FIRM VALUE AND CORPORATE CASH HOLDINGS. EMPIRICAL EVIDENCE FROM THE POLISH LISTED FIRMS

Sorin Gabriel Anton, Anca Elena Afloarei Nucu

Introduction

In the context of imperfect markets, corporate liquidity represents an important asset to finance investments without raising costly external resources, which imply transaction and information costs. Moreover, the cash holdings offer a buffer against financial distress costs when the firm faces frictions in generating operating cash flows, both in volume and timely. On the other hand, the increase in cash holdings implies several costs: a liquidity premium, tax disadvantages, and agency costs for shareholders (Chang, Benson, & Faff, 2017). The trade-off theory streamlined in the literature governs the firms which need to balance costs and benefits of holding cash to determine the optimal level. While a lot of studies have been done in the direction of identifying the determinants of corporate cash holdings, going further, it is important to understand the relationship between non-earning assets (cash holdings) and firm value, in order to evaluate the corporate financial policies and to attain the right equilibrium between liquidity and profitability.

The aim of our paper is to assess, empirically, the relationship between corporate cash holdings and firm value, on the example of Poland, an emerging economy, over the period 2007-2016. The results show that firm value increases in the linear form of cash holdings and it decreases in the quadratic form, highlighting an inverted U-shaped curve relationship. The value impact is validated under the double interaction of cash with financial constraints and financial crisis, respectively. We further seek to find the inflection point or optimal level of cash holding that maximize the firm value. Our findings are robust for different proxies and methodologies, namely a panel model with fixed effects and the Generalized Method of Moments (GMM) estimation, respectively.

To the best of our knowledge, this study is among the first performed on a sample of 719 listed firms from emerging Europe. The institutional framework and macroeconomic environment make Poland an interesting country to be analyzed on the proposed topic. Being a developing economy, the cost of capital is higher compared to developed ones and the recent economic and financial crisis represented a shock in credit supply, lowering liquidity and adding more value to saving cash, in order to finance investments (Duchin, Ozbas, & Sensoy, 2010). Also, the capital market in Poland is less mature when contrasted to Western European markets. In a financial market that can face restrictions and a high dependence on international flows, cash becomes more valuable. Chang et al. (2017) argue that the amount of cash holdings is more relevant to constrained firms. Polish firms hold a higher level of cash, as it represents around 10% of the total assets compared to other developing markets, i.e. 5%, 3.5% and 3% for Russia, China, and India, respectively, as reported by Al-Najjar (2013). This difference might be due to the different investigated period, our data covering the period of global financial crisis, while the study of Al-Najjar (2013) employs the pre-crisis period and also a short period after the crisis (2002-2008). Moreover, Botrić and Božić (2017) state that access to finance problems post-transition EU member countries are "potentially harmful to the development of entrepreneurship, innovation performance, and overall growth". Therefore, it is an interesting topic to combine the precautionary and transaction reason for seemingly excess cash and firm value in a setup like Poland, over the period 2007-2016, under differential financial constraints status.

Our paper brings significant contributions to two strands of literature. Firstly, we extend

the literature by providing new evidence on the trade-off theory between cash holding and firm value, based on both static and dynamic panel specifications. To examine the impact of cash holding on value, initially, we regress the firm value, based on cash holdings, focusing on the estimated coefficients, while controlling for firm characteristics, such as financing policy and investment policy. A second phase of the analysis adopts a matching process to test for the nonlinear relationship between cash holding and firm value in financially constrained and less financially constrained firms. The third phase analyses, further, the influences of the financial crisis. We validate the non-linear relationship implications of cash holdings on the value in the context of two intervening effects: financial constraints and financial crisis, in order to capture the impact of liquidity shocks. Secondly, once the inverse U-shape' relationship between firm value and cash holdings is confirmed, we calculate the optimal level of corporate cash holdings for Polish firms. We highlight that the optimum level of cash for financially constrained firms is more than double compared to the optimum level of cash for less financially constrained firms and we support, empirically, on the example of emerging markets, the niche of academic literature which shows that cash holdings are more valuable to constrained firms. Despite the fact that our paper joins a large body of literature seeking to explain the implications and determinants of corporate cash holdings, we fill the gap in the literature on the behavior of Polish firms, highlighting evidence on cash policies and firm value under different financial conditions. Therefore, the contribution of this study lies on the under-researched relationship between cash holdings and firm value, by employing a larger dataset (3,043 observations) and time period, compared to fewer previous papers which documented the non-linear relationship between the non-earning asset and firm value. Our findings have empirical implications for business managers, investors, and academics.

The rest of the paper is structured as follows: Section 1 comprises a brief review of the literature. Section 2 describes the sample used in the empirical analysis and the empirical methods employed. Section 3 presents the empirical results and robustness checks. Section 4 summarizes our study and highlights the practical implications of our findings.

1. Literature Review

In corporate finance literature, the direct relationship between cash holding and firm value has become a topic of interest, after many papers focused on factors influencing the firm cash holdings. Within this line of research, it is assumed both a linear relationship and a non-linear (concave) one between cash holdings and firm value, based on the example of developed economies (Martínez-Sola, García-Teruel, & Martínez-Solano, 2013; Cao & Chen, 2013; Tong, 2014). Regarding developing economies, the topic has received little attention to date in the literature (Kao, 2012; Nguyen, Nguyen, & Le, 2016).

Kao (2012) found a non-linear relationship between cash holding and firm value on the example of the tourism industry in Taiwan. Martínez-Sola et al. (2013) investigate the effect of cash holding on firm value for a sample of US industrial firms over the period 2001-2007 and analyze whether deviations from the optimum cash level decrease firm value. Based on GMM estimation with different proxies for firm value (Tobin's Q, Market-To-Book ratio), the authors find a concave relation between cash holding and firm value, pointing out that there is an optimal level of cash holding. Their paper highlights both a positive (when cash level is below the optimal) and a negative relationship (when cash level is above the optimal) between cash holding and firm value. Tong (2014) tested the trade-off theory of corporate cash holdings employing a sample of US firms over the period 1985 to 2005. Using a two-step methodology, the author found that the marginal value of cash for shareholders is higher when a change in cash moves corporate cash holdings towards the optimal level. Nguyen et al. (2016), based on both static and dynamic regressions, highlight a non-linear relationship between cash holding and firm value on a sample of non-financial Vietnamese firms over the period 2008-2013. Moreover, the authors tested the existence of the concave relationship for more and less financially constrained firms and found it to be robust in both situations.

Contrary to the mainstream literature standpoint, Cao and Chen (2013), by employing regression analysis on a sample of Chinese industrial firm during 2010-2013, find that cash holding is positively related to firm value. Despite both the U.S. and China are big economies, the main reason for the difference

may be the fact that, compared with U.S. firms, Chinese firms face more financing constraints. This argument is also sustained by López-Gracia and Sogorb-Mira (2015), who shed light on different firms' cash policy in a context of financial constraints. By using a large data panel of Spanish firms for the period 1996-2010, the authors show that constrained firms are inclined to reserve more cash out of generated cash flow than the unconstrained ones. The academic literature reveals that more financially constrained firms have the tendency to hold more cash compared with less financially constrained firms, regardless the criteria used to define constrained and unconstrained firms (Almeida, Campello, & Weisbach, 2004; Arslan, Florackis, & Ozkan, 2006; Song & Lee, 2012; López-Gracia & Sogorb-Mira, 2015; Chang et al., 2017). The characteristics of emerging economies represent a good environment to consider financial constraints while evaluating the relationship cash-firm value. The underdeveloped legal systems, the presence of less advanced financial systems and weaker institutions show that financial constraints are more obvious in transition economies (Bernini & Montagnoli, 2017). Also, Hashi and Krasniqi (2011) highlight that external financing constraints represent a growth determinant of SMEs in advanced transition economies (Poland, Hungary, and the Czech Republic).

A few studies documented a non-linear relationship between cash holdings and firm value on the example of developed and emerging economies (Kao, 2012; Martínez-Sola et al., 2013; Nguyen et al., 2016). The non-linear relationship implies that until a certain point-called the optimum, an increase in cash holdings have a positive impact on firm value. Above the optimal level, the accumulation of cash holdings leads to a decrease in the firm value. This relationship between cash holdings and firm value has substantial practical implications. Firstly, there is an optimum level of cash that maximizes the value of listed firms. The optimum level has some determinants: growth potential, access to capital markets, size and leverage (Martínez-Sola et al., 2013). We demonstrate that the optimum level of cash is much higher for financially constrained firms, compared to less financially constrained firms. Secondly, it is very useful for managers to understand and evaluate this relationship, because the value of a firm can be increased by

reducing its cash holding towards the optimum, but also considering the financial constraints.

No general agreement on the effects generated by cash holdings on firm value, as shown by the review of the literature, and the lack of evidence on European emerging markets motivate our research. Compared to the previous studies which documented the non-linear relationship between cash holdings and firm value, we employ both a larger sample of firms (719) and an extended period (2007-2016), the final dataset including 3,043 observations. Nguyen et al. (2016) performed the study on a sample of 273 Vietnamese firms and 1,638 firm-year observations, while the study of Martínez-Sola et al. (2013) is based on a sample comprising 472 firms. Our study includes also financial crisis period when it is recognized the increased dependence of financially constrained firms on cash (Maheshwari & Rao, 2017).

2. Data and Empirical Models

Our data are drawn from Amadeus, the database maintained by Bureau Van Dijk. The initial sample comprises 839 firms listed on the Warsaw Stock Exchange. After usual cleaning procedures have been applied (we exclude firms from the financial intermediation sector and insurance industries (NACE codes 64-66); we eliminate observations with negative assets and negative sales; we also eliminate firms that did not have complete records on our main regression variables), the final sample covers 719 firms, which corresponds to 3,043 observations.

In order to test the existence of an optimum level of cash holdings for the Polish listed firms we estimate the following model according to the relevant literature (Martínez-Sola et al., 2013; Nguyen et al., 2016):

$$TQ_{i,t} = \alpha + \beta_1 CASH_{i,t} + \beta_2 CASH^2_{i,t} + \beta_3 INTA_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 LEV_{i,t} + \mu_{i,t} + \lambda_j + \varepsilon_{i,t} \quad (1)$$

where the dependent variable ($TQ_{i,t}$) is the firm value measured via Tobin's Q; the variables of interest are $CASH_{it}$, which measures cash and cash equivalent to total assets holding by the firm i at time t, and its square term ($CASH^2_{i,t}$) to test for the nonlinearity of our model; as control variables we employ $INTA_{i,t}$ (as measure the growth opportunities), $SIZE_{i,t}$ (the size of the firm) and $LEV_{i,t}$ (the leverage); $\mu_{i,t}$ denotes the

unobservable firm and time effects; λ_j is an industry unobservable effect; ε_{it} represents the error term.

Consistent with the general practice in the corporate finance literature, firm value is measured using Tobin's Q. We compute Tobin's Q by dividing market value of a firm by the replacement value of its assets, where market value is given by the following relation:

$$Market\ value_{it} = total\ assets_{it} - \\ - book\ value\ of\ equity_{it} + \\ + market\ value\ of\ equity_{it} \quad (2)$$

Our independent variable of interest (CASH) is computed as cash and cash equivalents to total assets. In line with previous studies (Martínez-Sola et al., 2013; Nguyen et al., 2016), we employ the most important determinants of Tobin's Q, namely investments in intangible assets as a proxy for growth opportunities, firm size, and leverage. Firm size is measured by total assets and scaled up by the natural logarithm (SIZE1). Alternatively, Following Dang, Li, and Yang (2018), we used natural logarithm of total sales as the second measure for firm size (SIZE2) in order to test the sensitivity of the results to the firm size variable. Leverage (LEV) is computed as the ratio of total debt to total assets.

Following previous literature (e.g., Nguyen et al., 2016), we compute the turning point or the optimal of cash holding by taking the derivative of firm value (TQ) with respect to cash holdings variable and letting the result equal to zero.

$$dTQ/dCASH = \beta_1 + 2\beta_2 CASH \\ CASH^* = -\beta_1/(2\beta_2) \quad (3)$$

In the second part of our analysis, we test if this nonlinear relationship between cash level and firm value holds for firms that are financially constrained. We extend the Model 1 by adding an interaction variable between financial constraint and cash holding. Following Baños-Caballero, García-Teruel and Martínez-Solano (2014) and Nguyen et al. (2016), we use the cash flow to total assets as a proxy for the degree of financing constraints faced by the firm. We define the dummy variable FC which equals one if a firm is identified as financially constrained (the level of cash flow is below the median value in our sample) and zero otherwise. This leads to the following equation for Model 2:

$$TQ_{i,t} = \alpha + (\beta_1 + \alpha_1 FC)CASH_{i,t} + \\ + (\beta_2 + \alpha_2)CASH^2_{i,t} + \beta_3 INTA_{i,t} + \quad (4) \\ + \beta_4 SIZE_{i,t} + \beta_5 LEV_{i,t} + \mu_{i,t} + \lambda_j + \varepsilon_{i,t}$$

We use the same approach as in the previous specification to compute the optimal level of cash holding for less or more financially constrained firms. For less financially constrained firms, the coefficient $-\beta_1/(2\beta_2)$ represents the optimal level of cash holdings, while for more financially constrained firms the coefficient is computed as $-(\beta_1+\alpha_1)/2(\beta_2+\alpha_2)$.

In the third part of the analysis, we control for the influence of the financial crisis on the relationship between cash holdings and firm value. We extend the Model 1 by adding an interaction variable between financial crisis (CRISIS) and cash holding. Following Botoc and Anton (2017), the dummy variable CRISIS takes value 1 for the financial crisis period (2007-2008) and 0 for the post-crisis period (2009 to 2016). This leads to the following equation for Model 3:

$$TQ_{i,t} = \alpha + (\beta_1 + \alpha_1 CRISIS)\ CASH_{i,t} + \\ + (\beta_2 + \alpha_2)CASH_{i,t}^2 + \beta_3 INTA_{i,t} + \quad (5) \\ + \beta_4 SIZE_{i,t} + \beta_5 LEV_{i,t} + \mu_{i,t} + \lambda_j + \varepsilon_{it}$$

We estimated our empirical models using two different methods. In order to obtain robust results and to deal with endogeneity issues, we resort to a static, as well as to a dynamic panel data analysis.

Firstly, we draw on a static panel model. We performed a Hausman test to determine the exogeneity of the unobserved errors and to choose between fixed-effects and random-effects models. The test rejects the random-effects specification to all model specifications so fixed-effects estimations are employed.

The last estimation approach accounts for the fact that independent variables (regressors) might be correlated with a firm-specific, time-varying, idiosyncratic component of the error term which represents a potential source of endogeneity (Moretti, 2014). To solve this endogeneity issues, we use the first difference GMM (FD-GMM) estimator developed by Arellano and Bond (1991) and Arellano and Bover (1995). In line with Martínez-Sola et al. (2013), we consider that this estimation approach is appropriate for our sample as "firms are heterogeneous, and there are always factors influencing firm value that

are difficult to measure or hard to obtain". All variables are treated as endogenous and the lagged independent variables are used as an instrument.

Following Petersen (2009), the robust standard errors clustered at the firm level were used to simultaneously relax both the assumption of homoscedasticity and the assumption of no autocorrelation in our panel dataset. We include industry and time fixed effects to control for effects that might affect market value with respect to firms with similar production processes and for macro shocks that might affect market value in a given year.

3. Results and Discussions

This section presents the results of the estimations. Sub-section 3.1 presents the descriptive statistics for our sample. In sub-section 3.2, we first comment on the main estimations regarding the nonlinear relationship between corporate cash holdings and firm value, testing also the robustness of the findings to several proxies. We continue with results regarding the nonlinear relationship between corporate cash holdings and firm value under financial constraints (sub-section 3.3) and complete the analysis with results for the nonlinear relationship between corporate cash holdings and firm value during the financial crisis (sub-section 3.4).

3.1 Descriptive Statistics

Tab. 1 presents the descriptive statistics for the full unbalanced panel dataset with 719 firms and 3,043 observations. Outliers have been eliminated by winsorizing observations in the

top and bottom 1 percentile for independent financial variables before presenting the summary statistics.

Tobin's Q fluctuates from 0.330 to 13.780 with a standard deviation of 1.826, indicating how diverse our sample of firms is. The variable, used as a proxy for firm value, shows a mean of 1.587 higher than the median of 1.085, which means the data is skewed to the right.

The CASH variable ranges from 0.00 to 0.677 and has a standard deviation of 0.126. The mean of cash ratio (0.099) is higher than median (0.053), as highlighted by other studies on the example of both developed economies (Ozkan & Ozkan, 2004; Martínez-Sola et al., 2013) and respectively emerging economies (Nguyen et al., 2016) and, indicates that the distribution of cash holdings skews to the left. If we compare the mean value of the cash ratio -10%, we found to be close to the mean cash ratio from other emerging economy for similar period: 10% for Vietnam (Nguyen et al., 2016), but also much higher compared to other developing markets, i.e. 5%, 3.5% and 3% for Russia, China, and India, respectively (Al-Najjar, 2013) for the period from 2002 to 2008. The mean of cash ratio seems to be higher while comparing to mean cash ratio for developed economies: 7.9% for US (Martínez-Sola et al., 2013); 6.57% for Spain (García-Teruel & Martinez-Solano, 2008). The descriptive statistics show that 10% of firms from Poland have a very small ratio of cash (below 0.6% of cash over total assets), while 10% of Polish firms hold more than 24.2% of cash. The 10th and 90th percentiles of cash holding in our sample are of similar magnitude

Tab. 1: Descriptive statistics for variables employed in the analysis

Variable		Mean	Median	Perc. 10	Perc. 90	Std. Dev.	Min	Max
Firm value	TQ	1.587	1.085	0.666	2.595	1.826	0.330	13.780
Cash	CASH	0.099	0.053	0.006	0.242	0.126	0.000	0.677
Growth opportunities	INTA	0.111	0.029	0.000	0.392	0.175	0.000	0.766
Firm size	SIZE1	10.412	10.487	7.205	13.310	2.333	5.012	16.190
	SIZE2	10.100	10.378	6.539	13.352	2.682	2.004	15.738
Leverage	LEV	0.175	0.139	0.000	0.379	0.171	0.000	0.939

Source: own calculations

to those reported by Martínez-Sola et al. (2013), which shows a distribution pattern comparable to developed countries.

Throughout the whole sample, firm size, measured as the natural logarithm of total assets, has a minimum of 5.012 and a maximum of 16.190 and there are no big differences while comparing with firm size, measured as the natural logarithm of total sales. The average growth rate is 0.111 with a maximum of 0.766 in the whole sample. The average of leverage is 0.175

which is slightly lower than the value reported by Nguyen et al. (2016) for the Vietnamese firms (0.32) over the period 2008-2013. Overall, despite comparable cash levels with other emerging economies, the results show that Polish firms rely less on debt, most probably due to the difficult access to credit in this region. The percentiles report that only 10% of Polish firms have leverage higher than 37%.

The correlation between variables is presented in Tab. 2. The results show that there

Tab. 2:	**Pearson correlations**					
	TQ	**CASH**	**INTA**	**SIZE1**	**SIZE2**	**LEV**
TQ	1.000					
CASH	0.181	1.000				
INTA	0.056	-0.077	1.000			
SIZE1	-0.267	-0.143	-0.069	1.000		
SIZE2	-0.201	-0.108	-0.086	0.863	1.000	
LEV	-0.007	-0.273	-0.068	0.127	0.044	1.000

Source: own calculations

are no high correlations among the explanatory variables and therefore, multi-colinearity does not represent a concern.

3.2 The Nonlinear Relationship between Corporate Cash Holdings and Firm Value Model

In what follows, we report the empirical results on the relationship between cash holdings and firm performance in Poland. In all tables (3-6), the first column shows the estimated coefficients of a fixed effect model. The second column represents the Generalized Method of Moments (GMM) estimation, which controls for unobservable heterogeneity and addresses potential endogeneity concerns among variables. The lagged independent variables are used as instruments. We report AR (1) and AR (2) to underline the validity of GMM estimations. The statistically insignificant p-value of AR (2) test statistics reports that there is no second-order serial correlation in the error term.

Tab. 3 and 4 show the empirical results of the first econometric specification, which establishes firm value as a quadratic function

of cash and its square while controlling for leverage, firm size, and investment opportunities. Under the static and dynamic panel data models, CASH is positive and statistically significant ($\beta_1 > 0$), while CASH^2 is negative and significant ($\beta_2 < 0$) in both static and dynamic regressions.

In line with Martínez-Sola et al. (2013) and Nguyen et al. (2016), the cash holdings increase the value of the firm until a certain point, after which, increases in the cash holdings have a negative impact on the Polish firms' value. The coefficients on cash holdings provide evidence for the trade-off between Polish firms' investment spending and their cash stocks. The sign and the significance of the coefficients under different panel data estimations demonstrate the robustness of the findings regarding the nonlinear relationship between cash holdings and firm value. According to the money demand function formulated by Keynes (1936), transaction and precautionary reasons are predominant at a lower level of cash holdings, and there is a positive nexus between cash and firm value. At a higher level of cash holdings, the speculation reasons/

Tab. 3: The relationship between corporate cash holdings and firm value

	Panel FE (1)	FD-GMM (2)
CASH	1.5623*** (-0.5624)	1.5083** (-0.6440)
CASH^2	-3.0081*** (-1.0227)	-2.7866** (-1.2371)
INTA	-0.2731 (-0.2510)	-0.2373 (-0.3525)
SIZE1	-0.6894*** (-0.0465)	-0.3061*** (-0.061)
LEV	1.0169*** (-0.1949)	0.2258 (-0.2294)
Time FE	Yes	Yes
Industry FE	Yes	Yes
Observations	2,904	1,691
R-squared	0.1664	
AR(1) (p-value)		0.0000
AR(2) (p-value)		0.1170
Hansen test (p-value)		0.5640

Source: own calculations

Notes: CASH and CASH^2 measure cash holding. Control variables are INTA, SIZE, and LEV. Hansen test of over-iden-tification is under the null that all instruments are valid. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$. Robust standard errors are reported in brackets.

opportunity costs are predominant and the result is a negative relationship between cash and firm value, as under "liquidity trap", where interest rates play an important role.

For the FD-GMM estimation, the optimum level of cash is 27.06% of total assets. The result indicates that the accumulation of cash holdings up to 27.06% of total assets will increase the firm value, and, after this level, firm value decreases. The cost of holding cash dominates if the cash level is below the optimal level, leading to improved performance as cash level increases. Our findings are in line with Nguyen et al. (2016) who reported an inflection point of 26.81%.

In line with prior research (Garcia-Teruel & Martinez-Solano, 2008; Martínez-Sola et al., 2013), we observe that the coefficient of LEV is positive in both regressions and statistically significant under FE estimations. This may indicate that firms in Poland prefer to keep high cash levels rather than using it to reduce the degree of indebtedness, taking into account that Polish firms rely less on debt and the capital market is less developed. Firm size, measured as the natural logarithm of total assets, relates negatively to firm value, as predicted by Yang and Chen (2009) and Martínez-Sola et al. (2013). A possible explanation could be the fact that small firms face fewer agency problems and a more flexible structure to encounter the changes. Growth opportunities are not found to be a significant determinant of firm performance in Poland.

In order to test the robustness of our econometric specification, we re-estimate our models by using an alternative proxy for firm size (the natural logarithm of total sales) and reported the results in Tab. 4. The coefficients of the empirical results, under the fixed-effects method and GMM respectively, subscribe to the non-linear relationship reported above, in signs and in approximate magnitude. Moreover, the sign of the coefficients for control variables

Tab. 4:	The relationship between corporate cash holdings and firm value (robustness check)	

	Panel FE (1)	FD-GMM (2)
CASH	1.9456*** (-0.5917)	1.7771*** (-0.6696)
CASH^2	-4.2029*** (-1.0756)	-3.4199*** (-1.2799)
INTA	-1.0747*** (-0.2649)	-0.5922 (-0.3606)
SIZE2	-0.0560* (-0.0297)	-0.0631* (-0.0355)
LEV	1.0908*** (-0.2057)	0.1754 (-0.2374)
Time FE	Yes	Yes
Industry FE	Yes	Yes
Observations	2,887	1,683
R-squared	0.0860	
AR(1) (p-value)		0.0000
AR(2) (p-value)		0.1680
Hansen test (p-value)		0.3650

Source: authors' calculations

Notes: CASH and CASH^2 measure cash holding. Control variables are INTA, SIZE2, and LEV. Hansen test of over-identification is under the null that all instruments are valid.   *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$. Robust standard errors are reported in brackets.

(positive for LEV and negative for SIZE2) agrees with predictions from Tab. 3. In this case, the breakpoint of the cash-value relationship is 25.98%, below, but very close to the initial model which indicate an optimal cash level of 27.06% of total assets.

3.3 The Nonlinear Relationship between Corporate Cash Holdings and Firm Value under Financial Constraints

Tab. 5 reports the results from Equation (4) which analyses the cash holdings – firm value relationship under financial constraints conditions. The majority of academic literature shows that cash holdings are more valuable to constrained firms. In other words, less financially constrained firms tend to hold less cash compared with more constrained ones (Almeida et al., 2004; Arslan et al., 2006; Song & Lee, 2012; López-Gracia & Sogorb-Mira, 2015; Chang et al., 2017).

Based on static model and dynamic panel data regressions, we find a nonlinear relationship between firm value and corporate cash holdings in Polish listed firms, irrespective of more or less financially constrained status. These results confirm the previous findings of Nguyen et al. (2016), who reported an inverse U-shape nexus between firm value and cash holdings under more and less financially constrained conditions for non-financial Vietnamese firms.

Our findings, reported in Tab. 5, show that CASH relates positively to Tobin's Q, the proxy of firm value, while CASH squared has a negative impact on Tobin's Q. The coefficients of CASH and CASH squared are statistically significant at 1%.

The coefficients of the interaction between cash holdings squared and dummy variable of financial constraints are positive and statistically significant at 1%. If firms face constraints in terms of getting the necessary financial resources, they can decide to hold more cash

Tab. 5:	The relationship between corporate cash holdings and firm value under financial constraints	
	Panel FE (1)	FD-GMM (2)
CASH	2.7744*** (-0.6142)	2.2763*** (-0.6980)
CASH^2	-5.7336*** (-1.1929)	-4.9445*** (-1.4463)
INTA	-0.3055 (-0.2499)	-0.2441 (-0.3507)
SIZE1	-0.6886*** (-0.0463)	-0.2971*** (-0.0610)
LEV	1.1254*** (-0.1954)	0.2871 (-0.2294)
CASH * FC	-2.8353*** (-0.5955)	-1.7684*** (-0.6831)
CASH^2 * FC	5.8103*** (-1.2913)	4.4618*** (-1.5367)
Time FE	Yes	Yes
Industry FE	Yes	Yes
Observations	2,904	1,691
R-squared	0.1749	
AR(1) (p-value)		0.0000
AR(2) (p-value)		0.1700
Hansen test (p-value)		0.5830

Source: authors' calculations

Notes: CASH and CASH^2 measure cash holding. Control variables are INTA, SIZE, and LEV. Hansen test of over-identification is under the null that all instruments are valid.   *p < 0.10; **p < 0.05; ***p < 0.01. Robust standard errors are reported in brackets.

as a buffer for precautionary reasons and to adopt investment projects with positive NPVs. Differences in access to external finance could explicate that the accumulation of cash balances is positive.

For the FD-GMM estimation, the optimum level of cash is 23.01% of total assets for less financially constrained firms and 52.61% for more financially constrained firms. These results indicate a larger difference in the optimal level of cash holdings for the two types of firms. In the context of the nonlinear relationship between corporate cash holdings and firm value under financial constraints, we report two inflection points for Polish listed firm, with the mention that the optimum level of cash for financially constrained firms is more than double compared to the optimum level

of cash for less financially constrained firms. From this perspective, our study brings a major contribution, due to the fact that our findings support, empirically, the niche of academic literature which shows that cash holdings are more valuable to constrained firms in emerging markets. For financially constrained firms, an increase in cash holding up to 52.61% of total assets generate an increase in firm value; after this point, firm performance decreases. This means that, under financial constraint conditions, holding a high level of corporate cash holdings is a sign of good liquidity and performance, the capital market behavior revealing the importance of the amount of cash holdings to firm value. Nguyen et al. (2016), on the example of Vietnam, also reported two inflection points of the cash-value relationship,

	Tab. 6: The relationship between corporate cash holdings and firm value during the financial crisis		
	Panel FE (1)	**FD-GMM** (2)	
CASH	1.3024** (-0.5744)	4.6369** (-2.0011)	
CASH^2	-2.6070** (-1.0376)	-7.9087** (-3.496)	
INTA	-0.2432 (-0.2512)	-0.1021 (-0.7567)	
SIZE1	-0.6874*** (-0.0465)	-0.2384** (-0.0940)	
LEV	1.0356*** (-0.1950)	0.5936 (-0.4717)	
CASH * CRISIS	4.1904* (-2.502)	-1.3185 (-4.4384)	
CASH^2 * CRISIS	-9.0177 (-8.2651)	7.4309 (-16.6345)	
Time FE	Yes	Yes	
Industry FE	Yes	Yes	
Observations	2,904	1,691	
R-squared	0.1683		
AR(1) (p-value)		0.0000	
AR(2) (p-value)		0.1790	
Hansen test (p-value)		0.4860	

Source: authors' calculations

Notes: CASH and CASH^2 measure cash holding. Control variables are INTA, SIZE, and LEV. Hansen test of over-iden-tification is under the null that all instruments are valid. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$. Robust standard errors are reported in brackets.

23.35% and 27.32% for less and more financially constrained conditions, respectively. Our results are consistent regarding the optimum level of cash holdings for unconstrained firms, but inconsistent regarding the breakpoint of cash for constrained firms. We show that corporate cash holdings are of higher value for constrained firms and liquidity represent an important driver of firm performance in Poland in the context of financial constraints, as an intervening effect.

3.4 The Nonlinear Relationship between Corporate Cash Holdings and Firm Value during the Financial Crisis

Tab. 6 reports the results from Equation (5), which tests for the influence of the financial crisis on the relationship between cash holdings and firm value.

The results reported in Tab. 6 show that the interaction between cash holdings and financial crisis is not significant neither in static nor in dynamic regressions. The results are consistent with the baseline estimations in supporting the nonlinear relationship between firm value and cash holdings and show that there is no additional value of extra cash for Polish firms during the financial crisis. We conclude that the financial crisis has no additional impact on the non-linear relationship between cash holdings and firm value. From the macroeconomic perspective, Poland presented a relatively good resilience during the worldwide recession of 2007-2009 and therefore the relationship between cash holdings and firm value has not been influenced.

Conclusions

In this paper, we examined the impact of corporate cash holdings on firm value, on the example of Poland, an emerging economy, over the period 2007-2016. The results show that firm value increases in the linear form of cash holdings and it decreases in the quadratic form, highlighting an inverted U-shaped curve relationship. Moreover, we test whether a nonlinear relationship between firm value and cash holding exists in the context of financial constraints and the financial crisis, respectively. The sign and statistically significance of the estimated coefficients for three different specifications of the independent variable – firm value, support the robustness of the results regarding the nonlinear relationship between cash holdings and firm value, in the context of two financial intervening effects: constraints and crisis. We validate the financial constraints as having a more pronounced effect on the relationship between corporate cash holdings and firm value, compared to the financial crisis, as intervening effects, in the context of the Polish economy. Our findings are in line with the recent body of academic literature on the existence of an optimal level of corporate cash holdings (Nguyen et al., 2016; Martínez-Sola et al., 2013), which support the trade-off theory of corporate cash holdings in Poland. For the FD-GMM estimation, the optimum level of cash is found to be 27.06% of total assets. The result indicates that the accumulation of cash holdings up to 27.06% of total assets will increase the firm value, and, after this level, firm value decreases. Moreover, we highlight differences in the optimal level of cash holdings, in the context of financial constraints. We report two breakpoints of the cash-value relationship and the results indicate a larger difference in the optimal level of cash holdings for the two types of firms – 23.01% of total assets for less financially constrained firms and 52.61% for more financially constrained firms. The results suggest that corporate cash holdings are of higher value for constrained firms and liquidity represent an important driver of firm performance in Poland in the context of financial constraints, as an intervening effect.

Our paper provides practical information able to support the business decision of firms in a challenging economic environment. Firstly, the response of the market emphasizes useful insights. Firms' market value is positively related to the accumulation of cash holdings until a certain point, after which, increases in the cash holding have a negative impact on the Polish firms' value. Therefore, liquidity management is a determinant of shareholder value (Martínez-Sola et al., 2013). If a firm has too many cash holdings, the value of the firm can increase by reducing the cash holdings towards the optimal level. Second, it is very important for business managers to determine the optimal level of cash holding and to test its relevance over time. Thirdly, managing the cash conversion cycle is the art of attaining the right trade-off between liquidity and profitability (Maheshwari & Rao, 2017). Finally, the investors would be more interested in how firm cash is managed in order to take the best investment decision.

As for directions for future research, we recognize that the role of board characteristics and corporate governance require investigation on the relationship between cash holdings and firm value, on the example of emerging economies.

References

Almeida, H., Campello, M., & Weisbach, M. (2004). The cash flow sensitivity of cash. *Journal of Finance*, *59*(4), 1777-1804. https://doi.org/10.1111/j.1540-6261.2004.00679.x.

Al-Najjar, B. (2013). The financial determinants of corporate cash holdings: Evidence from some emerging markets. *International Business Review*, *22*(1), 77-88. https://doi.org/10.1016/j.ibusrev.2012.02.004.

Arellano, M., & Bond, S. (1991). Some test of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies, 58*(2), 277-297. https://doi.org/10.2307/2297968.

Arellano, M., & Bover, O. (1995). Another look at the instrumental-variable estimation of error-components model. *Journal of Econometrics*, *68*(1), 29-51. https://doi.org/10.1016/0304-4076(94)01642-D.

Arslan, O., Florackis, C., & Ozkan, A. (2006). The role of cash holdings in reducing investment-cash flow sensitivity: Evidence from a financial crisis period in an emerging market. *Emerging Markets Review*, *7*(4), 320-338. https://doi.org/10.1016/j.ememar.2006.09.003.

Baños-Caballero, S., García-Teruel, P. J., & Martínez-Solano, P. (2014). Working Capital Management, Corporate Performance, and Financial Constraints. *Journal of Business Research*, *67*(3), 332-338. https://doi.org/10.1016/j.jbusres.2013.01.016.

Bernini, M., & Montagnoli, A. (2017). Competition and financial constraints: A two-sided story. *Journal of International Money and Finance, 70*, 88-109. https://doi.org/10.1016/j.jimonfin.2016.07.003.

Botoc, C., & Anton, S. G. (2017). Is profitability driven by working capital management? Evidence for high-growth firms from emerging Europe. *Journal of Business Economics and Management*, *18*(6), 1135-1155. https://doi.org/10.3846/16111699.2017.1402362.

Botrić, V., & Božić, L. (2017). Access to finance: innovative firms' perceptions in post-transition EU members. *Economics and Management*, *20*(1), 129-143. https://doi.org/10.15240/tul/001/2017-1-009.

Cao, L., & Chen, C. (2013). *Corporate Cash Holdings and Firm Value – Evidence from Chinese Industrial Market* (Master thesis in finance). Simon Fraser University.

Chang, Y., Benson, K., & Faff, R. (2017). Are excess cash holdings more valuable to firms in times of crisis? Financial constraints and governance matters. *Pacific-Basin Finance Journal*, *45*, 157-173. https://doi.org/10.1016/j.pacfin.2016.05.007.

Dang, C., Li, Z., & Yang, C. (2018). Measuring firm size in empirical corporate finance. *Journal of Banking and Finance*, *86*, 159-176. https://doi.org/10.1016/j.jbankfin.2017.09.006.

Duchin, R., Ozbas, O., & Sensoy, B. A. (2010). Costly external finance, corporate investment, and the subprime mortgage credit crisis. *Journal of Financial Economics*, *97*(3), 418-435. https://doi.org/10.1016/j.jfineco.2009.12.008.

Garcia-Teruel, P., & Martinez-Solano, P. (2008). On the determinants of SME cash holdings: Evidence from Spain. *Journal of Business Finance & Accounting*, *35*(1-2), 127-149. https://doi.org/10.1111/j.1468-5957.2007.02022.x.

Hashi, I., & Krasniqi, B. A. (2011). Entrepreneurship and SME growth: evidence from advanced and laggard transition economies. *International Journal of Entrepreneurial Behavior & Research, 17*(5), 456-487. https://doi.org/10.1108/13552551111158817.

Kao, S. W. (2012). Cash holding and firm value: The case of Taiwan's tourism industry. *Tourism Economics, 18*(4), 897-902. https://doi.org/10.5367/te.2012.0150.

Keynes, J. M. (1936). *The General Theory of Employment, Interest and Money*. London: Harcourt Brace.

López-Gracia, J., & Sogorb-Mira, F. (2015). Financial constraints and cash–cash flow sensitivity. *Applied Economics*, *47*(10), 1037-1049. https://doi.org/10.1080/00036846.2014.987918.

Maheshwari, Y., & Rao, K. T. V. (2017). Determinants of corporate cash holdings. *Global Business Review*, *18*(2), 416-427. https://doi.org/10.1177/0972150916668610.

Martínez-Sola, C., García-Teruel, P., & Martínez-Solano, P. (2013). Corporate cash holding and firm value. *Applied Economics*, *45*(2), 161-170. https://doi.org/10.1080/00036846.2011.595696.

Moretti, L. (2014). Local financial development, socio-institutional environment, and firm productivity: Evidence from Italy. *European Journal of Political Economy*, *35*, 38-51. https://doi.org/10.1016/j.ejpoleco.2014.03.006.

Nguyen, T. L. H., Nguyen, L. N. T., & Le, T. P. V. (2016). Firm value, corporate cash holdings and financial constraint: A study from a developing market. *Australian Economic Papers*, *55*(4), 368-385. https://doi.org/10.1111/1467-8454.12082.

Ozkan, A., & Ozkan, N. (2004). Corporate cash holdings: An empirical investigation of UK companies. *Journal of Banking and Finance*, *28*(9), 2103-2134. https://doi.org/10.1016/j.jbankfin.2003.08.003.

Peterson, M. A. (2009). Estimating standard errors in finance panel data sets: Comparing

approaches. *Review of Financial Studies*, *22*(1), 435-480. https://doi.org/10.1093/rfs/hhn053.

Song, K. R., & Lee, Y. (2012). Long-term effects of a financial crisis: Evidence from cash holdings of East Asian firms. *Journal of Financial and Quantitative Analysis*, *47*(3), 617-641. https://doi.org/10.1017/S0022109012000142.

Tong, Z. (2014). Deviations from optimal corporate cash holdings and the valuation from a shareholder's perspective. *Applied Economics*, *46*(30), 3695-3707. https://doi.org/10.1080/00036846.2014.939374.

Yang, C. H., & Chen, K. H. (2009). Are small firms less efficient? *Small Business Economics*, *32*(4), 375-395. https://doi.org/10.1007/s11187-007-9082-x.

Assoc. Prof. Sorin Gabriel Anton, Ph.D.
Alexandru Ioan Cuza University of Iasi
Faculty of Economics and Business Administration
Finance, Money, and Public Administration
Department
Romania
sorin.anton@uaic.ro

Assist. Prof. Anca Elena Afloarei Nucu, Ph.D.
Alexandru Ioan Cuza University of Iasi
Faculty of Economics and Business Administration
Finance, Money, and Public Administration
Department
Romania
anca.afloarei.nucu@uaic.ro

Abstract

FIRM VALUE AND CORPORATE CASH HOLDINGS. EMPIRICAL EVIDENCE FROM THE POLISH LISTED FIRMS

Sorin Gabriel Anton, Anca Elena Afloarei Nucu

In the context of imperfect markets, it is important to understand the relationship between non-earning assets and firm value, in order to evaluate the corporate financial policies and to attain the right equilibrium between liquidity and profitability. The aim of our paper is to assess the relationship between corporate cash holdings and firm value for a sample of 719 Polish listed firms over the period 2007-2016. The study reports an inverted U-shape relationship between cash holdings and firm value, irrespective of whether we use static regression methods or dynamic panel regression. Our results confirm the existence of an optimum level of cash holdings at 27.06% of total assets. Furthermore, the nonlinear relationship between firm value and corporate cash holdings is found for all Polish listed firms, financially and less financially constrained. We report two breakpoints of the cash-value relationship, in the context of financial constraints, and the results indicate that the optimum level of cash holdings is much higher for financially constrained firms than less financially constrained ones. Finally, we show that the financial crisis has no additional impact on the non-linear relationship between cash holdings and firm value. We validate the financial constraints as having a more pronounced effect on the relationship between corporate cash holdings and firm value, compared to the financial crisis, as intervening effects, in the context of the Polish economy. This study holds important microeconomics policy implications – firm-level financial policies should evaluate the tradeoff between cash holdings and market value in order to maintain the firm financial performance.