“Investment and financing constraints: can working capital management make a difference in South Africa?”

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Investment and financing constraints: can working capital management make a difference in South Africa?

Abstract

The 2008/2009 financial crisis resulted in renewed interest in the usually neglected subject working capital management by both practitioners and researchers because of the scarcity and high cost of funds of financial markets during the crisis. In this study, the author uses a balanced panel of 85 firms listed on Johannesburg Stock Exchange over the period 2001-2010 to analyze the linkages between investment in fixed and working capital and financing constraints. Using the generalized method of moments (GMM) estimation on the panel data for these firms, the author finds that working-capital investment is sensitive to fixed capital investment and cash-flow fluctuations. The study contends that good working capital management may help firms to alleviate the effects of financing constraints on fixed investment. Finally, the study suggests some policy implications for the managers and investors in South African markets.

Keywords: cash flow, financing constraints, fixed investment, working capital management.
JEL Classification: G30, G32.

Introduction

Winners and losers in the market place are distinguished by the corporate investments they undertake (Boquist, Todd & Thakor, 1998). Recent empirical research has attributed the persistent and phenomenal growth of the Chinese economy and firms despite financial constraints to the use of internal resources and good working capital management (Ding, Guariglia & Knight, 2013; Hale & Long, 2011). There are wide sources of finance for South African firms; the stock market, the bond market and the banking system. Despite the presence of a well-developed capital market and financial system[1] which ranks among the top countries in terms of financial development (Skerritt, 2009), South Africa has a very low growth rate, an average of 2.7%. South Africa's rate of growth is below its peers in the Brazil, Russia, India, China and South Africa (BRICS) alliance and some of its peers in the South Africa Development Community (SADC) region, who have not achieved its level of financial development. Fixed investments by companies contribute to economic growth.

Raising funds in capital markets have proved to be increasingly difficult and costly (Salawu, 2007). Issuance costs incurred when raising external finance make internal financing cheaper for a firm[2]. The cost of issuing new securities, the volatility of short term markets, the high cost and the scarcity of funds make working capital a very important subject. Financialization, which is broadly defined as a pattern in which investors make profits through financial channels instead of trade and commodity production (Krippner, 2005), is one of the major causes of the scarcity of funds. Working capital can be considered a reservoir of internal financial resources because funds locked up in working capital can be tapped into and redeployed to support business growth. By pursuing efficient working capital management policies, managers can tap into this hidden reserve of working capital and pursue profitable investment opportunities without going to the capital market to issue expensive and risky securities and avoid the negative signals associated with external securities.

Financial development eases firm level financial constraints (Khurana, Martin & Pereria, 2006; Love, 2003). As stated earlier, South Africa has high levels of financial development. In light of this, the present study seeks to answer the following questions. First, does internal finance have any role to play for firms operating in a highly-developed and sophisticated financial system? Second, does working capital alleviate financial constraints in economies where the capital market and the financial system are functioning very well?

This paper is an attempt to investigate whether internal finance has any role to play for firms operating in a highly-developed and sophisticated financial system and whether working capital alleviates financial constraints in economies with well-functioning financial systems. Our results show that the cashflow investment sensitivity of working capital investment is high, therefore working capital can alleviates financial constraints. Therefore South African firms can smooth their fixed investment by employing good inventory and receivables management.

The rest of the paper is structured as follows; Section 1 provides an overview of the cash flow investment sensitivity literature. The data and metho-

[1]The South African banking sector, for example, though oligopolistic in nature, ranks among the world's top ten. The regulatory framework, the depth of financial infrastructure and markets and the vitality of the banking system serve as proof of the advanced nature of the South African financial sector. South Africa is the most liquid emerging bond market in the world and is also the leader in terms of the number of bonds listed and turnover.

[2]For example, in raising R3.9 billion through an Initial Public Offering in 2003, Telkom incurred R220 million in expenses which was approximately 6% of the amount raised (Firer, Ross, Westerfield & Jordan, 2012).

dology are discussed in Section 2, followed by the development of the estimation model in Section 3. Estimation results and robustness checks are presented in this Section. Final Section concludes the study.

1. A brief review of the literature

Financially-constrained firms only undertake investments when they have ample internal resources and will be compelled to cut down their investment, and hence their growth, following reductions in their cash flow. When a financially-constrained firm experiences a negative cash flow shock it may decide to forgo working capital investment. Thus efficient working capital management may be crucial for financially-constrained firms for them to keep relatively high and smooth levels of fixed investment. However, the degree to which working capital can contribute to smoothing fixed investments depends on its level of working capital. This means that a drop in working capital negatively impacts on fixed investment directly since it implies a fall in internal funds and indirectly by raising the cost of external funds while huge investments in working capital capacitate the firm to smooth fixed investments. Using the example of the financially constrained Chinese firms, Ding et al. (2013) posit that good working capital management may be particularly important for such firms to maintain relatively high and smooth levels of fixed investment and can be an important mechanism through which they cope with financing constraints.

Chan (2010) argues that working capital represents a significant proportion of firms' financial needs, especially in developing countries; therefore it is likely to be an important avenue by which financial constraints can affect firm behavior. Working capital represents both a source and a use of short-term capital (Chiou, Cheng & Wu, 2006), and is a readily reversible store of liquidity, which can be used to smooth a company's fixed investment relative to cash flow shocks if a firm becomes financially constrained (Ding et al., 2013; Fazzari & Petersen, 1993). Fazzari and Petersen (1993) emphasized the reversibility of working capital was by stating that working capital investment can temporarily be negative (when raw materials consumption is faster than its replacement) and can be improved upon by intensifying collections efforts and tightening credit policies on new sales. More efficient management working capital mean less requirements for external financing and better financial performance (Shin & Soenen, 1998).

Fazzari and Petersen (1993) found that US firms were indeed able to smooth fixed investment with working capital. Since fixed capital investment is characterized by high adjustment costs, firms benefit from having smooth fixed investment. In the presence of negative cash flow shocks and financing constraints, it is mainly those firms which have sufficiently high levels of working capital that can absorb the shocks without having to reduce their fixed investment. The results of their regression analysis showed that working capital investment as an independent variable had a negative coefficient and concluded that the means that working capital competes with capital investment for limited funds. In addition working capital is more sensitive to cash flow than fixed investment.

Ding et al. (2013) used a panel of 121,237 firms of four different ownership types in China over the period 2000-2007 to study the relationship investment in fixed and working capital and financing constraints. The study found that firms characterized by high working capital display high sensitivities of investment in working capital to cash flow and low sensitivities of investment in fixed capital to cash flow. Ding et al. (2013) argue that, in spite of severe external financing constraints, those firms with low fixed capital to cash flow and high working capital to cash flow have the highest fixed investment rates, suggesting that good working capital management may help firms to ease the impact of financing constraints on fixed investment.

Non-financially constrained firms are better able to finance their net working capital than financially constrained firms. Therefore the optimal level of a non-financially constrained firm will be higher than that of financially constrained firms. Ding et al. (2013) state high working capital can alleviate the effects of financial constraints on cash flow investment sensitivity. It is important to bear in mind that a high net working capital has to be financed (Hill, Kelly & Highfield, 2010). On its own high net working capital is good liquidity position but it might also mean poor utilization of resources (Erasmus, 2010). Therefore when testing the role of working capital in alleviating financial constraints it is important that one considers the profitability of the firm. In true sense, working capital makes a difference in alleviating financial constraints when consider high working capital firms that are delivering value to shareholders.

Baños-Caballero, Garcia-Teruel, and Martinez-Solano (2009) found that working capital management depends on bargaining power and other financial factors such as the availability of internal finance, cost of financing and access to capital markets. Based on these findings, they argue that under in imperfect market conditions, the working capital level held by companies may also be sensitive to these financial factors. It is critical therefore to ap-

preciate that working capital level investment is influenced by several factors under market imperfections but this working capital also influences the level of fixed investment. The question that arises therefore; is how market imperfections influence fixed investment once working capital is included.

The amount working capital holdings that ensures smooth flow of production and implementation of investment plans depend on firm reputation in the financial markets among other factors. Calomiris, Hubbard, and Watchel (1995) state that firms that are considered high long term and short term credit quality have lower stocks of inventories and financial working capital. Such firms do not need to accumulate working capital as a buffer against fluctuations in cash flow as they can easily obtain external funds at favorable terms like the commercial paper market.

Portal, Zani, and da Silva (2012) found that the external funds of constrained firms consistently present less negative sensitivity to cash flow compared with those of unconstrained companies. Their study further established that the internal funds of constrained companies demonstrate a positive sensitivity to cash flow, whereas those of unconstrained companies do not show any such significant behavior. Using international data from 44 countries over the 1995-2007 period, Marhfor, M'Zali, and Cosset (2012) found that higher investment-cash flow sensitivity can be interpreted as evidence that firms are more financially constrained, consistent with Fazzari, Hubbard, and Petersen (1988).

Wale (2014) used data taken from selected six African countries and observed that the investment curve is U-shaped when firms are classified on the basis of internal financial constraint measure (i.e. cash flow). Using external financial constraint proxies (age, size and payout) this study found that all category of firms show positive and significant investment cash flow sensitivity. On the basis of these findings Wale (2014) concluded that the sampled African firms are externally financial constrained and that the way firms are a priori classified as internal vs. external financial constrained matters.

2. Data and methodology

The empirical study is based on a sample of 85 JSE-listed firms. Sample firms' data were collected from the financial statements for the accounting period 2001 to 2010 available on the McGregor BFA Library. In order to produce a balanced panel, firms with missing financial statements were eliminated. Firms in the financial services sector were excluded because the nature of their working capital is different from the context of this study.

Table 1 presents the descriptive statistics. I_{it} denotes fixed investment for firm i at time t, K_{it} represents beginning of the year fixed assets and CF_{it} its cash flow, Q_{it} ratio is the Tobin's Q calculated as the market value of the enterprise's equity plus the book value of interest-bearing debt to the replacement cost of its fixed assets. Change in net working capital (ΔW), was calculated as net working capital (NWC) (current assets – current liabilities) at the end of year minus net working capital at the beginning of the year ($NWC_{it} - NWC_{it-1}$).

Table 1. Descriptive statistics

Variable	Mean	Std. Dev.	Median
Q RATIO	2.1583	1.7787	1.62
Fixed investment/fixed capital (*I/K*)	0.2554	0.2314	0.2498
Cash flow/fixed capital (*CF/K*)	1.3273	1.4161	0.7395
Change in working capital / fixed capital ($\Delta W/K$)	0.1846	0.7819	0.0613
Total Investment *IWK* ($I/K + \Delta W/K$)	0.4400	0.8831	-0.1590
Net working capital / fixed capital (*NWC/K*)	7.1667	1.55	0.6530
Non-cash working capital / fixed capital ($\Delta NCWC/K$)	1.08	16.30	0.2578

Source: Own calculations using a balanced panel over the period 2001 to 2010. Data obtained from the McGregor BFA library.

The average fixed investment to fixed capital (*I/K*) is 0.26 (median value 0.25) with a volatility of 0.23. The average change investment in net working capital to fixed capital ($\Delta W/K$) was 0.18 (median value 0.06) which indicates a scattering to the right of the tail. The volatility of investment in working capital ($\Delta W/K$), is 0.78, which is far higher than the volatility of fixed investment (*I/K*) is (0.23), which supports the notion that working is reversible that fixed investment and could be an indication that these firms use working capital to alleviate financial constraints. The average cash flow to fixed capital (*CF/K*) is 1.33 (median value 0.73).

3. Development of the model

We estimate the sensitivity of fixed investment to cash flow using Equation 1.

$$I / K_{it} = \beta_0 + \beta_1 CF / K_{it} + \beta_2 QRATIO_{it} + \eta_i + \lambda_t + \varepsilon_{it}. \quad (1)$$

I denotes fixed investment for firm i at time t, K_{it} represents beginning of the year fixed assets, CF_{it} is its cash flow Q_{it} ratio is the Tobin'sQ η_i is the unobserved heterogeneity that is likely to affect the fixed

investment of the firm, λ_t is time specific component and ε_{it} is the error term.

To test the sensitivity of working capital to cash flow, we study follow Fazzari and Petersen (1993) and Ding et al. (2013)[1] who produced Equation (2) in which change in working capital was the dependent variable, ΔW. Other variables were as previously defined and change in working capital (ΔW) was calculated as net working capital (*NWC*) (current assets – current liabilities) at the end of the year minus net working capital at the beginning of the year ($NWC_{it} - NWC_{it-1}$).

$$\Delta W / K_{it} = \beta_0 + \beta_1 CF / K_{it} + \beta_2 QRATIO_{it} + \eta_i + \lambda_t + \varepsilon_{it}. \quad (2)$$

Equation 3 estimates the sensitivity of total investment (*IW*) (fixed plus working capital) to cash flow.

$$IW / K_{it} = \beta_0 + \beta_1 CF / K_{it} + \beta_2 QRATIO_{it} + \eta_i + \lambda_t + \varepsilon_{it}. \quad (3)$$

Equation 4 evaluates the sensitivity of fixed investment to cash flow and investment in working capital. The inclusion of $\Delta W/K_{it}$ helps to determine if investment in working capital competes with fixed investment for funds. It is hypothesized that $\Delta W/K_{it}$ is inversely related to *I/K* if investment in working capital competes for funds with fixed investment.

$$I / K_{it} = \beta_0 + \beta_1 CF / K_{it} + \beta_2 QRATIO_{it} + \beta_3 \Delta W / K_{it} + \\ + \eta_i + \lambda_t + \varepsilon_{it}. \quad (4)$$

All equations were estimated in first-differences, to control for firm-specific, time-invariant effects. The use a first-difference Generalized Method of Moments (GMM) approach advanced by Arellano and Bond (1991) enables to control for possible endogeneity problems. Two or more lags of each of the regressors are used as instruments.

3.1. Cashflow, fixed investment and working capital sensitivity. Table 2 Column 1 reports the results of Equation 1, the sensitivity of investment to cash flow. The coefficient of *CF/K* is positive and very significantly away from zero (0.10). These results show that cash flow strongly affects fixed investment. The cash flow elasticity[2] evaluated at sample mean is 0.5. A 10% increase in cash flow leads to a 50% increase in fixed investment. The coefficient of *CF/K* can be interpreted as an indication of financial constraints faced by firms (Ding et al., 2013). The positive coefficient is consistent with previous studies (Guariglia, 2008) but is far below the one obtained by Fazzari and Petersen (1993) who obtained a coefficient of 0.38. The result obtained in Column 1 of Table 2 might be understated if firms used working capital to smooth fixed investment.

The coefficient and the elasticity of working capital to cash flow are far high than the coefficient of fixed investment to cash flow. This is consistent with the expectation that working capital is used to smooth fixed investment. The coefficient (0.25) and elasticity (1.79) of cash flow on working capital investment is far higher than its coefficient (0.10) and elasticity (0.5) on fixed investment. This is consistent with the argument that working capital is more reversible than fixed investment (Fazzari & Petersen, 1993) and working capital investment adjustment costs are lower than fixed capital adjustment costs (Carpenter, Fazzari, & Petersen, 1994). In the presence of a negative shock on cash flow, firms do not cut their working capital and fixed investment proportionately. Working capital is highly reversible and working capital investment can temporarily be negative if the firm decides to engage a more aggressive approach to working capital management (Fazzari & Petersen, 1993). On the contrary fixed investment is highly irreversible and it is more costly to change the level of fixed investment. A negative working capital means that working capital is a source of funds (Chiou et al., 2006). It means that short term finance is being financed not only by short term investments but long term projects.

Table 2. Cashflow, fixed investment and working capital

	(1)	(2)	(3)	(4)
	I/K	*ΔW/K*	*IW/K*	*I/K*
CF/K	0.0946***(27.47)	0.249***(49.42)	0.341***(32.76)	0.104***(52.02)
QRATIO	0.0385***(7.02)	-0.269***(-32.51)	-0.223***(-21.51)	0.0402***(11.14)
ΔW/K	-	-	-	-0.0464***(-17.88)
m2	0.801	0.743	0.720	0.859
Hansen	66.48	71.89	69.93	76.85
df	61	61	61	81
p-values	0.294	0.16	0.203	0.610
N	762	762	762	762

Note: *t* statistics in parenthesis *, ** and *** significant at 10%, 5% and 1% respectively. Time dummies' coefficients not reported for brevity.
Source: own calculations using a balanced panel over the period 2001 to 2010. Data obtained from the McGregor BFA library.

[1] Ding et al. (2013) did not include the Tobin's Q because the study was based on firms not listed on a stock exchange.
[2] Elasticity was calculated as follows; the coefficient on CF/K multiplied by mean value of CF/K) divided by the mean value of I/K.

The results of the relationship between cashflow and working capital investment (Equation 2) are presented in Column 2 of Table 2. The results show that investment in working capital is strongly sensitive to cash flow. The coefficient of cash flow is 0.25 and it is precisely defined. The cashflow elasticity evaluated at sample mean is 1.79. Both the coefficient and the elasticity are below the ones reported previous studies (Ding et al., 2013; Fazzari & Petersen, 1993). In their study Fazzari and Petersen (1993) found that the cashflow coefficient was 0.839 and the cash flow elasticity was 1.67. For the Chinese foreign, private and collective firms the coefficients of cash flow were respectively 0.5, 0.4 and 0.7 while the elasticities of the same firms were respectively 1.24; 2.35 and 3.76 (Ding et al., 2013).

In Column 3 the results of Equation 3, the cash flow and total investment relationship are presented. Total investment is defined fixed capital investment plus working capital investment. By construction the coefficient of cashflow in Column 3 (0.35) should be equal to the sum of the coefficients in Column 1 (0.95) and Column 2 (0.25). The elasticity of the total investment of the firm calculated at sample means is 1.03.

Column 4 of Table 2 presents the results of Equation 28 where working capital is included in the cashflow-fixed investment regression. Consistent with expectation *W/K* has negative sign (-0.05). The negative sign suggests that working capital competes with fixed investment for limited funds in a financially constrained firm (Fazzari & Petersen, 1993). The elasticity of *WK* is 0.03 which means that when working capital increases by 10%, fixed investment goes down by 0.3% which suggests that the level of competition is very low.

3.2. High/low working capital firms: cash flow investment sensitivity. The sensitivity of working capital to cash flow fluctuations and the sensitivity of fixed capital to cash flow were tested after classifying firms as high and low working capital firms. High (low) working capital firms are those firms that are above (below) the sample median, ΔW. It was hypothesized that the cash flow of firms characterized by high working capital is more sensitive to working capital investment compared with their counterparts. Dummy variables; *HIWK* and *LOWK* were created to represent firms characterized by high working capital and firms characterized by low working capital, respectively. These dummies were interacted with the variable *CF*/*K* in order to determine the sensitivity of cash flows to fixed and working capital for both high and low working capital firms. If working capital is used to smooth fixed investment cash flow fluctuations, then the sensitivity of low working capital firms is expected to be higher than that of high working capital firms. Firms characterized by low working capital cannot use working capital to mitigate the impact of cash flow shocks on fixed investment.

Equation 5 evaluates the sensitivity of working capital to cash flow fluctuations after classifying firms as high and low working capital firms.

$$\Delta W / K_{it} = \beta_0 + \beta_1 (CF / K)_{it} \times LOWK + \beta_2 (CF / K)_{it} \times \\ \times HIWK + \beta_3 QRATIO_{it} + \eta_i + \lambda_t + \varepsilon_{it}. \quad (5)$$

Equation 6 evaluates the sensitivity of fixed investment to cash flow fluctuations to working capital after classifying firms as high and low working capital firms.

$$I / K_{it} = \beta_0 + \beta_1 (CF / K) \times LOWK_{it} + \beta_2 (CF / K) \times HIWK_{it} + \\ + \beta_3 QRATIO_{it} + \eta_i + \lambda_t + \varepsilon_{it}. \quad (6)$$

The results of Equation 5 and 6 are presented in Table 3. The sensitivity of investment in working capital to cash flow is significant for both, firms with high working capital and firms with low working capital. The coefficient of *HIWK* is higher than *LOWK*, consistent with expectation. The sensitivity of working capital investment to cash flow of firms with large working capital is higher than the sensitivity of firms with low working capital. Working capital acts as a "shock absorber" when cashflows become negative, therefore firms characterized with higher working capital are better positioned to absorb the shock than firms with low working capital. In the presence of negative shock to cashflow, both high working capital firms and low working adjust their working capital investment. However, the magnitude of adjustment is larger for firms with high working capital level. The marginal value of working capital to low working capital firms is very high which means that these firms are not willing offset the negative cash flow with working capital (Carpenter et al., 1994).

Table 3 Column 2 shows that the sensitivity of investment in fixed capital to cash flow of low working capital firms is higher than the sensitivity of investment in fixed capital to cash flow of higher working capital firms. The cash flow coefficients of high working capital firms and low working capital are 0.12 and -0.05 respectively. The marginal value of working capital is relatively low to high working capital firms; therefore in the presence of cash flow shocks, such firms have better capacity to adjust their investment in working capital. Firms with high working capital can draw down form their working capital investment until it becomes negative. A negative working capital means that the firm is using short term

funds to support not only short term investments but also fixed or long term investments and in that case working capital is a source of funds (Firer et al., 2012). As hypothesized, the sensitivity of investment in fixed capital to cash flow of low working capital firms is higher than their counterparts because they cannot absorb the shock as much as high working capital firms can do. Low working capital firms respond to cash flow shocks by cutting their fixed investment because the marginal value of working capital is relatively high (and they cannot easily adjust their working capital investment) (Ding et al., 2013). The perishability of nature of projects results in its higher sensitivity to cash flow fluctuations for low working capital firms (Fazzari & Petersen, 1993).

Table 3. Cash flow-working capital sensitivity

	(1) *ΔW/K*	(2) *I/K*
*CF/K*LOWK*	0.0489***(4.30)	0.120***(16.93)
*CF/K*HIWK*	0.312***(39.45)	-0.0477***(-9.56)
QRATIO	-0.211***(-20.94)	0.0493***(6.02)
m2	0.716	0.855
Hansen	69.16	60.50
df	56	57
p-values	0.13	0.351
N	762	762

Note: *t* statistics in parenthesis *, ** and *** significant at 10%, 5% and 1% respectively. Time dummies' coefficients not reported for brevity.

Source: Own calculations using a balanced panel over the period 2001 to 2010. Data obtained from the McGregor BFA library.

On the basis of these findings, we conclude that in the presence of cash flow shocks, listed-South African firms adjust both their fixed investment and their working capital. These findings also confirm the hypothesis of the reversibility of working capital. Firms can maintain high levels of working capital and enable themselves to deal with cash flow shocks and use such working capital to absorb shocks of cash flows and reduce the sensitivities of fixed investment to cash flows. The reduction of cash flow sensitivities using working capital means firms can maintain consistent levels of fixed investment.

3.3. Working capital, cashflow and fixed investment of high (low) profitability firms. This section illustrates that the cash flow investment sensitivity of firms considering their profitability and working capital level. High working capital on its own may represent inefficient use of capital. In order to test whether working capital alleviates financial constraints at the same time as the firm is delivering good returns to investors, working capital levels were interacted with the profitability level. Profitability was measured by the return on assets (ROA). Return on assets was calculated as follows;

$$ROA = \frac{Net\ Profit\ after\ Tax}{Total\ Assets}. \quad (7)$$

High (low) profitability firms are those firms that are above (below) the sample median ROA. It was hypothesized that the cash flow of firms characterized by high working capital and high profitability are more sensitive to working capital investment compared with firms characterized by low working capital and low profitability. Dummy variables; *HIGHROA* and *LOWROA* were created to represent firms characterized by high profitability and low profitability, respectively. These dummies were interacted with the variable *CF/K*HIWK* in order to determine the sensitivity of cash flows to fixed and working capital for both high/low working capital firms and high/low profitability firms.

Equation 8 evaluates the sensitivity of working capital to cash flow fluctuations after classifying firms as high working capital /high profitability firms and low working capital / low profitability firms.

$$\Delta W / K_{it} = \beta_0 + \beta_1 (CF / K)_{it} \times LOWK \times LOWROA + \beta_2 (CF / K)_{it} \times HIWK \times HIGHROA + \\ + \beta_3 QRATIO_{it} + \eta_i + \lambda_t + \varepsilon_{it}. \quad (8)$$

Equation 9 evaluates the sensitivity of fixed investment to cash flow fluctuations to working capital after classifying firms as high working capital/high profitability firms and low working capital/low profitability firms.

$$I / K_{it} = \beta_0 + \beta_1 (CF / K) LOWK_{it} \times LOWROA + \beta_2 (CF / K) HIWK_{it} \times HIGHROA + \\ + \beta_3 QRATIO_{it} + \eta_i + \lambda_t + \varepsilon_{it}. \quad (9)$$

The results presented in Column 1 of Table 4 show that the cash flow working capital sensitivity of high working capital yielding high profitability ($CF/K*HIWK_{HIGHROA}$) is higher (0.22) than the sensitivity of firms with low working capital with low profitability ($CF/K*LOWK_{LOWROA}$) (0.003). Column 2 of Table 4 shows that profitable firms with low working capital ($CF/K*HIGHROA_{LOWK}$) have a higher (0.199) cash flow working capital investment sensitivity than less profitable firms with high working capital ($CF/K*LOWROA_{HIWK}$) (0.0903). In the presence of a cash flow shock profitable firms with low working capital cut their working capital investment more than less profitable firms with high working capital. This shows that despite their good returns, profitable firms are forced to cut their investment in the presence of a cash flow shock. Less profitable firms with high working capital investment are better positioned to absorb shocks to their cash flows with their high working capital compared to their counterparts with low working capital. This finding may also explain why profitable firms with poor working capital management can go into bankruptcy while less profitable with good working capital management can weather storms of economic upheavals.

Column 3 of Table 4 shows that the cash flow fixed investment sensitivity of high working capital yielding ($CF/K*HIWK_{HIGHROA}$) is higher (0.04) than the sensitivity of firms with low working capital with low profitability ($CF/K*LOWK_{LOWROA}$) (-0.002). This finding is contrary to expectation because it was expected that firms with low working capital delivering low returns display a high sensitivity – such firms cut their fixed investment. One possible explanation for this result is that less profitable firms might on average have low fixed investment hence it is not very sensitive to cash flow.

Column 4 of Table 4 shows that the cash flow fixed investment sensitivity of less profitable firms with high working capital ($CF/K*LOWROA_{HIWK}$) is far lower (0.02) profitable firms with low working capital ($CF/K*HIGHROA_{LOWK}$) (0.09). In the presence of a cash flow shock profitable firms with low working capital cut their fixed investment more than less profitable firms with high working capital. This finding provides more evidence to the role of working capital in alleviating financial constraints. Less profitable firms are able to minimise cuts to their fixed investment by absorbing the shock with their high working capital. Despite recording good returns (as measured by the ROA) profitable firms are forced to cut their fixed investment in simply because their "shock absorber" is small.

Table 4. Cash flow-working capital investment and profitability sensitivity

	(1)	(2)	(3)	(4)
	ΔW/K	*ΔW/K*	*I/K*	*I/K*
$CF/K*HIWK_{HIGHROA}$	0.216***(40.86)	-	0.0367***(9.20)	-
$CF/K*LOWK_{LOWROA}$	0.00272***(4.49)	-	-0.00199***(-4.10)	-
$CF/K*LOWROA_{HIWK}$	-	0.0903***(18.35)	-	0.0147***(3.79)
$CF/K*HIGHROA_{LOWK}$	-	0.199***(66.26)	-	0.0918***(27.01)
QRATIO	-0.121***(-24.69)	-0.239***(-25.59)	0.0710***(18.89)	0.0266***(4.15)
m2	0.71	0.906	0.703	0.593
Hansen	78.88	70.82	66.45	58.29
df	57	57	57	57
p-values	0.029	0.103	0.184	0.428
N	762	762	762	762

Note: *t* statistics in parenthesis *, ** and *** significant at 10%, 5% and 1% respectively. Time dummies' coefficients not reported for brevity.
Source: Own calculations using a balanced panel over the period 2001 to 2010. Data obtained from the McGregor BFA library.

3.4. Tests for robustness. The previous section presented the model used to demonstrate that working capital can palliate the impact of cash flow shocks on fixed investment. This section seeks to illustrate that the cash flow investment sensitivity of firms with high working capital facing low financial constraints is lower than the sensitivity of firms with low working capital facing binding financial constraints.

A number of proxies for financial constraints have been used and these include: dividends, size, age, and intangible assets (Almeida, Campello & Weisbach, 2004; Faulkender & Wang, 2006; Fazzari et al., 1988; Guariglia, 2008; Moyen, 2004). The expectation is that the sensitivity of investment of firms to cash flow of bigger firms (using total assets as a proxy for size) holding large working capital is less than that of smaller firms with low working capital. Using age as an alternative measure of financial constraints, it is hypothesized that the sensitivity of investment of firms to cash flow of mature/older firms holding large working capital is less than that of younger firms with low working capital. In this study, age was used as a proxy for financial constraints because older firms are ex-

pected to be more creditworthy than younger firms; they might have forged relationships with banks and suppliers and have wider sources of finance. The variable *CF/K LOWK* (from the previous section) is interacted with the size dummy, *SMALL* for firms with total assets below the mean and the variable *CF/K HIWK* (from the previous section) is interacted with the size dummy, *LARGE* for firms with total assets above the mean. The resultant estimation model is given below.

$$I/K_{it} = \beta_0 + \beta_1 (CF/K)_{it} \times LOWK \times SMALL + \beta_2 (CF/K)_{it} \times HIWK \times LARGE + \\ + \beta_3 QRATIO_{it} + \eta_i + \lambda_t + \varepsilon_{it}. \quad (10)$$

The variable *CF/K*LOWK* is also is interacted with the age dummy, *YOUNG* for firms below the mean age of the sample and the variable *CF/K HIWK* is interacted with the age dummy, *OLD* for firms above the mean age of the sample. The resultant estimation model is given below.

$$I/K_{it} = \beta_0 + \beta_1 (CF/K)_{it} \times LOWK \times YOUNG + \beta_2 (CF/K)_{it} \times HIWK \times OLD + \\ + \beta_3 QRATIO_{it} + \eta_i + \lambda_t + \varepsilon_{it}. \quad (11)$$

Column 1 of Table 5 presents the results of the estimation of small firms characterized with low working capital ($LOWK_{LARGE}$) and large firms characterised with high working capital ($HIWK_{LARGE}$). As hypothesized the cash flow investment sensitivity of low working capital small firms is higher (0.11) than the cash flow investment sensitivity of higher working capital large firms (0.05). Column 2 of Table 5 presents the results of the estimation of young firms characterized with low working capital ($LOWK_{YOUNG}$) and older firms characterized with high working capital ($HIWK_{OLD}$). As hypothesized the cash flow investment sensitivity of low working capital younger small firms is higher (0.11) than the cash flow investment sensitivity of high working capital old firms (-0.02 – absolute value). The coefficient of old firms characterized with high working capital is poorly defined.

Table 5. Cash flow-fixed investment sensitivity model

	(1)	(2)
	I/K	*I/K*
$CF/K*LOWK_{SMALL}$	0.112***(21.26)	-
$CF/K*HIWK_{LARGE}$	0.0560***(10.21)	-
$CF/K*LOWK_{YOUNG}$	-	0.109**(3.12)
$CF/K*HIWK_{OLD}$	-	-0.0203(-0.28)
QRATIO	0.0391***(5.72)	0.0344(1.33)
m2	0.989	0.829
Hansen	61.67	69.96
df	57	57
p-values	0.329	0.116
N	762	762

Note: *t* statistics in parenthesis *, ** and *** significant at 10%, 5% and 1% respectively. Time dummies' coefficients not reported for brevity.
Source: own calculations using a balanced panel over the period 2001 to 2010. Data obtained from the McGregor BFA library.

In this section we present the results where the variable *CF/K* is interacted with two dummies – the working capital investment level dummy and the size dummy. Column 1 in Table 6 presents the results of the estimation of large firms characterised with low working capital ($LOWK_{LARGE}$) and large firms characterised with high working capital ($HIWK_{LARGE}$). As hypothesized the cash flow investment sensitivity of low working capital large firms is higher (0.170) than the cash flow investment sensitivity of higher working capital large firms (-0.09 – absolute value). The coefficient of large firms characterized with high working capital is poorly defined. Column 2 of Table 6 presents the results of the estimation of small firms characterised with low working capital ($LOWK_{SMALL}$) and small firms characterized with high working capital ($HIWK_{SMALL}$). Again as hypothesized the cash flow in vestment sensitivity of low working capital small firms is higher (0.08) than the cash flow investment sensitivity of higher working capital small firms (0.04 – absolute value). The coefficient of small firms characterized with high working capital is poorly defined.

Tabl 6. Cash flow investment sensitivities of large and small firms

	(1)	(2)
	I/K	*I/K*
$CF/K*LOWK_{LARGE}$	0.170***(3.72)	-

Tabl 6 (cont.). Cash flow investment sensitivities of large and small firms

	(1)	(2)
CF/K^*HIWK_{LARGE}	-0.0962**(-2.65)	-
CF/K^*LOWK_{SMALL}	-	0.0798*(2.62)
CF/K^*HWK_{SMALL}	-	-0.0345 (-0.98)
QRATIO	0.0430 (1.55)	0.0656* (2.41)
m2	0.702	0.701
Hansen	62.78	64.71
df	57	57
p-values	0.279	0.261
N	762	762

Note: *t* statistics in parenthesis *, ** and *** significant at 10%, 5% and 1% respectively. Time dummies' coefficients not reported for brevity.
Source: own calculations using a balanced panel over the period 2001 to 2010. Data obtained from the McGregor BFA library.

Summary and conclusion

The aim of the study was to examine the relationship between cash flow, working capital and fixed investment and financial constraints. The results showed that investment in fixed assets is very sensitive to cash flow. However its sensitivity is much less than the sensitivity of working capital to cash flow. When investment in working capital was included in the cash flow-fixed investment analysis it was observed that it was inversely related fixed investment confirming the hypothesis that there is competition for funds between fixed investment and investment working capital. The study also found that working alleviates the impact of cash flow shock on fixed investment. A further analysis revealed that the sensitivity of fixed investment to cash flow of low working capital firms is higher than the ones of higher working capital firms in South Africa. Based on these findings, we conclude that working capital can play an important role in alleviating financial constraints faced by firms. Therefore we recommend that finance managers and firms to adopt efficient working capital management practices such as speedily turning over their inventory, good receivables management and delaying payables close to the due date. Such practices will help improve firms' performance and alleviate the challenges of access to resources.

The study used data from listed firms that supposedly have wider sources of finance compared to unlisted firms. Therefore the findings of this study cannot be generalized and applied to unlisted firms. The use financial statements as the main source of data is another limitation of this study because financial statements can be manipulated by managers through window dressing of accounts and creative accounting. This study investigated the investment cashflow sensitivity and the role of working capital in alleviating financial constraints. How market imperfections influence working capital investment and working capital investment go on to affect fixed investment via a transmission process is area for further research on investment cashflow sensitivity when working capital is included.

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