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Full Length Article

The financial determinants of corporate cash holdings in an oil rich country: Evidence from Kingdom of Saudi Arabia

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Abstract

This paper investigates the determinants of the cash holdings for a sample of Saudi firms over the period 2006–2014, using static and dynamic panel models. Our results show that leverage, firm size, capital expenditure, net working capital and cash flow volatility are important in determining cash holdings. When we divide our sample into two sub-samples: petrochemical and non-petrochemical firms, our results show a significant difference between the determinants of cash holdings of the two groups of firms. We also investigate the characteristics of high liquid firms (conservative firms). The results indicate that conservative firms are less leveraged, have large size, have low investment expenditures and have low cash flow fluctuation. Furthermore, dynamic panel estimation indicates that Saudi firms adjust their liquidity holdings quickly towards an endogenous target cash ratio.

JEL classification: G30; G32; G39

Keywords: Cash holdings; Petrochemical firms; Conservative firms

1. Introduction

In a world of perfect capital markets, holdings of liquid assets are irrelevant because companies can easily raise funds to finance their profitable investment projects at negligible transaction costs. Therefore, shareholder wealth is unchanged with the liquid asset investing within the firm. However, in reality, recent studies show that firms invest in liquid assets by maintaining important cash holdings. For example, Dittmar, Mahrt-Smith, and Servaes (2003) find that the largest corporations around the world held 9% of the book value of their assets in cash or cash equivalents. Ferreira and Vilela (2004) find that EMU corporations, at the end of the year 2000, held 15% of their total book value of assets in cash or cash equivalents. Gao, Harford, and Li (2013) find that public firms in the U.S. held on average 18.8% of their assets in cash or near-cash instruments.

Recent literature suggest that corporate cash holdings are usually determined and influenced by three important theories in corporate finance, that are trade off theory (Myers, 1977), pecking order theory (Myers & Majluf, 1984) and free cash flow theory (Jensen, 1986). According to the trade-off theory (TOT), companies set their optimal level of cash holdings by balancing the marginal costs and marginal benefits of holding cash (Afza & Adnan, 2007; Dittmar et al., 2003; Ferreira & Vilela, 2004; Kariuki, Namusonge, & Orwa, 2015; Opler, Pinkowitz, Stulz, & Williamson, 1999). Marginal benefits related to cash holdings are: the lower transaction costs (associated with using cash for payments without having to liquidate assets), reduction in the likelihood of financial distress and the possibility of implementing investment projects that could not be carried out without these funds owing to the existence of financial constraints. The main cost of holding cash is the opportunity cost of the capital invested in liquid assets. The pecking order theory (POT) suggests that asymmetric information between managers and investors makes external financing costly. Therefore, firms

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should finance investments first with retained earnings, then with safe debt and risky debt, and finally with equity to minimize asymmetric information costs and other financing costs. According to this theory, firms do not have target cash levels, but cash is used as a buffer between retained earnings and investment needs. Finally, the free cash flow theory (FCFT) postulates that managers have an incentive to build up cash to increase the amount of assets under their control and to gain discretionary power over the firm investment decision. Cash reduces the pressure to perform well and allows managers to invest in projects that best suit their own interests, but may not be in the shareholders best interest.

However, neither the pecking order theory nor the free cash flow theory suggests that there exist target cash holding levels while the trade-off theory does. According to this theory, firms trade off the benefits and costs of holding cash to determine the target cash reserves, and when the actual cash holdings deviate from the target levels, firms tend to adjust their cash reserves to the target level.

There is considerable empirical evidence to support the existence of optimal target levels for corporate cash holdings in the extent literature. Drobetz and Grüninger (2007), Alles, Lian, and Yan (2012) and Rehman and Wang (2015) confirm the presence of target levels of cash reserves and firms tend to adjust towards target cash levels.

The existing research on corporate cash holdings is replete with evidence from the U.S and developed markets with little attention given to the emerging markets. Several factors make cash holdings different in emerging markets from that of developed markets. According to Scott (1995), institutional factors may affect firm's financial practices such as cash holdings. One of these factors is the socio-economic factor including laws, and actor's attitudes which is considered to be weak in many emerging markets relative to that in developed markets such as the US (North, 2005). This is likely to raise the level of uncertainty in transactions and consequently encourage a range of unproductive practices such as cash retention (Al-Najjar, 2013). Moreover, slow institutional development (i.e., stock market, bank, and other financial institutions) may motivate firms to adopt conservative financial practices (North, 2005).

As an emerging market, Kingdom of Saudi Arabia (KSA) has different business practices. KSA is an oil rich country, the stock market is relatively underdeveloped and an Islamic banking system is present, the legal origin is based on Sharia Law. Two of the most important aspects of the Islamic values relating to corporate financing are that Islamic law prohibits loan interests whether giving or taking by individuals or business institutions. Second, the obligation of Zaket that should be giving, calculated based on the capital of the business or individual, and given to specific groups (Al-Nodel and Hussainey, 2010).

The first objective of this research is to provide empirical evidence on the determinants of cash holdings among Saudi listed firms, a context that is different from other countries studied in the literature. Because it is an oil rich country, one would expect the cash holding level to differ across firms' activity sector. To test this assumption, we examine the determinants of cash levels by dividing our sample into two sub samples: petrochemical industry and non-petrochemical industries. The second objective is to investigate the fundamental characteristics of conservative firms. We specify the features of high cash holding firms. The third objective is to examine the presence of target level of cash reserves and how KSA firms adjust their cash holdings toward this target level.

The remainder of this paper is organized as follows. Section 2 discusses the theoretical framework. Section 3 develops the hypotheses. The sample and the methodology are discussed in Section 4. Section 5 analyses the empirical results of our regressions. Section 6 concludes.

2. Corporate cash holdings: theory and empirical evidence

Recent studies suggest three theoretical models that can help identify which firm characteristics determine corporate cash holdings decisions: Trade-off theory, Pecking order theory and Free-cash flow theory. This section discusses these theories, then, we highlight the findings of the previous empirical studies.

2.1. Trade-off theory

According to the trade-off theory, we can identify two costs of holding cash. If we assume that managers maximize shareholder wealth, the main cost experienced by holding cash is the opportunity cost of the capital invested in liquid assets (Ferreira & Vilela, 2004). With respect to Dittmar et al. (2003), this cost is often called the cost-of-carry, which means the difference between the return on cash and the interest that would have to be paid to finance an additional dollar of cash. On the other hand, if managers don't maximize shareholders' value, they increase their cash holdings to increase assets under their control and so to be able to increase their managerial discretion (Saddour, 2006). As a result, the cost of cash holdings will increase and include the agency cost of managerial discretion.

The benefits of holding cash stems from two motives. According to the transaction costs motive, the main advantage of holding cash is that the firm saves transaction costs to raise funds and does not have to liquidate assets to make payments. Consequently, firms will hold more cash when it is likely to incur higher transactions costs to convert non-cash assets to cash. Alternatively, firms will tend to hold lower amount of cash when the opportunity costs of cash retention are greater (Bates, Kahle, & Stulz, 2009; Baumol, 1952; Miller & Orr, 1966). The precautionary motive emphasizes that a firm can use the liquid assets to finance its activities and investments if other sources of funding are not available or are excessively costly (Dittmar et al., 2003).

2.2. Pecking order theory

The pecking order theory of Myers (1984) and Myers and Majluf (1984) asserts that to minimize asymmetric

information costs and other financing costs, firms should finance investments first with retained earnings, then with safe debt and risky debt, and finally with equity. Extending this theory to the explanation of the determinants of cash leads to the conclusion that there is no optimal cash level but instead, cash is used as a buffer between retained earnings and investment needs. Under this theory, the cash level would just be the result of the financing and investment decisions. Consequently, when current operational cash flows are enough to finance new investments, firms repay debt, to pay dividends and finally to accumulate cash. When retained earnings are insufficient to finance current investments, firms use the accumulated cash holdings and, if needed, issue new debt and finally when they get out of their debt servicing capacity they will issue securities.

2.3. Free cash flow theory

As argued by Jensen (1986), entrenched managers would rather retain cash than increase payouts to shareholders when the firm has poor investment opportunities. They have incentive to hoard cash to increase the amount of assets under their control and to gain discretionary power over the firm investment decision. By retaining excess cash flow, managers reduce the ongoing need for raising finance from the capital markets, thereby giving them the freedom from capital providers' monitoring. Dittmar and Mahrt-Smith (2007) and Pinkowitz, Stulz, and Williamson (2006) show that cash is worth less when agency problems between insiders and outside shareholders are greater.

2.4. Empirical evidence

Numerous studies have focused on cash holdings. Those studies focus a great deal of attention on the determinants of corporate cash holdings and the empirical literature mainly refers to US listed companies (Bates et al. 2009; Gao et al. 2012; Opler et al. 1999). Some empirical evidence has also been reported for EMU listed firms (Ferreira & Vilela, 2004), UK listed firms (Al-Najjar & Belghitar, 2011; Ozkan & Ozkan, 2004) and French listed firms (Saddour, 2006). Others use cross-country comparisons (Al-Najjar, 2013; Dittmar et al. 2003; Guney, Ozkan, & Ozkan, 2007; Ramírez and Tadesse 2009). Yet, little attention has been given to the determinants of cash holdings in emerging markets, which are characterized by weak socio-economic factors and slow institutional development relative to that in developed markets. For example, Al-Najjar (2013) look into the effect of capital structure and dividend policy on cash holdings in Brazil, Russia, India, and China and compare the results with a control sample from the US and the UK. Uyar and Kuzey (2014) analyze the factors that might explain the level of corporate cash holdings in a broad sample of Turkish-listed nonfinancial firms. To the best of our knowledge, no study was undertaken on the Saudi market. Thus, this study aims to bridge this gap in the literature by examining the determinants of cash holdings in a sample of Saudi firms over the period 2006 to 2014.

3. The determinants of cash holdings: hypotheses development

Previous studies reported various determinants of cash holdings. In this part, we discuss the implications of Saudi business environment for the three tested theories.

3.1. Leverage

In line with the transaction cost motive, highly levered firms face high costs when investing in liquid assets and should hence hold less cash (Ferreira & Vilela, 2004; Kim, Mauer, & Sherman, 1998). In emerging markets, Al-Najjar (2011) suggests that bankruptcy related costs are also important, since different studies in the emerging market context find evidence for these costs. Further, according to the pecking order theory, cash holdings should decrease with leverage, because if internally generated funds are not sufficient, firms will use its liquid reserves before issuing debt, but if the firm has internal surplus it will pay down its debt. On the other hand, Jensen (1986)'s free cash flow argument suggests that, payouts, in the form of interest payments, reduce the resources under the management, thereby reducing managers' power and increasing the likelihood of monitoring by the capital markets. However, low leverage firms are less subject to monitoring, allowing for superior managerial discretion.

A growing number of studies have found that the level of financial leverage negatively affects corporate cash holdings (Al-Najjar & Belghitar, 2011; Opler et al. 1999; Ozkan & Ozkan, 2004).

The legal system of Saudi Arabia is derived from Islamic Law that prohibits interest rate. Both types of system, Islamic and interest-based, issue credit to finance assets of the firm. Islamic system uses the same formulas and annuity tables for computing amounts due and monthly installments used by interest-based banks. Furthermore, in Islamic finance, debt can be seen as a governance mechanism as the debt in conventional system. Hence, based on the previous discussion, our first hypothesis is:

H1: There is a negative relationship between leverage and cash holdings.

3.2. Dividend payments

Based on the trade-off theory, the relationship between dividend payments and cash should be negative, since firms that pay dividend can trade off the costs of holding cash by reducing dividend payments (Al-Najjar & Belghitar, 2011). Previous studies such as Opler et al. (1999) and Drobetz and Grüninger (2007) argue that firms that currently pay dividends can raise funds at low cost by reducing their dividend payments, therefore they don't need to hold high amounts of cash. In contrast, firms that do not pay dividends need to use the capital markets to raise funds. Similarly, Ozkan and Ozkan (2004) argue that these costs can be avoided for firms facing low internal financing resources by issuing equity or even reducing payment of dividends.

In Saudi Arabia, there are no taxes on dividends and capital gains. According to Al-Ajmi and Abo Hussain (2011), Saudi companies pay "zakat" (an Islamic tax), which represents 2.5 percent of a firm's unused assets in hand (i.e. zakat base). Thus, zakat can be seen as a penalty for those assets. Therefore, companies are encouraged to distribute generated income unless it is needed to finance expansion.

Based on the previous empirical findings and the trade-off theory, we hypothesize that:

H2. There is a negative relationship between dividends and cash holdings.

3.3. Profitability

According to the pecking order theory, firms with higher financial results retain higher level of liquidity because profitable firms accumulate the cash flow generated. Consequently, controlling for investment, the most profitable companies should have more cash. Opler et al. (1999) argue that there is a positive relationship between cash flows and cash levels. Ferreira and Vilela (2004) and Al-Najjar and Clark (2016) confirm this argument. Consequently, there is a positive association between firm's profitability and cash holdings. Based on the pecking order theory and empirical findings, we hypothesize that:

H3. There is a positive relationship between profitability and cash holdings.

3.4. Growth opportunities

Based on the trade-off theory, there is a positive association between growth opportunities and cash holdings. The opportunity cost due to a lack of liquidity should be more severe for firms with high quality investment project. In addition, the financial distress costs for these firms are higher (Williamson, 1988) which can make the external financing more expensive (Harris & Raviv, 1990). To avoid these costs, firms with high quality investment project will have a propensity to provide liquidity in order not to run the risk of underinvestment in the future. Therefore, to avoid any shortfall in cash is in accordance with transaction motives of cash (Opler et al., 1999). Second motive of avoiding financial distress is consistent with motive of precaution (Bates et al., 2009). Similarly, the pecking order theory argues for a positive link between growth opportunities and cash holdings. Firms with higher growth opportunities need higher cash level to cope with any shortfall in cash. Hence, we hypothesize that:

H4. There is a positive relationship between growth opportunities and cash holdings.

3.5. Firm size

As argued by Rajan and Zingales (1995), because of diversification, larger firms have more stability of cash flow and therefore they have lower probability of being in financial distress. It would be easier for these firms to have access to diversified funding sources (Ferri & Jones, 1979), which is often not possible for smaller one. In a similar vein, Al-Najjar and Belghitar (2011) argue that large firms are considered to be more diversified than their small counterparts and in turn less prone to bankruptcy related costs. Consequently, they are less likely to store cash reserves. In line with these arguments, Bates et al. (2009) state that big firms are more likely to be able to liquidate part of non-core assets to obtain cash, which reduces the likelihood of encountering financial distress. Contradicting the trade-off view, the pecking order theory affirms that cash holdings increase with firm size, because larger firms are expected to have been more profitable historically and thus accumulated more cash. Opler et al. (1999) argue that larger firms presumably have been more successful, and hence should have more cash, after controlling for investment. Thus, we argue that firm size is an important determinant of cash holdings and do not predict the sign of the association between firm size and cash holdings:

H5. There is a negative/positive relationship between firm size and cash holdings.

3.6. Capital expenditure

Based on the pecking order theory, firms with larger investment expenses have less or no surplus from internally generated funds to invest in liquid asset reserves, and hence they hold less liquid assets (Opler et al., 1999). In the same vein, Bates et al. (2009, 1999) argue that *if capital expenditures create assets that can be used as collateral, capital expenditures could increase debt capacity and reduce the demand for cash*. Hence, based on the pecking order theory, we argue for a negative relationship between capital expenditure and cash holdings and hypothesize that:

H6. There is a negative relationship between capital expenditure and cash holdings.

3.7. Net working capital

According to the trade-off theory, an inverse association exists between cash and net working capital. This is so because net working capital majorly consists of liquid asset cash substitutes. The existence of liquid assets will lead firms to be less reliable on capital markets to obtain cash (Al-Najjar, 2013). Previous researchers like Bates et al. (2009) and Ferreira and Vilela (2004) suggest that net working capital consists of assets that substitute for cash. Based on the empirical findings and trade-off theory, we hypothesize that:

H7. There is a negative relationship between net working capital and cash holdings.

3.8. Cash flow volatility

Based on the trade-off theory, companies with more volatile cash flows face a higher probability of experiencing cash shortage due to unexpected cash flow deterioration, which leads them to forgo some profitable investment projects. Opler et al. (1999) show that uncertainty leads to situations in which, at times, the firm has more outlays than expected.

Bates et al. (2009) suggest that firms with greater cash flow risk hold more precautionary cash. Empirically, Saddour (2006) and Ferreira and Vilela (2004) argue about a positive link between cash flow uncertainty and cash holdings. Based on the trade-off theory and the previous empirical findings, we hypothesize that:

H8. There is a positive relationship between cash flow volatility and cash holdings.

4. Data description and methodology

4.1. Sample selection

Our sample consists of firms listed on the Saudi Stock Exchange. Data are hand-collected. We have used three data sources for the compilation of our sample: (1) the website "argaam.com" for data relating to companies in the financial reports of listed companies in the market, (2) the website "tadawul.com" for information on stock prices and (3) the website "macrotrends.net" for data relating to oil price. The analysis is about the period from 2006 to 2014. The year 2005 serves to calculate some parameters that are variations. The panel data set for this study has been constructed as follows. First, we exclude financial institutions because banks and insurance are subject to specific rules and regulations. Second, we exclude missing firm-year observations for any variable in the model. These criteria have provided us with a total of 630 firm-year observations.

Hereafter, Table 1 classifies the sample by business sector. The results show that firms are prevalent in various sectors such as Petrochemical Industries (12), Cement (8), Agriculture and Food Industries (13), Industrial Investment (12), Building and Construction (12) and others (5).

4.2. Variable definition

Consistent with the majority of previous studies such as Ferreira and Vilela (2004), Drobetz and Grüninger (2007), Hall et al. (2009), our variables are defined as follows (Table 2).

4.3. Methodology and model specification

To investigate empirically the determinants of corporate liquidity in KSA firms, this study employs two models: (1) the static cash-holding model and (2) the partial (dynamic) adjustment model. The static cash-holding model tests two sets of regressions. The first set of regressions aims at investigating cash holdings for the overall sample using panel data regression. The second set of regression examines the determinants of cash levels by dividing our sample into two subsamples of firms: petrochemical industry and non-petrochemical industries. Because it is an oil rich country, one would expect the cash holding behavior to differ among petrochemical and non-petrochemical industries.

Table 1
Sample distribution by business sector.

Business sector	Frequency	Percentage
Petrochemical Industries	12	17.14%
Cement	8	11.43%
Agriculture and Food Industries	13	18.57%
Industrial Investment	12	17.14%
Building and Construction	12	17.14%
Retail	8	11.43%
Others (Real Estate Development, Telecommunication and Information Technology)	5	7.15%
	70	100%

We use also a logit regression to investigate the characteristics of high cash holding firms. Relating to the dynamic panel data model, we employ the generalized method of moments (GMM) technique for estimating the determinants and the speed of adjustment (SOA) of cash for the overall sample and the two sub-samples of firms.

4.3.1. Static panel models

The most commonly used ways of assessing the determinant of corporate cash holdings, considering static panel models, are: (1) pooled OLS regression; (2) panel model of random effects; (3) panel model of fixed effects. Considering the previously defined determinants of cash holdings used in this study, the evaluation of a pooled OLS regression can be presented as follow:

$$\begin{aligned} CASH_{it} = {} & \beta_0 + \beta_1 LEV_{it} + \beta_2 DIVY_{it} + \beta_3 PROF_{it} + \beta_4 Q_{it} \\ & + \beta_5 SIZE_{it} + \beta_6 CAPEX_{it} + \beta_7 NWC_{it} \\ & + \beta_8 CFVOL_{i,t} + \beta_9 OIL_t + d_t + e_{i,t} \end{aligned} \quad (1)$$

Where d_t is temporal dummy variable that measures the impact of possible macroeconomic alterations on company cash holdings, and $e_{i,t}$ is the error which is assumed to have a normal distribution $\varepsilon_{it} \sim N(0,1)$. OIL_t is an exogenous variable that represents the oil price at the end of year t.

Using a pooled OLS regression, companies' non-observable individual effects are not controlled. Consequently, heterogeneity can influence measurements of the estimated parameters.

Panel models of random or fixed effects can control the implications of companies' non-observable individual effects on the estimated parameters. Considering the existence of non-observable individual effects, we have:

$$\begin{aligned} CASH_{it} = {} & \beta_0 + \beta_1 LEV_{it} + \beta_2 DIVY_{it} + \beta_3 PROF_{it} + \beta_4 Q_{it} \\ & + \beta_5 SIZE_{it} + \beta_6 CAPEX_{it} + \beta_7 NWC_{it} \\ & + \beta_8 CFVOL_{i,t} + \beta_9 OIL_t + d_t + u_{i,t} \end{aligned} \quad (2)$$

Where $u_{i,t} = v_i + e_{i,t}$, with being companies' non-observable individual effects. The difference between a pooled OLS regression and a model considering non-observable individual effects lies precisely in v_i.

To test the relevance of non-observable individual effects we use the Lagrangian Multiplier (LM) test. This tests the null hypothesis of non-relevance of non-observable individual effects, against the alternative hypothesis of relevance of non-

Table 2
Variable definition and measurement.

Variable type	Variable name	Variable abbreviation	Measurement method
Dependent variable	Cash holdings	CASH	Total cash and equivalents/(Total assets − Total cash and equivalents).
Independent variables	Leverage	LEV	Total debt/Book value of total assets
	Dividend payments	DIV	Dividend per share/The year-end stock price
	Profitability	PROF	Operating profit/Total assets.
	Growth opportunities	Q	(The market value of equity + the book value of debt)/The book value of assets.
	Firm size	SIZE	Ln (Total assets).
	Capital expenditure	CAPEX	capital expenditures/Total assets
	Net working capital	NWC	[Current assets (except total cash and equivalent) − Current liabilities]/Total assets
	Cash flow volatility	CFVOL	Standard deviation of firm cash flow
	Oil price	OIL	The year-end oil price

observable individual effects. Not rejecting the null hypothesis, we can conclude that non-observable individual effects are not relevant, and so a pooled OLS regression is an appropriate way of carrying out evaluation of cash holdings determinants.

However, there may be correlation between companies' non-observable individual effects and cash holdings determinants. In the absence of correlation between companies' non-observable individual effects and cash holdings determinants, random effects are the most appropriate way to perform evaluation. In the presence of correlation between companies' individual effects and cash holdings determinants, fixed effects are the most appropriate way of carrying out the evaluation. To distinguish between fixed and random effects, we resort to Hausman (1978) test statistic for each specification. The null hypothesis supports the absence of correlation between non-observable individual effects and the explanatory variables. Rejection of the null hypothesis is usually interpreted as evidence for the presence of fixed effects.

Furthermore, we develop additional evidence on the fundamental characteristics of conservative firms. Since high cash holdings is a discrete event, we employ a binary logit regression model to investigate the driving factors behind the conservative behavior. The explanatory variables for the logit model represent various fundamental characteristics of the firm. We use the following logistic regression model:

$$L_{it} = \ln\left(\frac{P_{it}}{1-P_{it}}\right) = \varphi_0 + \varphi_1 LEV_{it} + \varphi_2 DIVY_{it} + \varphi_3 PROF_{it} + \varphi_4 Q_{it} + \varphi_5 SIZE_{it} + \varphi_6 CAPEX_{it} + \varphi_7 NWC_{it} + \varphi_8 CFVOL_{i,t} + \varepsilon_{it} \quad (3)$$

Where

P_{it} is the probability of a firm i to be conservative in period t (the cash holding level in period t is over the median value);
φ_i, the estimated parameters;
ε_{it}, the error term.

4.3.2. Dynamic panel estimators

According to Ozkan and Ozkan (2004), the static cash-holding model frequently used in previous research implicitly assumes that firms can instantaneously adjust towards the target cash level following changes in firm-specific characteristics and/or random shocks. We assume that an unobservable target cash ratio exists denoted as CASH*, then the target cash ratio of firm "i" at time "t" is modeled as follows:

$$CASH^*_{it} = \sum_k \beta_k X_{kit} + \varepsilon_{it} \quad \text{where } \varepsilon_{it} \sim N(0,1) \quad (4)$$

Adjustment is not immediate because firms have to bear costs of adjustment, the speed of this adjustment process is captured by a constant adjustment coefficient, denoted as λ. The adjustment dynamics are modeled as:

$$CASH_{i,t} - CASH_{i,t-1} = \lambda\left(CASH^*_{it} - CASH_{i,t-1}\right) \quad \text{where } 0<\lambda<1 \quad (5)$$

The coefficient λ takes a value between 0 and 1 to capture a firm's ability to adjust to its target cash reserves. When $\lambda = 1$, the model implies that firms can immediately adjust to their target levels. When $\lambda = 0$, the model implies that firms cannot adjust their actual level of cash reserves.

Claiming that firms have target cash reserves, firms endeavor an adjustment process and hence dynamic modeling. With regard to model (5), both $CASH_{i,t}$ and $CASH_{i,t-1}$ are likely to be correlated across firms with the firm-specific effect α_i implying that an ordinary least squares estimator is biased and inconsistent. Moreover, shocks that jointly affect the cash ratio and the exogenous variables could lead to endogeneity problems due to an omitted variables bias. To address these problems, we use Generalized Method of Moment (GMM) dynamic panel estimator which provides consistent parameter estimates by utilizing instruments that can be obtained from the orthogonality conditions that exist between the lagged values of the variables and disturbances (Arellano & Bond, 1991). This procedure contains two steps. First, we rewrite the dynamic model in first difference in order to eliminate the specific effects α_i. We then obtain the following model expression:

$$\Delta CASH_{i,t} = \gamma_0 \Delta CASH_{i,t-1} + \sum_k \gamma_k \Delta X_{k,i,t} + \Delta\alpha_t + \Delta\mu_{i,t} \quad (6)$$

However, this last model transformation raises another problem relating to the correlation between $\Delta CASH_{i,t-1} = (CASH_{i,t-1} - CASH_{i,t-2})$ and $\Delta\mu_{i,t} = (\mu_{i,t} - \mu_{i,t-1})$. Therefore, the estimator of the ordinary least squares is biased since

$CASH_{i,t-1}$ depends on $\mu_{i,t-1}$, what necessarily makes, in a second step, the use of a method of instrumental variables for the estimation of the equation (4). That is why, in a second step, the technique consists (for $t \geq 2$) to use the delayed endogenous variables as instruments to estimate the equation (4). The Sargan test allows testing the validity of the instruments.

The quality of the GMM estimates depends in particular on the validity of the matrix of instruments and on the assumption that the error term does not exhibit an autocorrelation. Two tests are then proposed:

Test 1 (Instruments): the matrix of instruments must not be correlated with disturbance. Sargan-test allows assessing this hypothesis.

Test 2 (autocorrelation of residues): Given that the equation of reference has been formulated in first differences, the residues are supposed to be correlated to the order 1 but not to order 2. The tests AR (1) and AR (2) of Arellano and Bond (1991) verify this hypothesis.

5. Results and discussion

5.1. Descriptive statistics

Table 3 presents descriptive statistics for the variables in the analysis. Panel A provides means and standard deviations for the variables of the whole sample and the two subsamples Petrochemical and Non-Petrochemical Industries. Panel B provides descriptive statistics and test for equality for the variables of the two categories of firms: Conservative firms vs Non-Conservative firms.

Table 3
Descriptive statistics of variables over the period 2006–2014.

Panel A: Summary statistics for our sample over the period 2006–2014

	Whole sample		Petrochemical industry		Non-petrochemical industries	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
CASH	0.14	0.24	0.15	0.13	0.13	0.26
LEV	0.17	0.17	0.32	0.16	0.14	0.16
DIVY	0.04	0.04	0.03	0.03	0.04	0.04
PROF	0.09	0.10	0.07	0.09	0.10	0.10
Q	3.08	37.9	1.22	0.76	3.46	41.64
SIZE	9.31	0.71	10.03	0.62	9.16	0.63
CAPEX	0.57	0.21	0.72	0.12	0.54	0.21
NWC	0.08	0.16	0.002	0.07	0.09	0.17
CFVOL	0.85	24.35	0.23	14.59	0.98	25.93
OIL	79.25	19.79	79.25	19.79	79.25	19.79

Panel B: Conservative firms vs Non-conservative firms

Variable	*Conservative* firms		*Non-Conservative* firms		Test for equality
	Mean	Std Dev.	Mean	Std Dev.	
LEV	0.14	0.01	0.21	0.01	−0.07***
DIVY	0.04	0.04	0.03	0.03	0.01***
PROF	0.11	0.10	0.08	0.10	0.03***
Q	1.68	1.13	4.47	53.60	−2.79
SIZE	9.30	0.76	9.31	0.66	−0.01
CAPEX	0.56	0.20	0.58	0.22	−0.02*
NWC	0.08	0.15	0.07	0.17	0.01
CFVOL	−0.50	7.20	2.20	33.66	−2.70*

Over the period 2006–2014, KSA firms hold, on average, 14% of their net assets in cash. Compared with others studies, we find that our average cash ratio is similar to that found by Saddour (2006) of French firms over the period 1998–2002 (14.7%) and Ferreira and Vilela (2004) for firms of EMU countries over the period 1987–2000 (14.8%). However, Saudi firms seem to be more conservative than their counterparts in other emerging countries. Al-Najjar (2013) find an average cash ratio of 5.6% for a sample of emerging countries including Brazil, Russia, India and China over the period (2002–2008).

For explanatory variables, our firms hold a leverage of 17%, a dividend yield of 4%, a profitability of 9%, an 85% of volatility in cash flow. In addition, the firms of our sample have more growth opportunities which make the market value of assets greater than the book value (men value of Tobin's Q = 1.68) and they have 57% of their assets invested in tangible assets.

Petrochemical companies hold on average 15% of their net assets in cash, with a leverage of 32%, a profitability of 7%, a dividend yield of 3%, a 23% of volatility in cash flow and invest approximately 58% of their assets in tangible assets.

Panel B of Table 4 shows that Conservative firms and Non-Conservative firms hold on average 24% and 3.4% of their net assets in cash respectively. They are less leveraged and more profitable than Non-Conservative firms. Moreover, they have higher dividend yield, lower growth opportunities, lower tangible assets and lower cash flow uncertainty. For all these variables, the t-tests show significant differences between groups.

To verify the absence of multicollinearity among the independent variables, we calculated the Pearson correlation coefficients between the independent variables and we have calculated the "Variance Inflation Factor (VIF)". This index shows how much the variance of an estimated regression coefficient is increased due to multicollinearity. Studenmund (2006) indicates that a common critical point is 5 or 10. If the VIF is larger than 5 or 10, then multicollinearity is quite high in the respective regression model.

As indicated in Table 4, the VIF values of all explanatory variables are lower than 5, supporting the absence of multicollinearity problems.

5.2. Results of static panel models

5.2.1. Determinants of corporate cash holdings

Table 5 presents the results of the static panel model estimations for our whole sample and two sub-samples of firms: petrochemical industry and non-petrochemical industries, where CASH is the dependent variable. For each specification, we report the results from OLS regression, fixed effects and random effects regressions. As a result of the analysis, the LM tests indicate that we can reject the null hypothesis, at 1% significance, that companies' non-observable individual effects are not significant. Therefore, a pooled OLS regression

Table 4
Correlation matrix and VIF values.

	CASH	LEV	DIV	PROF	Q	SIZE	CAPEX	NWC	CFVOL	OIL	VIF
CASH	1										
LEV	−0.21	1									1.63
DIVY	−0.001	−0.09	1								1.26
PROF	−0.004	−0.24	0.39	1							1.45
Q	−0.01	0.06	−0.04	−0.03	1						1.01
SIZE	−0.08	0.49	0.19	0.08	−0.02	1					1.58
CAPEX	−0.26	0.12	−0.04	−0.18	−0.03	0.24	1				1.49
NWC	−0.03	−0.32	0.01	0.32	0.03	−0.30	−0.55	1			1.74
CFVOL	−0.01	0.20	−0.03	0.01	−0.01	0.002	−0.07	0.02	1		1.07
OIL	−0.06	0.001	0.06	−0.02	−0.05	0.04	0.03	0.05	−0.06	1	1.02

will not be the most appropriate way of carrying out evaluation of the relationship between cash holdings and its determinants, and then we do not consider the heterogeneity of companies.

The results of the Hausman test show that we reject the null hypothesis of absence of correlation between companies' non-observable individual effects and explanatory variables. Therefore, we can conclude that the most appropriate way to carry out evaluation of the relationship between cash holdings and its determinants is evaluation of a fixed effects panel model.

Next, we present the comparison of the results of the static panel models previously presented. For the whole sample, our results show that leverage, firm size, capital expenditure, net working capital and cash flow volatility are the main determinants of cash holdings of Saudi firms. Consistent with theoretical expectations and H1, we detect a negative relationship between leverage and cash holdings. Thus, Saudi firms with the ability to access external funds are less in need of cash to pay for investments. In accordance with the pecking order theory, high levels of debt and little cash holdings occur simultaneously when firms' investment exceeds retained earnings (Ferreira & Vilela, 2004). Further, in line with free cash flow theory, high leverage firms are more subject to monitoring by capital markets preventing superior managerial discretion. The argument that high-levered firms have less cash holdings is also supported by the transaction cost motive, but the main reason is that highly levered firms face higher costs when investing in liquid assets and should hence hold less cash. We find limited evidence for the relationship between firm size and cash holdings. The results show a positive and significant sign only for OLS regression. This finding is consistent with the pecking order theory predictions. Therefore, large Saudi firms are more diversified and have an increased need to hold cash. Consistent with the pecking order theory and H6, we detect a negative and significant association between capital expenditure and cash holdings for the three regressions. Hence, Saudi firms with larger investment expenses have less or no surplus from internally generated funds to invest in liquid asset reserves, and consequently they hold less liquid assets. In line with the trade-off theory and H7, the

Table 5
Regression of cash holdings on firm characteristics (Static Panel Models).

Indep. variable	Whole sample			Petrochemical industry			Non-Petrochemical industries		
	OLS	RE	FE	OLS	RE	FE	OLS	RE	FE
LEV	−0.47***	−0.50***	−0.36***	−0.09	0.03	0.11	−0.64***	−0.74***	−0.62***
DIVY	−0.25	0.06	0.24	0.66**	0.29	0.08	−0.14	0.16	0.25
PROF	−0.11	−0.03	−0.08	0.42**	0.33**	0.17	−0.13	−0.01	−0.05
Q	−0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00
SIZE	0.03**	0.02	−0.04	−0.03*	−0.04**	−0.06	0.01	−0.01	−0.03
CAPEX	−0.52***	−1.00***	−1.33***	−0.51***	−0.73***	−0.86***	−0.62***	−1.09***	−1.38***
NWC	−0.51***	−0.97***	−1.10***	−0.54***	−0.54***	−0.53***	−0.57***	−1.07***	−1.22***
CFVOL	0.00	0.01*	0.00	−0.00	−0.01*	−0.01**	0.00	0.01**	0.01**
OIL	−0.00	−0.00	0.00	−0.01***	−0.01***	−0.01***	−0.00	0.00	0.00
Intercept	0.30**	0.71***	1.45***	0.85***	1.14***	1.41***	055***	0.98***	1.33**
Observations	630	630	630	108	108	108	522	522	522
LM(χ^2)		358.43***			156.26***			348.19***	
Hausman(χ^2)		190.56***			26.82***			133.57***	
R^2 within		0.45	0.46		0.60	0.62		0.48	0.48
R^2 between		0.04	0.03		0.66	0.45		0.06	0.05
R^2overall	0.18	0.17	0.15	0.66	0.63	0.53	0.22	0.22	0.20
F	16.36***		51.98***	21.49***		15.83***	17.41***		47.57***

Notes: 1. The LM(χ^2) tests the null hypothesis that non-observable individual effects are not relevant in explaining the dependent variable, against the alternative hypothesis of relevance of non-observable individual effects in explaining the dependent variable. 2. The Hausman (χ^2) tests the null hypothesis that non-observable individual effects are not correlated with the explanatory variables, against the null hypothesis of correlation between non-observable individual effects and the explanatory variables. 3. *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

three regressions show a negative relationship between net working capital and cash holdings. Thus, Saudi firms with more liquid assets can convert these assets to cash and in turn have less need to hold cash. We detect a positive relationship between cash flow volatility and cash holdings. The result is significant only for the random effect regression. This finding confirms the trade-off theory predictions, and therefore Saudi firms with greater cash flow risk hold more precautionary cash. Finally, there is no evidence of the impact of dividend payouts, profitability, growth opportunity and oil price on cash holdings.

When we estimate our regression models for the two sub samples, we find that some results are similar for the two categories of firms and some of them are specific to each one. In addition, we report that petrochemical firms have a substantially higher R^2 than non-petrochemical firms, indicating that, in petrochemical firms, the model explains variation in cash holdings much better.

The results of the OLS and random and fixed effect show that petrochemical and non-petrochemical firms decrease significantly their cash level with investment level (CAPEX/total assets) and level of liquid assets substitutes of cash (NWC). Moreover, we report that cash flow volatility is a common determinant of cash holdings. However, the signs associated to the coefficients are different. For petrochemical industry, contrary to the trade-off theory expectations and H8, we find that firms with more volatile cash flows hold less cash. Whereas, for non-petrochemical industries, we detect a positive relationship between cash flow volatility and cash holdings in accordance with the trade-off theory expectations and H8.

For the sub sample of petrochemical firms, our results indicate that dividend yield, profitability, firm size, cash flow volatility and oil price are the specific determinants of cash holdings. The OLS results show a positive relationship between the dividend yield and cash holdings, which contradicts trade-off theory expectations and H2. This might indicate that petrochemical firms, which pay dividends, may have to reduce or cut their dividends when having a cash shortage. Thus, holding large amount of cash enables firms to avoid these situations to keep the reputation of paying dividends. Consistent with pecking order theory and H3, we report a positive relationship between profitability and cash holdings. Finally, the three regressions show a negative relationship between oil price and cash holdings. Thus, petrochemical firms tend to reduce their cash holding levels when oil price increases because of liquidity excess.

For the sub sample of non-petrochemical firms, we report that leverage is the only specific determinant of cash holdings. The sign of the coefficient is negative and significant for all regressions in conformity with theoretical expectations and H1.

5.2.2. Characteristics of conservative firms

To analyze the characteristics of high liquid firms (conservative firms), we estimate the parameters of equation (3). The results (coefficient estimates and their significance) are presented in Table 6. Following these results, we find a negative and significant relation between the probability of the firms to be conservative and leverage, capital expenditure and cash flow volatility. Conservative firms are those that are less leveraged, have low investment expenditures and have low cash flow fluctuation. On the other hand, we report a positive and significant coefficient associated to firm size. Thus, conservative firms are those that are larger.

5.3. Results of dynamic panel models

Table 7 presents the results from two-step dynamic Generalized Method of Moments (GMM) estimation. The tests AR (1) and AR (2) of Arellano and Bond (1991) show that the residues are correlated in the first order and not in the second order. The p values obtained by the AR (2) test and the Sargan test for the model exceed 0.05, suggesting that the model is correctly specified.

For the whole sample, the estimated speed of adjustment (SOA) coefficient is about 0.85 (1−0.15). It means that KSA firms can close 15% of the gap between their actual and desired level of cash reserves within one year. This result indicates that a typical firm requires approximately 1.176 (1/0.85) years to adjust toward its target level of cash reserves.

The adjustment speed (0.85) of listed KSA firms toward target cash reserves is higher than the adjustment speed reported in other countries. For example, Rehman and Wang (2015) report an estimated annual SOA of cash of 0.45 for Chinese firms. Dittmar and Duchin (2011) find a SOA of cash for US firms ranging between 0.29 and 0.43. Guney, Ozkan, and Ozkan (2003) document similarities in the adjustment coefficients across countries. Their results show an SOA of 0.558, 0.556, 0.602, and 0.561 for French, German, UK, and Japanese firms, respectively.

According to Ozkan and Ozkan (2004), one possible explanation for the relatively high value of the adjustment coefficient might be that the costs of deviating from the target are significant and firms' cash holdings are persistent over time.

Table 6
Logistic regression results.

Independent variables	Coefficient	z-stat.
LEV	−3.83	−5.71***
DIVY	2.03	0.87
PROF	0.79	079
Q	−0.01	−0.36
SIZE	0.40	2.69***
CAPEX	−0.87	−1.74*
NWC	−0.96	−1.42
CFVOL	−0.03	−1.78*
Intercept	−2.66	−2.04**
Observations	630	
LR(χ^2)	53.67***	
Pseudo R^2	0.06	

For each variable, the coefficient value is followed by the value of Wald (z) with the significance levels: *** ($p < 0.01$), ** ($p < 0.05$) and * ($p < 0.1$). LR(χ^2): regression significance test.

Table 7
Estimation results for the dynamic GMM model.

Independent variables	Whole sample		Petrochemical industry		Non-petrochemical industries	
	Coefficient	z-stat.	Coefficient	z-stat.	Coefficient	z-stat.
CASH(t-1)	0.15	5.59***	0.14	2.28**	0.15	5.27***
LEV	−0.42	−3.96***	0.18	2.09**	−0.65	−5.14***
DIVY	−0.11	−0.49	−0.01	−0.02	−0.20	−0.82
PROF	0.15	1.45	0.22	1.58	0.18	1.57
Q	−0.00	−0.35	0.03	1.44	−0.00	−0.26
SIZE	0.49	5.66***	0.19	3.15***	0.61	5.77***
CAPEX	−1.50	−16.60***	−1.24	−12.25***	−1.51	−14.94***
NWC	−1.26	−16.42***	−0.28	−2.59***	−1.35	−16.09***
CFVOL	−0.01	−1.44	−0.01	−3.63***	−0.01	−1.47
OIL	−0.00	−0.93	−0.01	−4.68***	−0.00	−0.19
Intercept	−0.13	−3.81***	−0.02	−4.78***	−0.01	−2.97***
Observations	490		84		406	
Sargan test	Chi2 (27) = 62.58		Chi2 (27) = 27.63		Chi2 (27) = 49.87	
	Pr > Chi2 = 0.098		Pr > Chi2 = 0.430		Pr > Chi2 = 0.172	
AR(1)	z = −5.35 Pr > z = 0.000		z = −1.77 Pr > z = 0.076		z = −5.00 Pr > z = 0.000	
AR(2)	z = −1.36 Pr > z = 0.17		z = −0.66 Pr > z = 0.51		z = −1.23 Pr > z = 0.22	

Notes: 1. The Sargan test has $\chi 2$ distribution and tests the null hypothesis of significance of the validity of the instruments used, against the alternative hypothesis of non-validity of the instruments used. 2. The AR (1) tests the null hypothesis of absence of first order autocorrelation, against the alternative hypothesis of existence of first order autocorrelation. 3. The AR (2) tests the null hypothesis of absence of second order autocorrelation against the alternative hypothesis of existence of second order autocorrelation.4. *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

For the two sub-samples, we find similar SOA. The estimated speed of adjustment (SOA) coefficients are about 0.84 and 0.85. Hence, petrochemical firms require approximately 1.19 years to adjust toward their target level of cash reserves, while non-petrochemical firms require approximately 1.176 years.

In addition to the estimates for the adjustment coefficients, table 8 also presents the estimates for the determinants of the target cash ratio. Most of the results are relatively similar to those in Table 6. The coefficient associated to leverage (LEV), capital expenditure (CAPEX) and net working capital (NWC) are negative and significant. The coefficient associated to firm size (SIZE) is positive and significant. The coefficients on the cash flow volatility and oil price are significant only for petrochemical firms.

6. Conclusion

This paper has investigated the empirical determinants of corporate cash holdings of KSA listed firms over the period 2006–2014 using both static and dynamic panel models. The main motivation of this study lies in the specific characteristics of Saudi business context. Kingdom of Saudi Arabia is an oil rich country, the stock market is relatively underdeveloped and an Islamic banking system is present, the legal origin is based on sharia law. Accordingly, our main objective in this study is to provide new evidence on the financial determinants of cash holdings in a specific emerging market.

First, we conduct our regressions on the overall sample and two sub-samples of firms: petrochemical and non-petrochemical firms. To examine the cash holdings determinants, we use three regressions: OLS, random effect and fixed effect. To sum up, we detect that, for the whole sample, leverage, firm size, capital expenditure, net working capital and cash flow volatility impact cash holdings. When we conduct our regressions on the two sub-samples, we find that some results are similar for the two categories of firms and some of them are specific to each one. The results show that petrochemical and non-petrochemical firms decrease their cash level with investment level and level of liquid assets substitutes of cash. For petrochemical firms, our results indicate that dividend yield, profitability, firm size, cash flow volatility and oil price are the specific determinants of cash holdings. However, for non-petrochemical firms, we report that leverage is the only specific determinant of cash holdings.

Overall, we provide further evidence that trade-off theory, pecking order theory and agency cost theory play important roles in understanding cash holdings in developing countries.

Second, we investigate the characteristics of high liquid firms (conservative firms). The results indicate that conservative firms are less leveraged, have large size, have low investment expenditures and have low cash flow fluctuation.

Finally, we analyze KSA firms' speed of adjustment towards an endogenous target cash ratio. Our analysis reveals that there are significant dynamic effects in the determination of firms' cash holdings. The estimated adjustment coefficient from dynamic panel model is about 0.85, indicating that KSA firms adjust quickly towards their target cash ratio. One possible explanation for the relatively high value of the adjustment coefficient might be that the costs of deviating from the target are significant and firms' cash holdings are persistent over time (Alles et al. 2012; Ozkan & Ozkan, 2004).

The high speed of adjustment of cash reserves of KSA firms leads to conclude that managers follow a conservative financial policy. As stated by Drobetz and Grüninger (2007), conservative financial policies are often criticized as serving the interests of managers rather than those of shareholders.

Therefore, it is important, in future work to explore whether cash holdings have positive or negative valuation impacts on KSA firms. Further, the governance system in KSA is different from other contexts. The legal system of Saudi Arabia is derived from Islamic law. The Sharia compliant companies have different characteristics from traditional companies. Consequently, it is interesting, for future research, to investigate the effect of corporate governance on cash holdings behavior in Sharia compliant companies.

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