W kierunku umiędzynarodowienia / Towards internationalization

Does information asymmetry influence cash holding in the most liquid public companies in Poland?

Czy asymetria informacji wpływa na rezerwy płynnościowe w najbardziej płynnych spółkach publicznych w Polsce?

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Abstract

Purpose: This paper analyses the relationship between information asymmetry and the cash hoarded by companies listed on the Warsaw Stock Exchange (WSE).

Methodology/approach: We applied the Ordinary Least Squares approach to cross-sectional data of the 212 most liquid public companies for which data on bid-ask spread was available.

Findings: We show that companies with greater information asymmetry hold more cash, confirming the investment opportunities hypothesis. The average bid-ask spread negatively impacts cash reserves, no matter the character of discretionary accruals. Net working capital and cash flow to non-cash asset ratios positively affect cash holdings, in contrast to the debt ratio. The results show that the costs of monitoring managers are lower than information asymmetry costs in Poland and suggest that holding more cash is more beneficial than going into debt. The default risk or the threat of borrowing costs rising in turbulent times is worse than a loss due to keeping cash.

Research limitations/implications: Research limitations concern cross-sectional data only for one year – 2017.

Originality/value: Our paper is the first study of the relationship between information asymmetry and cash holdings for the transition economy. The novelty of our research is also the use of a different approach to measure information asymmetry in the Polish capital market.

Keywords: information asymmetry; cash holdings; Poland; accruals, bid-ask spread.

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Streszczenie

Cel: Celem artykułu jest analiza zależności między asymetrią informacji a gromadzeniem środków pieniężnych przez spółki notowane na Giełdzie Papierów Wartościowych w Warszawie.
Metodyka/podejście badawcze: Zastosowano Metodę Najmniejszych Kwadratów do analizy danych przekrojowych 212 najbardziej płynnych spółek publicznych, dla których dostępne były dane o *spread bid-ask*.
Wyniki: Pokazano, że spółki o większej asymetrii informacji posiadają więcej środków pieniężnych, potwierdzając hipotezę o możliwościach inwestycyjnych. Średni *bid-ask spread* negatywnie wpływa na rezerwy środków pieniężnych, niezależnie od charakteru uznaniowych różnic memoriałowych. Kapitał obrotowy netto oraz wskaźnik przepływów pieniężnych do aktywów niegotówkowych pozytywnie wpływają na zasoby środków pieniężnych, w przeciwieństwie do wskaźnika zadłużenia. Wyniki pokazują, że koszty monitoringu menedżerów są w Polsce niższe niż koszty asymetrii informacji. Sugerują one, że posiadanie większych zasobów środków pieniężnych jest korzystniejsze niż zadłużanie się. Ryzyko niewykonania zobowiązania lub ryzyko wzrostu kosztów kredytu w burzliwych czasach są bardziej szkodliwe niż straty z powodu utrzymywania gotówki.
Ograniczenia/implikacje badawcze: Badanie zostało przeprowadzone na danych przekrojowych, tylko dla jednego okresu – 2017 roku.
Oryginalność/wartość: Artykuł jest pierwszym opracowaniem zależności między asymetrią informacji i rezerwami płynności dla gospodarki w okresie transformacji. Nowością w badaniu jest również wykorzystanie wieloaspektowego podejścia do pomiaru asymetrii informacji na polskim rynku kapitałowym.
Słowa kluczowe: asymetria informacji, rezerwy płynnościowe, Polska, rezerwy, bid-ask spread.

Introduction

The International Monetary Fund has indicated that there has been a significant increase in the cash hoarded by listed companies worldwide. An increase in cash holdings is closely linked to financial flexibility (a firm's ability to respond to changes in cash flows or an investment opportunity set by providing cost-effective financing (Denis, 2011), the rise in operational risk, and research and development (R&D) expenses (Bates et al., 2009; Chung, 2017). Cash holdings are not only an internal source of financing but also a capital conservation buffer in case of shock liquidity changes (Białek-Jaworska, 2017). The balance between available cash and cash needs is considered the most important success factor for every business unit (Joudi et al., 2019). Maintaining financial liquidity, which prevents bankruptcy, maximises a company's income, and increases its value, is what every company should strive for (Gennaro, 2021). Liquidity reflects a company's financial situation, is a prerequisite for its smooth operation, and affects investors' credibility and market assessment. Cash holdings also allow profitable investment opportunities to be exploited and mandatory debt repayments to be made if there are cash flow shortfalls without needing to access external capital markets. However, higher liquidity reserves become unfavourable if managers use them for their own benefit and at the expense of shareholders (Chung et al., 2015).

In joint-stock companies, where external investors do not influence the company's daily affairs, information asymmetry is frequent. Information asymmetry is when one party in a transaction has more information than the other. It may lead to abuse by the company's management, whose decisions may conflict with the interests of shareholders (Cheryta et al., 2018). For example, shareholders may expect to invest any amount of free cash to multiply their wealth and induce management to take out a bank loan to reduce monitoring costs (passing them on to the lender, i.e. the bank). Conversely, the board of directors may hoard cash in anticipation of lucrative investment opportunities and hedge against financial constraints (financial frictions). Therefore, in the theory of free cash flows and agency theory, the influence of information asymmetry on the amount of cash held in public limited companies is of significant importance. However, the results of numerous studies on this subject are ambiguous. Therefore, it is worth investigating this relationship in Poland's most liquid public companies before turbulent times.

This article studies the relationship between information asymmetry and the cash holdings of the most liquid public companies (whose stocks have been traded most frequently so that Bid-Ask Spread data is available) in Poland as an example of a transition economy. In 2017, cash holdings in joint-stock companies listed on the primary market of the Warsaw Stock Exchange (WSE) accounted for an average of 10.40% of assets. The largest share of cash in total assets, 70%, was held by LiveChat Software S.A., an IT firm; in contrast, AAT Holding S.A. recorded the smallest percentage (0.02%).

Information asymmetry influences enterprises' cash holdings because of its effect on managerial behaviour and external investors' ability to understand it (Blanchard et al., 1994). The relationship between the information environment, its quality and cash holding has been extensively studied in the literature (Clarkson et al., 2020; Farinha et al., 2018; Xiong et al., 2021; Chung et al., 2010). According to agency theory, higher information asymmetry may exacerbate the free cash flow problem, making it more difficult for external investors to monitor and interpret managerial activities (Jensen, 1986). Alternatively, when the capital market is imperfect, i.e., information asymmetry between external investors and internal people, investors it will require the company to pay a premium for external resources, making external financing more expensive than internal financing (Majluf, 1984). Thus, our article aims to ascertain the following: Does information asymmetry influence the cash that is hoarded by companies listed on the WSE? To answer that, we formulated two hypotheses:

H1. The monitoring cost hypothesis of cash holding: A company's cash holdings (liquidity reserves) are negatively influenced by the level of information asymmetry between its managers and external shareholders.

H2. The investment opportunities hypothesis of cash holdings: A company's cash holdings (liquidity reserves) are positively influenced by the level of information asymmetry between its managers and external shareholders.

Our paper is the first study of this relationship for the transition economy. Although there is some literature on the factors that affect cash management in Polish

small and micro-enterprises (Parkitna, Górski, 2008), there is no such research on Polish public companies. The novelty of our research is that it uses a different approach to measure information asymmetry in the Polish capital market (including average bid-ask spread, applied beta, market-to-book ratio, the EBITDA (earnings before interest, tax, depreciation, and amortisation) margin, and discretionary accruals). Hence, it contributes to the literature on capital market imperfectness that results from information asymmetry and adds to the research stream on financial flexibility. The paper is structured as follows: the theoretical background, literature review, and research hypotheses are presented in the initial section, followed by a description of the data used and the research design. The results of the empirical study are presented with findings interpreted and discussed with reference to the literature on the subject. The paper ends with a summary and conclusions.

1. Literature review

Keeping a large cash buffer helps managers manage their organisation efficiently, solves liquidity problems, and allows them to become independent of capital from the external market and its cost. However, in some circumstances, such as an imperfect market, managers may benefit from the stored cash at the expense of shareholders (Le et al., 2018). In addition, information asymmetry may affect the cash hoarded by companies through two channels – by influencing managers' behaviour and the ability of external stakeholders to understand the decisions made in a company (Chung et al., 2015).

Higher information asymmetry may exacerbate the problem of free cash flow by affecting external investors' ability to monitor and understand the activities of internal investors. Cash is highly susceptible to abuse by managers since they can access it easily and use excess cash on a discretionary basis (Chung et al., 2015). Jensen (1986) proposed a theory of free cash flow to explain management's incentive to hold cash from the point of view of agency costs. He argued that it is difficult for external investors to oversee management behaviour. Managers seek to maximise their interests and make investment decisions that diverge from the company's best interests by investing free cash in projects that may increase company's size. Managers may be interested in building their corporate empire or diversifying their investments to gain personal prestige, strength, status, a raise in salary, and other additional personal income, reducing the value of the company's cash (Chung et al., 2015). While corporate cash conflicts of interest have been well recognised since Jensen, the effect of information asymmetry on this agency conflict is ambiguous (Jensen, 1986). Nikolov and Whited (2014) argued that the amount of cash might be explained by agency costs, such as private benefits for managers from excessive consumption. According to the monitoring cost hypothesis, cash holdings held by a company are inversely proportional to the level of information asymmetry between the company's managers and its external shareholders. This relationship was confirmed by Chung et al. (2015), who investigated public companies listed on

the New York Stock Exchange (NYSE) and the American Stock Exchange (AMEX) between 1993 and 2009. These prior empirical results allowed us to adopt the following research hypothesis:

H1. The monitoring cost hypothesis of cash holding: A company's cash holdings (liquidity reserves) are negatively influenced by the level of information asymmetry between its managers and external shareholders.

Alternatively, greater information asymmetry may cause concerns about the capital needs of a company in both its shareholders and managers. As managers have more information than external investors, Myers and Majluf (1894) proposed the pecking order theory - in an imperfect capital market, due to information asymmetry, investors can request a premium for providing equity to a company. This makes internal financing preferable to external funding because of its lower costs. Myers and Majluf (1894) further suggested that there is no optimal level of cash, and that maintaining it is done to reduce the cost of information asymmetry. Dennis and Sibilkov (2010) stated that cash allows high-value-added investments, and that companies facing financial constraints, such as insufficient cash holdings, may lose investment opportunities due to information asymmetry. A positive correlation between information asymmetry and cash holdings was also confirmed by Hesari et al. (2014). Based on that, we formulated the second hypothesis:

H2. The investment opportunities hypothesis of cash holdings: A company's cash holdings (liquidity reserves) are positively influenced by the level of information asymmetry between its managers and external shareholders.

Whether cash levels decrease or increase with the level of information asymmetry depends on the relative size of the monitoring costs and the cost of external financing. Ceteris paribus, if monitoring costs exceed borrowing costs, it provides evidence to support the monitoring cost hypothesis that cash holdings decrease with information asymmetry. In contrast, if borrowing costs exceed monitoring costs, evidence would be found to support the investment opportunity hypothesis that cash holdings increase with information asymmetry.

Sound cash management is fundamental to the survival and development of any economic entity, and it is the most crucial source of growth in its value. However, a lack of proper organisation in cash holdings may cause many adverse effects, such as an increase in fixed costs and a loss of control over variable costs, weaker efficiency of holdings, or an increase in the cycle of receivables collection (Śpiewak, 2008).

The determinants of maintaining cash holdings include transaction costs and agency and tax motives. Sher (2014) and Mulligan (1997) analysed the reasons for transaction costs, while Bates et al. (2009) rejected them as one of the determinants of cash reserves. The agency motive of cash holdings was analysed by Le et al. (2018) and Nikolov and Whited (2014) using an international sample.

In practice, the amount of cash held by a firm is due to external and internal factors. The share of cash in assets (Rutkowski, 2003) results from:
- the need to meet the deadline to repay liabilities when the inflow of receivables is delayed,

– hedging against high costs of raising additional capital when there is an increased liquidity risk, which affects the cost of capital,
– a reduction in potential losses that result from the sale of some of the assets at a price below the cost to cover unforeseen expenses,
– implementing an adopted working capital management strategy aligned to a change in the sales volume or the growth rate.

Nguyen et al. (2016) determined companies' cash needs. They found that companies tend to maintain a higher level of cash when they have limited creditworthiness or plan to carry out investment projects. According to Bates et al. (2009), the cash resource ratio increases for financially constrained companies with better and more profitable investment opportunities. Ahrends et al. (2018) argued that companies with more investment opportunities invest more, thus needing more cash. Companies with better investment opportunities may have more cash to secure their ability to finance future investments and avoid underinvestment costs. Chung et al. (2015) demonstrated that cash allows companies to benefit from profitable investment opportunities, making it optimal to maintain larger cash reserves to minimise transaction costs. Cash and cash equivalents also enable the debt to be repaid in a shortfall in cash flows without the need for external financing.

The trade-off theory implies that firms with higher capital expenditures should raise more cash to avoid financial constraints. Companies paying dividends are inherently less financially constrained, thus having less cash. This can be explained by companies that can afford to have less cash paying dividends because they are more capable of raising funds (Harris, Raviv, 2017). However, according to the pecking order theory, firms with higher capital expenditures should accumulate less cash; larger firms presumably have been more successful. Hence they should have more cash in case of higher cash flows after controlling for investment, and dividend payments may demand either less cash holdings or more cash holdings in the presence of high cash flows (Artica, 2019).

Research also shows that larger firms may have lower cash holdings because of their better access to capital markets. On the other hand, companies with low indebtedness have a higher cash flow, suggesting that the high costs of incurring debt make maintaining cash more advantageous. The negative correlation between cash holdings and the net working capital ratio is considered the substitutability of cash and working capital (Chung et al., 2015).

Non-monetary assets may also be regarded as a cash substitute. Surveys show that company-specific assets positively correlate with cash holdings, as companies may rely on selling non-core assets at a lower price to ensure their liquidity (Artica et al., 2019). The negative dependence between cash holdings and non-cash assets was also confirmed by Le et al. (2018).

Substitution theory, confirmed by Bigelli and Sanchez-Vidal (2012), Azar et al. (2016) and McLean (2011), predicts a positive relationship between the volatility of cash flows and maintaining cash. Therefore, in times of crisis, more cash should be maintained as collateral for a company whose cash flow volatility is high to improve

its chances of survival. Falato et al. (2013) and Graham and Leary (2018) indicated the significance of the nature of the company's assets as a factor that affects the size of cash holdings. They also showed that the cash holdings vary depending on the sector to which the company belongs.

The factors positively correlated with the value of cash holdings held by the company are uncertainty, the amount of cash flows and future economic conditions, bankruptcy vision, investment opportunities, and expenses and transaction costs related to acquiring external sources of capital (Im et al., 2017). Negatively correlated factors include the level of capital and non-monetary assets held, the degree of indebtedness and the payment of dividends.

Given the different motives for a firm to hold cash when determining the optimum cash level, it is possible to increase the efficiency of an economic operator. However, maintaining assets in cash does not generate income, unlike other assets. Moreover, the need to finance the cash available in certain liability items increases the opportunity costs. Therefore, one of the primary tasks of cash management is to determine the optimum level of cash from the point of view of generated revenues and incurred costs (Śpiewak, 2008).

2. Methodology

We obtained data for the 212 most liquid non-financial joint-stock companies listed on the primary market of the Warsaw Stock Exchange whose stocks have been traded most frequently so that Bid-Ask Spread data is available. They belong to the following sectors: trade & technology, consumer goods, energy & materials, services, manufacturing and real estate. We excluded financial companies as their main activity is cash-related, and accounting standards differ greatly. We focus on public companies because, due to the numerous investors and, in consequence, relatively high stock liquidity, they represent a good sample to examine the impact of information asymmetry between internal and external investors on cash holdings. Observations with insufficient data to estimate the linear regression were also excluded. We use cross-sectional data (for 2017) taken from the Bloomberg database. To address the relationship between information asymmetry and cash held by Polish companies, we use a quantitative design and estimate the linear regression using the Ordinary Least Squares (OLS) method performed in Stata/IC 15.1. The dependent and control variables were scaled and used as indicators to unify the values of variables and better compare them. As in Chung et al. (2015), the value of corporate non-monetary assets is the common denominator. Table 1 presents the definitions of the dependent and independent variables used to measure information asymmetry and control variables. Following the literature review, selected control variables are considered determinants of corporate cash holdings.

Table 1. Definition of variables

Variable	Definition of the variable	Expected sign
cash holdings	The dependent variable equals to ln [1 + (cash + securities)/non-cash assets]	
Variables measuring information asymmetry		
applied beta	change in the stock price as the effect of a 1% change in its benchmark index	+/–
bid-ask spread	average of all bid-ask spreads as a percentage of the average price	+/–
EBITDA margin	$\dfrac{\text{earnings before interest, tax, depreciation and amortisation}}{\text{total revenue}}$	+/–
DAC	discretionary accruals equal residuals estimated by Dechow's model (the modified Jones's model), extended by the ROA, described in equation (1)	+/–
market-to-book ratio	$\ln \left(\dfrac{\text{book value of assets} - \text{book value of equity} + \text{market value of equity}}{\text{non\_cash assets}} \right)$	+/–
Control variables		
NCA	ln [assets – cash – transferable securities]	–
cash flow	cash flow/non-cash assets	+
net working capital	(current assets without cash – short-term liabilities)/non-cash assets	–
debt ratio	total debt/non-cash assets	–
capex	capital expenditure ratio equals the purchase of property, plant, and equipment divided by non-cash assets	–
dividend dummy	the dummy variable equals 1 when a firm has paid out a dividend in a given year, 0 otherwise	–
sector	a binary variable that indicates which industry a company belongs to, including trade & technology; consumer goods; energy & materials; services; manufacturing; real estate	+/–

Note:
+/– means different sign expectations depending on the theoretical background, supported by ambiguous empirical results in the literature.

Source: authors' compilation.

To address the issue of correlation between a firm's current and past performance (Othman, Zeghal, 2006), we utilise Dechow's model extended by incorporating return on assets (ROA) to estimate discretionary accruals (DAC). These accruals, denoted as residuals in equation (1), are computed for firm *i* in year *t* as follows:

$$\frac{TA_{i,t}}{A_{i,t-1}} = a_1 \frac{1}{A_{i,t-1}} + a_2 \frac{\Delta REV_{i,t} - \Delta REC_{i,t}}{A_{i,t-1}} + a_3 \frac{PPE_{i,t}}{A_{i,t-1}} + a_4 ROA_{i,t} + \varepsilon_{i,t} \quad (1)$$

where:

TA_t – total accruals scaled by lagged total assets in year t, described in equation (2);

A_{t-1} – total assets in year t–1;

ΔREV_t – revenues in year t minus revenues in year t–1 scaled by total assets at t–1;

ΔREC_t – net receivables in year t less net receivables in year t–1 scaled by total assets at t–1;

PPE_t – gross property, plant and equipment in year t scaled by total assets at t–1;

ROA_t – return on assets in year t;

$\varepsilon_{i,t}$ – random error.

$$TA_{i,t} = \frac{(\Delta CA_{i,t} - \Delta CL_{i,t} - \Delta Accruals_{i,t} - \Delta CASH_{i,t} - \Delta DEP_{i,t})}{A_{i,t-1}} \quad (2)$$

where:

ΔCA_t – change in current assets in year t;

A_{t-1} – lagged total assets (in year t–1);

ΔCL_t – change in current liabilities (without debt) in year t;

$\Delta Accruals_t$ – change in prepaid expenses in year t;

$\Delta Cash_t$ – change in cash and cash equivalents in year t;

DEP_t – depreciation and amortisation expense in year t.

Due to the negative values of some variables, the Box-Cox transformation was not used to select the best form of variable transformation. The choice was based on the functional form used by Chung et al., 2015), histogram analysis and a general-to-specific method to select the best-fitting model. The dependent variable was logarithmically transformed after adding 1 to the cash ratio (to protect against deletion of no-cash observations). The non-cash assets and market-to-book ratio variables were also logarithmically transformed to improve their distributions.

The final form of the model used to check whether and how cash holdings are linked to information asymmetry, including control variables, was chosen based on the literature review, is as follows:

$$cash\ holdings_i = \beta_0 + \beta_1 applied\ beta_i + \beta_2 bid\text{–}ask\ spread_i + \beta_3 EBITDA\ margin_i +$$
$$\beta_4 DAC_i + \beta_5 market\text{–}to\text{–}book_i + \beta_6 NCA_i + \beta_7 cash\ flow_i + \beta_8 net\ working\ capital_i +$$
$$\beta_9 debt\ ratio_i + \beta_{10} capex_i + \beta_{11} dividend\ dummy_i + \sum_{j=2}^{6} \beta_{12j} sector_{j,i} + \varepsilon_i \quad (3)$$

where:

j – an indicator of the industry to which firm i belongs;

β_0 – constant;

ε_i – a random error;

i – an indicator of a firm, where i = 1, 2, ..., 212.

3. Empirical results and discussion

Table 2 presents descriptive statistics of the dependent variable by companies that pay or do not pay dividends and in subgroups of companies belonging to different sectors. In the sample of 212 firms, cash assets represent an average of 8.96% of non-cash assets. This value amounts to 9.96% in companies that pay dividends, while in entities that not pay dividends, it is 7.58%. These results counter the trade-off theory, whereby firms that pay dividends are less financially constrained and, therefore, should hold less cash (Ozkan, Ozkan, 2004). However, the results are consistent with the pecking order theory that firms that pay dividends and spend more on investment should have greater liquidity reserves (Artica et al., 2019).

Table 2. Descriptive statistics of variables

Variable	Obs	Mean	Standard deviation	Min	Max
cash holdings	212	0.0896	0.0693	0.0002	0.5551
applied beta	212	0.5198	0.1981	−0.0386	1.1018
bid-ask spread	212	0.5631	1.5668	0.0107	16.0505
EBITDA margin	212	0.1678	0.8114	−1.8763	11.1686
DAC	203	−0.0055	0.0927	−0.5077	0.4952
market-to-book ratio	212	0.9233	0.6564	0.1269	7.5413
NCA	212	6.2285	1.753	3.0935	15.1904
cash flow ratio	212	0.0624	0.1046	−0.3286	0.8494
net working capital ratio	212	0.0842	0.1928	−0.4498	0.8114
debt ratio	212	0.2305	0.16	0	0.8947
capex	212	0.0501	0.0457	0	0.274
dividend dummy	**cash holdings by events of dividend payments**				
dividend non-payers	89	0.0758	0.0568	0.0002	0.2402
dividend payers	123	0.0996	0.0758	0.0011	0.5551
sector	**cash holdings by sector**				
trade & technology	35	0.1086	0.0982	0.008	0.5551
consumer goods	54	0.0842	0.0637	0.003	0.2936
energy & materials	38	0.0761	0.0519	0.003	0.2024
services	22	0.0963	0.061	0.0195	0.2149
manufacture	49	0.0840	0.0685	0.002	0.2776
real estate	14	0.1094	0.0548	0.041	0.232

Note: The definition of each variable is provided in Table 1.

Source: authors' compilation.

Table 3. Correlation matrix

	Variable	1	2	3	4	5	6	7	8	9	10	11
1	applied beta	1										
2	bid-ask spread	–0.039	1									
3	EBITDA margin	0.2052	0.0091	1								
4	DAC	0.1141	–0.031	–0.023	1							
5	market-to-book	–0.003	0.2289	–0.076	0.056	1						
6	NCA	0.5182	0.0025	–0.002	0.1797	–0.02	1					
7	cash flow	0.1048	0.1335	0.0113	–0.270	0.282	0.038	1				
8	networking capital	–0.123	–0.071	–0.054	–0.044	–0.17	–0.160	0.0523	1			
9	debt ratio	0.0681	–0.002	–0.095	0.1624	0.252	0.2512	–0.128	–0.334	1		
10	capex	0.1328	0.0989	–0.037	0.0219	0.248	0.1071	0.328	–0.179	0.1138	1	
11	dividend dummy	0.029	0.1133	–0.063	0.0085	0.186	0.1294	0.2397	0.1468	–0.106	0.0549	1

Note: The definition of each variable is provided in Table 1.

Source: authors' compilation.

The diversity of cash holdings can also be seen among firms from various industries. Above the average for the entire sample were firms that belong to the trade & technology, services, and real estate sectors, where cash and securities represent 9.97%, 9.05% and 10.26% of assets, respectively. Below-average sectors include consumer goods, energy & materials, and manufacturing companies, with an average of 7.92%, 7.22% and 7.87%, respectively.

The correlation between all variables was also checked (Table 3). The correlation value of each pair is not higher than 0.6, so there is no contraindication to place all variables in the model.

3.1. Application of linear regression analysis

Seven OLS regression equations were estimated for the model described in equation (3). They differ in the number of independent variables considered. We checked five measures of information asymmetry separately (models 1–5), all together (model 6) and finally jointly, excluding insignificant variables (model 7). Table 4 presents the results. In the case of the binary variable that identifies the payment

of dividends, level 1 was considered the basis (123 observations). The regression was carried out on a complete sample (212 companies), excluding banks, insurance, and financial sectors.

The RESET test was conducted to verify the correctness of the model's functional form. At a significance level of 5%, there is no basis to reject the RESET test hypothesis of no omitted variables for models 5–7, so the model's functional form can be considered correct for the last three models. Next, the Breusch-Pagan test was conducted to test the heteroskedasticity of the random error. Only for model 7 is there no basis to reject the null hypothesis at the 5% significance level, which states that the variances of the random errors are equal to each other. Since homoskedasticity is a crucial assumption based on which OLS estimator is the best linear unconstrained estimator, the White test was used. The null hypothesis also states that the random error is homoskedastic. The values of the χ^2 statistic and p-value indicate rejection of the null hypothesis at the 5% significance level. Finally, the Jarque-Bera normality test confirmed that the residuals in models 1, 2 and 4 have a normal distribution. Although this test failed in the remaining models, this result is not very serious in its implications for sufficiently large samples since the distributions of the statistics tend toward a normal distribution, even if the normality assumption is not met.

In the regression, due to a lack of data (for variables DAC and EBITDA margin), 207 observations were included instead of 212. Although all variables in the model are collectively relevant (the F-statistic's p-value is 0.00), several are individually insignificant. For example, the variables bid-ask spread, cash flow, net working capital, market-to-book and debt ratio, and the constant are statistically significant at the 1% level. For the EBITDA margin, NCA, capex and dividend dummy variables, the p-value exceeds the acceptable 10% level. Therefore, they were eliminated from model 7 using the general-to-specific method.

All sector variables are significant, particularly in the all-variable model. However, regarding the direction of impact, only real estate companies have more cash holdings than companies outside this sector. For other sectors, the relation is negative.

Estimations of the final version of the model after excluding statistically insignificant variables are presented in the last column of Table 4 – model 7. The determination coefficient R^2 slightly decreased (from 0.5214 to 0.5032). The standard deviations of variables also decreased, indicating an improvement in model fit. Regarding the statistical significance of the variables, all variables, both in aggregate and individually, are relevant.

In models 6 and 7, three out of the five variables that measure information asymmetry are statistically significant, including the applied beta and the market-to-book variables, which positively impact cash holdings, and the bid-ask spread variable, which has a negative impact. The difference may result from the data used to calculate the applied beta and market-to-book ratio variables concerning the last listing on WSE in 2017. The variable bid-ask spread is the average bid-ask spread for the whole of 2017. Therefore, these results do not allow us to reject the investment opportunities hypothesis of cash (H2) compared to the monitoring cost hypothesis of cash holdings (H1). This suggests that the cost of monitoring managers may be lower than the cost of information asymmetry considered by Myers and

Majluf (1894). Furthermore, the results are consistent with Hesari et al. (2014) findings for companies listed on the Tehran Stock Exchange.

The positive relationship between cash held and the information asymmetry discussed above does not contradict the theory of cash maintenance derived from the prudential motive indicating that firms hold cash for unforeseen expenses. Our findings are in line with Bigelli and Sanchez-Vidal (2012) for Italian private firms, Chung et al. (2015) for companies listed on the NYSE and AMEX, and Azar et al. (2016) for the USA. The cash flow and net working capital also positively impact corporate cash holdings. The positive impact of both variables is in line with the trade-off theory, which implies that capital-intensive firms should raise more cash to protect them from financial constraints, e.g., in turbulent times.

Table 4. Estimation results of ordinary least squares (OLS) models

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
applied beta	0.0378*					0.0402*	0.035**
	(0.0218)					(0.0200)	(0.0155)
bid-ask spread		−0.0028				−0.006***	−0.006***
		(0.0023)				(0.0024)	(0.0020)
EBITDA margin			−0.0050			−0.0039	
			(0.0045)			(0.0040)	
DAC				0.0250		−0.0149	
				(0.0427)		(0.0365)	
market-to-book					0.0597***	0.068***	0.063***
					(0.0077)	(0.0081)	(0.0073)
NCA	−0.0033	−0.0008	−0.0008	−0.0005	0.0012	−0.0006	
	(0.0026)	(0.0023)	(0.0023)	(0.0025)	(0.0020)	(0.0024)	
cash flow	0.026***	0.272***	0.286***	0.2716***	0.2040***	0.207***	0.204***
	(0.0376)	(0.0378)	(0.0382)	(0.0406)	(0.0342)	(0.0364)	(0.0313)
net working capital	0.059***	0.056***	0.0532**	0.0498**	0.0728***	0.062***	0.069***
	(0.0205)	(0.0206)	(0.0206)	(0.0218)	(0.0183)	(0.0186)	(0.0169)
debt ratio	−0.0061	−0.0108	−0.0156	−0.0133	−0.0676***	−0.0826	−0.075***
	(0.0256)	(0.0258)	(0.0260)	(0.0275)	(0.0239)	(0.0246)	(0.0218)
capex	0.0492	0.0734	−0.0013	0.0521	−0.0031	−0.0582	
	(0.0850)	(0.0859)	(0.0882)	(0.0896)	0.0754	(0.0785)	
dividend dummy	−0.0076	−0.0076	−0.0048	−0.0089	0.0037	0.0014	
	(0.0075)	(0.0075)	(0.0076)	(0.0078)	(0.0068)	(0.0068)	
trade & technology	0.0016	−0.0008	−0.0104	−0.0232	−0.0108	−0.052***	
	(0.0145)	(0.0145)	(0.0190)	(0.0178)	(0.0128)	(0.0171)	
consumer goods	−0.0068	−0.0081	-0.0194	−0.0326*	−0.0108	−0.051***	
	(0.0137)	(0.0137)	(0.0179)	(0.0166)	(0.0120)	(0.0162)	

cont. tab. 4

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
energy & materials	−0.0202	−0.0229*	−0.0336*	−0.0471***	−0.0218*	−0.061***	−0.0151*
	(0.0138)	(0.0138)	(0.0185)	(0.0173)	(0.0122)	(0.0165)	(0.0080)
services	omitted	omitted	−0.0110	−0.0247	omitted	−0.0422**	
			(0.0199)	(0.0187)		(0.0178)	
manufacturing	−0.0037	−0.0042	−0.0168	−0.0284*	−0.0062	−0.045***	
	(0.0135)	(0.0136)	(0.0180)	(0.0167)	(0.0119)	(0.0161)	
real estate	0.0290	0.0229	omitted	omitted	0.0372**	omitted	0.048***
	(0.0182)	(0.0179)			(0.0159)		(0.0126)
constant	0.069***	0.077***	0.090***	0.0992***	0.0915***	0.135***	0.080***
	(0.0208)	(0.0205)	(0.0237)	(0.0239)	(0.0182)	(0.0215)	(0.0107)
N	212	212	207	203	212	200	212
Adjusted R^2	0.2871	0.2815	0.2922	0.2641	0.4427	0.4796	0.4836
R^2	0.3276	0.3223	0.3334	0.3078	0.4744	0.5214	0.5032
F-statistic	8.08***	7.89***	8.09***	7.04***	14.97***	12.46***	25.70***
RESET Test	6.13	5.51	6.01	5.59	1.65***	2.35**	1.56***
p-value	0.0005	0.0012	0.0006	0.0011	0.1801	0.0744	0.2000
Breusch-Pagan Test	1.87	1.51	0.44	1.23	2.12	1.24	2.88*
p-value	0.1714	0.2194	0.5052	0.2683	0.1454	0.2659	0.0896
White Test	105.21**	94.99*	88.14	95.96**	105.13**	163.78**	63.08**
Jarque-Bera Test	66.36***	73.47***	−	72.09***	−	−	−

Note:
A definition of each variable is provided in Table 1; *, **, and *** indicate significance at the 0.10, 0.05, and 0.05 levels, respectively. Standard deviations are in parenthesises.

Source: authors' results.

The debt ratio may be related to the costs of incurring debt (external financing), which hurts the liquidity reserves. Therefore, it suggests that it is more advantageous for firms to maintain higher cash holdings in case of increased borrowing costs. This relationship is also consistent with Chung et al. (2015) for companies listed on the NYSE and AMEX and Le et al. (2018) for American firms.

The dividend dummy variable was also assessed to check the statistical significance of differences between cash holdings depending on whether dividends were paid. The mean-comparison t-test at the significance level of 1% and two-sample Wilcoxon and rank-sum (Mann-Whitney) tests (see Table 5) conclude that the payment of dividends affects cash. However, this variable is statistically insignificant in all the analysed models. The outcomes of tests shown in Table 5 confirm that Polish public companies that pay dividends hold more cash than others.

Table 5. Effects of paying or not paying dividends on corporate cash holdings

Group	Obs	Mean	mean-comparison t-test	Rank sum	Expected	Wilcoxon test
non-dividend-paying firms	89	0.0758	−2.4985***	8425	9478.5	−2.390**
dividend payers	123	0.0996		14153	13099.5	

** indicates a significance level of 0.05, *** indicates a significance level of 0.01.

Source: authors' results.

It contradicts the trade-off theory, which predicts that dividend payers are less financially constrained and, therefore, should hold less cash. However, companies with a higher average bid-ask spread have smaller cash reserves (see Table 4 for the entire sample and Table 6 for two subsamples). It may also result from the prevailing institutional investors on WSE that have more resources to access and analyse these public companies' data through their analytics. Therefore, it may weaken the information asymmetry for institutional investors but not for retail investors. Therefore, this relationship may be specific to the Polish capital market.

Comparing the two subsamples based on the sign of discretionary accruals (Table 6) shows that firms with higher information asymmetry in the group with positive DAC hold more cash. In Table 6, all variables in both models are collectively relevant based on the F-statistic. Next, the RESET test confirms the correctness of the model's functional form. Finally, the Breusch-Pagan and the White tests indicate that the random error is homoskedastic. Furthermore, the same positive relationship between information asymmetry and cash holdings was observed for two other measures of information asymmetry: applied beta and market-to-book ratio. Therefore, it allows us to confirm the investment opportunities hypothesis of cash (H2), suggesting that the cost of monitoring managers is lower than the cost of information asymmetry for firms with positive discretionary accruals. By contrast, firms with higher information asymmetry hold less cash among the subsample with nonpositive DAC. Thus, for the group with nonpositive discretionary accruals, we have no basis to reject the monitoring cost hypothesis of cash holdings (H1).

However, the coefficient at the market-to-book variable is positive no matter the character of discretionary accruals, i.e., both for positive and nonpositive DAC. Therefore, it adds to our findings of a positive correlation between information asymmetry and cash reserves (in line with hypothesis H2) for the Polish market using the following measures: applied beta, market-to-book ratio, and discretionary accruals (the latter for companies with positive DAC).

In the case of negative DAC, firms with low earnings also tend to have low total accruals. Both the Jones and Dechow models attribute some of the lower accruals to negative discretionary accruals (Jones, 1991; Dechow, 1995). The results for the control variables are the same as for the entire sample. It means that cash flow and net working capital positively correlate with cash holdings, while the debt ratio is negatively related to the explained variable.

Table 6. Estimation results of the OLS models
on subsamples of negative and positive DAC

Variable	Model 8 DAC ≤ 0	Model 9 DAC > 0
applied beta	0.0060	0.0647*
	(0.0283)	(0.0314)
bid-ask spread	−0.0084*	−0.0056*
	(0.0050)	(0.0029)
EBITDA margin	−0.0019	0.0033
	(0.0041)	(0.0225)
DAC	−0.1791***	0.1388*
	(0.0637)	(0.0761)
market-to-book	0.0896***	0.0570***
	(0.0124)	(0.0120)
NCA	0.0057	−0.0037
	(0.0037)	(0.0034)
cash flow	0.1832***	0.2230***
	(0.0465)	(0.0687)
net working capital	0.0772***	0.0532*
	(0.0253)	(0.0301)
debt ratio	−0.0744***	−0.0693*
	(0.0327)	(0.0391)
capex	−0.0901	−0.0635
	(0.1111)	(0.1119)
dividend dummy	−0.0013	0.0039
	(0.0093)	(0.0114)
trade & technology	−0.0428	−0.0518**
	(0.0298)	(0.0218)
consumer goods	−0.0463*	−0.0502**
	(0.0278)	(0.0220)
energy & materials	−0.0568*	−0.0608***
	(0.0286)	(0.0220)
services	−0.0082	−0.0686***
	(0.0305)	(0.0238)
manufacturing	−0.0360	−0.0503**
	(0.0278)	(0.0216)
constant	0.1015***	0.1286***
	(0.0334)	(0.0304)
N	110	90

Variable	Model 8 DAC ≤ 0	Model 9 DAC > 0
Adjusted R^2	0.5814	0.3556
R^2	0.6428	0.4715
F-statistic	10.46***	4.07***
RESET Test	1.35***	1.35***
p-value	0.2654	0.2654
Breusch-Pagan Test	4.33**	4.33**
White Test	90	90
p-value	0.4504	0.4504

Note:
The definition of each variable is provided in Table 1; *, **, and *** indicate significance at the 0.10, 0.05, and 0.05 levels, respectively. Standard deviations are in parenthesises.

Source: authors' results.

Our results, which show that companies with greater information asymmetry hold more cash, confirming the investment opportunities hypothesis, are consistent with Hesari et al. (2014), but are in contrast to Chung et al. (2015). We also support Im et al. (2017) in the statement on the impact of cash flow on cash holding. Moreover, the significance of the sector that the company operates in is in line with Falato et al. (2013) and Graham and Leary (2018). However, in contrast to Artica et al. (2019), we do not find that non-cash assets significantly impact cash holding.

Conclusion

Previous studies showed that several factors, including transaction costs and prudential motives, taxes, the regulatory and legal environment for investor protection, cash flow uncertainty, ownership structure and internal management mechanisms, determine a firm's cash holdings. Our article contributes to the literature by examining the impact of information asymmetry on public companies' decisions regarding their cash holdings.

Throughout the analysis, two hypotheses were verified that address the relationship between information asymmetry and cash held in the most liquid public companies in Poland. Firstly, based on agency theory, higher information asymmetry may exacerbate the free cash flow problem, making it more difficult for external investors to control managerial activities. Consequently, corporate cash holdings should decrease with increased information asymmetry (the monitoring cost hypothesis of cash holding). Secondly, by focusing on the information asymmetry theory, in a situation of market failure, i.e., information asymmetry, external investors may require a premium for external funding from the firm, which makes internal funding cheaper than external funds. Therefore, corporate cash holdings

should grow proportionally to information asymmetry (the investment opportunities hypothesis of cash).

To test the hypotheses, we estimated several models using the OLS method applied to cross-sectional financial data of 212 companies listed on the primary market of WSE in 2017. There were no grounds to reject the investment opportunities hypothesis of cash using different measures of information asymmetry (applied beta, EBITDA margin, discretionary accruals, and market-to-book ratio). We showed that the amount of liquidity reserves a public company holds is directly proportional to the level of information asymmetry between its managers and shareholders. The results for Polish-listed companies align with the findings of Hesari et al. (2014) for companies quoted on the Tehran Stock Exchange. Only the average bid-ask spread has an opposite (negative) impact on cash reserves, no matter the character of discretionary accruals or earning management (measured by discretionary accruals) in a subsample of companies with nonpositive DAC. The control variables showed that cash flow and net working capital positively correlate with liquidity reserves, while the debt ratio harms cash holdings. Thus, the costs of monitoring managers seem lower than information asymmetry in Poland. It suggests that holding more cash is more beneficial than going into debt. The default risk or a threat of borrowing costs rising in turbulent times is worse and more expensive than losses (sunk costs) due to keeping cash. Companies that pay dividends hold more cash than others, which contradicts the trade-off theory, i.e., that firms that pay dividends are less financially constrained and, therefore, should hoard less cash. However, companies with higher average bid-ask spread hold fewer cash reserves. It can be explained by the effects of the prevailing institutional investors on WSE.

Research limitations concern the cross-sectional data, which was only for one period. Therefore we suggest considering the panel data approach in future research. Furthermore, it may be interesting to check whether the relationship between cash holdings and information asymmetry changed in circumstances of close-to-zero interest rates or during the COVID-19 pandemic.

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