

Full Length Research Paper

The corporate cash holdings: Determinants and implications

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Accepted 30 November, 2011

Several empirical studies have reported that the level of short-term financing is higher in firms operating in developing countries. Short-term financing increases risk of default as it matures quickly and leaves little room for the borrowing firm to manage its cash flows. But if the firm has a cash buffer, it can avoid such a risk. If firms in developing countries have higher level of short-term debts, do they carry larger cash balances too? Do firms in Pakistani match the maturity of assets with the maturity of their debts? In this study, we investigate these questions using a sample of 380 listed firms over a period of 1996 to 2008. The descriptive statistics show that cash-to-total assets ratio of the sampled firms is almost the same as reported in other empirical studies for developed countries such as US and UK. This finding raises an important question of how firms in Pakistan with more short-term financing carry relatively smaller balances of cash. As an answer, this study puts forward several explanations, which have important implications for capital market and firm financing. Results of panel data models indicate that cash-to-total assets ratio increases with growth opportunities, size of a firm, dividends ratio, and decreases with debt-maturity and conversion cycle. To allow for the possibility that cash-to-total assets ratio is adjusted gradually over time by firms in an attempt to reach optimal ratio, the study also employs a partial adjustment model by using the generalized methods of movements (GMM).

Key words: Cash holding, short term financing, cash flows, capital market, generalized methods of movements (GMM).

INTRODUCTION

Cash is one of the least-productive assets because it generates very little or, in many cases, no accounting returns. Despite this fact, some firms choose to lock quite a big portion of their assets in cash and cash-equivalents. Two such cases are the Oil and Gas Development Company (OGDC) and the Fauji Fertilizers Company (FFC). The annual report of OGDC shows a whopping cash balance of Rs. 19 billion in the year 2003 which further inflated to Rs. 25 billion in the year 2004. Not only the magnitude of OGDC's cash holdings was huge, the cash-to-total assets ratio was also very high. The cash-to-total assets ratio was 22.89 and 26.38% in the year 2003 and 2004, respectively. Similarly, FFC had Rs. 3.1 billion and Rs. 4.1 billion assets in the form of cash and cash equivalents in the year 2003 and 2004, respectively. This observation raises a researchable query that, if cash is a least-productive asset, then why do some

organizations still have very large cash balances. Being agent to shareholders, managers of a firm attempt to maximize the wealth of shareholders. Theoretically, the decision to invest a given percentage of total assets in cash should be based on the marginal costs and benefits of cash holdings. The optimal level of cash holding will reach a point where the costs and benefits of investment in cash become equal (Opler et al., 1999).

The benefits of cash holdings arise from a variety of motives as identified by Keynes (1936). According Keynes (1936), the motives to have liquid assets can be "transaction, precautionary, or speculative." The transaction motive suggests that costs can be associated with the conversion of other assets into cash or getting funds from external sources. Compared to external financing, just like the pecking order theory predicts, liquid assets generated from internal sources can be a cheaper

source of financing. Under the precautionary motive, a firm will keep a sufficient level of liquid assets to meet any unexpected shortfalls in cash-flows; otherwise, the firm will face the costs of premature liquidation by defaulting on its financial obligations. And the speculative motive suggests that a firm should keep a certain level of liquid assets in order to avail itself of future profitable investment opportunities: otherwise, the firm will face the costs of forgoing such investments.

The costs of liquid assets arise from a variety of sources. The first is the fact that liquid assets either earn no return, for example, cash, or a very low rate of return, for example, marketable securities. Secondly, the return from such assets is made further unattractive by double taxation. Thirdly, liquid assets are either easy to be used in a suboptimal way or misused by way of squandering them on perquisites by managers (Jensen and Meckling, 1976): thus, liquid assets exacerbate the agency conflict between shareholders and managers.

In the presence of imperfect capital markets, the costs of external financing can be very high in some circumstances. The last two motives to hold liquid assets will hold true compellingly when external financing is not available at a fair price. Where the access to and the cost of external financing for an individual firm depends upon many factors, including the firm's specific characteristics, recent literature suggests that the stage of financial development of the capital and money markets also plays an important role in this respect. Islam and Mozumdar (2007) argue that external financing is problematic in less-developed economies. In support of their argument, they found that cash flow sensitivity is higher in less developed financial markets; hence firms in these markets hold relatively higher levels of cash. Their findings suggest that determinants of liquidity differ among developed and less-developed markets. The area of research on determinants of liquidity in developing markets is relatively unexplored, especially in Pakistan. Our study tries to fill this gap by providing evidence from Pakistan.

Furthermore, there is one more reason for conducting a separate research on liquidity of firms in less-developed markets. In judging the short-run solvency of a firm, standard textbooks establish relationship between liquidity and short-term obligations of a firm through liquidity ratios like current ratio and acid test ratio. Firms having relatively higher level of short-term obligations should maintain the current ratio above 1 and acid test ratio somewhat near 1. The corporate finance literature provides some evidence that firms in developing countries rely more on short-term financing (Booth et al., 2001; Shah and Khan, 2007, 2009). If these firms follow the standard textbooks prescription, then according to the maturity matching hypothesis, they will also maintain relatively higher level of liquid assets so as to remain solvent in the short-run. On the other hand, judicial efficiency is low in many developing countries (World

Bank: Doing Business Report, 2010). Slower and costly judicial process may discourage lenders to sue borrowers even if borrowers do not pay their loan on time. This argument creates an alternative hypothesis that firms in developing countries do not need to have higher cash-to-total assets ratio even if these firms have higher short-term financing. All these interesting hypotheses are tested in this paper using a panel data of 280 firms over a 13-year period. Keeping in view all these, this paper contributes to the empirical literature in several aspects. First, the maturity-matching hypothesis needs to be tested and confirmed using data set from developing countries as many empirical studies have found that short-term financing is higher among firms in developing countries, but the liquidity aspects of these firms have attracted much less attention. The study tries to fill this gap. Secondly, this study employs both static and dynamic panel data models. If firms face difficulty in adjusting to their optimal cash-to-total assets ratio over time, then dynamic panel model captures dynamic component in best manner. For dynamic model, the paper takes advantage of generalized methods of movements (GMM) which has gained enormous importance among researchers due to its efficiency and precision.

RELATED LITERATURE AND HYPOTHESES DEVELOPMENT

The presence of imperfect markets suggests that there is an optimal level of liquid assets. The decision to invest in short-term assets is influenced by many factors at the same time. A rational manager acting in the interest of shareholders will evaluate the benefits and costs of holding liquid assets. The manager will be maximizing the shareholders' wealth in all cases where the benefits of investing in one additional dollar in liquid assets are greater than the costs of that dollar. Literature on corporate cash holdings suggests that the main sources of benefits and costs of investment in liquid assets arise from; i) information asymmetry, ii), transaction costs iii) agency costs of debt. The proxies for these aspects are further discussed.

Growth

When information about the true value of a firm's cash flows is not symmetrical between managers and investors, external financing can be costly. Myers and Majluf (1984) state that firms facing information asymmetry problems will prefer internally generated funds over external funds. Information asymmetry problems are often severe with growing firms. Growing firms may find the external financing too costly and pass up projects with positive net present values. To avoid such situations, growing firms will hold excess liquid assets. Given this

information asymmetry hypothesis, a positive relationship is expected between growth opportunities and investments in liquid assets.

Highlighting the agency costs of debt in the presence of growth opportunities, Myers (1977) shows that a growing firm is more likely to forego even positive net present value projects when it has a risky debt on its balance sheet. Again, the solution is to build excess liquid assets reserves.

The positive relationship between cash holdings and growth opportunities is also predicted by the fact that costs of financial of financial are higher for firms with more growth opportunities. This is because the value of growth opportunities and intangible assets drops sharply in financial distress (Williamson, 1988; Haris and Raviv, 1991; Shleifer and Vishny, 1992).

In light of all of these factors, one would expect a firm with relatively more growth opportunities to hold higher level of investments in liquid assets. However, Ferreira and Vilela (2004) add agency perspective to cash holdings decision and state that entrenched managers hold higher cash reserves even when the managers do not have profitable investment opportunities. This prediction leads us to expect a negative relation between cash holdings and market to book value of assets.

We use the proxy of market-to-book value per share, designated as MV/BV, and defined as the share price divided by the book value per share. Because of some problems with determining the market-value of equity, which are further discussed concerning data and methodology, we also use an alternate proxy of annual

percentage increase in total assets, denoted as GRT, to identify growth opportunities.

Financial distress

When a firm experiences financial distress, it encounters various types of bankruptcy costs including those directly related to the bankruptcy process as well as the probable reduction in sales revenues due to customer doubts about the firm's ability to maintain quality. Moreover, the additional pressure generated by deteriorating financial conditions adversely affects management initiatives since expenditures for research, development and employee training will likely be reduced. To avoid being forced to sustain such costs, management must hold higher levels of liquid assets as a hedge. On the other hand, it is also logical to expect a financially-distressed firm to have a reduced level of cash holdings (Kim et al., 1998). Therefore, the alternative hypothesis is that cash holdings are inversely related to the possibility of financial distress.

To proxy for the possibility of financial distress, we use the inverse of Altman (1968) Z-score, denoted by INVZ. A number of studies on corporate cash holdings have used this proxy (Mackie-Mason, 1990; Kim et al., 1998; Drobetz and Gruninger, 2007). The original version of the Altman's (1968) Z-score includes a measure of liquidity; we exclude it so as to avoid the problem of circularity and finally the Z-score is calculated as:

$$Z - Score = 3.3x \frac{EBIT}{Total\ assets} + 1.0x \frac{Sales}{Total\ assets} + 1.4x \frac{Retained\ earnings}{Total\ assets} + 0.6x \frac{Market\ value\ of\ equity}{Book\ value\ equity}$$

Cash flow volatility

Firms with volatile cash flows have more chances of running out of cash at times. There are a number of costs for being short of cash, for example, costs of bankruptcy, foregoing profitable investment opportunities. Minton and Schrand (1999) argue that volatile cash flows cause firms to forego profitable investment opportunities permanently, firms being unable to change the timing of discretionary investments to the timing of cash flows. Extra cash holdings will provide a buffer when cash flows from operations unexpectedly fall. The above suggests that cash holdings are positively related to the measure of cash flow volatility. Cash flow volatility, denoted by CFV, is measured by the value of deviations from mean cash flows of a given firm scaled by the mean cash flow of that

firm.

Size

Size of a firm can substantially alter the impact of information asymmetry and the possibility of financial distress. Literature on corporate finance suggests that information asymmetry is less severe with large firms as they have economy in producing and disseminating information about themselves (Pettit and Singer, 1985; Collins et al., 1981; Brennan and Hughes, 1991). Therefore, large firms face lower costs of transactions in accessing external sources of financing. The hypothesis is that cash holdings are negatively related to the size of a firm.

The literature also suggests that the chances of bankruptcy are lower with large firms as they are more diversified (Titman and Wessels, 1988; Rajan and Zingales, 1995). Following this argument, again, the hypothesis is that cash holdings are negatively related to the size of a firm.

Besides this, various hypotheses on the relationship between cash holdings and size of a firm predict negative relationship. For example, Miller and Orr (1966) suggest large firm have economies of scale to manage cash. Thus, large firms will hold less cash. Peterson and Rajan (2003) argue that external borrowing is less costly for large firms as the fixed fee they pay for obtaining financing constitutes only a smaller percentage of the overall amount of financing. Smaller firms will hold large cash balance as they face higher costs of external financing.

Contrary to these lines of arguments, Opler et al. (1999) argue that large firms are in a better position to accumulate cash as they are presumably more profitable. The alternative hypothesis is that cash holding are positively related to firm size. Our proxy for size, denoted by SIZE, is the natural logarithm of a firm's total assets.

Leverage

A firm can use different substitutes for holding high levels of cash. Among these substitutes, one is leverage. Whenever there is cash shortfall, a firm may borrow funds if the firm has the ability to issue debt. Ansic and Hey (1993) argues that leverage can act as a proxy for a firm's ability to issue debt. This suggests that leverage is negatively related to the level of cash holdings. The pecking order hypothesis, given by Myers and Majluf (1984), also suggests a negative relationship between cash holdings and leverage. Negative relationship between the two is suggested by Baskin (1987) with one more different explanation. He says that the cost of funds invested in liquidity increases with the level of leverage.

However, the relationship is not linear. Leverage increases the possibility of financial distress. In that case, a firm with higher level of leverage should maintain relatively higher level of liquid assets. Cash also minimizes the likelihood of Myers (1977) underinvestment problem which is more pronounced in the presence of risky debt. Therefore, one would expect a positive relationship between leverage and cash holdings. To proxy for leverage, we use the ratio of total debt divided by total assets. The proxy is denoted by LEV.

Convertibility

Assets that have ready market value or are easily convertible into cash can serve as a substitute to holding extra cash. Ozkan and Ozkan (2004) argue that cost of

converting current assets other than cash into cash is presumably much lower as compared with other assets. Thus, a firm with higher ratio of account receivables and inventory is expected to hold less cash. Our proxy for convertibility, labeled as CNVT, is the ratio of current assets other than cash divided by total assets minus current assets other than cash.

Dividend payments

Firms that pay dividends can have one more substitute to holding extra cash by missing dividend payment when the cash shortfall occurs. To the extent that dividends can be used as a substitute for cash, one would expect a negative relationship between dividend payments and cash holdings (Opler et al., 1999). On the other hand, dividend theories suggest that firms follow a pattern in paying dividends. So, a challenging hypothesis is that dividend paying firms will maintain larger cash balances for paying dividends. For the proxy dividend payments, denoted by DIVDEND, we use the ratio of dividend per share divided by face value of a share.

Profitability

A profitable firm will have comparatively strong cash flows from operating activities. A strong cash flow reduces the need for hoarding cash reserves which implies that profitability can be a substitute to cash holdings (Kim et al., 1998). A competing hypothesis is that profitable firms are inclined to have financial slack (Opler et al., 1999; Ferreira and Vilela, 2004). Our measure of profitability is the ratio of earnings before interest and tax (EBIT) divided by gross sales. The proxy for profitability is denoted by CF.

Debt maturity

Given the maturity matching hypothesis, firms financed with more of short-term debt are expected to hold greater liquid assets. Stohs and Mauer (1996) suggest mismatch in assets and debt maturities will make a firm exposed to liquidation risk. Besides this, positive relation is expected between short-term financing and liquid assets because short-term financing increases the risk of financial distress if constraints are met to the renewal of short-term debt.

Cash cycle

Short cash cycle enhances a firm's ability to replenish its cash balance quickly. A firm with short cash cycle will not have to go with cash shortage for long. Thus, negative

Table 1. Matrices correlation among the variables.

Variable	CASH	GRT	MVBV	CFV	SIZE	LEV	DIV	IVZ	CF	DEMA
CASH	1									
GRT	0.0834	1								
MVBV	0.103	-0.012	1							
CFV	-0.0369	-0.022	-0.028	1						
SIZE	0.2185	0.154	0.068	-0.098	1					
LEV	-0.2987	0.098	0.066	0.0802	0.1436	1				
DIV	0.3064	0.047	0.3291	-0.137	0.1842	-0.163	1			
IVZ	-0.1981	-0.106	-0.301	0.3371	-0.089	0.2012	-0.388	1		
CF	0.1653	0.080	0.051	-0.285	0.0994	-0.163	0.248	-0.44	1	
DEMA	-0.2357	0.032	-0.1313	0.0599	0.218	0.3615	-0.178	0.345	-0.083	1
CNVRT	-0.126	-0.024	0.155	-0.0489	-0.145	0.0741	0.1097	-0.175	-0.013	-0.351

relation is expected between cash cycle and cash holdings. To calculate cash cycle (CYC), we needed data on a firm's accounts receivable, inventories and accounts payable in all of the years from 2000 to 2004. Unfortunately, our data source, the Balance Sheet Analysis (BSA) book by State Bank of Pakistan, started publishing inventories data from the year 2003 and onward. Furthermore, data on accounts payables is not reported in BSA. Resultantly, our cash cycle formula is reduced to the following form:

$$CC\ YCLE = \frac{\text{Recivables}}{\text{Sales}} + \frac{\text{Inventories}}{\text{Cost of sales}}$$

Table 1 shows correlation matrices between explanatory variables from the year 2001 to 2008 for 280 firms in non-financial sectors. Cash is the ratio of cash plus liquid assets divided by total assets. GRT is the annual percentage increase in total assets. MV/BV is defined as the share price divided by the book value per share. CFV is the value of deviations from mean cash flows of a given firm scaled by the mean cash flow of that firm. SIZE is the natural log to total assets. LEV is the ratio of total debt to total assets. DIV is the ratio of dividend payment divided by total equity. IVZ is the inverse of Altman's (1968) Z-score for financial distress. CF is measured as a ratio of net income plus depreciation divided by total sales. DEM A is the ratio of long-term liabilities divided by total liabilities. CNVRT is the ratio of current assets other than cash divided by total assets minus current assets other than cash.

Table 2 (Panel A) shows descriptive statistics of 280 non-financial firms listed on the Karachi Stock Exchange over the period from 2001 to 2008, whereas Table 2 (Panel B) shows statistics for the full sample from 1996 to 2008.

As shown in the descriptive statistics in Table 2, the cash ratio of Pakistani non-financial firms, measured by the ratio of cash plus liquid assets divided by total assets, is

not different from the cash ratios of firms in developed countries like US and UK. The average cash ratio for a sample of 280 firms listed on Karachi Stock Exchange over the period from 1996 to 2008 is 8.26%. Kim et al. (1998) found that the average cash ratio for US firms is 8.1%. Ozkan and Ozkan (2004) report that average cash ratio for UK firms are 9.9%. This finding is very interesting because previous research studies show that the ratio of short-term financing-to-total debts is higher among firms in developing countries (Booth et al., 1999); however, according to maturity-matching hypothesis, firms in developing countries should have higher ratio of liquid assets-to-total assets as compared to firms in developed countries. One possible reason why firms in developing countries have higher short-term financing and still operate with comparatively low cash holdings is that judicial system and court process in developing countries is slow and costly (World Bank, Doing Business Report 2010). The creditors do not prefer to enforce their rights through judicial system even if the borrowers do not pay the debt on time. Thus, judicial inefficiency favors the borrowers who would like to invest small amounts in cash (least-productive asset) even if the borrower has higher short-term obligation.

METHODOLOGY

Data

This study uses data of 280 firms listed on the Karachi Stock Exchange. The data are taken from "Balance Sheet Analysis of Joint Stock Companies Listed on the Karachi Stock Exchange", a publication of the State Bank of Pakistan. The publication provides information about balance sheets and income statements of all the listed non-financial firms.

The scope of this study includes all the listed firms in the Karachi Stock Exchange but certain constraints reduced the sample size. The financial firms and firms with the negative equity are excluded from the analysis. Moreover, outliers where a given observation was below 1st percentile and above 99th percentiles were removed from the sample. Finally, we were left with a panel of 280 firms for the years 1996 to 2008. The analysis is conducted using full sample

Table 2. Descriptive statistics.

Variable	Observation	Mean	Minimum	Maximum	Standard deviation
Panel A (2001-2008)					
CASH	1350	0.0861	0.0000	0.6740	0.1188
GRT	1350	0.1157	-0.6950	1.0300	0.2258
MVBV	1350	1.0438	0.0010	23.5840	1.5796
CFV	1350	0.6065	0.0000	12.0290	1.2178
SIZE	1350	6.7895	2.4420	11.0840	1.3470
LEV	1350	0.5731	0.0460	0.9990	0.1871
DIV	1350	0.0470	0.0000	0.5920	0.0666
IVZ	1350	0.5223	0.0110	2.0000	0.3565
CF	1350	0.0759	-2.7020	0.7000	0.1747
DEMA	1350	0.2114	0.0000	0.9170	0.2143
CNVT	1350	0.9723	0.0050	0.005	0.9382
Panel B (1996-2008)					
CASH	3444	0.0826	0.0000	0.9130	0.1331
SIZE	3444	6.8213	2.3888	12.1405	1.4492
GRT	3444	0.0959	-0.4716	0.7501	0.1097
DEMA	3444	0.2308	0.0000	0.9846	0.2181
LEV	3444	0.6112	0.0043	0.9996	0.2064
TBILLS	3444	0.0857	0.0187	0.1574	0.0370
CF	3444	4.7724	-1.6094	10.8133	1.8672
DIV	3444	0.1597	0.0000	4.4640	0.3495
CNVT	3444	0.9541	0.0004	9.5330	1.0761
CV	3444	1.3900	-1.9970	6.5217	0.9191

from the year 1996 to 2008, and a more recent sample from 2001 to 2008. The reason for using two separate samples is that the data required for calculation of certain variables such as Altman's Z-score (IVZ) and operating cycle (CYC) were not available prior to 2001. Also, using full sample and sub-sample can give more information about the trends and stability in economic and statistical significance of the explanatory variable in determining the level of cash holdings.

Model specification

The static panel data models

First, we use static panel data techniques to estimate the relationship between cash ratio and the explanatory variables. Panel data analysis allows us to control for the unobserved heterogeneity that may be present in the cross-sectional units or time periods. The panel data techniques also make it possible to study the relationship between different variables dynamically, so that changes in the variables over different time periods are determined as they occur. Specifically, we use pooled, fixed effects and random effects models with their required assumptions and known limitations. Then, we also present results from a cross-sectional regression for the purpose of comparison. The time series technique smoothes out extreme fluctuations in data over different time periods. Later, relaxing the assumption that firms adjust their cash ratios instantly to reach their target cash ratios, we employ the generalized methods of moments (GMM) technique. Our basic static panel data model is given as follows:

$$CASH_{it} = \alpha + \sum_{i=1}^n \beta_i X_{it} + \eta_i + \eta_t + \varepsilon_{it} \quad (1)$$

The dependent variable $CASH_{it}$ is the ratio of cash and cash equivalents to total assets of firm i at time t . X_{it} represents the explanatory variables for firm i at time t . Each firm's unobserved

heterogeneity is captured through dummy variable η_i that is fixed over time but varies from firm to firm. The presence of such fixed effects is expected due to the fact that management styles and risk preferences are usually not the same among all firms. Fixed effects resulting from the presence of some macro-economic phenomena

in a given time period are captured with the dummy variable η_t

that is fixed across cross-sectional units but varies over time. ε_{it} is the usual disturbance term.

RESULTS AND DISCUSSION

Static panel data regressions

Table 3 presents results of the static regression models using data from 2001 to 2008. The first column of the table shows the explanatory variables and the following columns present the results from alternative specifications of different regression models. Under each

Table 3. Regression results of the sub-sample (2001-2008).

Variable	Cross sectional		Pooled		Fixed effects		Random effects	
	Coeff:	p-values	Coeff:	p-values	Coeff:	p-values	Coeff:	p-values
GRT	0.007 (0.047)	0.891	0.030 (0.016)	0.050	0.030 (0.01)	0.004	0.036 (0.01)	0.000
MVBV	0.000 (0.005)	0.998	0.003 (0.004)	0.427	-0.001 (0.003)	0.346	0.001 (0.003)	0.807
CFV	0.009 (0.005)	0.088	0.005 (0.002)	0.039	-0.001 (0.002)	0.416	-0.001 (0.002)	0.679
SIZE	0.021 (0.005)	0.000	0.020 (0.002)	0.000	0.020 (0.012)	0.086	0.016 (0.004)	0.000
LEV	-0.149 (0.052)	0.004	-0.131 (0.021)	0.000	0.011 (0.024)	0.729	-0.038 (0.021)	0.0700
DIV	0.424 (0.184)	0.023	0.347 (0.073)	0.000	0.203 (0.049)	0.000	0.271 (0.049)	0.000
DEMA	-0.161 (0.04)	0.000	-0.133 (0.017)	0.000	-0.077 (0.014)	0.000	-0.091 (0.014)	0.000
IVZ	0.027 (0.021)	0.18	0.004 (0.009)	0.593	-0.010 (0.009)	0.304	-0.010 (0.008)	0.194
CF	0.086 (0.07)	0.218	0.035 (0.017)	0.045	0.027 (0.012)	0.036	0.021 (0.009)	0.020
CNVT	-0.012 (0.007)	0.108	-0.023 (0.003)	0.000	-0.070 (0.007)	0.000	-0.054 (0.005)	0.000
CYCLE	-0.026 (0.017)	0.131	-	-	-	-	-	-
Constant	0.035 (0.043)	0.421	0.046 (0.02)	0.018	0.012 (0.078)	0.879	0.055 (0.028)	0.060
Firms		280		280.00		280.00		280.00
No. of obs		280		1,350		1350		1350
F-Test	9.89	0.00	19.4	0.000				
R ² = within						0.2943		0.2735
between						0.0799		0.1549
overall	0.3158	0.00	0.2647			0.115		0.1748
Adj: R ²	0.2839	0.00						

Table 4. Regression results the full-sample (1996-2008).

Variable	Pooled	Fixed-firm	Fixed-industry	Cross-sectional
SIZE	0.017(0.003)*	0.012(0.003)*	0.006(0.002)**	0.032(0.013)**
GRT	0.033(0.025)	0.397(0.068)*	-0.048(0.026)***	0.007(0.057)
DEMA	-0.139(0.014)*	-0.111(0.011)*	-0.136(0.013)*	-0.165(0.051)*
LEV	-0.111(0.013)*	0.027(0.013)**	-0.08(0.014)*	-0.174(0.043)*
TBILLS	0.026(0.077)	-0.109(0.048)**	-0.019(0.069)	0.351(0.606)
ROA	0.004(0.002)**	0.009(0.001)*	0.003(0.002)***	-0.015(0.012)
DIV	0.069(0.007)*	0.028(0.006)*	0.042(0.007)*	0.116(0.025)*
CNVT	-0.026(0.002)*	-0.041(0.003)*	-0.027(0.002)*	-0.026(0.008)*
CV	-0.014(0.004)*	-0.011(0.006)**	-0.022(0.004)*	-0.008(0.01)
CONSTANT	0.076(0.017)*	0.007(.037)	0.076(0.017)*	0.069(0.076)
R ²	0.2612	0.76	0.41	0.3677
Adj. R ²	0.2588	0.73	0.401	0.356
F-Test	106.55*	27.54	51.9	17.25
Obs.	2722	2722	2722	277
Hausman Chi ²	58.4			

specification, there are two sub-columns for the value of coefficients and p-values. The heteroscedasticity-robust standard errors are given in parentheses under each coefficient value.

Table 4 displays results of the static regression models using data from 1996 to 2008. The first column of the

table shows symbols of the explanatory variables and the following columns present the results from alternative specifications. The column headings 'pooled', 'fixed-firm', 'fixed-industry', and 'cross-sectional' refer to regression results from pooled panel data regression, firm-specific fixed effects regression, industry-specific fixed effects

regression, and cross-sectional regressions, respectively. Under each specification, coefficients of the explanatory variables are reported outside the parentheses whereas their standard errors are given inside the parentheses. With each coefficient value, the statistical significance is indicated by *, **, and ***, at 1, 5, and 10%, respectively.

The assumption of the pooled regression model is that all cross-sectional units face similar conditions and have similar risk and return preferences with regard to investing in liquid assets. To find out the validity of this assumption, we use the restricted F-test (Gujrati, 2003). What is relevant here is that the restricted F-test rejected the afore assumption. Therefore, our preferred results would be either from the fixed effects model or the random effects model. The fixed effects model is costly because so many degrees of freedom are lost when constructing the dummy variables, while the random effects model may suffer from the inconsistency in estimates arising from the correlation between individual effects and other regressors (Greene, 2006). A formal test to choose between these two models was developed by Hausman (1978), which has a null hypothesis that fixed effects and random effects estimators do not differ systematically. If the null hypothesis is rejected, then the fixed effects model is the best one. The chi-square value of Hausman test in the sub-sample is 115.41 with p-value of 0.00 and in the full-sample the value is 58.4. These values clearly indicate that the results of fixed effects models are preferable.

Our first explanatory variable "GRT", measured by the annual percentage increase in assets, is significant in all of the of panel data models. The level of significance is 5% in pooled and fixed effects regression and 1% in the random effects model.

However, its counterpart MVBV - measured by the market value of equity divided by book value of equity - is insignificant in all of the models. As discussed previously, the data on market value of equity was problematic. The share prices showed abnormal increases in 2002 and in the following years. Though we normalized the market value of equity by using average share prices of the years 2003 and 2004 for the years 2000, 2001 and 2002, still the data did not show the true picture. Our preferable proxy for the growth options is, hence, the annual percentage increase in assets. The GRT variable is significant and has the expected positive sign that is in line with the findings of previous studies on cash holdings for example, Kim et al. (1998), Opler et al. (1999), Ferreira and Vilela (2004), and Ozkan and Ozkan (2004). The finding supports the view that growing firms find external financing costly, as a result they try to build extra cash reserves to avoid passing up projects with positive net present value.

Table 3 shows regression results of different specifications using data of 280 firms in non-financial sectors listed on KSE from the year 2001 to 2008.

The coefficient of cash flow volatility, CFV, is

insignificant and negative in both the fixed effects and random effects models. The notion that firms with more volatile cash flows hold extra cash is not supported by our results. Similar findings are reported by Ozkan and Ozkan (2004). One explanation for the insignificant relationship may be that fear of facing the consequences of financial distress is not severe among firms, because the court process is slow and investors' activism rare in Pakistan. In their study on determinant of capital structure of 286 Pakistani listed firms, Shah and Khan (2007) report that 15% of the firms had a negative equity figure. These firms do not consider the chances of bankruptcy as an active variable in deciding the level of cash holdings.

We document significant positive relationship between the proxy for the size of the firm and the level of cash holdings. This finding is in contrast to the theoretical predictions of the information asymmetry hypothesis, the possibility of financial distress hypothesis, the economies of scales in managing liquid assets theory, and the transaction costs hypothesis that says that a relatively higher fixed fee on obtaining external financing discourages small firms. However, our results confirm the argument given by Opler et al. (1999) that large firms are in a better position to accumulate cash as they are presumably more profitable. Our results show that profitable firms do accumulate more cash (see the results for CF variable). The information asymmetry and the financial distress theories do not seem to be at work in Pakistan. The information asymmetry problem is relatively more pronounced in the case of the public debt issue. The Pakistani capital market, like any developing country's market, is still underdeveloped. There is a negligible number of public debt issues so far in Pakistan. For this reason, the information asymmetry theory, and, for the reasons discussed in the preceding paragraph, the financial distress theory do not necessarily force small firms to hold extra cash reserves.

In the fixed effects model, leverage is not significant at any conventional level. This is inconsistent with the view that leverage increases the chances of financial distress; therefore, an increase in the level of leverage will be accompanied by an increase in the level of cash holdings. However, results of the full sample reported in Table 4 show that cash holdings decrease with the ratio of leverage. There are two possible explanations for this observation. First, there is a possibility that results are impacted by the presence of financially-distressed firms. Such firms are expected to have higher leverage ratios and lower cash balances. To check for this possibility, we re-ran the regressions with the constraint that the leverage ratio is not higher than 60%. The selection of 60% is because of its proximity with the mean leverage value of all firms in all years. The number of observations in the full sample reduced from 2722 to 1797 due the above constraint; however, the leverage coefficient was still negatively (for example, coefficient = -0.23,

t-value = -10.75 in the pooled regression). The second explanation can be given from the point of view of judicial inefficiency in Pakistan. Higher leverage increases the possibility of financial distress and bankruptcy. Given that, firms with higher leverage would prefer to hold more liquid assets to avoid falling in financial distress or bankruptcy. However, they will not do so if they know that the probability of actions taken by creditors against them are less, even when they do not pay the credit on time. Research indicates that judicial efficiency is an important determinant of whether or not creditors use judicial systems for suing firms which default on their loans (Claessens et al., 2003). Thus, the second explanation cannot be ruled out while judicial efficiency is considerably lower in Pakistan. The Doing Business Report (2010) ranks Pakistan 158 out of a total of 183 countries on the scale of contract enforcement.

Table 4 shows regression results of different specifications using data of 280 firms in non-financial sectors listed on KSE from the year 1996 to 2008. Cash is the ratio of cash plus liquid assets divided by total assets. GRT is the annual percentage increase in total assets. CFV is the coefficient of variation of net income. SIZE is the natural log to total assets. LEV is the ratio of total debt to total assets. DIV is the ratio of dividend payment divided by total equity. CF is measured as a ratio of net income plus depreciation divided by total sales. DEMA is the ratio of long-term liabilities divided by total liabilities.

We find, both statistically and economically, a significant positive relationship between the proxy for dividend and the level of cash holdings. Against the notion that missing dividend payments can serve as a substitute to cash holdings, the result supports the alternative hypothesis that firms follow a pattern in paying dividends for which they hold extra cash.

The coefficient of DEMA variable is negative and statistically significant in all models. The result is in line with the maturity matching hypothesis. The result substantiates Stoh's view that firms match the assets' maturity with debt-maturity; otherwise the cash flows from the assets will not be sufficient to meet their debt obligation. Though this finding is in support of the financial distress theory, it may be said that maturity matching is not strictly done keeping in view the probability of bankruptcy; rather, good firms may do it to create and maintain reputation in the market.

A more direct test of the financial distress theory is provided by the IVZ variable, the inverse of Altman's (1968) Z-score. The coefficient of IVZ is insignificant in all models. This confirms that the possibility of financial distress has no bearing on the dividend decision of Pakistani listed firms. It is important to note that IVZ could not be included in the full sample regressions because of data limitations.

Our regression results show that firms with strong cash flows accumulate extra cash. The coefficient of the explanatory variable CF is positive and significant at 5% level in all models except in the cross-sectional regression.

The coefficients of CF maintain its positive sign and statistical significance in both the sub-sample and the full-sample regressions. This finding extends support to our explanation for the positive relationship between the size variable and dividends. Opler et al. (1999) view large firms as presumably more profitable and are in a better position to accumulate cash. In other words, they suggest that profitable firms will hold high level of dividends. Our results do not support the alternative hypothesis that better cash flows reduce the need for holding extra cash.

In line with our hypothesis, regression results show a significant negative relationship between the variable CNVT and dividends. This finding lends support to the prediction that assets with ready market value are easily convertible into cash and thus serve as a surrogate for holding extra cash. This is also consistent with the view of Ozkan and Ozkan (2004) that the cost of converting current assets other than cash into cash is much lower than that of other assets.

Finally, we find no support for the view that a quick conversion cycle will reduce cash levels. However, this finding may not be reliable since calculations for all individual components of the variable CYC could not be computed because of incomplete data. Specifically, information on accounts payable was unavailable, and inventory data was available only from 2003 and onward. As a result, we calculated the variable CYC without using accounts payable information, and due to the missing years of inventory data we were unable to include CYC in the panel data regression.

Dynamic panel data estimation

Under the assumption that firms can swiftly adjust to target or optimal cash holdings level without facing costs of adjustments, a static panel data model can be employed for analysis. However, if firms cannot instantly switch to the desired level of cash holdings, then dynamic model should preferably be used. Under the later assumption, the following partial adjustment model can be estimated:

$$CASH_{it} = \alpha CASH_{i,t-1} + \sum_{k=1}^k \beta_k X_{it} + \lambda_i + \lambda_t + e_{it} \quad (2)$$

Where $CASH_{it}$ is cash-to-total assets ratio of firm i in time t . X_{it} denotes various explanatory variables. Each firm's unobserved heterogeneity is captured through dummy variable λ_i that is fixed over time but varies from firm to firm. The presence of such fixed effects is expected due to the fact that management styles and risk preferences are usually not the same among all firms. Fixed effects resulting from the presence of some macro-economic

Table 5. System GMM results.

Variable	Coefficients	Robust std. errors	z	P> z
CASH _{it-1}	0.518*	0.081	6.360	0.000
GRT	0.006	0.014	0.470	0.641
CFV	-0.004	0.004	-1.050	0.295
SIZE	0.023*	0.009	2.660	0.008
LEV	-0.102**	0.045	-2.280	0.023
DIV	0.074	0.076	0.970	0.330
DEMA	-0.050***	0.027	-1.850	0.064
IVZ	-0.014	0.027	-0.540	0.592
CF	0.052	0.047	1.110	0.267
CNVT	-0.027*	0.008	-3.300	0.001
Constant	-0.011	0.058	-0.190	0.846

Significance at 1, 5 and 10% levels are denoted by *, **, and *** respectively.

phenomena in a given time period are captured with the dummy variable λ_t that is fixed across cross-sectional units but varies over time. ε_{it} is the usual disturbance term.

However, Bond (2002) argues that the individual effects (λ_i) are stochastic and hence they are usually correlated with the variable CASH_{it-1}. Ordinary least-square regression does not estimate the α and β_k consistently. The result of OLS is biased upward for α because of the correlation between the lagged dependent variable and

the error terms which is composed of ($\lambda_i + \varepsilon_{it}$). Efficient way to remove the firm-specific effects is to estimate the partial adjustment model by taking a first difference of the equation (2) in the following manner:

$$\Delta CASH_{it} = \alpha \Delta CASH_{i,t-1} + \sum_{k=1}^k \beta_k \Delta X_{it} + \Delta \lambda_t + \Delta e_{it} \quad (3)$$

However, this model is not efficient as well because the differenced error terms Δe_{it} is correlated through terms CASH_{it-1} and $e_{i,t-1}$. To get around this problem, Arrelano and Bond (1991) suggest the method of generalized methods of movements (GMM) which uses instruments that are correlated with the lagged dependent variable but not with the error terms. GMM uses all moments which are available in the orthogonality conditions between the CASH_{it-1} and the error terms

GMM proposed by Arrelano and Bond (1991) is also known as difference GMM. Blundell and Bond (2000) suggest estimates of difference GMM are biased downward if the data suffer from finite sample bias. The finite sample bias is pronounced more in the case of highly persistent series. An alternative to difference GMM

is system GMM which was developed by Arellano and Bover (1995) and Blundell and Bond (1998). System GMM has considerable small finite sample bias and estimates parameters of partial adjustment models with good precision even in the case of persistent series. In separate tests, the results of which are not reported for the sake of parsimony, many explanatory variables were found to be highly persistent. This is why our preferred results are from system GMM.

Dynamic panel data model

Results of the dynamics panel date model is given in Table 5. The first column shows names of the variables; second column presents coefficient of the variables whereas robust standard errors, the z-value and its p-value are given in columns three, four and five respectively. Table 5 shows that α value (the coefficient of the lagged dependent variable CASH_{it-1}) is positive and statistically significant. The adjustment coefficient, $\gamma = (1-\alpha)$, is close to 0.5 which suggests that firms experience delay in adjusting to their optimal cash ratios.

Table 5 shows results of regressions estimated with system GMM technique using panel data of 280 firms listed on KSE in non-financial sectors over the period 2001 to 2008. Cash is the ratio of cash plus liquid assets divided by total assets. GRT is the annual percentage increase in total assets. MV/BV is defined as the share price divided by the book value per share. CFV is the value of deviations from mean cash flows of a given firm scaled by the mean cash flow of that firm. SIZE is the natural log to total assets. LEV is the ratio of total debt to total assets. DIV is the ratio of dividend payment divided by total equity. IVZ is the inverse of Altman's (1968) Z-score for financial distress. CF is measured as a ratio of net income plus depreciation divided by total sales. DEMA is the ratio of long-term liabilities divided by total

liabilities. CNVT is the ratio of current assets other than cash divided by total assets minus current assets other than cash.

The results of system GMM are not totally different from fixed and random effects models of static panel regressions. Variables like SIZE, DEMA, IVZ, LEV and CONVT maintain their signs and statistical significance in the dynamic models whereas variable GRT, CFV, and CF keep their signs but they lose their statistical significance in the GMM regression.

The results strengthen the view that more profitable firms are in a better position to accumulate cash. This is evident from the coefficient of variable SIZE and CF. Since large firms are presumably more profitable because of their economies of scale and market share, they are in better position to have higher cash reserves. This result is in line with the arguments of Opler et al. (1999). The variable CF also suggests the same. Firms with higher cash inflows will have higher cash balances. The results also show that firms with quick conversion cycle have relatively smaller cash balances. And finally, firms with higher leverage ratios carry smaller cash on their balance sheet. This finding confirms the predictions of Ansic and Hey (1993) who argues that leverage can act as a proxy for a firm's ability to issue debt. Firms with greater ability to raise funds through debt financing will maintain smaller cash balance. The result also is in line with the pecking order hypothesis, given by Myers and Majluf (1984).

Conclusion

This paper studies the empirical determinants of corporate cash holdings among 280 non-financial firms listed on Karachi Stock Exchange from 1996 to 2008. For this purpose, the study employs both static and dynamic panel data models. In static panel data models, results of the Hausman test indicate that fixed-effects model gives consistent estimates. Results of the static panel data model shows that growing firms, large firms, dividend paying firms and firms with more cash inflows have more cash than other firms. Firms with longer maturity of debts and firms with quick conversion cycle have less cash balances.

IMPLICATIONS

The evidence in paper is more in favor of the cash accumulation hypothesis than in favor of the bankruptcy hypothesis. This is evident from the positive association of cash holdings with the firm size and cash inflows and negative association of cash holdings with volatility of net income and inverse of the Altman's (1968) Z-score. This finding is also substantiated by the descriptive statistics where the cash-to-assets ratio in Pakistan is almost the

same as it is in developed countries. The cash-to-assets ratio should have been higher in Pakistan given the fact that short-term financing ratio is quite higher in Pakistan. The insignificance of bankruptcy possibility in cash holding decisions might imply that the judicial efficiency is low and court process is costly in Pakistan which is why borrowers do not hold extra cash even in face possible financial distress and bankruptcy. These results have important implications for corporate behavior. These results indicate that managers acting in the interest of shareholders create moral hazards for creditors by keeping less amount in liquid assets than what might be considered optimal from the point of view of creditors. The reason why managers do not invest more in liquid assets even in highly volatile cash flows and higher leverage is that liquid assets like cash and cash equivalents do not generate accounting returns. Consequently, firms are naturally tempted to invest less in liquid assets in order to maximize the wealth of shareholders. But insufficient balance of liquid assets can lead to financial distress and ultimate bankruptcy of the firm. However, if judicial efficiency is low, firms will manage to survive even with little cash on hand. Thus, it can be expected that cash to total assets ratios will be lower in districts where judicial efficiency is low. Such a practice creates moral hazard problems for lenders. In a future research, this possibility can be checked in a systematic manner.

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