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The influence of capital expenditures on working capital management in the corporate sector of an emerging economy: the role of financing constraints

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ABSTRACT

Relying on firm-level panel data from an emerging economy, this study explores the impact of fixed capital expenditure on working capital management practices. When facing insufficient internally generated cash flows and external funds for accommodating capital investments, companies are found to finance capital expenditure by primarily depleting cash reserves and increasing trade payables. Corroborating the postulates of the financing constraints theory, working capital investments are found to be inversely related to the degree of financing constraints, and positively sensitive to operating cash flow fluctuations and availability of external finance. For financially constrained companies, capital expenditures are found to more likely exercise a negative impact on working capital investments. Contributing to the discussion on the nature of business cycles, we document that the negative cash flow shocks are likely to be transmitted to firms' counterparties through the trade credit channel rather than through the reduction of investment demand. The empirical findings also suggest that financial managers fail to properly account for capital expenditures in short-term liquidity planning, which, under conditions of limited access to imperfect capital markets, may induce the recurrence of costly working capital adjustments.

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1. Introduction

A large body of empirical evidence (e.g., Almeida, Campello, & Weisbach, 2004; Dasgupta, Noe, & Wang, 2011; Gatchev, Pulvino, & Tarhan, 2010) suggests that the presence of binding financing constraints engendered by capital market imperfections and information asymmetry may significantly impact the financing and investment decisions of firms. Debate persists, however, regarding the measurement and operationalisation of financing constraints, with the overwhelming majority of studies focusing on the role of investment–cash flow

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sensitivity in predicting firms' financial status (Allayannis & Mozumdar, 2004; Deng, Ding, Zhu, & Zhou, 2017; D'Espallier & Lopez-Iturriaga, 2009; Moyen, 2004). While within a standard reduced-form investment equation, the Q theory of investment uses cash flows as a proxy for a company's internal financial resources (Hayashi, 1982), the alternative view holds that cash flows may in fact approximate the company's immediate growth opportunities. The mismeasurement of investment opportunities by the market-to-book value ratio (Abel & Eberly, 2002) may thereby render investment–cash flow sensitivity a biased indicator of the degree of financing constraints.

This study departs from the assumption that the working capital stock may represent a more accurate estimate of the company's internally available financial resources than the operating cash flows. When confronted with binding financing constraints, that is, a wedge between the costs of external and internal finance (Kaplan & Zingales, 1997), firms may use the accumulated working capital stock as a relatively cheaper source of funds for fuelling or smoothing their capital expenditures. Firms' propensity to deplete their working capital in response to negative cash flow shocks may be indicative of their financially constrained status.

Working capital has several advantages over operating cash flows in approximating the availability of internal financial resources. First, our empirical tests confirm that, unlike cash flows, working capital investments are not driven by a company's growth opportunities. Therefore, the use of working capital as a proxy for internal finance allows the addressing of one of the most important issues related to the operationalisation of financing constraints. At the same time, working capital investments are liquid, reversible and adjustable without significant implicit costs. Therefore, working capital may be perceived as a readily available source of internal finance and an imperfect substitute for operating cash flows. By the same token, working capital is likely to have a cost advantage over external funds; therefore, it should have a priority over debt and equity in the pecking order preference (Myers & Majluf, 1984).

The aim of this study is to examine the influence of firms' capital expenditures on working capital management practices. Pursuing the goal of establishing a relationship between the source and the use of funds, we test an inverted investment equation regressing working capital investments on capital expenditures.

If confirmed, an empirically observed positive association between working capital investments and capital expenditures would point to the validity of the following conjectures: 1) both variables represent complementary factors for a firm's organic growth (Bushman, Smith, & Zhang, 2011); and 2) the presence of binding financing constraints does not induce firms to choose between the two when allocating the limited pool of internally generated cash flows.

In contrast, the negative relationship between working capital investments and capital expenditures may imply the following: 1) working capital and fixed investments partake of the limited internally generated cash flows; 2) when facing a cash flow shortage, firms are likely to curtail their working capital investments in order to smooth fixed investments; and 3) the presence of financing constraints may exacerbate the negative impact of capital expenditures on working capital investments, owing to the relatively higher liquidity, reversibility and lower adjustment costs of the latter.

In line with the tenets of the financing constraints theory, we hypothesise that limited access to external finance and insufficiency of internally generated operating cash flows

may cause the fixed investments to 'crowd out' working capital investments (Fazzari & Petersen, 1993). If capital markets were frictionless as postulated by Modigliani and Miller (1958), the corporate sector would be able to raise the necessary amount of external finance to supplement internal cash flows, and fund both working capital investments and capital expenditures. If a company's investment opportunities are not explicitly observable to the investors, however (Myers & Majluf, 1984), external finance may become costly and scarce (Akerlof, 1970). If the lack of external financing is magnified with negative cash flow shocks, firms may decide to curtail working capital investments and use the released liquidity to maintain their capital expenditures in order to minimise adjustment costs.

Our empirical findings indicate that financing constraints may significantly impact working capital management strategies. Financially constrained companies are found to have lower working capital investments than their less financially constrained counterparts. Similar to capital expenditures, working capital investments are sensitive to operating cash flow fluctuations and the availability of external finance. In the presence of financing constraints, capital expenditures are documented to exercise a negative impact on working capital investments, thereby confirming the pervasive pattern of investment smoothing. This empirical relationship appears to be more pronounced among more financially constrained firms. A closer analysis of the components of working capital revealed that fixed investments are primarily smoothed with the accumulated cash reserves and increased trade payables.

The research hypotheses are tested on an extensive data set comprising 719 listed companies from Poland – the largest emerging economy of the Central and Eastern European (C.E.E.) region. The choice of the geography for the empirical study is dictated by the following key considerations. First, the empirical literature does not seem to articulate the specificity of the phenomenon of financing constraints within the context of emerging markets. Second, the Polish stock market is currently one of the largest markets in the C.E.E. region in terms of market capitalisation and the number of listed companies. Third, the Polish financial market has a few distinguishing features that may be particularly important from the standpoint of the financing constraints theory: 1) the dominant role of foreign-owned commercial banks in fuelling financial intermediation (Hasan, Jackowicz, Kowalewski, & Kozlowski, 2017); 2) the relatively weaker role of the public debt market in enterprise financing; 3) the progressing internationalisation of the equity market with a dynamic growth of the share of foreign residents in the stock exchange turnover; and 4) the swift transformation and deregulation of the financial system over the last two decades.

Our empirical findings contribute to the ongoing discussion over the influence of financing constraints on corporate investment decisions. First, we show that the negative relationship between working capital investments and capital expenditures may be perceived as an indicator and an alternative/corroboratory approach to the identification/operationalisation of financing constraints. Second, we document that negative cash flow shocks may translate into working capital reduction with the negative impact being more pronounced among financially constrained companies. Third, we supplement the existing body of research by analysing each element of working capital separately in order to identify the exact sources of liquidity channelled to fixed investment smoothing. Apart from drawing on companies' cash reserves, investment smoothing is evidenced to be transmitted to the trade credit market with the trade payables' increase being a salient manifestation of the deficiency of internal financial resources for accommodating planned investment projects. Therefore, our

findings supplement the existing evidence on the interplay between corporate investment policies and trade finance.

Apart from potentially imperilling companies' financial standing, the discovered empirical patterns may have economy-wide repercussions. The transmission of cash flow shocks to the trade credit market may be responsible for the phenomenon of trade credit contagion (Bastos & Pindado, 2013), whereby demand contraction may cause firms to rely more on trade finance.

Additionally, the empirical findings reported in the study may contribute to the theory of managerial decision-making. We show that firms with higher working capital stock exhibit higher financial flexibility and, therefore, may be less likely to forego or delay attractive investment projects when confronted with negative cash flow shocks. Our results also help to elucidate the motives for precautionary cash savings (Opler, Pinkowitz, Stulz, & Williamson, 1999): financially constrained companies, which are more likely to struggle with adverse selection in financial markets, may be forced to maintain relatively higher cash reserves in order to be able to deplete them for investment purposes in case of adverse market conjuncture. Finally, the negative impact of capital expenditures on the dynamics of trade payables may be explained by the inability of financial managers to properly accommodate investment outlays in cash flow projections. Therefore, when facing a trade-off between delaying or downsizing investment projects and reducing working capital investments, the management may prefer to increase trade payables, even at the possible cost of damaging business relations with the firm's counterparties.

This paper is structured as follows. First, we present a theoretical review of the research problem along with empirical predictions. Thereafter, we formulate the research hypotheses and present the data set and methodology. Subsequently, we present the empirical findings. Finally, we discuss the implications for effective working capital management practices in the Polish corporate sector, which may be of interest to practicing financial managers.

2. A theoretical overview: financing constraints, working capital management, and investment smoothing

Several empirical studies analysed the relationship between the cash flow sensitivity of investments and the degree of firms' exposure to financing constraints (e.g., Hovakimian, 2009; Moyen, 2004): after controlling for growth opportunities, the studies found that internally generated cash flows constituted an important determinant of capital expenditures and that investment decisions were majorly shaped by the access to imperfect capital markets.

Insufficiency of internally generated cash flows for financing planned investments combined with limited access to external finance may cause firms to resort to investment smoothing. Firms strive to preclude fluctuations in capital expenditures due to increasing marginal adjustment costs of investments (Eisner & Strotz, 1963; Mussa, 1977). Fazzari and Petersen (1993) note that the investment process is predominantly non-continuous with most projects requiring large initial outlays, which cannot be evenly distributed over time in order to match the internally generated cash flows.

Irreversibility is another characteristic of fixed capital investments which may considerably alter the investment function and induce investment smoothing. The theoretical model developed by Bertola and Caballero (1994) relies on the assumption that under conditions of prevalent idiosyncratic risk combined with inherent irreversibility of capital expenditure, the

corporate sector may deliberately delay investment projects, thereby smoothing the aggregate investment function. Based on panel data for Polish, Bulgarian, Romanian, and Czech companies, Guariglia, Tsoukalas, and Tsoukas (2012) found that the cash flow sensitivity of capital investment was significantly lower for companies that experienced irreversibility constraints. Companies with high levels of irreversibility were also found to exhibit greater propensity to accumulate cash, which was subsequently used to finance discrete investment projects. Fazzari and Petersen (1993) emphasise that the acceptance or rejection of investment projects based exclusively on the adequacy of internally generated funds constitutes a deviation from the strategy of shareholder value maximisation and may considerably impede a company's growth potential.

Temporary deviations from the generally applicable strategy of investment smoothing may be observed during economic turmoil when capital constraints become particularly exacerbated. Campello, Giambona, Graham, and Harvey (2011) report that internal cash flow shocks accompanied with restricted access to capital markets make firms choose between saving and investment. Moreover, while companies with considerable liquidity reserves manage to sustain their corporate spending, financially constrained entities having difficulties with renegotiation of credit lines, may be forced to cut back on investments. Brown and Petersen (2015) found that during the recent financial crisis, publicly traded U.S. companies maintained only R&D budgets, while reducing fixed capital expenditures and precautionary cash reserves.

Working capital constitutes a substantial and readily available reserve of liquidity for financially constrained companies as it may be converted into cash with relatively low transaction and adjustment costs. Carpenter, Fazzari, Petersen, Kashyap, and Friedman (1994) studied the phenomenon of procyclical volatility of inventories and its connection with the dynamics of operating cash flows: when facing internal finance deficiency, firms tend to drastically reduce inventory expenditure with the effect being more pronounced among small companies which are more likely to face the information asymmetry problem and, consequently, financing constraints. Similar findings were reported by Gertler and Gilchrist (1994), who found that small manufacturing companies exhibit higher sensitivity of inventory investments to internal cash flow fluctuations under conditions of monetary policy shocks, which may be attributed to the limited access to imperfect capital markets.

Account payables and account receivables may also be used in order to alleviate the problem of internal cash flow shortage. Based on panel data for 600 thousand companies from eight Euro area countries, Ferrando and Mulier (2013) conclude that the active utilisation of accounts payable and accounts receivable plays a crucial role in managing growth. Additionally, firms that are more susceptible to financing constraints are found to rely more on the trade credit channel in managing their growth potential.

The theoretical model developed by Sopranzetti (1999) suggests that active management of receivables may help solve the underinvestment problem engendered by risky debt contracted by the corporate sector (Myers, 1977). Selling pledgeable trade receivables may provide the necessary resources to smooth the investment function and reduce the negative effect of debt structure on the value of growth opportunities embedded in real options. Empirical evidence (Sopranzetti, 1997) shows that under conditions of financial difficulties and restricted access to external finance, firms increase their use of factoring services.

Petersen and Rajan (1997) demonstrate that trade credit may be substituted for external finance when companies have limited access to capital markets. They also find that negative

cash flow shocks entailed by diminishing revenues cause small companies, which experience severe cash shortage, to increase trade payables. Additionally, trade credit may reduce the problem of information asymmetry and, consequently, transaction costs for contracting additional credit resources for financially constrained companies. Choi and Kim (2005) report that trade credit may be actively used by the corporate sector to alleviate the effects of contractionary monetary policy. As a response to shrinking credit markets, firms tend to increase both payables and receivables, which is expected to alleviate the liquidity shortage caused by credit contraction. Lin and Chou (2015) study the dynamics of payables and receivables during the financial crisis and conclude that companies tend to reduce the availability of trade credit and tighten their conditions when faced with negative demand shocks. Additionally, Lin and Chou (2015) report a positive correlation between the availability of external finance and trade receivables, and a negative correlation between bank loans and trade payables, which may imply substitutability between bank borrowing and trade finance.

Fazzari and Petersen (1993) were among the first to analyse the interrelations between firms' investment policy and working capital management under assumptions of financing constraints. The data set comprised U.S. manufacturing companies which refrained from paying dividends and therefore, were considered to experience shortage of internal funds. The tested hypothesis predicted smoothing of fixed capital expenditures with working capital. The reported empirical findings were consistent with theoretical predictions. Operating cash flows were found to be an essential determinant of working capital investment along with the initial stock of working capital. At the same time, negative coefficients of working capital investment as explanatory variable in the investment equation suggested that firms may use working capital to smooth capital expenditures when confronting financing constraints.

Research appears to be relatively scarce on the influence of capital expenditure on working capital management practices. Polish literature mostly concentrates on the technicalities of working capital management and liquidity measurement (Cegłowski & Wnuczak, 2010; Sierpińska & Wędzki, 2007) without paying due attention to the underlying interrelations between different compounds of financial management. Research on the cash flow sensitivity of investments on the Polish data (Jackowicz, Kozłowski, & Mielcarz, 2016; Konings, Rizove, & Vandenbussche, 2003) do not sufficiently cover this gap. We attempt to fill this gap by analysing the relation between working capital and capital expenditure. We amplify the analysis by studying the influence of financing constraints on the sensitivity of working capital to fixed capital expenditure. Additionally, we attempt to determine which elements of working capital are particularly sensitive to investment and internal cash flow fluctuations, and present our recommendations regarding potential improvements in working capital management in the Polish corporate sector.

3. Hypotheses development

Similar to Fazzari and Petersen (1993), we adopt the assumption that under conditions of financing constraints, firms try to maintain equal marginal rates of return on all assets, which are approximated by the shadow value of finance. Sudden internal cash flow fluctuations force a company to adjust the structure of assets as the shadow value increases and capital becomes scarce. The firm may have to reduce capital expenditure; due, however, to potential

irreversibility constraints and falling value of real options, the management might prefer to use working capital as a cushion against the negative cash flow shock.

Fixed capital expenditure and working capital investments are expected to partake the limited cash flows with the fixed investment ultimately having the priority due to increasing marginal costs of adjustment and substantially lower liquidity. The company may have five possible options to alleviate the negative cash flow shock: 1) deplete cash holdings; 2) reduce accounts receivable; 3) reduce inventory investments; 4) increase trade payables; and 5) incur additional debt.

In an attempt to analyse the influence of capital expenditure on working capital investment, we formulate four principal research hypotheses.

> H1: Capital expenditures exercise a negative impact on working capital investments, which may imply that companies resort to investment smoothing by means of reducing working capital investment or temporarily setting it at a negative level.

In line with the 'pecking-order' theory, the management attempts to accommodate negative cash flow shocks with an internal pool of finance, and after having exhausted the internally generated resources, contemplates the possibility of contracting additional debt on incomplete capital markets.

> H1.1: An increase of investment expenditures is associated with the depletion of cash reserves, an increase of accounts payable and a decrease of inventory investments and trade receivables, which ultimately results in a reduction of working capital investments.

The aim of testing hypothesis H1.1 is to analyse the influence of capital expenditure on each component of working capital separately. We verify which elements are the most sensitive and tend to be most frequently used by managers as a cushion against negative cash flow shocks.

> H2: After having exhausted the internal sources of finance in an attempt to accommodate capital expenditures, firms tend to incur additional debt. The validity of this hypothesis would imply a positive association between: 1) the dynamics of cash holdings and external borrowing; and 2) working capital investment and external borrowing.

In the context of the financing constraints theory, the positive verification of the above hypotheses would imply that working capital and borrowed funds manifest complementarity when it comes to accommodating cash flow shocks entailed by capital investments (as opposed to substitutability of working capital and external finance under conditions of demand shocks).

> H3: Working capital investments are monotonically decreasing with the degree of financing constraints.

Since financially constrained companies are more likely to suffer from shortage of internal funds, they may be forced to implement a relatively more aggressive working capital management strategy, resulting in lower levels of working capital investments *ceteris paribus*.

> H4: The phenomenon of investment smoothing is more pronounced for financially constrained companies.

Constrained companies may be forced to resort to investment smoothing more often due to persisting cash flow insufficiency and limited access to capital markets. As a result, capital expenditures may have a negative impact on working capital investments.

4. Methods and data

The data set represents an unbalanced panel of 719 Polish companies quoted on the Warsaw Stock Exchange, NewConnect, and the over-the-counter market administered by MTS CeTO SA for the period between 1997 and 2014. We excluded financial companies from the sample due to the distinctive features of their investment process. We deliberately included data for the companies that ceased to exist as a result of bankruptcy, merger or acquisition, in order to avoid the survivorship bias. The data set contains 4561 observations. Data were retrieved from the Notoria Database http://ir.notoria.pl. The descriptive statistics for the compiled research sample are presented in Table 1.

To test the research hypotheses we use static panel models with random effects, as we believe that unobserved firm-specific effects influence the dependent variable (Greene, 2008). All regressions include year and industry dummies to control for industry-specific and common macroeconomic effects, however. All nominal variables were scaled by total assets in order to avoid the heteroscedasticity problem. The general specification of the econometric model for testing the hypotheses is presented in equation (1).

$$\left(\frac{WCI}{A}\right)_{it} = f\left(\left(\frac{I}{A}\right)_{it}; \left(\frac{ExF}{A}\right)_{it}; CONSTR_{it}; CONSTR_{it}\ x\left(\frac{I}{A}\right)_{it}; CONTROL_{it}\right) \quad (1)$$

where $\frac{WCI}{A}$ represents working capital investments (including cash) by the *i*-th company in year *t* scaled by the contemporaneous value of total assets, $\frac{I}{A}$ denotes fixed capital investment scaled by total assets, $\frac{ExF}{A}$ represents additional debt issuances by the *i*-th company in year *t* scaled by total assets, *CONSTR* is a set of proxy variables for financing constraints and *CONTROL* is a set of control variables discussed below. The same equation with different dependent variables (cash holdings increase (YoY) scaled by total assets (Δ Cash Holdings/A), payables change (YoY) scaled by total assets (Δ Trade Payables/A), receivables change (YoY) scaled by total assets (Δ Trade Receivables/A), and inventory change scaled by total assets (Δ Inventories/A) is estimated in order to verify H1.1 and H2. In order to verify H4, we introduce interaction terms, being a product of fixed capital investments and proxies for financing constraints.

In order to introduce the factor of financing constraints into the models we use several proxies for the degree of information asymmetry and exposure to capital market imperfections. *Constr* is a dummy variable calculated relying on the Age-Size criterion proposed by Devereux and Schiantarelli (1990). We modified the original Age-Size indicator by replacing firm's age with

Table 1. Summary statistics for the research sample.

Variable	Mean	SD	Minimum	Maximum
WCI/A	−0.0511	0.2198	−0.8592	0.8124
Δ Cash holdings/A	0.0255	0.1542	−0.3043	0.3420
Δ Trade payables/A	0.0407	0.1688	−0.4450	0.4390
Log assets	10.9980	2.5326	6.3600	17.1630
P/BV	1.2611	1.8137	−1.0893	12.7020
ExF/A	0.0329	0.1555	−0.2125	0.3140
Dividend payout ratio	0.0690	0.1990	0.0000	1.1940
I/A	0.0611	0.0839	−0.1108	0.4970
OCF/A	0.0656	0.1818	−0.6131	0.4230
R.O.A.	0.0299	0.2310	−0.9880	0.5380
Sales growth	0.2706	0.9753	−0.9828	12.8430

Source: own elaboration.

time elapsed since the company's I.P.O. We believe that this structure of the variable allows the approximation of the company's exposure to information asymmetry. The research sample was divided into two equal subsamples relying on the modified Age-Size criterion with '1' encoding the companies with Age-Size below the sample median (these firms are assumed to be relatively less financially constrained) and '0' encoding the entities with Age-Size above the sample median (these firms are assumed to be more financially constrained).

Market is a dummy variable with '1' encoding the companies quoted on the main market of Warsaw Stock Exchange (W.S.E.) (these companies are assumed to be financially unconstrained) and '0' denoting other firms predominantly quoted on the NewConnect (an exchange listing mostly small fast-growing entities). The companies listed on the W.S.E. are larger and older, enjoy an extensive analyst coverage and presumably have better access to external finance. Stringent reporting requirements may also alleviate the problem of information asymmetry.

DivDummy is a dummy variable with '1' encoding firms that have a positive dividend payout ratio in the given period. These companies are assumed to be unconstrained (Fazzari, Hubbard, Petersen, Blinder, & Poterba, 1988). On the other hand, '0' encodes the companies paying no dividends.

Size is a dummy variable based on the size criterion. First, all sampled companies were ranked using the natural logarithm of total assets as a classificatory criterion. '1' encodes the companies with the natural logarithm of total assets higher than the sample median (the less constrained companies). On the other hand, '0' encodes the firms with the natural logarithm of total assets lower than the sample median.

Crisis is a dummy variable where '1' is used to encode the period of crisis (2008–2011). Financial crisis is assumed to aggravate the problem of financing constraints by affecting the operating cash flows and by restricting the access to external finance. The consequences of an economic downturn may force companies to look for alternative sources of funds to finance investment projects, thereby creating an opportunity to study the influence of tightening financing constraints on investment and financing strategies of the sampled companies. It is worth noting that the repercussions of the economic crisis were less pronounced in Poland than in other European Union (E.U.) countries. The potential demand shocks were largely mitigated by robust internal consumption (Jasiński & Mielcarz, 2013).

4.1. Control variables

Operating cash flow scaled by total assets ($\frac{OCF}{A}$). We intend to analyse whether working capital (and each of its elements) exhibits the patterns of cash flow sensitivity similar to those of fixed capital expenditures (Fazzari et al., 1988). If confirmed, the empirically observed positive sensitivity of working capital investments to internal cash flows would signify that the capital expenditures and working capital investments are competing for the limited pool of internally generated financial resources.

Size. We use the natural logarithm of firms' total assets as a proxy for size, which may be an important determinant of the investment and cash disposal decisions. Fazzari et al. (1988) use size as one of the proxies for financing constraints and note that smaller companies are more likely to have limited access to external finance due to information asymmetry and adverse selection on the financial markets. A company's size is also evidenced to influence its payout decisions and capital investments (Duchin, 2010; Hovakimian, 2011). Denis and Sibilkov (2010) report that smaller companies tend to hold relatively larger stocks of cash,

which they supposedly use for hedging purposes and for financing attractive investment opportunities.

Growth opportunities. We use price-to-book-value ratio as a control variable approximating the growth opportunities of a company, future returns on investments and the market sentiment surrounding a particular stock (which may be important in the context of the 'pecking order' theory). Investment opportunities influence a firm's decisions regarding capital expenditures, cash retention and dividend payout policy. A review of the existing literature demonstrates that small financially constrained companies with significant investment opportunities are more likely to refrain from dividend payments, accumulate cash and smooth capital expenditure by reducing working capital investments, while mature companies with stable cash flows and lack of valuable real options are more likely to smooth dividends (Lintner, 1956) and incur additional debt. The price-to-book-value ratio is also included into the model specification in order to check whether working capital investments are driven by companies' growth opportunities. The opponents of the reduced-form investment equation argue that the market-to-book-value ratio is a noisy and unreliable proxy for firms' immediate growth opportunities (Cummins, Hassett, & Oliner, 2006), and suggest multiple alternatives including cash flows and sales growth.

Sales growth. Standard investment equations including Tobin's Q as an explanatory variable (Fazzari et al., 1988) have been prevalent in the analysis of financing constraints. Neoclassical investment equations featuring cost of capital proxies (Jorgenson, 1971) and models capturing the accelerator influence of the variables approximating investment demand, however, have also proven quite useful. Sales growth rate represents one such proxy for investment demand. We include it in all of the specified econometric models in order to confirm the cash flow sensitivity of the dependent variables.

Return on assets (R.O.A.). Since the ultimate goal of financial managers is to adjust the asset structure in response to cash flow fluctuations and shifts in the shadow value of finance, R.O.A. is used as a measure approximating the effectiveness of the firm in exploiting the available resources. Additionally, R.O.A. may serve as a proxy for the availability of internal funds, growth potential, scale of agency problem and information asymmetry.

Dividend payout ratio. The variable is introduced to control for one of the uses of generated cash flows. The determinants of dividend policy vary depending on the institutional environment, tax regime and maturity of capital markets. Chemmanur, He, Hu and Liu (2010) report that dividend smoothing is still prevalent among U.S. companies, while, in Hong Kong, firms tend to be more flexible in terms of payouts. We would like to control for the potential effects of dividend policy on working capital management. Research appears to be scarce on the dividend policy of companies operating in emerging markets, which substantiates the inclusion of the variable.

5. Empirical results

Tables 2 to 7 present the empirical results of hypothesis testing. Models featuring working capital investment, change in payables and cash holdings increase scaled by total assets possess good econometric properties and allow for a valid inference. The regressors are jointly statistically significant at the conventional levels. The studied explanatory variables demonstrate individual statistical significance at the conventional levels and maintain their sign after switching control variables. The models featuring changes in receivables and

payables scaled by total assets as explained variables did not yield statistically significant results and, therefore, are not presented in this study.

Results presented in Table 2 positively validate H1 and H2. Working capital investments appear to be adversely affected by increasing capital expenditures. This result may imply that the Polish corporate sector exhibits symptoms of binding financing constraints. Fixed capital investments appear to compete with working capital for limited internally generated financial resources. It may signify that because of failure to properly address the liquidity problems following large-scale capital budgeting decisions, managers resort to investment smoothing and use working capital as a readily available financial reserve.

Table 2. Test results for H1–H3 (regressand: working capital investment, including cash).

Model no.	1		2		3		4		5	
No. of observations	4512		4512		4512		4512		4512	
Wald (joint)	183.6	***	183.8	***	191.8	***	191.4	***	185.0	***
R^2	0.082		0.082		0.084		0.083		0.082	
AR(1) test	−3.509	***	−3.518	***	−3.494	***	−3.589	***	−3.520	***
AR(2) test	−2.408	**	−2.415	**	−2.392	**	−2.475	**	−2.450	**
Constant	0.01787		0.00000	***	0.06205		0.10545	**	0.02198	
	(0.041)		(000)		(0.044)		(0.052)		(0.042)	
Log assets	−0.00177		−0.00177		−0.00707	*	−0.00634	*	−0.00180	
	(0.003)		(0.003)		(0.004)		(0.004)		(0.003)	
P/BV	−0.00099		−0.00099		−0.00097		−0.00100		−0.00099	
	(0.001)		(0.001)		(0.001)		(0.001)		(0.001)	
ExF/A	0.14212	***	0.14210	***	0.14456	***	0.14060	***	0.14490	***
	(0.032)		(0.032)		(0.031)		(0.031)		(0.032)	
Dividend payout ratio	1.8523×10^{-5}		1.8514×10^{-5}		1.8009×10^{-5}		1.9485×10^{-5}		1.7907×10^{-5}	
	(000)		(000)		(000)		(000)		(000)	
OCF/A	0.18778	***	0.18778	***	0.18852	***	0.18629	***	0.19123	***
	(0.019)		(0.019)		(0.019)		(0.019)		(0.019)	
R.O.A.	−0.08672	***	−0.08674	***	−0.08631	***	−0.08423	***	−0.08659	***
	(0.011)		(0.011)		(0.010)		(0.011)		(0.011)	
Sales growth	-3.02656×10^{-5}	**	−0.000030247	**	-3.00726×10^{-5}	**	-3.01811×10^{-5}	**	-3.04659×10^{-5}	**
	(000)		(000)		(000)		(000)		(000)	
I/A	−0.08342	**	−0.08338	**	−0.08523	**	−0.08258	**	−0.08506	**
	(0.034)		(0.034)		(0.034)		(0.034)		(0.034)	
Crisis			0.01793							
			(0.041)							
Market					0.05530	***				
					(0.020)					
Constr							−0.04800	***		
							(0.017)			
DivDummy									−0.01252	
									(0.010)	

Notes: All models include the time and industry dummies (not reported). This table presents the static panel model estimates. The heteroscedasticity robust standard errors are provided in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. OxMetrics 7.10, Developer: OxMetrics Technologies, Goring, UK.
Source: own elaboration.

Working capital investments are found to be positively sensitive to the fluctuations of internally generated operating cash flows, which may also be explained by the presence of financing constraints. Interesting conclusions may be drawn from the coefficient for external borrowing scaled by total assets, which is statistically significant and demonstrates persistent influence on the explained variable. The positive relationship between working capital investment and contemporaneous debt issuances may imply that in the case of cash flow shocks caused by fixed capital expenditures, working capital and external finance act as complementary sources of funds tapped in order to cover the temporary liquidity gap. The latter findings support H2.

Dividend policy is found to be irrelevant for working capital management, which may be the consequence of the inclusion of small non-dividend paying companies into the sample. It may also indirectly imply that dividend-paying companies are least likely to face binding financing constraints. Therefore, they may be less likely to deplete working capital to mitigate the consequences of cash flow volatility. The coefficient of R.O.A. suggests that more profitable companies are more aggressive as well as more efficient in managing working capital. The positive profitability coefficient shows that companies may effectively use working capital management as a means of growth enhancement and value creation.

The coefficient of the *Market* dummy (Model 3) indicates that companies listed on NewConnect (which are more likely to be financially constrained and face information asymmetry issues) invest less in working capital compared to those listed on the main market of the Warsaw Stock Exchange. A similar conclusion may be derived from the coefficient of the *Constr* dummy (Model 4), which is statistically significant: firms that are assumed to face financing constraints relying on the Age-Size criterion have lower working capital investment compared to their unconstrained counterparts. These findings point to the validity of H3. Other proxies for financing constraints (Models 2 and 5) did not yield statistically significant results.

Table 3 summarises the H1.1 tests for changes in trade payables, which are found to be insensitive to operating cash flows, dividend payouts and amount of contracted debt obligations. On the other hand, payables are significantly affected by the dynamics of capital expenditures, implying that financial managers may intentionally increase account payables in order to accommodate fixed investment in the cash flow planning. More profitable companies, which are consequently less financially constrained, are found to rely less on trade credit for their operations (possibly thanks to a better access to external finance). Trade payables are found to decrease during the crisis years (Model 7), suggesting that contracting trade credit during an overall economic slump may become more difficult. The coefficient of the *Market* dummy (Model 8) suggests that constrained companies tend to rely more on trade finance and, consequently, exhibit a higher trade payables growth.

Table 4 summarises the H1.1 and H3 test results for cash holdings increase scaled by total assets. Operating cash flows and external finance appear to be the principal sources of cash accumulation. In line with expectations, the implementation of investment projects results in the depletion of cash reserves. Companies with more growth opportunities appear to experience a cash shortage, which may point to their financially constrained status. The positive coefficient of external borrowing suggests, however, that internally generated funds are insufficient for financing the available investment projects. Of the financing constraints proxies, only *DivDummy* yielded statistically significant results (Model 15). In line with the precautionary cash-saving hypothesis (Denis & Sibilkov, 2010), dividend paying firms are evidenced to accumulate relatively less cash than non-dividend paying companies.

Table 3. Test results for H1.1 and H3 (regressand: change in payables).

Model no.	6		7		8		9		10	
No. of observations	4512		4512		4512		4512		4512	
Wald (joint)	21.73	***	42.09	***	27.82	***	22.58	***	21.79	***
R^2	0.033		0.033		0.035		0.033		0.033	
AR(1) test	−5.646	***	−5.655	***	−5.656	***	−5.646	***	−5.661	***
AR(2) test	−0.495		−0.500		−0.547		−0.507		−0.494	
Constant	−0.02015		0.06394	***	−0.03844	*	−0.03381		−0.01970	
	(0.020)		(0.024)		(0.021)		(0.025)		(0.020)	
Log assets	0.00064		0.00064		0.00283		0.00135		0.00063	
	(0.002)		(0.002)		(0.002)		(0.002)		(0.002)	
P/BV	−0.00034		−0.00034		−0.00035		−0.00034		−0.00034	
	(000)		(000)		(000)		(000)		(000)	
ExF/A	−0.00262		−0.00262		−0.00377		−0.00234		−0.00229	
	(0.016)		(0.016)		(0.016)		(0.016)		(0.016)	
Dividend payout ratio	-8.11828×10^{-6}		-8.11486×10^{-6}		-7.85874×10^{-6}		-8.25822×10^{-6}		-8.18916×10^{-6}	
	(000)		(000)		(000)		(000)		(000)	
OCF/A	−0.00066		−0.00067		−0.00100		−0.00040		−0.00026	
	(0.009)		(0.009)		(0.009)		(0.009)		(0.010)	
R.O.A.	−0.01675	***	−0.01674	***	−0.01688	***	−0.01717	***	−0.01673	***
	(0.005)		(0.005)		(0.005)		(0.005)		(0.005)	
Sales growth	1.31049×10^{-5}	**	1.30903×10^{-5}	**	1.30399×10^{-5}	**	1.31069×10^{-5}	**	1.30728×10^{-5}	**
	(000)		(000)		(000)		(000)		(000)	
I/A	0.03515	**	0.03515	**	0.03596	**	0.03499	**	0.03495	**
	(0.017)		(0.017)		(0.017)		(0.017)		(0.017)	
Crisis			−0.08411	***						
			(0.018)							
Market					−0.02233	**				
					(0.009)					
Constr							0.00747			
							(0.008)			
DivDummy									−0.00141	
									(0.005)	

Notes: All models include the time and industry dummies (not reported). This table presents the static panel model estimates. The heteroscedasticity robust standard errors are provided in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.
Source: own elaboration.

Models with the same specification have been tested for changes in receivables and inventories; their explanatory power is unsatisfactory, however, and does not allow completion of the verification of H1.1.

Table 5 presents the H4 test results for working capital investment. Only the term interacting *Market* dummy with capital expenditures (Model 17) has a statistically significant coefficient, suggesting that for the companies identified as financially constrained, an increase in capital expenditures may translate into a lower working capital investment.

Table 6 summarises the H4 test results for change in payables (YoY). The coefficient of the variable interacting *Constr* dummy with capital expenditures scaled by total assets (Model 21) signifies that constrained companies rely more on payables as a source of finance for investment smoothing compared to their unconstrained counterparts. A similar conclusion may be derived from the $Market \times I/A$ interaction term (Model 22): firms quoted on

Table 4. Test results for H1.1 and H3 (regressand: cash holdings increase).

Model no.	11		12		13		14		15	
No. of observations	4512		4512		4512		4512		4512	
Wald (joint)	682.3	***	682.8	***	683.9	***	683.4	***	704.3	***
R^2	0.141		0.141		0.141		0.141		0.144	
AR(1) test	−4.197	***	−4.207	***	−4.218	***	−4.221	***	−4.248	***
AR(2) test	−2.910	***	−2.917	***	−2.959	***	−2.936	***	−2.947	***
Constant	0.00049		0.01232		−0.00649		0.01253		0.00579	
	(0.015)		(0.018)		(0.016)		(0.019)		(0.015)	
Log assets	−0.00104		−0.00104		−0.00020		−0.00167		−0.00109	
	(0.001)		(0.001)		(0.001)		(0.001)		(0.001)	
P/BV	−0.00061	**	−0.00061	**	−0.00062	**	−0.00061	**	−0.00061	**
	(000)		(000)		(000)		(000)		(000)	
ExF/A	0.14878	***	0.14877	***	0.14827	***	0.14852	***	0.15295	***
	(0.012)		(0.012)		(0.012)		(0.012)		(0.012)	
Dividend payout ratio	2.90006×10^{-6}		2.89655×10^{-6}		3.02163×10^{-6}		3.00438×10^{-6}		2.09674×10^{-6}	
	(000)		(000)		(000)		(000)		(000)	
OCF/A	0.18869	***	0.18868	***	0.18854	***	0.18846	***	0.19376	***
	(0.007)		(0.007)		(0.007)		(0.007)		(0.007)	
R.O.A.	−0.00076		−0.00076		−0.00078		−0.00039		−0.00053	
	(0.004)		(0.004)		(0.004)		(0.004)		(0.004)	
Sales growth	-1.35968×10^{-7}		-1.35652×10^{-7}		-1.69579×10^{-7}		-1.17016×10^{-7}		-4.78509×10^{-7}	
	(000)		(000)		(000)		(000)		(000)	
I/A	−0.07173	***	−0.07170	***	−0.07138	***	−0.07160	***	−0.07486	***
	(0.013)		(0.013)		(0.013)		(0.013)		(0.013)	
Crisis			−0.01183							
			(0.014)							
Market					−0.00834					
					(0.007)					
Constr							−0.00655			
							(0.006)			
DivDummy									−0.01599	***
									(0.004)	

Notes: All models include the time and industry dummies (not reported). This table presents the static panel model estimates. The heteroscedasticity robust standard errors are provided in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.
Source: own elaboration.

W.S.E. are found to rely less on payables than those identified as potentially facing financing constraints.

Table 7 presents the H4 test results for cash holdings increase scaled by total assets. In the crisis settings (Model 28), financing of investment projects significantly reduces the rate of accumulation of cash reserves. For companies identified as financially constrained and defined by the *Market* criterion (Model 27), one may observe a negative relationship between capital expenditures and cash accumulation. Dividend paying companies appear to accumulate relatively less cash compared to non-dividend paying firms (Model 29). For large companies (identified by the *Size* criterion), investment may be associated with a relatively lower increase of cash holdings (Model 30). The latter finding may be explained by the fact that smaller companies, which are more likely to be financially constrained, may be more reliant on internal finance (including cash) in financing their investment projects. Limited access to capital markets and bank credit may force these companies to accumulate cash in order to be able to smooth capital expenditures in case of negative cash flow dynamics.

Table 5. Test results for H4 (regressand: working capital investment, including cash).

Model no.	16		17		18		19		20	
No. of observations	4512		4512		4512		4512		4512	
Wald (joint)	183.6	***	188.2	***	185.1	***	183.5	***	185.8	***
R^2	0.082		0.083		0.082		0.082		0.082	
AR(1) test	−3.453	***	−3.548	***	−3.388	***	−3.519	***	−3.552	***
AR(2) test	−2.380	**	−2.461	**	−2.253	**	−2.418	**	−2.374	**
Constant	0.01626		0.03806		0.02130		0.01802		0.00472	
	(0.042)		(0.042)		(0.041)		(0.041)		(0.042)	
Log assets	−0.00164		−0.00302		−0.00166		−0.00177		−0.00061	
	(0.003)		(0.003)		(0.003)		(0.003)		(0.003)	
P/BV	−0.00099		−0.00098		−0.00101		−0.00099		−0.00098	
	(0.001)		(0.001)		(0.001)		(0.001)		(0.001)	
ExF/A	0.14293	***	0.13868	***	0.13974	***	0.14209	***	0.14285	***
	(0.032)		(0.032)		(0.032)		(0.032)		(0.032)	
Dividend payout ratio	1.85256×10^{-5}		1.86131×10^{-5}		1.81918×10^{-5}		1.84848×10^{-5}		1.85549×10^{-5}	
	(000)		(000)		(000)		(000)		(000)	
OCF/A	0.18798	***	0.18629	***	0.18624	***	0.18794	***	0.18795	***
	(0.019)		(0.019)		(0.019)		(0.019)		(0.019)	
R.O.A.	−0.08671	***	−0.08654	***	−0.08663	***	−0.08673	***	−0.08699	***
	(0.011)		(0.011)		(0.010)		(0.011)		(0.011)	
Sales growth	-3.03348×10^{-5}	**	-3.03743×10^{-5}	**	-3.06024×10^{-5}	***	-3.02608×10^{-5}	**	-3.03138×10^{-5}	**
	(000)		(000)		(000)		(000)		(000)	
I/A	−0.08984	**	−0.22160	***	−0.06092		−0.08204	**	−0.05290	
	(0.043)		(0.073)		(0.039)		(0.035)		(0.039)	
Constr × I/A	0.01375									
	(0.060)									
Market × I/A			0.16786	**						
			(0.079)							
Crisis × I/A					−0.08518					
					(0.069)					
DivDummy × I/A							−0.01219			
							(0.082)			
Size × I/A									−0.09305	
									(0.062)	

Notes: All models include the time and industry dummies (not reported). This table presents the static panel model estimates. The heteroscedasticity robust standard errors are provided in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.
Source: own elaboration.

6. Discussion and conclusions

The empirical results reported in the study demonstrate that financing constraints play a salient role in shaping firms' investment policies. Capital market imperfections cause the cost of external finance to functionally decrease in the company's internal financial resources. At the same time, access to external capital endogenously influences firms' investment policies.

Our empirical findings contribute to the ongoing discussion of the determinants and consequences of financing constraints. First, we show that working capital investments are sensitive to operating cash flow fluctuations. Therefore, rather than being complementary factors of organic firm growth, working capital investments and capital expenditures should be regarded as alternative uses of internally generated financial resources. Since fixed investments are inherently irreversible, non-continuous, less illiquid and more costly to adjust, in the event of negative cash flow shocks, firms may tap working capital as a complementary source of internal finance in order to avoid incurring more expensive external capital. The

Table 6. Test results for H4 (regressand: change in payables).

Model no.	21		22		23		24		25	
No. of observations	4512		4512		4512		4512		4512	
Wald (joint)	25.67	***	30.28	***	23.36	***	21.81	***	22.74	***
R^2	0.034		0.035		0.034		0.033		0.033	
AR(1) test	−5.739	***	−5.707	***	−5.678	***	−5.644	***	−5.637	***
AR(2) test	−0.487		−0.536		−0.497		−0.503		−0.525	
Constant	−0.02594		−0.03389	*	−0.01978		−0.01958		−0.02464	
	(0.020)		(0.020)		(0.020)		(0.020)		(0.020)	
Log assets	0.00104		0.00150		0.00066		0.00064		0.00103	
	(0.002)		(0.002)		(0.002)		(0.002)		(0.002)	
P/BV	−0.00033		−0.00035		−0.00034		−0.00034		−0.00034	
	(000)		(000)		(000)		(000)		(000)	
ExF/A	0.00061		−0.00036		−0.00259		−0.00299		−0.00235	
	(0.016)		(0.016)		(0.016)		(0.016)		(0.016)	
Dividend payout ratio	-8.27698×10^{-6}		-8.20773×10^{-6}		-8.2739×10^{-6}		-8.18239×10^{-6}		-8.12873×10^{-6}	
	(000)		(000)		(000)		(000)		(000)	
OCF/A	0.00021		0.00019		0.00004		−0.00088		−0.00059	
	(0.009)		(0.009)		(0.009)		(0.009)		(0.009)	
R.O.A.	−0.01705	***	−0.01685	***	−0.01672	***	−0.01678	***	−0.01684	***
	(0.005)		(0.005)		(0.005)		(0.005)		(0.005)	
Sales growth	1.31271×10^{-5}	**	1.31267×10^{-5}	**	1.30438×10^{-5}	**	0.000013091	**	1.30713×10^{-5}	**
	(000)		(000)		(000)		(000)		(000)	
I/A	0.00773		0.12676	***	0.04092	**	0.03827	**	0.04533	**
	(0.022)		(0.035)		(0.017)		(0.019)		(0.020)	
Constr × I/A	0.05870	**								
	(0.030)									
Market × I/A			−0.11243	***						
			(0.038)							
Crisis × I/A							−0.01147			
							(0.034)			
DivDummy × I/A					−0.05195					
					(0.041)					
Size × I/A									−0.03128	
									(0.031)	

Notes: All models include the time and industry dummies (not reported). This table presents the static panel model estimates. The heteroscedasticity robust standard errors are provided in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.
Source: own elaboration.

pattern of investment smoothing confirmed in this study should be interpreted as evidence of the presence of financing constraints.

Fazzari et al. (1988) were among the first to suggest that firms with abundant internal funds should exhibit a lower investment–cash flow sensitivity. Their approach to the operationalisation of financing constraints was, however, subsequently criticised for two important reasons: 1) rather than approximating the availability of internal funds, cash flows could in fact reflect a firm's immediate growth opportunities; and 2) the investment–cash flow relationship was shown to be nonmonotonic: companies with the lowest cash flows were evidenced to invest more than their counterparts with intermediate cash flows (Cleary, Povel, & Raith, 2007). The use of working capital as a proxy for internal funds allows the addressing of both issues. First, working capital investments have been empirically shown to exhibit no significant relationship with firms' growth opportunities. Second, our findings show that working capital investments may be monotonically decreasing with the degree

Table 7. Test results for H4 (regressand: cash holdings increase).

Model no.	26		27		28		29		30	
No. of observations	4512		4512		4512		4512		4512	
Wald (joint)	687.7	***	715.1	***	707.3	***	696.3	***	690.4	***
R^2	0.142		0.146		0.145		0.143		0.142	
AR(1) test	−3.820	***	−4.429	***	−3.478	***	−4.338	***	−4.175	***
AR(2) test	−2.772	***	−2.734	***	−2.210	**	−2.984	***	−2.877	***
Constant	−0.00247		0.01911		0.00530		0.00127		−0.00878	
	(0.015)		(0.015)		(0.014)		(0.015)		(0.015)	
Log assets	−0.00084		−0.00223	*	−0.00111		−0.00099		−0.00023	
	(0.001)		(0.001)		(0.001)		(0.001)		(0.001)	
P/BV	−0.00060	**	−0.00060	**	−0.00061	**	−0.00061	**	−0.00060	**
	(000)		(000)		(000)		(000)		(000)	
ExF/A	0.15090	***	0.14595	***	0.14735	***	0.14897	***	0.14938	***
	(0.012)		(0.012)		(0.012)		(0.012)		(0.012)	
Dividend payout ratio	2.8646×10^{-6}		3.15071×10^{-6}		2.67454×10^{-6}		2.49538×10^{-6}		2.81403×10^{-6}	
	(000)		(000)		(000)		(000)		(000)	
OCF/A	0.18938	***	0.18780	***	0.18780	***	0.19035	***	0.18889	***
	(0.007)		(0.007)		(0.007)		(0.007)		(0.007)	
R.O.A.	−0.00087		−0.00052		−0.00083		−0.00070		−0.00097	
	(0.004)		(0.004)		(0.004)		(0.004)		(0.004)	
Sales growth	-1.24356×10^{-7}		-2.74309×10^{-7}		-1.6767×10^{-7}		-2.64478×10^{-7}		-1.96218×10^{-7}	
	(000)		(000)		(000)		(000)		(000)	
I/A	−0.08777	***	−0.19419	***	−0.05193	***	−0.05931	***	−0.05093	***
	(0.017)		(0.027)		(0.015)		(0.014)		(0.015)	
Constr × I/A	0.03183									
	(0.023)									
Market × I/A			0.15191	***						
			(0.029)							
Crisis × I/A					−0.08388	***				
					(0.027)					
DivDummy × I/A							−0.11119	***		
							(0.032)			
Size × I/A									−0.06445	***
									(0.024)	

Notes: All models include the time and industry dummies (not reported). This table presents the static panel model estimates. The heteroscedasticity robust standard errors are provided in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.
Source: own elaboration.

of financing constraints. Third, the crowding-out effect of capital expenditures on working capital investments may have an important implication: because of lower working capital stock, financially constrained companies have less flexibility in alleviating negative cash flow shocks with working capital depletion. Therefore, while exhibiting a relatively higher sensitivity of working capital investments to capital expenditures, financially constrained firms are simultaneously expected to exhibit higher investment–cash flow sensitivity.

Our findings are in perfect accord with the existing body of empirical literature analysing the impact of capital market frictions on corporate investments. At the same time, elaborating upon previous findings, we postulate that the sensitivity of working capital investments to capital expenditures is a better and clearer indicator of the degree of financing constraints than conventional investment–cash flow sensitivity. Higher exposure to financing constraints is shown to increase firms' propensity to smooth fixed investments at the expense of working capital stock.

Expanding the previous research, we study the impact of fixed investments on each component of working capital separately. We document a persistently negative impact of capital expenditures on the dynamics of cash holdings and trade payables. Our results may help to elucidate two empirically observed patterns reported in the literature: 1) a higher propensity of financially constrained companies to hold precautionary cash reserves; and 2) the evidence of trade credit contagion through the supply chain commonly observed in emerging economies (Bastos & Pindado, 2013).

Denis and Sibilkov (2010), Opler et al. (1999) and Almeida et al. (2004) report higher cash accumulation among companies experiencing dynamic growth (and therefore exhibiting higher investment demand), high volatility of cash flows and problems with accessing external finance. These firms are conjectured to accumulate cash reserves in order to be able to fuel their investment demand when attractive investment projects emerge. It remains unclear, however, as to why these firms, which are documented to channel almost their entire operational cash flow towards investment, do not immediately consume their cash savings to increase their investment demand and enhance their cash flows. The current explanations for precautionary cash accumulation also appear to be in disaccord with the concept of an optimal debt contract (Povel & Raith, 2002). Due to insufficiency of cash flows and external capital to finance the planned investments, financially constrained companies may be induced to decrease their investment expenditures, thereby generating substantial adjustment costs and potentially destroying the value of the available real options. The theory of corporate value management suggests that the precautionary cash reserves should be primarily directed towards precluding the fluctuations of fixed investments. In order to reconcile the seemingly ambiguous evidence, we reverse the argumentation of the pattern of precautionary cash savings: in contrast to previous studies, we posit that financially constrained firms stash more cash in order to be able to subsequently alleviate negative cash flow shocks rather than to be able to finance emerging investment projects. In the case of financially unconstrained firms, the internal liquidity gaps are primarily covered with external finance.

Postulating that trade credit may be a substitute for external finance, Bastos and Pindado (2013) describe the phenomenon of trade credit contagion through the supply chain during economic turmoil. When facing tightening financing constraints, firms are likely to simultaneously grant more trade credit to their customers and delay payments to their suppliers. Hence, the empirical literature frequently attributes the phenomenon of trade credit contagion to the corporate practice of matching trade payables and receivables (Fabbri & Klapper, 2008). Our study looks at trade credit contagion from another perspective: we find that, at least to a certain extent, negative cash flow shocks are transmitted to the trade credit market through investment smoothing. Whenever they are experiencing a shortage of internal funds, firms are likely to increase trade payables in order to accommodate the increased investment demand. Therefore, we highlight an alternative transmission mechanism relating corporate investment policies and working capital management strategies.

Our empirical findings may also have important implications at the macroeconomic level. We document that cash flow shocks are primarily transmitted to the trade credit market rather than to the market for investment goods. Fixed investment smoothing is shown to significantly contribute to the deterioration of firms' financial standing whenever cash flows and external finance become scarce. Therefore, financing constraints seem to have tangible balance sheet effects, which may significantly exacerbate the economic repercussions of a

general economic slump. We also show that, despite the dynamic development of financial markets over the last two decades, the corporate sector in Poland remains confronted with binding financing constraints, which may call for a targeted remedial action policy.

The research findings documented in this study point to several issues requiring further empirical investigation. Despite predicting a positive relationship between the scale of investment smoothing and investment–cash flow sensitivity, the study does not directly verify this relationship. Further research is necessary to establish whether the sensitivity of working capital investments to capital expenditures may be used as a reliable indicator of the degree of financing constraints: we suggest using synthetic measures of financing constraints similar to that developed by Hadlock and Pierce (2010) in order to identify firms with different exposure to financing constraints. Further research may also clarify which factors at the level of managerial decision-making may contribute to the phenomenon of investment smoothing. It might be the case that the empirical pattern of investment smoothing is driven by adverse selection on financial markets. It may also be the case, however, that financial managers fail to properly accommodate fixed investment outlays in financial planning and, consequently, are not prepared for contingent negative cash flow shocks. A further investigation may be necessary to establish whether the sudden increase of trade payables may be perilous for long-term business relations with the firms' trade counterparties. Finally, an in-depth study of the macroeconomic implications of investment smoothing may shed new light on the nature of business cycles (Fazzari & Petersen, 1993).

Disclosure statement

No potential conflict of interest was reported by the authors.

References

Abel, A., & Eberly, J. (2002). *Theory without adjustment costs and cash flow effects without financing constraints*. Mimeo: University of Pennsylvania and Northwestern University.

Akerlof, G. (1970). The market for "lemons": Quality uncertainty and the market mechanism. *The Quarterly Journal of Economics, 84*(3), 488–500.

Allayannis, G., & Mozumdar, A. (2004). The impact of negative cash flow and influential observations on investment–cash flow sensitivity estimates. *Journal of Banking & Finance, 28*, 901–930.

Almeida, H., Campello, M., & Weisbach, M. (2004). The cash flow sensitivity of cash. *Journal of Finance, 59*(4), 1777–1804.

Bastos, R., & Pindado, J. (2013). Trade credit during a financial crisis: A panel data analysis. *Journal of Business Research, 66*(5), 614–620.

Bertola, G., & Caballero, R. (1994). Irreversibility and aggregate investment. *Review of Economic Studies, 61*, 223–246.

Brown, J., & Petersen, B. (2015). Which investments do firms protect? Liquidity management and real adjustments when access to finance falls sharply. *Journal of Financial Intermediation, 24*(4), 441–465.

Bushman, R., Smith, A., & Zhang, X. (2011). Investment cash flow sensitivities really reflect related investment decisions. *Working Paper*. Retrieved from http://ssrn.com/abstract=842085

Campello, M., Giambona, E., Graham, J., & Harvey, C. (2011). Liquidity management and corporate investment during a financial crisis. *The Review of Financial Studies, 24*(6), 1944–1979.

Carpenter, R., Fazzari, S., Petersen, B., Kashyap, A., & Friedman, B. (1994). Inventory investment, internal-finance fluctuations, and the business cycle. *Brookings Papers on Economic Activity, 2*, 75–138.

Cegłowski, B., & Wnuczak, P. (2010). Advanced techniques of planning of accounts receivable and accounts payable. *Finanse, rynki finansowe, ubezpieczenia, 587*, 323–336.
Chemmanur, T., He, J., Hu, G., & Liu, H. (2010). Is dividend smoothing universal?: New insights from a comparative study of dividend policies in Hong Kong and the U.S. *Journal of Corporate Finance, 16*(4), 413–430.
Choi, W., & Kim, Y. (2005). Trade credit and effects of macro-financial shocks: Evidence from US panel data. *Journal of Finance and Quantitative Analysis, 40*(4), 897–925.
Cleary, S., Povel, P., & Raith, M. (2007). The U-shaped investment curve: Theory and evidence. *The Journal of Financial and Quantitative Analysis, 42*(1), 1–39.
Cummins, J., Hassett, K., & Oliner, S. (2006). Investment behavior, observable expectations, and internal funds. *The American Economic Review, 96*(3), 796–810.
D'Espallier, B., & Lopez-Iturriaga, F. (2009). On the negative relation between investment-cash flow sensitivities and cash-cash flow sensitivities. *Faculty of Business and Economy, Katholieke Universiteit, Working Paper*.
Dasgupta, S., Noe, T., & Wang, Z. (2011). Where did all the dollars go? The effect of cash flows on capital and asset structure. *The Journal of Financial and Quantitative Analysis, 46*(5), 1259–1294.
Deng, K., Ding, Z., Zhu, Y., & Zhou, Q. (2017). Investment–cash flow sensitivity measures investment thirst, but not financial constraint. *Accounting and Finance, 57*(1), 165–197.
Denis, D., & Sibilkov, V. (2010). Financial constraints, investment, and the value of cash holdings. *The Review of Financial Studies, 23*(1), 247–269.
Devereux, M., & Schiantarelli, F. (1990). Investment, financial factors, and cash flow: Evidence from UK panel data. In R. Hubbard (Ed.), *Asymmetric Information, Corporate Finance and Investment* (pp. 279–306). Chicago, IL: University of Chicago Press.
Duchin, R. (2010). Cash holdings and corporate diversification. *The Journal of Finance, 65*(3), 955–992.
Eisner, R., & Strotz, R. (1963). *The determinants of business investment*. Englewood Cliff, NJ: Prentice-Hall Inc.
Fabbri, D., & Klapper, L. (2008). Market power and the matching of trade credit terms. *Technical Report, World Bank, Policy Research Working Paper 4754*.
Fazzari, S., & Petersen, B. (1993). Working capital and fixed investment: New evidence on financing constraints. *The RAND Journal of Economics, 24*(3), 328–342.
Fazzari, S., Hubbard, G., Petersen, B., Blinder, A., & Poterba, J. (1988). Financing constraints and corporate investment. *Brookings Papers on Economic Activity, 1*(1988), 141–206.
Ferrando, A., & Mulier, K. (2013). Do firms use the trade credit channel to manage growth? *Journal of Banking & Finance, 37*(8), 3035–3046.
Gatchev, V., Pulvino, T., & Tarhan, V. (2010). The Interdependent and intertemporal nature of financial decisions: An application to cash flow sensitivities. *The Journal of Finance, 65*(2), 725–763.
Gertler, M., & Gilchrist, S. (1994). Monetary policy, business cycles, and the behavior of small manufacturing firms. *Quarterly Journal of Economics, 109*(2), 309–340.
Greene, W. (2008). *Econometric analysis*. Upper Saddle River, NJ: Prentice Hall.
Guariglia, A., Tsoukalas, J., & Tsoukas, S. (2012). Investment, irreversibility, and financing constraints in transition economies. *Economics Letters, 117*, 582–584.
Hadlock, C., & Pierce, J. (2010). New evidence on measuring financial constraints: Moving beyond the KZ index. *Review of Financial Studies, 23*(5), 1909–1940.
Hasan, I., Jackowicz, K., Kowalewski, O., & Kozlowski, L. (2017). Do local banking market structures matter for SME financing and performance? New evidence from an emerging economy. *Journal of Banking & Finance, 79*, 142–158.
Hayashi, F. (1982). Tobin's marginal q and average Q: A neoclassical interpretation. *Econometrica, 50*(1), 213–224.
Hovakimian, G. (2009). Determinants of investment cash flow sensitivity. *Financial Management, 38*(1), 161–183.
Hovakimian, G. (2011). Financial constraints and investment efficiency: Internal capital allocation across the business cycle. *Journal of Financial Intermediation, 20*(2), 264–283.
Jackowicz, K., Kozłowski, Ł., & Mielcarz, P. (2016). Financial constraints in Poland: The role of size and political connections. *Argumenta Oeconomica, 1*(36), 225–240.

Jasiński, T., & Mielcarz, P. (2013). Consumption as a factor of Polish economic growth during the global recession of 2008/2009: A comparison with Spain and Hungary. *Contemporary Economics, 2*, 5–16.

Jorgenson, D. (1971). Econometric studies of investment behavior: A survey. *Journal of Economic Literature, 9*, 1111–1147.

Kaplan, S., & Zingales, L. (1997). Do investment-cash flow sensitivities provide useful measures of financing constraints? *The Quarterly Journal of Economics, 112*(1), 169–215.

Konings, J., Rizove, M., & Vandenbussche, H. (2003). Investment and financial constraints in transition economies: Micro evidence from Poland, the Czech Republic, Bulgaria, and Romania. *Economic Letters, 78*, 253–258.

Lin, T., & Chou, J. (2015). Trade credit and bank loan: Evidence from Chinese firms. *International Review of Economics & Finance, 36*, 17–29.

Lintner, J. (1956). Distribution of incomes of corporations among dividends, retained earnings, and taxes. *American Economic Review, 46*, 97–113.

Modigliani, M., & Miller, F. (1958). The cost of capital, corporation finance, and the theory of investment. *American Economic Review, 48*, 261–297.

Moyen, N. (2004). Investment–cash flow sensitivities: Constrained versus unconstrained firms. *The Journal of Finance, 59*(5), 2061–2092.

Mussa, M. (1977). External and internal adjustment costs and the theory of aggregate and firm investment. *Economica, 44*(174), 163–178.

Myers, S. (1977). Determinants of corporate borrowing. *Journal of Financial Economics, 5*, 147–175.

Myers, S., & Majluf, S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics, 13*(2), 187–221.

Opler, L., Pinkowitz, T., Stulz, R., & Williamson, R. (1999). The determinants and implications of corporate cash holdings. *Journal of Financial Economics, 52*, 3–46.

Petersen, M., & Rajan, R. (1997). Trade credit: Theories and evidence. *Review of Financial Studies, 10*(3), 661–691.

Povel, P., & Raith, M. (2002). Optimal investment under financial constraints: The roles of internal funds and asymmetric information. *Institute of Financial Studies, Carlson School of Management, Working Paper No. 0103.* Retrieved from Available at SSRN: https://ssrn.com/abstract=269497 or https://doi.org/10.2139/ssrn.269497

Sierpińska, M., & Wędzki, D. (2007). *Zarządzanie Płynnością Finansową w Przedsiębiorstwie*. Warsaw: Wydawnictwo Naukowe PWN.

Sopranzetti, B. (1997). *Managing credit risk? The economics of factoring accounts receivable*. Working Paper, Rutgers University.

Sopranzetti, B. (1999). Selling accounts receivable and the underinvestment problem. *The Quarterly Review of Economics and Finance, 39*(2), 291–301.