Optimal Cash Ratio and Adjustment Speed across Different Firm Characteristics

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ABSTRACT

This paper seeks to use fixed effect and dynamic panel models to examine role of firm characteristics, macroeconomic variables, control of corruption and political uncertainty in explaining cash holdings of Egyptian firms over the period 2011–2020. We find that firm characteristics strongly explain variations in corporate cash ratios and deviations from the target ratios. However, we document no considerable role of macro variables. Egyptian firms tend to hold liquid assets as cash substitutes in managing their working capital and use debt as cash substitute in financing their operations. The findings support the prediction of main corporate finance theory and support both the precautionary and transactionary motives to hold cash. As expected, Egyptian firms tend to hold more cash during periods of high political uncertainty. After sorting according to the most influential independent variables which are tangibility and dividend yield (high and low). We find that cash holdings of the firms respond differently to both the firm specific variables and macro variables. Specifically, the high tangibility firms adjust their cash holding to the optimal level faster than the low tangibility firms while the low dividend yield firms adjust faster than the high dividend yield firms. The results of dynamic panel models indicate that Egyptian firms follow a partial adjustment policy towards the optimal cash levels, which corresponds with trade off theory.

Keywords: Adjustment Speed, Firm Characteristics, Macroeconomic Variables, Control of Corruption, Political Uncertainty
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1. INTRODUCTION

Management set the firm's cash holdings at a level such that the marginal benefit of cash holdings equals the marginal cost of those holdings. There are two main benefits from holding liquid assets. First, the firm saves transaction costs to raise funds and does not have to liquidate assets to make payments. Second, the firm can use the liquid assets to finance its activities and investments if other sources of funding are not available or are excessively costly. The first benefit is described as the transaction cost motive for holding cash, and the second one as the precautionary motive (Keynes, 1936). On the other hand, the main cost of holding cash is to

give up investing that cash in positive net present value projects (Ferreira and Vilela, 2004). Accordingly, cash position is one of the major financial decisions, should not be an exception. It is worth exploring how firms should change cash holdings in response to the changes in firm specific characteristics and macroeconomic conditions.

There are three main theories focus on the costs and benefits of cash holdings: trade-off theory, pecking order theory and agency theory. The Tradeoff theory argues that the benefits of holding cash are based on two motives: transaction minimization and precautionary motives. In relation to the former, it is suggested

that firms stockpile cash when the rising-costs and the opportunity costs (related to cash deficits) are higher (Dittmar et al., 2003). And where the precautionary motive, based on the effect of asymmetric information on raising funds within capital markets such as securities underpricing. Furthermore, Ozkan and Ozkan (2004) argued that firms raise cash levels to direct more financial resources when the costs of outside financing are explicitly high. While, Opler et al. (1999) ascertain the prevalence of an optimal level of cash where the marginal costs of cash shortage match the marginal costs of holding cash. Ferreira and Vilela (2004) confirm that holding cash reduce the probability of financial distress in case of unexpected losses. It should be noted that market imperfections are more severe in emerging markets as well as bankruptcy related costs are significant in such markets, and hence trade-off theory can explain cash holding decisions in these markets. Pecking order theory suggests that there is no optimal level of cash holdings for a firm. Based on asymmetric information, firms follow a pecking order of financing to minimize costs related to information asymmetry where order starts with internal sources and use external sources only after the internal exhaustion (Myers and Majluf, Corporate Financing and investment decisions when Firms have information that investors do not have, 1984). Firms favor external funding by debt compared to equity issuance because of lower costs than equity financing (Myers, 1984). Therefore, cash can be seen as an outcome of the different financing and investment decisions proposed by the hierarchal pattern of financing (Dittmar et al., 2003). So, researchers such as Ferreira and Vilela (2004) claim that cash can be used for financing investments to pay firm's debt and in turn stockpile cash. Also, Dittmar et al. (2003) detect that firms with high level of cash flows are those to distribute dividends, apply for debt financing, and as a result hoard cash. Based on the previous literature we argue that information asymmetry is also important and might be more severe in developing countries. Free cash flow (agency) theory: Managers have an incentive to hoard cash to increase the amount of assets under their control and to gain discretionary power over the firm investment decision (Jensen, 1986). Thus, the managers do not need to raise external funds and to provide detailed information about the firm's investment projects. Hence, managers could undertake investments that have a negative impact on shareholders wealth (Ferreira and Vilela, 2004).

The remainder of this paper is organized as follows. Section 2 presents the most relevant empirical evidence on determinants of corporate cash holdings while section 3 describes evolution of corporate cash holdings over the study period. Sections 4-7 show the hypothesis development of firm specific variables as well as macro variables, description of econometric models used for estimation and the results. Finally, section 8 concludes the paper.

2. LITERATURE REVIEW

There is a considerable amount of theoretical and empirical research handle cash holding determinants especially from the perspective of firm specific characteristics and some others from macroeconomic factors Amess, et. al., (2015). Starting by firm specific Opler et al. (1999) find that firms with strong growth opportunities and riskier cash flows hold relatively high ratios of cash to total non-cash assets. Firms that have the greatest access to the capital markets, such as large firms and those with high credit ratings, tend to hold lower ratios of cash to total non-cash assets. Consequently, most scholars followed such as Ferreira and Vilela (2004) suggest that cash holdings are positively affected by the investment opportunity and negatively affected by asset's liquidity, leverage, size and bank debt. Moreover, firms in countries with superior investor protection and concentrated ownership hold less cash, and finally, Capital markets development has a negative impact on cash levels. Consistently, results of Ozkan and Ozkan (2004) confirm that growth opportunities, cash flows, liquid assets, leverage, and bank debt are important in determining cash holdings level. Bigelli and Sánchez-Vidal (2012) show that cash holdings are significantly related with smaller size, higher risk and lower effective tax rates, cash is also held by firms with longer cash conversion cycles and lower financing deficits, also dividend payments are associated with more cash holdings. Al-Najjar (2013) showed that capital structure and dividend policy affect cash holdings. Sher (2014) investigates the phenomenon of increase cash holding for non-financial firms in Japan and he found that that Japanese non-financial firms have accumulated cash at the expense of investment and dividends. Huang et al. (2015) reveal that the magnitude of over-investment is negatively related to the marginal value of cash holdings. Wasiuzzaman (2014) find a significant difference in the level of cash holdings between firms and across time. He suggests that significance of firm characteristics and their relationships with cash holdings indicate that other than the pecking order theory, the trade-off theory and the agency theory can help explain the level of cash holdings of firms in Malaysia. Rehman and Wang (2015) investigate firm specific factors that affects cash holdings in Chinese firms and found that Chinese firms has a lower adjustment coefficient in comparison with developed nations and also found that target level of cash holdings in Chinese firms is better explained by Trade off and Pecking order theories (Rehman and Wang, 2015).

On the same track of empirical studies, Sarlak and Ahmadi (2016) find that the difference in price between supply and demand has had a meaningful effect on cash. He and Wintoki (2016) shows that increasing sensitivity of cash holdings to R&D investment and the increase in R&D spending of the typical firm explain over 20% of the increase in aggregate cash holdings. In addition, Anderson and Hamadi (2016) finds a strong positive association between ownership concentration and cash holding. Guizani (2017) shows that leverage, firm size, capital expenditure, net working capital and cash flow volatility are important in determining cash holdings. Moreover, he shows a significant difference between the determinants of cash holdings of the two groups of firms: petrochemical and non-petrochemical and finds that conservative firms are less leveraged, have large size, have low investment expenditures and have low cash flow fluctuation. Chireka and Fakoya (2017) find evidence that liquid asset substitutes, capital expenditure, dividend payments and cash flow volatility significantly influence the cash holdings levels of retail firms listed on the Johannesburg Stock Exchange. Besides this, Leia et al. (2018) shows that financial development lowers the sensitivity of cash holdings to tangible assets and promotes firm growth and also find that sectors with a smaller proportion of tangible assets

grow faster in countries with more developed financial markets. Ahrends et al. (2018) highlight that shipping firms hold more cash than similar firms in other asset-heavy industries. Higher cash holdings in the shipping industry are not attributable to firm- or country-level characteristics and that shipping companies are more conservative than their peers in managing their cash positions. On the other hand, Begenau and Palazzo (2021) find that an increase in the precautionary savings motive—primarily driven by the decline in initial profitability among R&D-intensive new lists— explains about 50% of the upward trend in cash holdings. Pana et al. (2020) suggest that supply chain finance may significantly improve cash holdings by a core firm, speed up its cash turnover, and enhance its competitiveness. Such impacts are stronger when the firm is of lower efficiency. Diaw (2021) indicates that highly liquid firms in emerging countries show one or more of the following characteristics, having larger size, lower capital expenditure, R&D, net working capital, leverage, and intangible assets and inverse relationship between growth opportunities and cash holdings. Alim et al. (2020) show that the presence of more debts in capital structure is positively associated with minority shareholders' expropriation, whereas a negative association has been found between the level of cash holding and minority shareholders expropriation.

On macroeconomic Level, many empirical studies showed its effect on cash holding level such as, Sánchez and Yurdagül (2013) investigate the increasing trend of cash flow in United States, and they find that aggregate uncertainty is an important factor that affecting increasing trend of cash holding. Then, Abushammala and Sulaiman (2014) find that corporate cash holdings related positively with gross domestic production (GDP), and credit spread (CS) as well as government budget deficit and cash (BD). While Inflation (INF) and cash surplus/deficit (SURP) do not determine cash holdings of the firms. Wang et al. (2014) document a U-shaped relationship between operating cycle and cash holdings, and this relationship is similarly influenced by changes in the inflation level. Samaan and Schott (2016) find that macroeconomic uncertainty significantly affect cash holding volume. Xu et al. (2016) suggest that a firm holds significantly less cash if the country faces high political extraction risk, and that the market value of cash holdings is significantly negative during periods of political uncertainty. Chang et al. (2017) show that the equity market places a higher value on corporate cash holdings during the financial crisis (Chang et al., 2017). On the other hand, Ranajee and Pathak (2018) show that cash levels are significantly higher during crisis periods for Indian firms. Phan et al. (2019) find that policy uncertainty is positively related to firm cash holdings due to firms' precautionary motives and, to a lesser extent, investment delays. Zhang et al. (2020) show that the impact of oil price uncertainty on cash holdings exhibits an inverted U-shape. Cash holdings increase with oil price uncertainty, but after a point, this impact becomes negative. Tran (2020) argues that monetary loosening negatively affects cash holdings via both precautionary and transaction cost motives. Duong et al. (2020) find that U.S. corporations increase their cash holdings in response to higher economic policy uncertainty. On the other hand, Xie and Zhang (2020) show that firms in provinces with less government intervention (weak anti-corruption intensity) hold smaller (larger)

cash reserves than those in provinces with more government intervention (strong anti-corruption intensity). Fernandes et al. (2021) reveal that there is an increase in the banks' cash holdings after the 2008 financial crisis.

Many studies examine adjustment speed of cash holdings in different countries, Egyptian economy is subject to less empirical examination in literature. Abdel-Wanis (2019) examines effect of corporate governance mechanisms on relationship between audit fees and cash holdings using a sample of 78 Egyptian firms during a period 2014 – 2016. She finds that cash holdings increase audit fees and corporate governance mitigate this relationship (Abdel-Wanis, 2019). Regarding the determinants of corporate cash holdings, Abodoma (2018) contribute to literature by investigating financial and corporate governance determinants of corporate cash holdings on a sample of 157 Egyptian listed firms from 2008-2015. In this thesis, she finds support for tradeoff theory and agency theory (Abodoma, 2018). The current study contributes to literature by incorporating the macroeconomic variables and control of corruption in addition to firm specific variables to determine the current cash ratio and adjustment speed towards the target cash ratio. Most importantly, we investigate determinants of cash holdings across different groups of firms that are categorized according to the most significant firm characteristics.

Accordingly, Cash reserves give firms much needed financial independence, thereby enabling them to follow their policies without external intervention (Boubaker et al., 2015). Whereas become more resilience in the face of corruption deteriorates the financial and investment environment and eventually hinders economic growth (Barth et al., 2009). The extant literature has indicated the existence of various factors that affect firms' corporate cash holdings, including but not limited to cash flow ratio, growth opportunities, asset tangibility, size, dividends, cash flow, working capital, leverage and probability of financial distress. These factors are mostly viewed in perspective of three widely used theories as mentioned above trade-off, pecking order and agency theory.

3. MEASURING CORPORATE CASH HOLDINGS

We obtained annual financial data for 130 non-financial listed firms over the period 2011–2020 from Thomson Reuters DataStream – Eikon. Following many previous studies (e.g., Ozkan and Ozkan, 2004; Al-Najjar, 2013; Wasiuzzaman, 2014; Ahrends et al., 2018; Chireka and Fakoya, 2017, Sánchez and Yurdagül, 2013; Diaw, 2020), we measure cash ratio as sum of cash and marketable securities, scaled by total assets. The average cash ratio for Egyptian firms is 14% of total assets[1] over the period of 10 years. Figure 1 indicates that there has been a moderate downward trend in the amount of cash held by Egyptian firms over the 2011–2020 period, with two obvious drops from 15 percent to 14 percent in 2012 and from 14 percent to 12.7 percent in 2018. These curve

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[1]   The higher mean value in their analysis is most probably due to normalizing cash and marketable securities by total assets minus cash and marketable securities rather than total assets.
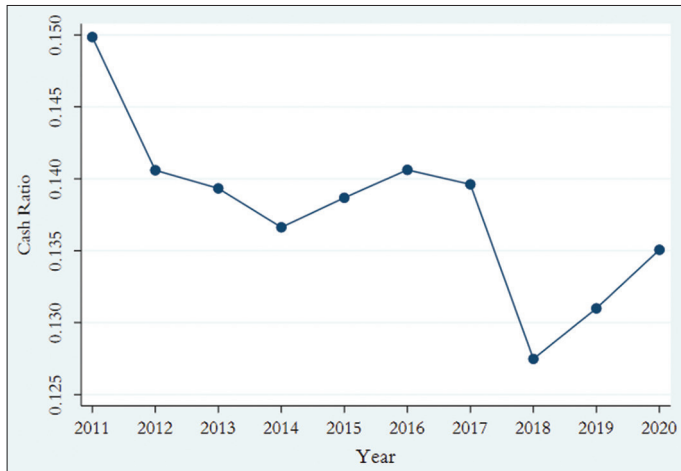
Source: Authors' analysis

movements indicate that the cooperate cash holding in Egypt affected by several factors which vary across the study period and give a strong support for this contribution.

4. ECONOMETRIC MODEL SPECIFICATION

4.1. Static Cash Holding Model

The basic assumption of the static model is that a firm adjusts simultaneously towards the target cash level according to changes in firm specific characteristics. Following Ozkan and Ozkan (2004), we first assume that each ith company has an optimal cash level at year t, function of the explanatory variables, and an error term, as developed in the following static model is used:

$$CASH_{it} = \beta_0 + \sum_{n=1}^{t=1} \beta_n X_{it} + \mu_{it} \tag{1}$$

Where

$CASH_{it}$ is the cash ratio of firm i at time t. X is vector of firm-specific characteristics that are expected to affect the corporate cash holdings. ϕ_t are year variables which included in the model as both trend and dummy variables. Year trend is included to estimate the average annual linear trend in cash holdings, while year dummies are used to reflect the influence of macroeconomic variables that are common to all firms in a given year and could affect their level of cash holdings. μ_{it} is the error term.

4.2. Dynamic (Adjustment) Model

As the adjustment involves costs which typically leads to a delay in the adjustment process. Therefore, there is a difference between the firm's actual cash level and its optimal level. This difference can be measured empirically in the following specification:

$$CASH_{it} - CASH_{it-1} = \lambda(CASH_{it}^* - CASH_{it-1}) \tag{2}$$

Where λ is the adjustment coefficient to the optimal cash level and ranges from 0 to 1:

- If $\lambda=0$, the adjustment cost is high, and it is inefficient for a firm to change its cash level
- If $\lambda=1$, the firm adjusts immediately towards the optimal cash level.

If the model does not incorporate firm specific characteristics, the estimated coefficient is likely to be biased (Ozkan and Ozkan, 2004). By substituting eq. (1) into Eq. (2), we have the following empirical specification:

$$CASH_{it} = \delta_0 + \delta_1 Cash_{it-1} + \sum_{n=1}^{t=1} \delta_n X_{it} + \eta_i + \phi_t + \varepsilon_{it} \tag{3}$$

Where $\delta_1=1-\lambda$, $\delta_k=\lambda\beta_k$, $\varepsilon_{it}=\lambda\infty_{it}$

The term η_i, is added to control the unobservable time-invariant characteristics of each company which could affect the level of cash holdings (Ozkan and Ozkan, 2004).

5. EXAMINING IMPACT OF FIRM SPECIFIC CHARACTERISTICS

5.1 Hypothesis Development

In literature, scholars use many common firm -specific characteristics such as firm size, leverage, cash flow, net working capital and investment opportunities and others add variables such as dividend yield, probability of financial distress or operating cash cycle. In this paper, we attempt to use all these variables to explain variations in corporate cash holdings over the study period (2011–2020). We collect financial data for 167 non-financial listed firms over the period 2011–2020 from Thomson Reuters DataStream – Eikon. The sample is reduced to 130 firms with a full set of data for most of required variables under consideration in this paper. Hence, a panel of 130 firms covering a period of 10 years (from year 2011 to 2020), resulting in 1,300 firm-year observations is used for this study. Appendix 1 presents measurement of each firm-specific variable used in the empirical estimation. Following early studies covering firm-specific determinants of corporate cash holdings (Ferreira and Vilela 2004; Kim et al., 1998; Opler et al., 1999; Ozkan and Ozkan, 2004), the following proxies are used in the empirical examination:

- *Growth opportunities*: Trade-off consistent with positive. While, Pecking order theory consistent with both positive and negative relationship between the market-to-book ratio and cash holdings. While negative according to agency perspective, so it tends to be positive
- *Asset Tangibility*: Firms with more tangible assets can be expected to hold less liquidity, so, we expect negative relationship between asset tangibility and cash flow holding
- *Cash flow* more profitable firms use their profits to build up liquidity, hence, they tend to hold more cash, and we expect to have a negative relationship
- *Dividend Paying*: most researches showed that dividend payers hold less cash or reluctant to omit dividends to hold larger amount and consequently we expect to have a negative relation
- *Probability of financial distress*: Tend to have a negative relation with cash flow to alleviate the financial distress

consequences, but considering that most firms in this case will have excess of cash

- *Size*: Most empirical studies consistent with Trade-off theory in explaining the association between firm size and corporate cash holdings as negative relationship
- *Leverage*: The Majority of recent studies have found that highly levered firms tend to hold less cash, expecting negative relationship
- *Net working capital*: Assets, which can substitute for cash, included in net working capital. Therefore, negative relation is expected
- *Operating cycle days*: More cash is reserved in current assets for a longer time, which decreases the firm's own cash supply and reduces its cash holdings. Accordingly, we expect negative relationship.

5.2 Firm-specific Determinants Models
By incorporating the firm-specific characteristics in static model and dynamic model, we can rewrite Eq. (1) and Eq. (3) as follow:

$$CASH_{it} = \beta_0 + \beta_1 SIZ_{it} + \beta_2 LEV_{it} + \beta_3 NWC_{it} + \beta_4 TNG_{it} + \beta_5 CF_{it} + \beta_6 PB_{it} + \beta_7 DY_{it} + \beta_8 Zscore_{it} + \beta_9 OCD_{it} + \phi_t + \mu_{it} \quad (4)$$

$$CASH_{it} = \delta_0 + \delta_1 Cash_{it-1} + \delta_2 SIZ_{it} + \delta_3 LEV_{it} + \delta_4 NWC_{it} + \delta_5 TNGg_{it} + \delta_6 CF_{it} + \delta_7 PB_{it} + \delta_8 DY_{it} + \delta_9 Zscore_{it} + \delta_{10} OCD_{it} + \eta_i + \phi_t + \varepsilon_i \quad (5)$$

Where

SIZ_{it} and LEV_{it} are the size and leverage of firm i at time t. NWC_{it} denotes the net working capital of firm i at time t while TNG_{it} refers to the tangibility of firm i at time t. CF_{it} is the cash flow of firm i at time t and PB_{it} is price to book value per share of firm i at time t. DY_{it} is the dividend yield of firm i at time t. $Zscore_{it}$ is the Z Score estimated for firm i at time t and can be used to predict the probability that a firm will go into bankruptcy within 2 years. OCD_{it} refers to the operating cycle days of firm i at time t. Descriptive statistics of firm-specific variables are reported in appendix (2).

5.3 The Best Panel Regression Model
The main statistical method used is the regression analysis. As the dataset of this study has only 10 years, it is sufficiently short enough to assume a fixed firm effect. The coefficient of the static model (Eq. 1) was estimated using both random-effects, and fixed-effect models, then we use Hausman's test, to choose the most appropriate model. The results of Hausman's test came in favor of the fixed-effects specification over the random effects one. The results for the static model (Eq. 1) using random-effects and fixed-effects model along with Hausman's test are shown in Table 1.

5.4 Estimation Results of Firm Characteristics Model
5.4.1 Static panel data model
In contrast with most of empirical evidence but in the line with results of (Chireka and Fakoya, 2017; Wasiuzzaman, 2014), firm size is found to be insignificant in explaining the cash holdings of the Egyptian firms. The Price-to-Book ratio is found to be negatively related with corporate cash holdings, suggesting that managers hold more cash when facing low investment opportunities. This evidence does not support predictions of the

Table 1: Results of the Pooled OLS, Random-effects, and Fixed-effects Models

CR	Random-effects			Fixed-effects		
	Coef.	Std. Err.	*p*-value	Coef.	Std. Err.	*p*-value
Size	−0.025[b]	0.011	0.021	−0.035	0.037	0.350
Lev	−0.077[a]	0.010	<0.001	−0.086[a]	0.025	0.001
NWC	−0.193[a]	0.015	<0.001	−0.190[a]	0.044	<0.001
Tang	−0.393[a]	0.023	<0.001	−0.471[a]	0.060	<0.001
CF	0.188[a]	0.033	<0.001	0.179[b]	0.070	0.012
PB	−0.001[a]	0.0005	0.006	−0.001[a]	0.0002	<0.001
DY	0.368[a]	0.062	<0.001	0.320[a]	0.097	0.001
Zscore	0.002[a]	0.0003	<0.001	0.002	0.001	0.255
OCD	0.000	0.000	0.286	0.000	0.000	0.531
Year	0.014	0.010	0.152	0.014[b]	0.007	0.045
2011	0.127	0.081	0.118	0.131[b]	0.063	0.041
2012	0.112	0.072	0.119	0.115[b]	0.055	0.039
2013	0.095	0.062	0.128	0.098[b]	0.048	0.045
2014	0.076	0.053	0.148	0.079[c]	0.041	0.061
2015	0.064	0.043	0.138	0.066[c]	0.033	0.051
2016	0.051	0.034	0.133	0.052[b]	0.026	0.049
2017	0.032	0.025	0.197	0.033[c]	0.019	0.080
2018	0.005	0.016	0.779	0.005	0.011	0.688
Hausman's test			χ^2=66.61, Pr.>χ^2=0.000			

Source: Authors' compilation and analysis. [a/b/c]Indicates a significant at 1%, 5%, and 10%, respectively. *We have eliminated year 2019, and 2020 dummies to avoid multicollinearity

pecking order and tradeoff theories, but it supports the free cash flow theory, assuming that managers of firms with poor investment opportunities tend to hold more cash to ensure the availability of funds to invest in growth projects (eventually with negative NPV). On the other hand, they hold more cash to avoid providing detailed information about investment projects required for accessing capital market (Ferreira and Vilela, 2004). This result contradicts with (Chen and Mahajan, 2010; Ozkan and Ozkan, 2004; Wasiuzzaman, 2014; Siddiqua, et al., 2019) but it consistent with Diaw (2021).

In line with most previous studies, the coefficient of cash flow (CF) affects positively the firm cash holdings, indicating that managers of Egyptian firms tend to hold more cash from the operating income for precautionary purpose: to avoid future shortfalls in operating cash flows (Chen and Mahajan, 2010). This result supports the pecking order theory that firms prefer to hold more funds from their higher cash flow to fund internally the investment projects. This result is consistent with (Chen and Mahajan, 2010; Ozkan and Ozkan, 2004; Siddiqua, et al., 2019; Ferreira and Vilela, 2004; Diaw, 2021) but it contradicts with the findings of (Hunjra et al., 2021). Consistent with the predictions of the tradeoff theory, Net working capital (NWC) has a negative effect on corporate cash holdings, suggesting that firms with more liquid assets tend to hold less cash because they can convert these assets quickly into cash to cover any financial need (Wasiuzzaman, 2014; Guizani, 2017; Diaw, 2021). This result supports the transactionary motive to hold cash (Wasiuzzaman, 2014). This result contradicts with that of Siddiqua, et al., (2019).

The results indicate that high levered firms tend to hold less cash. Ozkan and Ozkan (2004) argue that cost of holding more cash is

high for high levered firms. This assumes that high levered firms have transactionary motive to hold less cash (Wasiuzzaman, 2014). The negative effect of leverage on corporate cash holdings supports the pecking order theory, suggesting that when internal funds are not sufficient to fund investment, the firm hold less cash and borrow more debt simultaneously (Ferreira and Vilela, 2004). Consistent with free cash flow theory, high levered firms experience better monitoring from capital market and reduced managerial discretion (Drobetz and Grüninger, 2006). This nature of relation contradicts with that of Siddiqua, et al., (2019). The positive relationship between dividend yield and corporate cash holdings supports the tradeoff theory, suggesting that dividend paying firms have a precautionary motive to distribute cash dividends to avoid negative signal about their financial strength if they reduced dividends (Chireka and Fakoya, The determinants of corporate cash holdings levels: evidence from selected South African retail firms, 2017). This result is documented by many studies (e.g., Ozkan and Ozkan, 2004; Drobetz and Grüninger, 2006; Wasiuzzaman, 2014). Consistent with Drobetz and Grüninger (2006), we report negative effect of asset tangibility on corporate cash holdings, indicating that firms with more tangibile assets are more likely to hold less cash because the tangible assets can be sold in case of liquidity shortage. Moroever, the tangibles can be used as collaterals in case of issuing debt. Thus, firms with less tangible assets are more likely to face higher cost of external financing and thus they tend to hold more cash as precautionary savings (Bates et al., 2009; Lyandres and Palazzo, 2016).

5.4.2 Dynamic panel data model

Two issues related to the static model need to be handled, first, the presence of endogeneity bias. As fixed or random effects models ignore the influence of historical realizations of regressors on the dependent variable. Second, the hypothesis that firms, through an adjustment process, maintain their cash holdings at the target level. In regards with those issues, the adjustment effect is captured by introducing the lagged dependent variable, and to overcome the endogeneity bias the Generalized Method of Moments (GMM) estimator developed by Arellano and Bond (1991) is adopted to estimate the coefficients of the dynamic model (Eq. 5.).

Table 2 shows the GMM regression on the determinants of cash holdings. All the estimations have been carried out using the two-stage GMM estimator. To find valid instruments in GMM estimation, we carry several trials by using different combinations of the firm-characteristic variables as endogenous or predetermined variables, then perform a posteriori test to check the reliability of the instruments. This result in using the dependent variable as endogenous variable with two lags, while the independent variables were treated an exogenous variables, which yields the best results for diagnostic tests of instrument validity and serial correlation. We calculate Arellano-Bond test for AR(2) in first differences to test for the absence of second-order serial correlation in the first difference of the residuals. This statistic is found to indicate the absence of second-order serial correlation. Also, the Hansen test for over-identifying restrictions indicates that the correlation between the instruments and error term is absent.

The results in Table 2, demonstrate a highly significant lagged-dependent variable coefficient that indicates that the firms

Table 2: Two-steps GMM dynamic panel estimations

Variables	Coefficient	Robust Std. Err.	P-value
CR_{t-1}	0.525[a]	0.070	<0.001
SIZ	−0.023	0.030	0.441
LEV	−0.047[b]	0.019	0.016
NWC	−0.134[a]	0.036	<0.001
TNG	−0.264[a]	0.055	<0.001
CF	0.161[b]	0.064	0.011
PB	−0.001[a]	0.000	<0.001
DY	0.164[c]	0.092	0.075
Zscore	0.000	0.000	0.784
OCD	0.000	0.000	0.411
Year	0.009[b]	0.004	0.011
2012	0.067[a]	0.025	0.006
2013	0.065[a]	0.022	0.003
2014	0.050[a]	0.019	0.008
2015	0.044[a]	0.014	0.002
2016	0.036[a]	0.012	0.004
2017	0.022[a]	0.008	0.005
Firm-Year		904	
Instruments		24	
Hansen Test*		6.25 (0.511)	
AR (2)*		0.04 (0.968)	

Source: Authors' compilation and analysis. [a/b/c]Indicates a significant at 1%, and 5%, respectively. *P-value for the tests are reported between brackets. **We have eliminated year 2011, and years 2018–2020 dummies to avoid multicollinearity

have a target amount of cash, which they pursue, balancing the costs and benefits of holding cash. The adjustment speed, is 0.475 (1 – 0.525), indicating that a firm takes 2.11 years (1/0.475) to adjust its actual level of cash to the target level. The estimated coefficient differs slightly from 0.51 that is obtained by Abodomo (2018) using a sample of Egyptian firms.

6. EXAMINING IMPACT OF MACRO-VARIABLES

6.1 Hypothesis Development

Macroeconomic conditions could affect different corporate decisions. In this context, firms could change their cash holdings to mitigate any negative effect of changes in macroeconomic variables or to exploit growth opportunities. Based on this hypothesis, we select a set of macro variables that are commonly used in literature. We could give interpretation for each variable selected in the current analysis as follow:

a. GDP growth: Firms tend to hold more cash to fund future investment projects that would be associated with high GDP growth.

b. Inflation: Firms are more likely to hold less cash (non-interest bearing) during high inflation periods because of its high opportunity cost.[2]

c. Credit Market Development: Availability of credit to private sector in banks and other financial institutions at lower interest rate would discourage firms from holding more cash to fund any profitable investment opportunities.

d. Equity Market Development: Firms tend to hold less cash as

2   We exclude interest rate from empirical examination because the cash ratio, includes interest-bearing liquid assets (e.g., cash equivalents and marketable securities). Thus, an increase in interest rate could result in a shift from pure cash to interest-bearing liquid assets, resulting in ambiguous net change in cash ratio (Chen & Mahajan, 2010).

response to lower cost of raising equity capital in countries with highly developed equity markets.

e. Corporate Tax rate: Firms may hold less cash and raise more debt (as cash substitute) if taxes on corporate profits rise in order to benefit from tax savings associated with more debt.

f. Corruption: Firms are more likely to hold less cash as level of corruption decreases in the country (Xie and Zhang, 2020).

g. Political Uncertainty: A firm will hold more cash for precautionary and speculative purposes in response for expected political uncertainty (Xu et al., 2016). Following to Al-Samman and Otaify (2017), we use a dummy variable to reflect periods of political instability in Egypt after outbreak of revolution on 25 january, 2011.

6.2 Extended Econometric Models

To examine role of macroeconomic variables as well as corruption level and political uncertainty in determining the corporate cash holdings, with controlling the firm characteristics, the model of firm specific determinants is augmented by adding the macro variables as shown in the following empirical setting:

$$CASH_{it}=\beta_0+\beta_1 SIZ_{it}+\beta_2 LEV_{it}+\beta_3 NWC_{it}+\beta_4 TNG_{it}+\beta_5 CF_{it}+\beta_6 PB_{it}+\beta_7 DY_{it}+\beta_8 Zscore_{it}+\beta_9 OCD_{it}+\beta_{10} GDP_t+\beta_{11} CMD_t+\beta_{12} EMD_t+\beta_{13} INF_t+\beta_{14} TAX_t+\beta_{15} COR_t+\beta_{16} POL_t+\mu_{it} \quad (6)$$

$$CASH_{it}=\delta_0+\delta_1 Cash_{it-1}+\delta_2 SIZ_{it}+\delta_3 LEV_{it}+\delta_4 NWC_{it}+\delta_5 TNGg_{it}+\delta_6 CF_{it}+\delta_7 PB_{it}+\delta_8 DY_{it}+\delta_9 Zscore_{it}+\delta_{10} OCD_{it}+\delta_{11} GDP_{it}+\delta_{12} CMD_{it}+\delta_{13} EMD_{it}+\delta_{14} INF_{it}+\delta_{15} TAX_{it}+\delta_{16} COR_{it}+\delta_{17} POL_{it}+\eta_i+\phi_t+\varepsilon_{it} \quad (7)$$

Where GDP refers to growth rate of gross domestic product, CMD denotes credit market development which is proxied by domestic credit to private sector as a percentage of GDP while is EMD equity market development which is proxied by market capitalization of listed firms as a percentage of GDP. Inflation rate (INF) measured as annual change in Egypt's consumer price index (CPI). TAX refers to corporate tax rate in Egypt. COR refers to Control of Corruption (see definition of indicator in appendix no.). POL is a dummy variable that takes one in years 2011–2014 and zero otherwise to reflect the period of political uncertainty due to 25 of January Revolution in 2011. All data for macroeconomic variables (GDP growth, inflation and private credit) are obtained from Central Bank of Egypt (CBE) while corporate tax rate is obtained from KPMG's corporate tax Rate Survey. Data for control of corruption index is retrieved from world bank's governance indicators.[3] Descriptive statistics of macro variables are reported in appendix (2).

6.3 Estimation Results of Macro-variables Model

We apply natural logarithm on the macroeconomic variables (GDP, CMD, EMD, INF, TAX, and COR) to ensure the linearity of their relationship with cash ratio and to reduce the expected heteroscedasticity. Results in Table 3 indicates that coefficients of all macro-variables are significant at 5% level except those of tax rate (TAX) and control of corruption (COR) are significant at 10% level. However, the magnitude of effect[4] are small in

explaining corporate cash holdings and their effect are changed to be insignificant (except economic growth is significant at 10%) in the dynamic model which indicates less importance of macro-variables in adjusting the current level of cash holdings towards the target cash level. Conversely, political uncertainty has significant impacts in both models, indicating that Egyptian firms tend to hold more cash during periods of high political uncertainty.

7. EXAMINING CORPORATE CASH HOLDINGS SENSITIVITY TO FIRM CHARACTERISTICS

Results indicate that macroeconomic variables, control of corruption and political uncertainty have minor contribution in deciding the corporate cash holdings, as compared to firm-specific factors. Obviously, a more empirical examination is needed to explore how cash holdings of firms with characteristics could respond differently to both the firm-specific factors and macroeconomic factors. As documented in Table 1 that asset tangibility and dividend yield have the largest effect on cash holdings, we sort firms into HIGH and LOW groups according to those characteristics. Thus, we follow Diaw (2021) in sorting firms using median static. Typically, we sort firms by tangibility according to their median of tangibility across the study period into HIGH tangibility firms (HTNG, thereafter) and LOW tangibility firms (LTNG, thereafter). Similarly, we sort firms according to median of dividend yield into HIGH dividend firms (HDY, thereafter)) and LOW dividend firms (LDY, thereafter). Therefore, we have 4 characteristics-sorted groups of firms: HTNG, LTNG, HDY and LDY.

Table 4 presents results of applying the static and dynamic models (6 & 7) augmented with the macro-variables for each characteristic-sorted group of firms. To preserve the sample size, we classify a firm as high (low) according if its median of the characteristics of interest is higher (lower) than the median of this characteristic across all firms. Accordingly, the sample firms are divided into 64 firms as high tangibility and 66 firms as low tangibility while they are divided into 63 firms with high dividends yields and 67 firms with low dividend yield.

7.1 Determinants of Cash Holdings Across Asset Tangibility-sorted Firms

Results of fixed effect model for LTNG and HTNG panels are presented in Table 4, showing high explanatory power (R^2) inexplaining the cash holdings of the HTNG firms at 49%, compared with 21% for LTNG firms. Interestingly, coefficient of SIZ (size) is converted to be significant and positive for the HTNG panel, indicating that HTNG firms tend to hold more cash as their size increase. In other words, most HTNG are large firms. The results show that cash holdings of HTNG firms are more sensitive that debt obligations and investing in net working capital than LTNG firms. Thus, we can assume that LTNG firms tend to hold more cash than HTNG firms as debt ratio and NWC increases. Conversely, cash holdings of LTNG firms are more sensitive than

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3   See appendix (1) for more details about variable measurement and source of data.

4   To interpret the coefficient of macro variables multiply the coefficient with 0.01.

e.g., coefficient of TAX = 1.487, when multiplied by 0.01 = 0.01487, hence one percent increase in TAX is associated with nearly 1.5% in cash ratio, on average.

Table 3: Results of Fixed-effects Model and GMM dynamic panel estimations

Model	Fixed-effects Model		Two-steps GMM dynamic panel estimations			
Variables	Coef.	P-value	Coef.	P-value	Coef.	P-value
CR_{t-1}			0.469[a]	<0.001	0.469[a]	<0.001
SIZ	−0.026	0.527	−0.037	0.335	−0.037	0.335
LEV	−0.135[a]	<0.001	−0.094[a]	<0.001	−0.094[a]	<0.001
NWC	−0.249[a]	<0.001	−0.186[a]	<0.001	−0.186[a]	<0.001
TNG	−0.473[a]	<0.001	−0.284[a]	<0.001	−0.284[a]	<0.001
CF	0.171[b]	0.013	0.140[c]	0.061	0.140[c]	0.061
PB	−0.001[a]	0.006	−0.001[a]	<0.001	−0.001[a]	<0.001
DY	0.321[a]	0.001	0.237[b]	0.016	0.237[b]	0.016
Zscore	0.001	0.290	0.000	0.405	0.000	0.405
OCD	0.000	0.911	0.000	0.849	0.000	0.849
Year	0.028[c]	0.070	−0.001	0.881	−0.005	0.214
GDP	−0.224[b]	0.036	−0.032[c]	0.076		
CMD	1.056[b]	0.048	0.013	0.898	−0.145	0.169
EMD	0.504[b]	0.049	0.003	0.952	−0.073	0.149
INF	−0.109[b]	0.039	0.011	0.583	0.026	0.121
TAX	1.487[c]	0.065	−0.159	0.181	−0.454[c]	0.085
COR	−0.865[c]	0.067	−0.102	0.154	0.029	0.761
POL	−0.352[b]	0.049			0.060[c]	0.076
Firm-Year				792		
Instruments				23		
Hansen Test***				5.96 (0.428)		
N		1017				
R²		0.234				
Wald test **		F (7, 1017) = 30.9[a]				

Source: Authors' compilation and analysis. [a/b/c]Indicates a significant at 1%, 5%, and 10%, respectively. *All macroeconomic variables are used in natural logarithm form to ensure the linearity of their relationship with cash ratio. **Tests for joint significance of macro variables. [a/b/c]Indicates a significant at 1%, and 5%, respectively. *P-value for the tests are reported between brackets. ***We have eliminated POL to avoid multicollinearity

Table 4: Results of fixed-effects models for low and high tangibility firms

CR	Low-Tangibility			High-Tangibility		
	Coef.	Robust Std. Err.	P-value	Coef.	Robust Std. Err.	P-value
Size	−0.044	0.055	0.423	0.023[c]	0.014	0.090
Lev	−0.117[a]	0.028	<0.001	−0.223[a]	0.030	<0.001
NWC	−0.235[a]	0.062	<0.001	−0.312[a]	0.028	<0.001
Tang	−0.371[a]	0.114	0.002	−0.429[a]	0.028	<0.001
CF	0.242[c]	0.130	0.067	0.072[c]	0.041	0.075
PB	−0.001[a]	0.000	<0.001	−0.002	0.002	0.202
DY	0.412[a]	0.126	0.002	0.234[a]	0.071	0.001
ZNM	0.001	0.001	0.434	0.007[a]	0.001	<0.001
OCD	0.000	0.000	0.981	0.000	0.000	1.000
Year	0.045[c]	0.023	0.060	0.011	0.028	0.687
GDP	−0.285[c]	0.154	0.069	−0.161	0.185	0.383
CMD	1.441[c]	0.761	0.063	0.696	0.955	0.466
EMD	0.700[c]	0.364	0.059	0.320	0.462	0.489
INF	−0.171[b]	0.075	0.025	−0.047	0.101	0.646
TAX	1.809	1.166	0.126	1.267	1.309	0.333
COR	−1.057	0.687	0.129	−0.724	0.766	0.344
POL	−0.446[c]	0.255	0.085	−0.279	0.305	0.360
Firm-Year		527			490	
R²		0.212			0.492	

Source: Authors' compilation and analysis. [a/b/c]Indicates a significant at 1%, 5%, and 10%, respectively. *We have eliminated year 2019, and 2020 dummies to avoid multicollinearity

HTNG firms to cash flow and dividend yield. This indicates that LTNG firms tend to hold more cash than HTNG firms from their operating profits and to pay cash dividends. Coefficient of PB variable loses its significant effect for HTNG firms.

7.2 Adjustment Speed of Cash holdings Across Asset Tangibility-sorted Firms

The adjustment speed for both HTNG and LTNG firms is obtained by applying the dynamic model as shown in Table 5. The coefficient of lagged cash ratio is positive and significant for HTNG and LTNG firms. Most importantly, the higher value of lagged cash ratio indicates that LTNG firms adjust their current cash ratio to the optimal one faster than HTNG firms. More specifically, the adjustment speed for HTNG firms is 0.505 (1-0.495), indicating that they take approximately 1.98 years (1/0.505) to adjust their cash ratio to the optimal one. While the adjustment speed for LTNG firms is 0.386, indicating that they take approximately 1.62 year (1/0.614) to adjust their cash ratios. This implies that LTNG firms

face lower cost than HTNG firms to adjust their current cash ratio towards the optimal ratio. The coefficient of inflation turned to be significant, implying that HTNG firms consider the price level in adjusting their cash ratio while LTNG firms consider GDP growth and tax rate in adjusting their cash ratio. Notably, the coefficients of macro variables are significant at 10% level (except inflation at 5%) and their degree of effect are small.

7.3 Determinants of Cash Holdings Across Dividend Yield-sorted Firms

Table 6 report the results of fixed effect model which could explain 11% and 36% of variations in cash holdings of LDY firms

and HDY firms, respectively. The size coefficient turned to be significant and negative for the HDY firms, suggesting that HDY firms tend to hold more cash as their size decreases. Cash holdings of HDY firms are more responsive than those of LDY firms to debt ratio, net working capital and tangible assets. This suggests that HDY firms tend to hold less cash than LDY firms as leverage, NWC and tangibility increase. The coefficient of cash flow (CF) is still significant for LDY panel, but it become insignificant for HDY panel. This implies that LDY firms tend to hold more cash from their operating profits to distribute cash dividends. Similarly, the coefficient of growth opportunities is significant for LDY panel but with small effect while it is insignificant for the HDY

Table 5: Results of two-steps GMM dynamic panel models for low and high tangibility firms

Variables	Low-Tangibility				High-Tangibility			
	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value
CR_{t-1}	0.386[a]	<0.001	0.386[a]	<0.001	0.495[a]	0.004	0.495[a]	0.004
Size	−0.042	0.458	−0.042	0.458	−0.009	0.882	−0.009	0.882
Lev	−0.095[a]	<0.001	−0.095[a]	<0.001	−0.117[b]	0.028	−0.117[b]	0.028
NWC	−0.172[b]	0.010	−0.172[b]	0.010	−0.256[a]	<0.001	−0.256[a]	<0.001
Tang	−0.259[a]	0.007	−0.259[a]	0.007	−0.298[a]	<0.001	−0.298[a]	<0.001
CF	0.145	0.329	0.145	0.329	0.117[b]	0.017	0.117[b]	0.017
PB	−0.001[a]	<0.001	−0.001[a]	<0.001	−0.001	0.167	−0.001	0.167
DY	0.286[c]	0.068	0.286[c]	0.068	0.181[b]	0.035	0.181[b]	0.035
ZNM	0.000	0.520	0.000	0.520	0.003	0.120	0.003	0.120
OCD	0.000	0.927	0.000	0.927	0.000	0.825	0.000	0.825
Year	0.008	0.404	0.008	0.404	−0.011[c]	0.068	−0.013[a]	0.007
GDP	−0.050[c]	0.073			−0.013	0.511		
CMD	0.169	0.267	−0.075	0.632	−0.160	0.245	−0.225	0.106
EMD	0.082	0.254	−0.036	0.640	−0.089	0.152	−0.121[c]	0.060
INF	−0.026	0.434	−0.002	0.947	0.052[b]	0.013	0.059[a]	0.002
TAX	−0.342[c]	0.056	−0.802[b]	0.046	0.037	0.814	−0.086	0.785
COR	−0.138	0.288	0.065	0.680	−0.096	0.266	−0.041	0.707
POL			0.093[c]	0.073			0.025	0.511
Firm-Year	412				380			
Instruments	23				23			
Hansen Test *	4.21 (0.648)				6.46 (0.374)			
AR (2)*	−1.47 (0.142)				−0.78 (0.435)			

Source: Authors' compilation and analysis. [a/b/c]Indicates a significant at 1%, and 5%, respectively. *P-value for the tests are reported between brackets. **We have eliminated year 2011, and years 2018-2020 dummies to avoid multicollinearity

Table 6: Results of the fixed-effects models for low and high dividends yield

Cr	Low-dividend yield			High-dividend yield		
	Coef.	Robust std. Err.	P-value	Coef.	Robust std. Err.	P-value
Size	−0.013	0.048	0.787	−0.182[b]	0.071	0.013
Lev	−0.111[a]	0.022	<0.001	−0.159[c]	0.080	0.050
NWC	−0.166[a]	0.045	<0.001	−0.497[a]	0.062	<0.001
Tang	−0.406[a]	0.079	<0.001	−0.532[a]	0.089	<0.001
CF	0.229[a]	0.060	<0.001	0.008	0.093	0.928
PB	−0.001[a]	0.000	<0.001	−0.001	0.003	0.775
DY	0.336[c]	0.182	0.070	0.304[a]	0.103	0.004
Zscore	0.000	0.001	0.663	0.007[a]	0.001	<0.001
OCD	0.000	0.000	0.360	0.00001[a]	0.000	<0.001
Year	0.011	0.023	0.632	0.005	0.018	0.771
GDP	−0.081	0.156	0.605	−0.016	0.130	0.903
CMD	0.670	0.797	0.404	−0.236	0.654	0.720
EMD	0.339	0.383	0.380	−0.140	0.313	0.656
INF	−0.056	0.079	0.485	−0.001	0.063	0.983
TAX	0.989	1.181	0.406	−0.476	0.993	0.633
COR	−0.584	0.686	0.398	0.287	0.585	0.626
POL	−0.203	0.264	0.443	0.076	0.220	0.730
Firm-Year	484			533		
R²	0.113			0.360		

Source: Authors' compilation and analysis. [a/b/c]Indicates a significant at 1%, 5%, and 10%, respectively. *We have eliminated year 2019, and 2020 dummies to avoid multicollinearity

Table 7: Results of two-steps GMM dynamic panel model for low and high dividend yield

Variables	Low-dividend yield				High-dividend yield			
	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value
CR_{t-1}	0.467[a]	<0.001	0.467[a]	<0.001	0.411[z]	<0.001	0.411[a]	<0.001
SIZ	−0.004	0.935	−0.004	0.935	−0.140[b]	0.018	−0.140[b]	0.018
LEV	−0.069[a]	<0.001	−0.069[a]	<0.001	−0.085	0.162	−0.085	0.162
NWC	−0.126[a]	0.006	−0.126[a]	0.006	−0.421[a]	<0.001	−0.421[a]	<0.001
TNG	−0.202[b]	0.020	−0.202[b]	0.020	−0.360[a]	<0.001	−0.360[a]	<0.001
CF	0.167[b]	0.015	0.167[b]	0.015	0.044	0.704	0.044	0.704
PB	−0.001[a]	<0.001	−0.001[a]	<0.001	−0.003	0.325	−0.003	0.325
DY	0.318[c]	0.052	0.318[c]	0.052	0.181[c]	0.053	0.181[c]	0.053
Zscore	0.000	0.677	0.000	0.677	0.005[a]	0.008	0.005[a]	0.008
OCD	0.000	0.666	0.000	0.666	0.000	0.115	0.000	0.115
Year	−0.003	0.730	−0.003	0.620	0.006	0.526	−0.004	0.592
GDP	−0.001	0.972			−0.066[a]	0.006		
CMD	0.026	0.852	0.021	0.905	−0.091	0.484	−0.415[a]	0.002
EMD	0.028	0.668	0.025	0.764	−0.064	0.291	−0.220[a]	<0.001
INF	0.020	0.413	0.020	0.355	−0.001	0.977	0.032	0.210
TAX	0.024	0.888	0.015	0.971	−0.208	0.168	−0.818[b]	0.016
COR	−0.150[c]	0.092	−0.146	0.305	0.051	0.600	0.321[b]	0.022
POL			0.002	0.972			0.123[a]	0.006
Firm-Year	378				414			
Instruments	23				23			
Hansen Test*	6.21 (0.400)				4.21 (0.648)			
AR (2)*	−1.33 (0.184)				−0.36 (0.722)			

Source: Authors' compilation and analysis. [a/b/c]Indicates a significant at 1%, and 5%, respectively. *P-value for the tests are reported between brackets. **We have eliminated year 2011, and years 2018–2020 dummies to avoid multicollinearity

panel. Despite of the very low effect of probability of financial distress (proxied by z-score) and operating cash cycle (OCD), their coefficients turned to be significant for the HDY firms. All the coefficients of macro variables are insignificant for both HDY and LDY firms.

7.4 Adjustment Speed of Cash Holdings Across 7.1 Dividend Yield-sorted Firms

Based on results of dynamic model, the adjustment speed for LDY firms is 0.533 (1-0.467), indicating that they take approximately 1.87 years (1/0.533) to adjust their cash ratio to the optimal one (Table 7). While the adjustment speed for HDY firms is 0.589 (1-0.411), indicating that they take approximately 1.69 year (1/0.589) to adjust their cash ratios. This implies that HDY firms face lower cost than LDY firms to adjust their current cash ratio towards the optimal ratio. The coefficient of OCD returned to be insignificant for HDY firms but the coefficient of control of corruption turned to be significant at 10% level for LDY firms. Notably, signs of all coefficients of macro variables (except that of INF) turns to be significant for HDY firms by including POL (instead of GDP), suggesting the importance of political stability in deciding the cash levels.

8. CONCLUSION

This paper does not only examine firm specific determinants of cash holdings but also it incorporates effects of macroeconomic variables as well as corruption control and political uncertainty. Moreover, we subdivide the sample firms into 4 groups according to the most significant firm-specific variables: tangibility and dividend yield.

We find that firms with more tangible assets, higher cash flow, with higher dividends yield will hold more cash. Conversely, firms with more growth opportunities, higher liquid substitutes, more leverage will hold less cash. We find no significant role of operating cash cycle and probability of financial distress in explaining corporate cash holdings. Although some macro variables have significant effects in the fixed effect model, they do not largely contribute to explain changes in corporate cash holdings. Moreover, in the dynamic panel model, the coefficients of most significant macro variables turned to be insignificant, indicating that their effects are not persistent. The coefficients of lagged cash ratio are positive and statistically significant, indicating that Egyptian firms follow a partial adjustment policy towards the optimal cash levels, which corresponds with trade off theory. The adjustment speed is 0.475, indicating that this means that a firm can close 47.5% of the gap between the actual and optimal levels of cash holdings within 1 year.

Since the superiority of firm characteristics in explaining corporate cash holdings, the sample firms are sorted according to the most significant characteristics: tangibility and dividend yield. We apply the static and dynamic panel models on the characteristics sorted firms and find differential response of cash holdings to firm characteristics and have different adjustment speed. Results of estimating the dynamic model across characteristics-sorted groups of firms indicate that firms with different characteristics respond differently to both firm specific variables and macro variables in determining their cash holdings. Moreover, explanatory power of fixed effect model is greater for both high tangibility (HTNG) firms and high dividend yield (HDY) firms, as compared to low tangibility (LTNG) firms and low dividend yield (LDY) firms, respectively. Interestingly, The HTNG (LTNG) firms can close approximately 51 percent (61 percent) of the gap between the

actual and optimal levels of cash holdings within 1 year. The HDY (LDY) firms can close approximately 59 percent (53 percent) the gap between the actual and optimal levels of cash holdings within 1 year. The current study can be extended to examine other countries of non-financial firms to support our findings in determining the corporate cash holdings and, examine the behavior of financial institutions.

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APPENDIX

Appendix 1: Variable measurement

Variable	Abbreviation	Measurement
Cash Ratio	CASH	$CASH = \dfrac{Cash\ and\ Short\ Term\ Investments}{Total\ Assets}$
Firm Size	SIZ	Natural logarithm of total assets
Leverage	LEV	$Lev = \dfrac{Total\ Debt}{Total\ Assets}$
Tangibility	TNG	$Tangibility = \dfrac{net\ Property, Plant\ \&\ equipment}{Total\ Assets}$
Cash flow	CF	$CF = \dfrac{EBITDA}{Total\ Assets}$
Market-to-book ratio	PB	$PB = \dfrac{price\ per\ share}{book\ value\ per\ share}$
Dividend Yield	DY	$DY = \dfrac{dividends\ per\ share}{price\ per\ share}$
Z-score	Zscore	Zscore = (6.56 * Working Capital to Total Assets)+(3.26 * Retained Earnings–Total to Total Assets)+(6.72 * Earnings before Interest & Taxes (EBIT) to Total Assets)+(1.05 * Market Capitalization to Total Liabilities)
Operating cycle days	OCD	OCD=Average Inventory Days+Average Receivables Collection Days
Economic Growth	GDP	Annual Growth rate of Gross Domestic Product
Credit Market Development	CMD	$CMD = \dfrac{Domestic\ credit\ provided\ by\ banks\ to\ private\ sector}{GDP}$
Equity Market Development	EMD	$EMD = \dfrac{Market\ capitalization\ of\ listed\ domestic\ companies}{GDP}$
Inflation	INF	Growth rate in consumer price index
Corporate Tax rate	TAX	Annual tax rate on corporate profits
Control of Corruption	COR	Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Percentile rank indicates the country's rank among all countries covered by the aggregate indicator, with 0 corresponding to lowest rank, and 100 to highest rank. Percentile ranks have been adjusted to correct for changes over time in the composition of the countries covered by the WGI.
Political Uncertainty	POL	Dummy variable takes one in years: 2011, 2012, 2013 and 2014 and zero otherwise

Source: Authors' compilation

Appendix 2 : Descriptive statistics

Variable	n	Mean	Median	STD	Min.	Max.
CR	1300	0.14	0.08	0.15	0.00	0.77
Firm-specific Variables						
SIZ	1300	8.87	8.85	0.73	7.31	11.07
LEV	1300	0.18	0.08	0.38	0.00	7.92
NWC	1300	0.03	0.03	0.31	−2.45	0.98
TNG	1300	0.33	0.30	0.25	0.00	1.00
CF	1300	0.06	0.06	0.14	−1.42	0.66
PB	1259	1.44	1.09	4.64	−108.71	91.75
DY	1285	0.04	0.02	0.05	0.00	0.44
Zscore	1252	11.35	3.79	91.79	−71.59	2944.86
OCD	1174	1675.46	238.05	10708.68	−24893.92	256655.43
Macro-specific Variables						
GDP	10	3.64	3.88	1.33	1.76	5.56
CMD	10	27.62	26.79	3	24.02	34.13
EMD	10	17.55	18.28	4.42	10.02	22.93
INF	10	11.9	10.07	6.77	5.04	29.51
TAX	10	23.05	22.5	1.57	20	25
COR	10	30.94	31.25	2.87	25.59	35.58

Source: Authors' compilation and analysis