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Optimal level, Partial Speed of Adjustment and Determinants of Corporate Cash Holding: Evidence from MENA Countries

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This paper investigates the existence of an optimal cash level, speed of adjustment, and cash holding determinants. The threshold regression and dynamic model were used in this study on four MENA countries from 2007 to 2018. The findings show there is a nonlinear relationship between cash level and firm's value which is consistent with the trade-off theory. Furthermore, our study confirms that firms holding cash above the optimal level of having a lower speed of adjustment than the firms with cash levels below the optimal level with size, growth, and net-working capital being key corporate cash determinants. Our results extend the theoretical implications of the trade-off theory to MENA countries and would help corporate policymakers to adjust their cash levels within the thresholds' levels to maximize their firm value.

Keywords: *Cash holding; MENA region; Threshold regression; Trade-off.*

JEL Classification: G32

Introduction

It has become crucial within the corporate finance literature to study the cash behavior of companies. The manner by which companies tend to spend their cash and whether those companies target an optimal cash value will give more insights on how they seize external opportunities and remedy their internal conflicts. Major companies like Berkshire Hathaway have built-up a cash pile of more than USD125 billion by the end of December 2019 which raises many questions about why and for what purpose cash holdings are being built-up (Mohamed, 2020).

The most simplistic way to think about cash level is by making a balance between the benefits and costs of cash holding (Kim et al., 1998). Eventually, the optimal shall be reached when an additional unit of cash offsets its benefit. Furthermore, the variable of firm value is very important as the ultimate goal of a corporate manager would be firm value maximization. On one hand, the benefits of holding cash are mainly to secure financing for the firm's transactions and investment plans. On the other hand, the main cost of retaining cash is tax disadvantage and opportunity costs related to the unproductive nature of cash (Tahir et al., 2016).

One of the earlier discussions on cash holding was reported by Keynes (1936) with the liquidity preference theory which can explain most the corporate behavior around the cash variable. Keynes states that people hold money for three reasons: to cover their basic transactions (transaction motive), to hedge against un-

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expected events (precautionary motive), and to take benefit if the price would fall (speculation motive). However, the precautionary motive has become obsolete due to today's technological and financial improvements. Indeed, firms can now manage easily against all types of risks and firms can relatively secure financing to meet their basic transaction need. The Modigliani & Miller's theorem refutes the transaction motive as companies can easily go to capital markets to finance their profitable investment projects at negligible transaction costs (Modigliani & Miller, 1958). Similarly, the transaction cost does not hold for large companies as these transaction costs tend to be offset by the economies of scale (Mulligan, 1997).

Beside Keynes' work, many theories have tried to explain the corporate cash behavior through studying its optimal, deviation from this optimal and what determines the cash holding. Jensen (1986) agency theory serves as a good theoretical background for cash holding when companies started accumulating large amounts of cash in their balance sheets. It would be expected, according to the agency theory, that companies would retain more cash in the absence of good investment opportunities and managers decide not to return the cash to the shareholders. Nevertheless, the continuous trend to stock a huge pile of cash by companies has led to raising other factors to explain corporate cash levels.

In addition to that, there is also a tax motive that affects the cash level in firms. Indeed, companies facing high taxation on foreign earnings tend to hold more cash than nationwide companies. Thus, empirical studies have found various standardized cash levels among companies across different capital markets which indicate the existence of a targeted level that serves the value maximization purpose (Dittmar & Mahrt-Smith, 2007; Ferreira & Vilela, 2004; Gunney et al., 2003; Kalcheva & Lins, 2003).

Hence, the reason to study optimal cash level is important in order to provide both managers and shareholders with a proxy level by which the firm's value is maximized. Also, Jensen (1986) affirms that when managers have access to excess cash-flows they tend to waste it on value-destroying activities such as empire building. On the other hand, Liedgren & Carlsson (2009) reports that firms holding too much cash can also become targets for activist investors or LBO-transactions.

One of the main problems facing corporate cash studies in emerging countries is the weak corporate governance framework. Indeed, it is found that the relationship between cash levels and firm value in countries with poor investor protection is much weaker than in developed countries (Opler et al., 2001; Pinkowitz et al., 2006). Our paper contributes to the literature on cash holding decisions of firms on several grounds. First, fewer studies have investigated the cash holding behavior in emerging countries which will give another perspective on these countries through our study on the MENA and will offer more explicit evidence to support the trade-off theory.

Previous studies in the MENA region have investigated the relationship between corporate governance and cash holding. To the best of our knowledge, there has not been a study on how MENA countries adjust their corporate cash holding and what optimal level do they target. Indeed, the reason we chose MENA countries relate to the fact that corporate cash holding is poorly investigated in these countries as a bloc. Additionally, corporate cash holding in developing countries is an important issue to study as political and economic instability weights on corporate managers to adjust their cash holdings under these constraints. Indeed, countries with poor investors' protection deviate from the common established theory of cash and firm value relationship. Pinkowitz et al. (2006) confirm that the relation between cash holding and firm value is absent in those countries. Hence, this paper aims to bridge the empirical gap in this region by providing an empirical overview on the cash decision in the MENA region.

Moreover, our paper make use of a non-linear model to estimate the optimal cash level which defines more relevantly the concave function between cash and firm value. Indeed, previous studies (Azmat, 2014; Guangming & Fang, 2013; Siddiqua et al., 2019) have a linear regression model to estimate the optimal level.

Hence, the use of a threshold regression would give more insights on the optimal cash level in MENA countries. Using both the threshold regression to estimate the optimal level and a dynamic model to analyze partial adjustment, our paper would then give a general overview on corporate cash holdings decision in the MENA region.

The first section will present a brief literature review on past corporate cash holding studies. The following section will introduce our data and research design. Finally, results and discussion will be presented in the third section.

Literature Review

In the presence of a frictionless world, the absence of liquidity premiums and taxes would be pointless for firms. Hence, corporate cash decisions would be irrelevant as they will not affect the firm's value (Opler et al., 2001). Nevertheless, market imperfections experienced in practice would imply that an optimal cash level exists that maximizes the firm's value. The optimal level stands at the point where the marginal cost of cash matches the marginal benefits of cash (Martinez-Sola et al., 2013).

The corporate finance literature has dedicated much attention in recent years to study corporate cash behavior and its effect on the firm's value (Ashhari & Faizal, 2018; Tong, 2011; Zhang & Ling, 2016). The first papers to study corporate cash have assumed that an optimal level of cash exists and that companies tend to adjust their levels (Kim et al., 1998; Martinez-Sola et al., 2013; Opler et al., 2001; Ozkan & Ozkan, 2004). Four main theories have addressed the issue of cash holding: information asymmetries, agency costs, and the transaction model.

The existence of information asymmetry between creditors and debtors implies that firms will retain more cash to cover for their investment plans. Indeed, the problems of adverse selection will make it difficult for firms to raise external funds. Pecking order theory explains that firms in this case will make a hierarchy in their financing by using internal funds before appealing for markets (Myers & Majluf, 1984). As for the cost of holding cash, the problem of under-investment caused by the same information asymmetry can be offset by using retained cash to finance risky investment (Martinez-Sola et al., 2013). In addition to that, growth companies are expected to hold more cash to finance their projects. The case where these companies have high bankruptcy costs implies that they need to hold more cash to avoid financial distress (Harris & Raviv, 2008; Shleifer & Vishny, 1986).

Additionally, cash holding might raise agency problems between shareholders and managers when the latter chose to finance value-destroying projects instead of returning cash to shareholders (Jensen & Meckling, 1976). In fact, managers would retain cash either to pursue their own objectives or to avoid market discipline through takeovers for example. Shleifer and Vishny (1986) reported that when shareholders are mainly independent, the likelihood of takeovers on the firms becomes easy encouraging managers to build considerable cash holding. This situation creates an adverse effect on the firm as every dollar of cash retained would increase the firm's value by less than one dollar (Opler et al., 1999). As stated before, the fact that growth companies tend to hold more cash is also related to the existence of agency costs. These companies are often presented with risky investment and greater growth opportunities which make external funding expensive for them (Myers, 1977).

Opler et al. (1999) give much insight into Keynes' transaction model for cash. They show that the existence of an optimal cash level comes from the fact that in order for firms to raise outside funds, they must face transaction costs in the form of fixed and proportionate costs. Thus, this must be undertaken by liquidating assets, cutting investment, or dividends to pay for these costs. Consequently, the optimal level is achieved when the marginal costs of holding costs i.e. lower pecuniary return and the benefit of holding cash i.e. seize the opportunity to access external funding with lower costs. In addition to that, holding cash becomes crucial for specialized firms with firm-specific assets (Shleifer & Vishny, 1986). Indeed, for such firms, it becomes hard to raise funds through

asset selling in comparison to well-diversified firms with assets to sell.

Consequently, holding cash raises two mainstream discussions among academic literature; firms can either hold cash to pass over markets in financing their investments plan or holding excess cash might lead to conflicts and distorted behavior form managers against shareholders. This raises the issue of the firm's adjustment to meet the optimal level. Indeed, firms are expected to undertake adjustment movement downward or upward to keep their cash holding within the optimal level. Accordingly, firms with higher levels of cash holdings have a higher speed of adjustment than firms with cash deficiency (Jiang & Lie, 2016). Additionally, Rehman et al. (2016) suggest that the speed of adjustment downward is much higher than upward adjustment. Firms would have more to bring down their cash levels like loan payments or dividends along with lower costs associated with this adjustment.

In relation to previous empirical studies on optimal cash holding, Opler et al. (1999) conduct one of the first empirical studies on the US market which confirm the existence of an optimal cash level. Similarly, Tong (2011) investigates the optimal level on US firms and report that deviation from the optimal cash level reduces the value of cash to shareholders which is consistent with the trade-off theory. Likewise, previous studies like (Azmat, 2014; Martinez-Sola & Garcia-Teruel, 2011; T. Nguyen et al., 2016), confirm that a nonlinear relationship exists between cash and firm's performance. Accordingly, the trade-off theoretical framework stipulates the existence of an optimal cash level. Hence, the first research hypothesis shall be formulated as follow:

(H1): *A nonlinear relationship exists between cash holdings and firm's performance amongst MENA region listed non-financial companies.*

Numerous studies have investigated cash holding and partial adjustment in developing countries. Lian et al. (2012) carried out research on the Chinese market and reported that asymmetric adjustments are made to the optimal level. Moreover, firms rely on debt and equity financing to fill their cash shortages to meet the optimal level. Similarly, Siddiqua et al. (2019) conducted a study on the Pakistani market using a dynamic model. They found that firms adjust their cash holding toward the optimal level and that firms with levels above the optimal tend to have higher adjustment speed. Azmat (2014) prove that an optimal cash holding exists using a dynamic-model in the Pakistani market and that a deviation from this optimum affects firm value negatively. Venkiteshwaran (2011) conducted a study on US firms investigating their partial adjustment toward their optimal cash level. He reports that firms rapidly correct towards their optimal levels which can be brought to two years. This shows that companies do target an optimal cash level that maximizes their value. Cahyono et al. (2019) explored the optimal cash holding speed adjustments among Indonesian firms and found that any deviation from the optimal cash negatively affects the firm's value and that investment, managerial ownership, institutional ownership, and debt moderate this adjustment. Thus, as previous empirical studies like (Lian et al., 2012; T. L. H. Nguyen et al., 2016; Siddiqua et al., 2019; Venkiteshwaran, 2011) have confirmed the existence pf dynamic adjustment of firms toward the optimal level with firms having asymmetric adjustment speed, we develop the following hypothesis:

(H2): *There is an adjustment speed by firms toward their optimal cash holding.*

Research Methods

In order to estimate the optimal level of cash holding, a simplistic way of doing so is determined by a trade-off between costs and benefits of having liquid assets to derive an optimal cash level (Kim et al., 1998). The optimal cash level should be the point where marginal costs of cash just offset the marginal benefits (Martinez-sola, 2013). In order to do this, a threshold regression model will be employed to conduct our study.

The reason for choosing the threshold regression model relates to the heterogeneity problems in panel data. The classical fixed effect or

Table 1. Variable Description

Variable	Proxy
Cash	Cash and equivalent divided by total assets
Size	Natural Logarithm of total assets
Growth	Annual growth rate of sales
ROA	Operating income of total assets
NWC	Net working capital is measured by taking the difference of current assets and current liabilities on total assets
Lev	Leverage is measured as total debt on total book value of equity
CAPEX	Capital expenditure is the ratio of firm's total capital expenditure to firm's total assets

Source: Authors' estimate (2020)

random effect reflects only the heterogeneity in intercepts. Hence, Hansen (1999) proposes a panel threshold model to solve this problem and creates new insights for economic policy and financial analysis. Though threshold models are familiar in time-series analysis, their use with panel data has been limited (Wang, 2015). Our use for this model will serve to catch the non-linear feature of cash holding with the firm's value.

Before presenting our model, Table 1 details variables used in both the threshold and dynamic model.

The general presentation of the model in relation to our case of study can be expressed as follow:

$$ROA_{i,t} = \begin{cases} \mu_i + \theta' H_{it} + \beta_1 CASH_{it} + \varepsilon_{i,t} \\ if CASH_{it} \le \gamma \\ \mu_i + \theta' H_{it} + \beta_2 CASH_{it} + \varepsilon_{i,t} \\ if CASH_{it} > \gamma \end{cases} \quad (1)$$

Where $\theta'=(\theta_1, \theta_2, \theta_3)$ are the estimated regression coefficients and $H_{it}=(Size_{it}, Growth_{it}, LEV_{it})$ and ROA (Return on Total assets) represents the proxy for firm's performance. CASH is an explanatory variable and the threshold variable. Control variables were selected to be the size, the company growth and the company leverage. The γ is the threshold value and ε_{it} is the error, assumed to be independent and normally distributed.

In order to run our threshold regression, we should test first the null hypothesis of no threshold effect, H_0: $\beta_1 = \beta_2$ based on the likelihood ratio test: $F_1=(S_0-S_1(\hat{\gamma}))/\hat{\sigma}^2$, where S_0 and $S_1(\hat{\gamma})$ are sum of squared errors under null and alternative hypothesis, respectively. However, as the asymptotic distribution of F_1 is non-standard, the authors use the procedure of bootstrap to construct the critical values and P-value. If a threshold effect exists which is equal to H_0: $\beta_1 \neq \beta_2$, the authors should test for the asymptotic distribution of threshold estimate, H_0: $\gamma = \gamma_0$, and adopt the likelihood ratio test: $LR_1=(S_1(\gamma)-S_1(\hat{\gamma}))/\hat{\sigma}^2$ with the asymptotic confidence intervals: $c(\alpha) = -2\log(1-\sqrt{1-\alpha})$.

If there is a double threshold, the model can be modified as follow:

$$ROA_{i,t} = \begin{cases} \mu_i + \theta' H_{it} + \beta_1 CASH_{it} + \varepsilon_{i,t} \\ if\ CASH_{it} \le \gamma_1 \\ \mu_i + \theta' H_{it} + \beta_2 CASH_{it} + \varepsilon_{i,t} \\ if\ \gamma_1 < CASH_{it} \le \gamma_2 \\ \mu_i + \theta' H_{it} + \beta_3 CASH_{it} + \varepsilon_{i,t} \\ if\ CASH_{it} > \gamma_2 \end{cases} \quad (2)$$

The original static model derived from the earlier work of Opler et al. (1999) and Pinkowitz et al. (2006), the cash holding determinants equation can be expressed as follow:

$$Cash_{it}^{*} = \delta_0 + \beta_1 NWC_{it} + \beta_2 SIZE_{it} + \beta_3 Growth_{it} + \beta_4 LEV_{it} + \beta_5 CAPEX_{it} + \eta_i + \lambda_t + v_{it} \quad (3)$$

The star in the term Cash denotes the equilibrium or the optimal level expressed by the fitted line of the equation. Taking into consideration that cash adjustment toward the optimal level takes time through a partial adjustment process, the cash dynamic can then be expressed as follow:

$$Cash_{it} - Cash_{it-1} = \gamma(Cash_{it}^{*} - Cash_{it-1}) + \delta_{it} \quad (4)$$

Table 2. Descriptive Statistics

Variables	Observations	Mean	Median	SD	Min	Max
ROA	1152	3.1561	1.3243	10.3163	-56.1426	78.9852
CASH	1152	0.0779	0.0385	0.1069	0.0000	0.6973
SIZE	1152	11.2320	10.9571	1.5962	7.7417	15.8203
SG	1152	0.8873	0.0369	15.9731	-44.1787	445.3806
LEV	1152	1.5841	0.1209	13.6679	-134.9396	318.5263
NWC	1056	1.7728	0.2559	8.6090	-42.1854	86.0745
CAPEX	1056	0.3441	0.3178	0.2351	0.0002	0.9057

Note: ROA represents company performance; CASH represents the percentage of cash held by the company; SIZE represents company size; SG represents company growth; LEV represents company leverage. NWC represents net working capital. CAPEX represents capital expenditure.
Source: Authors' estimate (2020)

Table 3. Unit Root Test Results

Variables	LLC		IPS	
	t-statistic	*P*-value	*z*-statistic	*P*-value
ROA	−13.0998	*** 0.0000	−7.4723	*** 0.0000
CASH	−1.0e+02	*** 0.0000	−8.5102	*** 0.0000
SIZE	−3.0145	*** 0.0013	−3.9788	*** 0.0000
SG	−1.3e+02	*** 0.0000	−12.761	*** 0.0000
LEV	−3.4467	*** 0.0003	−8.7616	*** 0.0000
NWC	−16.6176	*** 0.0000	−4.8337	*** 0.0000
CAPEX	−6.4275	*** 0.0000	−2.6212	*** 0.0044

*Note: LLC and IPS are unit root tests of Levin et al. (2002) and Im et al. (2003) respectively. *** indicates significance at 1%.*
Source: Authors' estimate (2020)

By replacing the value of $Cash_{it}^{*}$ in Equation (2) by the expression above, we get the following model:

$$Cash_{it} = \beta_0\gamma+(1-\gamma)Cash_{it-1}+\gamma\beta_1 NWC_{it} +\gamma\beta_2 SIZE_{it}+\gamma\beta_3 Growth_{it}+\gamma\beta_4 LEV_{it} +\gamma\beta_5 CAPEX_{it}+\eta_i+\lambda_t+v_{it} \quad (5)$$

By simplification, equation (5) can be written as follow:

$$Cash_{it} = \alpha+\rho Cash_{it-1}+\delta_1 NWC_{it}+\delta_2 SIZE_{it} +\delta_3 Growth_{it}+\delta_4 LEV_{it}+\delta_5 CAPEX_{it} +\eta_i+\lambda_t+v_{it} \quad (6)$$

Where $\alpha=\gamma\delta_0$; $\rho=(1-\gamma)$; $\delta_k=\gamma\beta_k$; $v_{it}=\gamma\varepsilon_{it}$; The variable η_i is the unobservable heterogeneity or the firm's unobservable individual effects. The variable λ_t is a time dummy that changes in time but is equal for all firms in each of the time periods considered. Finally, parameters v_{it} are random disturbances. A two-step generalized method of moments (GMM) estimator will be used to resolve the issue of endogeneity and to estimate Equation (6).

Our data is retrieved from the DataStream database from the annual financial statements of active non-financial firms from 2007 till 2018. With this sampling method, data collected includes 96 non-financial companies after cleaning our data for any missing values and for companies newly listed on the stock exchange. In addition to that, some firms within our sample have negative book value of equity. We have proceeded to clean the data accordingly from negative equity values along with abnormal values using Winsor technique at 1%.

Results and Discussions

Descriptive statistics

Table 2 below presents descriptive statistics for the variables in the model. The results show that the average ROA on the MENA region is 3.16%, meaning that for each dollar used, the company is able to generate USD0.03 in operating income. The mean value for cash is 8% with the standard deviation of 10,6%. The average leverage ratio of our sample is quite high at 158% with the standard deviation of 8.63.

Table 4. Test Results of Threshold Effect of Cash Holding Ratio on Firm's Performance

Threshold value	*F*-statistic		Test critical values		
	F-statistic	P-value	1%	5%	10%
Single-threshold test					
0.2588	19.0196	0.06*	49.3888	21.6447	17.4163
Double-threshold test					
0.0068	17.2577	0.01***	15.4895	12.4517	11.3720
0.2588					
Triple-threshold test					
0.0068					
0.1406	9.0181	0.18	24.8206	14.2873	11.2817
0.2588					

*Note: F-statistics and P-value were obtained by executing a repeating bootstrap procedure 100 times for each bootstrap test. *** indicates significance at 1%; * indicates significance at 10%.*

Source: Authors' estimate (2020)

Table 5. Estimated Results of Regression Coefficient for Cash Holding Ratio

Coefficients	Estimated value	OLS SE	White SE	t_{OLS}	t_{White}
β_1	-22.7716	17.0066	11.8349	-1.3390	-1.9241*
β_2	44.1679	5.3276	9.1323	8.2903***	4.8364***
β_3	19.4585	4.4196	4.9836	4.4028***	3.9045***

*Note: β_1, β_2 and β_3 are the coefficients of the cash holding ratio variable corresponding to each value of the threshold. *** indicates significance at 1%; * indicates significance at 10%.*

Source: Authors' estimate (2020)

The average growth rate of operating sales is 89% and size by the average log of total assets is 11.23. Average value for net working capital is 1.77 with a standard deviation of 8.61. The mean value for capital expenditure is 0.34 with a standard deviation of 0.24.

Unit Root Test Results

The threshold regression model requires that all variables should be stationary to avoid spurious regression. We have used Levin et al. (2002) and Im et al. (2003) tests to check for unit root. The results are shown in table 3 below. According to both test, all variables are stationary and statistically significant at 1%.

Test results of threshold effect of cash holding ratio on firm's performance

We have used GAUSS software to estimate our model and applied bootstrap to obtain the F-statistics and the p-values. Hence, table 4 shows the results of single-threshold, double-threshold and triple-threshold tests.

We have first examined for the existence of a single-threshold, we obtained F-statistics and p-value of 19.0196 and 0.06 (>5%), respectively. We have then rejected the null hypothesis at the level of 5%. Similarly, we examined the existence of a double-threshold and obtained an F-statistics and p-value of 17.2577 and 0.01 (≤1%). The results suggest that that existence of a double-threshold is confirmed and statistically significant at 1%. Finally, the hypothesis of a triple-threshold is rejected as F-statistics and p-value are 9.0181 and 0.18 (>10%), respectively.

Thus, our results show that a double-threshold exists and significant at 1%. The values of our thresholds are 0.0068 and 0.2588. The first-step threshold occurs at 0.0068 and then the second-step threshold occurs at 0.2588 which divides our sample into three regions.

Table 5 shows the estimated coefficient, standard deviations according to the OLS and White methods. Our results show that all coefficients are statistically significant for the three regions of our model.

When the Cash is smaller than 0.68%, the proxy for the firm's value will decrease by 22.77% when the cash increases by 1%. Similarly, the ROA will increase by 44.17% when the cash value increases by 1% between 0.68% and 25.88%. Eventually, the ROA will increase by 19.46% if the cash increases by 1%

Table 6. Estimated Results of Coefficients for Control Variables

Coefficients	Estimated value	OLS SE	White SE	t_{OLS}	t_{White}
θ_1	0.0444	0.0159	0.0110	2.8006***	4.0482***
θ_2	2.1584	0.9520	1.1323	2.2672***	1.9062*
θ_3	-0.1187	0.0194	0.0449	-6.1021***	-2.6444***

*Note: θ_1, θ_2 and θ_3 are the estimated coefficients of company's size (SIZE), company's growth (SG), and leverage (LEV). *** indicates significance at 1%; * indicates significance at 10%.*
Source: Authors' estimate (2020)

Table 7. Number of Companies in Each Threshold by Year

Year	$CASH_{i,t}$ of ≤ 0.68%		0.68% < $CASH_{i,t}$ of ≤ 25.88%		$CASH_{i,t}$ of > 25.88%	
	Number	Percentage (%)	Number	Percentage (%)	Number	Percentage (%)
2007	13	14%	72	75%	11	11%
2008	13	14%	76	79%	7	7%
2009	21	22%	69	72%	6	6%
2010	18	19%	74	77%	4	4%
2011	21	22%	70	73%	5	5%
2012	19	20%	71	74%	6	6%
2013	25	26%	66	69%	5	5%
2014	24	25%	65	68%	7	7%
2015	28	29%	63	66%	5	5%
2016	21	22%	71	74%	4	4%
2017	26	27%	64	67%	6	6%
2018	21	22%	70	73%	5	5%
Total	250	22%	831	72%	71	6%

Source: Authors' estimate (2020)

above the level of 25.88%.

Table 6 shows the estimated coefficient, standard errors according to the OLS and White method for our control variables. It shows that all our variables (Size, Growth, and Leverage) are statistically significant. Our results show the estimated coefficient of the company's size (θ_1) is 0.0444 indicate a positive relationship with the ROA at 1% level which is consistent with Abor (2005). The growth coefficient (θ_2) is 2.1584 at 1% level indicating a positive relationship with the firm's performance. This results that growth is a factor in increasing company's efficiency which is consistent with the findings of Abor (2005) and Nguyen (2019). At the same time the estimated coefficient for company's leverage is -0.1187 and is inversely related to ROA at 1% which is consistent with the finding of (Abor, 2005; Vijayakumaran & Atchyuthan, 2017).

From the above results, the estimated model can be expressed as follow:

$$\begin{aligned} ROA_{i,t} = \mu_i &+ 0.0444 Size_{i,t} + 2.1584 Sg_{i,t} - 0.1187 Lev_{i,t} \\ &- 22.7716 Cash_{i,t} I(Cash_{i,t} \leq 0.0068) \\ &+ 44.1679 Cash_{i,t} I(0.068 < Cash_{i,t} \leq 0.2588) \\ &- 19.4585 Cash_{i,t} I(Cash_{i,t} \leq 0.2588) + e_{i,t} \end{aligned} \quad (6)$$

Table 7 shows the number of companies at each threshold level. Our results show over our studied period, 22% of our companies are having a threshold of less than 0.68% (meaning that about 13 to 28 companies fall into each year under the first threshold). Similarly, 72% of our companies fall into the second category of having a threshold between 0.68% and 25.88% (meaning that about 63–76 companies fall into this threshold each year). At the same time, 6% of the companies are having a cash level above 25.88% (meaning that about 4 to 11 companies fall into each year under this threshold).

Determinants of the CASH and speed of adjustment

Table 8 represents correlation between all the variables of study. The last column corresponds to the variance inflation factor (VIF). The results do not present any collinearity problem for multivariate analyses.

Arellano and Bond dynamic panel data model (GMM) is used to estimate Equation (6). Table 9 corresponds to the results of panel data regression for overall firms and each threshold. Results in table 9 show that firms within the

Table 8. Correlation Matrix and VIF Test

	CASH	NWC	SIZE	SG	LEV	CAPEX	VIF
CASH	1.0000						
NWC	-0.0102	1.0000					1.04
SIZE	0.0101	*-0.0734	1.0000				1.02
SG	-0.0045	-0.0167	-0.0329	1.0000			1.00
LEV	-0.0384	*0.1818	*0.0683	-0.0051	1.0000		1.05
CAPEX	*-0.1486	-0.0273	-0.0445	0.0020	*-0.0709	1.0000	1.01

Note: CASH represents the percentage of cash held by the company. SIZE represents company size; SG represents company growth. LEV represents company leverage. NWC represents net working capital. CAPEX represents capital expenditure.

Source: Authors' estimate (2020)

threshold level [0,68%:25.88%] have an adjustment rate toward the optimal level of 0.42 confirming the existence of partial adjustment policy followed by these firms. The coefficient of the lagged variable cash is 0.58 with a t-value of 76.72 which indicates that MENA region firms target an optimal level of cash following the trade-off theory.

In other terms, firms take 2.38 (1/0.42) year to adjust for the optimal level. The delay in adjusting their levels comes from the fact that adjustment movements entail costs which halts the immediate adjustment toward the optimal level. These results are consistent with previous studies by (Rehman et al., 2016; Siddiqua et al., 2019).

On the other hand, both firms below and above the threshold interval have a positive and statistically significant lagged cash coefficient indicating the presence of trade-off behavior across symmetry. Hence, firms below the threshold level (≤ 0.68%) have an adjustment rate 0.79 lower than the adjustment rate for the firms above the threshold level (> 25.88%). Indeed, it takes 1.27 years for firms below the threshold to reach the optimal while it takes 3.57 years for firms above the optimal level.

Accordingly, our results show that downward adjustment speed is lower than upward adjustment speed which is consistent with Rehman et al. (2016) and siddiqua et al. (2019). We can say that these findings confirm our hypothesis that downward adjustment speed toward the optimal threshold level is higher than upward adjustment speed.

Regarding corporate cash determinants, our results indicate that net working capital, size and growth have a significant and negative relationship with cash holding. The negative relationship between cash and size indicates that smaller firms tend to hold more cash to finance their activities as they tend to have unfavourable terms accessing other forms of external financing. This is in line with the trade-off theory and empirically proven by previous studies (Akben-Selcuk & Altiok-Yilmaz, 2017; Bates et al., 2009; Pinkowitz & Williamson, 2001).

Similarly, firms with liabilities due in short term tend to hold more cash to honour their financial obligations confirming the predictions of the trade-off theory (Artica et al., 2016). Also, Ferreira & Vilela (2004) suggest that net working capital can be used as a substitute for cash which can easily be converted to cash confirming the negative relationship between cash holding and net working capital. Finally, firms with growth opportunities tend to hold less cash. Our results do not confirm previous studies linking growth opportunities with extra cash holding and rising agency costs (Opler et al., 1999; Ozkan & Ozkan, 2004; Rehman et al., 2016; Siddiqua et al., 2019).

To test for the validity of our estimation, we have conducted Hansen and Arellano-Bond tests which yielded statistically insignificant results for all our samples. Note that Sargan tests for robustness of model and Abond tests for second-order autocorrelation and it has confirmed the absence of second-order autocorrelation in the model.

Conclusions

The present paper tried to investigate the existence of an optimal cash level for the MENA region countries. According to the trade-off theory, the existence of an optimal levels lies on the case where holding cash comes with costs and

Table 9. Determinants of Variable CASH and Speed of Adjustment

Variables	Coefficients			
	Overall Firms	$CASH_{i,t} \leq 0.68\%$	$0.68\% < CASH_{i,t} \leq 25.88\%$	$CASH_{i,t} > 25.88\%$
CASH_L1	0.8754 (182.78)***	0.2121 (132.52)***	0.5848 (76.72)***	0.7192 (6.32)***
NWC	-0.0025 (-8.73)***	-0.0001 (-2.80)***	0.0010 (1.83)*	0.0063 (0.17)
SIZE	-0.0017 (-5.40)***	-0.0003 (-3.41)***	-0.0031 (-5.68)***	-0.0019 (-0.16)
SG	-0.0001 (-4.81)***	-0.0010 (-14.75)***	-0.0001 (-2.80)***	0.1910 (1.77)
LEV	-0.0001 (-1.68)	0.0002 (7.96)***	0.0004 (3.30)***	0.1245 (0.54)
CAPEX	0.0034 (0.31)	0.0060 (8.01)***	-0.0646 (-8.39)***	-0.2010 (-0.59)
_Cons	0.0298 (5.85)***	0.0043 (5.46)***	0.0811 (13.34)***	0.1837 (1.19)
Adj. rate $(1-\rho)$	≈ 0.1246	≈ 0.7879	≈ 0.4152	≈ 0.2808
Arellano-Bond test for AR(2)	0.070	0.247	0.160	0.298
Hansen test	0.255	0.998	0.341	1.000
Observations	880	176	651	53

*Notes: GMM is Arellano and Bond estimation. t-test values are given in parentheses. CASH _L1 is the lagged cash variable. SIZE represents company size; SG represents company growth. LEV represents company leverage. NWC represents net working capital. CAPEX represents capital expenditure. *** indicates significance at 1%; * indicates significance at 10%.*

Source: Authors' estimate (2020)

benefits. Hence, the point where firm's value is maximized corresponds to the optimal point of the concave function between cash holding and firm's value. Hence, our study used the model developed by Hansen (1999) to estimate the optimal levels of cash within four countries of the MENA region from 2007 to 2018. Accordingly, we have used the return on assets (ROA) as a proxy for firm's value and the ratio of money and cash equivalents on total assets (CASH) to estimate corporate cash levels.

The empirical results show the existence of a double-threshold for listed companies on the MENA region. The coefficient is positive which implies that cash levels above this level would improve the company's efficiency. The coefficient tends to decrease when approaching a certain level which limits the efficiency potential of corporate managers. Consequently, our results prove the existence of a nonlinear relationship between cash holding and firm's value. These results are consistent with previous empirical studies confirming the trade-off theory between the marginal costs and benefits of cash (Opler et al., 1999; Azmat, 2014; Nguyen et al., 2016; Nguyen, 2019).

The findings in this paper contribute to the literature on cash policy. Indeed, a large growing number of empirical studies have been conducted on cash determinants and optimal cash adjustment on different countries but much less have investigated these issues in the case of the MENA region. The main managerial implication for this paper comes from the empirical confirmation on the existence of two optimal cash levels which maximises the firm's value. The fact that 72% of companies forming our sample are within the threshold level explains much of the manager's behaviour towards holding cash. Therefore, companies should constantly adjust their cash level within the threshold regions in order to improve their efficiency.

We have also applied a dynamic model to investigate the partial adjustment of listed MENA firms toward the optimal cash. Our results confirm that there is partial adjustment movement toward the optimal threshold level and that downward adjustment speed is lower than upward adjustment speed which is consistent with Rehman et al. (2016) and siddiqua et al. (2019). Additionally, we find that size, growth and net working capital are statistically significant and negatively related to cash holding. Eventually, both our hypothesis about the non-

linear relationship between cash holding and firm's performance and the existence of partial adjustment costs toward the optimal cash were confirmed.

Implications and Research Limitations

The main implication of our study is to offer corporate policy makers with an overall view of cash holding behaviour in emerging countries namely the MENA region. Our study combined both the investigation of optimal level, cash adjustment and corporate cash determinants. Future research may explore the existence of an optimal cash level considering the issue of endogeneity as our study used a non-dynamic model. Indeed, the use of a dynamic model to determine the optimal level may give rigorous results on corporate cash level.

Furthermore, previous studies like (T. L. H. Nguyen et al., 2016; Siddiqua et al., 2019) have either investigated the optimal level through a non-linear relationship or test individually for partial adjustments. On the contrary, our paper both mobilized the threshold and dynamic model to assist managers understanding corporate cash behaviour. Results also confirm that firms in emerging countries also adjust their cash holding according to the different independent variables used in the model. In addition to that, managers do follow their value maximisation goal through partial cash adjustment to meet the optimal levels. Finally, this paper confirms previous studies on the existence of a non-linear relationship between cash holding and firm value (Martinez-Sola et al., 2013; Azmat, 2014; T. Nguyen et al., 2016).

Our research use panel threshold regression to estimate the optimal level which is a non-dynamic model. Thus, further studies might suggest using extended threshold panel to take into consideration the problems of endogeneity. In addition to that, the cash determinants equation used lacks some key variables mainly corporate governance variables. Indeed, the integration of corporate governance shall provide policy makers with a greater visibility on cash holding decision. The same comment includes sectorial analysis through using industry dummy variables to dig further on corporate cash behavioural in developing countries.

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