and Hsiao (1982)), or the corrected FE estimator (Kiviet (1995)). The Arellano and Bond (1991) estimator is widely used in recent dynamic panel data studies, has some advantages compared to other estimators. It has interesting asymptotic properties and its performance in finite sample with N large - which is the case in our panel - is quite good, as Monte-Carlo evidence is able to show (Harris and Matyas (2004))[33]. This method is appropriate (the estimators are convergent) when the number of instruments is higher than exogenous variables, as is the case here.

Arellano and Bond (1991) derived a differenced Generalized Method of Moments estimator (or "difference GMM") for α and β. First differencing ("D.") equation 1 removes the ν_i and produces an equation that is estimable by instrumental variables:

$$D.CASH_{i,t} = \alpha D.CASH_{i,t-1} + \beta' D.\mathbf{X}_{i,t} + D.\varepsilon_{i,t} \tag{2}$$

We follow this approach to estimate (2), with all possible lagged vectors of right-hand variables as instruments. This asymptotically efficient estimator takes into account the presence of arbitrary heteroskedasticity. The instruments are optimally weighted by the expected variance-covariance matrix of the orthogonality conditions, as required for an optimal GMM estimator. An AR(1) autocorrelation in the errors in first differences doesn't induce biases in the Arellano and Bond (1991) estimator. But an AR(2) (or more) autocorrelation does.

We also implement the augmented version of the estimator or "system GMM", outlined in Arellano and Bover (1995) and Blundell and Bond (1998). This second estimator was designed to deal with the fact that lagged levels are often

[32] In a dynamic panel data model, the lagged dependent variable is correlated with the disturbance, then the fixed-effects as well as the random-effects estimators are inconsistent. See Nickell (1981).

[33] See also Judson and Owen (1999) who insist on the intrinsic limitations of FE estimators and are in favor of the use of the GMM estimators.

poor instruments for first differences[34]. One can add moment conditions to increase efficiency. This technique adds to the system of estimated differenced equations the original equations in levels. In these equations in level, predetermined and endogenous variables in levels are instrumented with suitable lags of their own first differences, in order to control for firm-specific effects. These lagged differences are appropriate instruments as long as the correlation between the explanatory variables and the firm-specific effect is time-invariant.

These two estimators have one- and two-step variants. Theoretically, the two-step estimators are asymptotically more efficient, but their estimates of the standard errors are biased. To take into account this fact, we use the finite-sample correction to the covariance matrix following Windmeijer (forthcoming).

The other main interest of these estimators is that they allow to avoid a potential endogeneity problem (exogenous random shocks can affect both cash holdings and other right-hand variables such as cash flow or total debt).

[34] Especially when the series are close to being random walks.

E Results of static estimations by country

Table 11: Financial factors

	Canada		France		Germany		Great-Britain		USA	
Variable	**Coefficient**	**(Std. Err.)**	**Coefficient**	**(Std. Err.)**	**Coefficient**	**(Std. Err.)**	**Coefficient**	**(Std. Err.)**	**Coefficient**	**(Std. Err.)**
$CASH\_FLOW$	0.13331***	(0.03534)	-0.06469*	(0.03450)	0.17369***	(0.04222)	0.00186	(0.02006)	0.08085***	(0.01073)
VAR_CF	0.00140	(0.00100)	0.02120***	(0.00362)	0.02898**	(0.01179)	-0.00046	(0.00246)	0.00227*	(0.00124)
$TOTDEBT$	-0.15587***	(0.02294)	-0.10421***	(0.02074)	-0.15915***	(0.02882)	-0.13839***	(0.01353)	-0.15031***	(0.00629)
LT_DEBT	0.05339***	(0.01738)	-0.00260	(0.01368)	0.02669*	(0.01575)	0.00266	(0.00823)	0.00691	(0.00477)
$SIZE$	-0.01162***	(0.00252)	-0.01219***	(0.00443)	-0.01867***	(0.00458)	-0.02680***	(0.00245)	-0.02022***	(0.00131)
$LIQUIDITY$	-0.50127***	(0.04195)	-0.35597***	(0.03113)	-0.31402***	(0.03038)	-0.70410***	(0.02067)	-0.42749***	(0.01156)
DIV	-0.00039	(0.00941)	-0.01118	(0.00679)	0.00208	(0.00629)	-0.02850***	(0.00565)	-0.00200	(0.00395)
$CAPEX$	-0.12631***	(0.01885)	-0.14777***	(0.02188)	-0.19109***	(0.02257)	-0.16277***	(0.01279)	-0.14050***	(0.00676)
TOB_Q	0.01825***	(0.00145)	0.01063***	(0.00098)	0.01387***	(0.00123)	0.01096***	(0.00062)	0.01323***	(0.00034)
INT_RATE	-0.06989***	(0.01515)	-0.05880***	(0.01235)	-0.03217***	(0.01178)	-0.06478***	(0.00587)	-0.05037***	(0.00453)
$INTERCEPT$	0.38538***	(0.05163)	0.50762***	(0.09012)	0.59614***	(0.09255)	0.79717***	(0.04670)	0.62454***	(0.02555)
N	1622		1981		1685		5818		15426	
R^2	0.4421		0.3813		0.1954		0.2216		0.4891	
ρ	.7380		.7066		.7633		.7243		.7443	

Notes: Significance levels : $*$: 10% $**$: 5% $***$: 1%.
Fixed-effects model.
ρ is the fraction of variance due to firm-specific residual.

F A simple indicator of the financial sector effectiveness

Following La Porta *et al.* (1997), Couderc and Jestaz (2004) have implemented a simple indicator of the financial sector effectiveness. Three criteria are supposed to be relevant, the size of the market, its liquidity and its capacity to be a place where firms could raise money. It's essential to have a basket of criteria since countries do not have systematically the same ranking for every criterion. This indicator is based on the rankings of 21 OECD countries on 6 variables. These 6 variables have been chosen to represent the depth, the size and the effectiveness of the country's financial sector (*ie.* the stock and bond markets). These variables are from different sources: OECD, Datastream, World Bank and World Federation of Exchanges. Among the available variables, we have retained:

- Profits of listed firms on Profit of all firms. This variable is a proxy for the importance of the stock market in the economy.
- Stock market capitalization to GDP. This is another proxy to catch the importance of the stock market for the economy.
- Stock market total value traded to GDP. The bigger the trades are, the more liquid the financial market is.
- Funds raised on Total market value. The larger are the raised funds, the more the stock market is able to really finance new firms or new projects.
- Private bond market capitalization to GDP. This proxy is devoted to the bond market size.
- Issuance of corporate bonds market value. How much the bond market finances the firms?

Following this indicator, we find that – it's not a surprise – the USA, the UK, Switzerland, Sweden and to some extent the Netherlands have strong, deep and liquid financial markets. On the opposite, Portugal, Greece, Austria, Belgium and Italy have very small financial markets. In the middle, we grab France, Germany and Canada. Among the not so expected results, we find that Spain has a well dynamic financial market. Japan, despite some variables that put Japan in the group of the top financial market, had a large set of variables drags it down below Italy and Portugal. A striking result of this simple index is that neighbor countries present different values of this index: Spain and Portugal belong to two different categories, like Sweden and Norway, Canada and the United States or Ireland and the United Kingdom (the latest is the probably the less surprising).