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Debt holdings and investment cash flow sensitivity of listed firms

Johnson Worlanyo Ahiadorme
Investment and Research, IGS Financial Services Limited, Accra, Ghana and
Department of Finance, University of Ghana, Accra, Ghana, and
Agyapomaa Gyeke-Dako and Joshua Yindenaba Abor
Department of Finance, University of Ghana, Accra, Ghana

Abstract
Purpose – The purpose of this paper is to examine the effect of debt holdings on the sensitivity of firms’ investment to availability of internal funds.
Design/methodology/approach – For a panel data set of 27 Ghanaian listed firms for the period 2007–2013, the paper applies the Euler equation approach to the empirical modeling of investment.
Findings – The study finds support for the assertion that listed firms face less severe corporate control problems and lower financing constraints, and thus, have lower investment cash flow sensitivities. The study also finds that a significant positive sensitivity of investment to internal funds is associated with firms that have high debt holdings.
Practical implications – An implication of this study is that firms with high debt holdings face greater challenges in accessing external finance. These firms are likely to experience under-investment which at a macro level would translate into lower investments and economic growth for the country.
Originality/value – Empirical literature document that in the presence of market imperfections, investments of financially constrained firms become sensitive to the availability of internal finance. There are also contradictory evidences regarding the pattern of the observed investment cash flow sensitivity. This study examines the effect of debt holdings on the sensitivity of firms’ investment to availability of cash flow. This is yet to be empirically tested despite some theoretical explanations.
Keywords Investment, Corporate governance, Cash flow, Managerial discretion, Ownership structure, Cash constraints
Paper type Research paper

1. Introduction
Investment decisions and practices have received increasing attention from policy makers and researchers in the arena of finance and economics. The debate has been underpinned largely by the motivation to identify which model best explains investment behaviors and practices. In 1988, Fazzari, Hubbard and Petersen published a prominent study depicting a relationship between investment and internal funds and ever since, there have been a plethora of empirical studies (e.g. Laeven, 2003; Mizen and Vermeulen, 2005; Degryse and de Jong, 2006; Aggarwal and Zong, 2006) providing evidence of the sensitivity of investment to cash flow. Despite the largely observed positive relationship, the controversy has been on what explains the observed relationship between investment and cash flow. There are largely two alternative explanations. According to the asymmetric information problem explanations (e.g. Myers and Majluf, 1984), the sensitivity is an indication that external fund is just too expensive relative to internal fund. The free cash flow hypothesis advocated by Jensen (1986) on the other hand suggests that investments’ sensitivity to cash flow is not due to the rather expensive nature of external capital, but because managers have the inclination to overinvest their free cash flow.

Empirically, Fazzari et al. (1988) were the first to test the investment cash flow sensitivity. In their seminal work, Fazzari et al. (1988) report that the sensitivity of investment to cash flows is stronger for firms that have high financial constraints. They proxy financial
constraints with dividend payout, and show that firms that have low dividend payout (high financial constraints), have higher investment cash flow sensitivities than high dividend paying firms. Several studies (e.g. Kato et al., 2002; Moyen, 2004; Mizen and Vermeulen, 2005) have since documented findings in line with those by Fazzari et al. (1988), using data from a variety of contexts and employing other factors perceived to be accounting for the variations in the firms’ financing obstacles.

Kaplan and Zingales (1997, 2000) offer a challenge to these interpretations and insist that a justification of investment cash flow sensitivities as evidence of financial constraints, only distracts attention from the more important question as to what exactly causes the sensitivity. Kaplan and Zingales (2000), thus, opine that perhaps “the sensitivities are at least partially caused by excessive conservatism by managers, which may arise because of the way firms are organized internally” or “because of non-optimizing behavior by managers” as hinted by Hines and Thaler (1995).

Within the corporate governance context, there have been some empirical investigations of the investment cash flow sensitivities. Gugler (2003) posits that managerial discretion for over-investment is the reason for the positive sensitivity of investment to internal funds shown by state controlled firms. Pawlina and Renneboog (2005) document that positive investment cash flow sensitivities of UK listed firms “appear” to be driven by agency costs of free cash flows. Chen et al. (2013) find that the observed investment cash flow sensitivities exhibited by China’s listed firms “seem” to be driven more by the managerial discretion arguments.

Notwithstanding the enthusiasm surrounding the investigation of investment cash flow sensitivities, empirical literature on the responsiveness of firms’ investment to cash flow is not well developed in developing countries. A study of the cash flow effects on corporate investments using data from a frontier market is, therefore, crucial to determine whether knowledge of investment and internal fund relationship derived from studies of most developed countries, applies only to those markets or have general applicability.

While Fodio et al. (2013) investigate the impact of firm size and industry classification on the investment cash flow sensitivity among quoted Nigerian manufacturing firms, this study investigates the relationship between corporate investment and internal fund within a corporate governance and cash constraint context, using firms listed on the Ghana Stock Exchange (GSE), given the growing nature of the GSE and the increasing awareness of corporate governance issues (Abor, 2007). The study first provides an extension to prior studies by focusing on how debt claims influence the sensitivity of investment to cash flows. Even though Jensen (1986) espouses the disciplinary role of leverage, and Jensen and Meckling (1976) define ownership structure to include debt claims, none of the existing empirical studies has had as a primary focus the effect of debt claims on the investment cash flow sensitivity. This void is filled by this study.

Empaneling data on 27 firms listed on the GSE, the paper examines how debt characteristics moderate the investment and cash flow relationships. Kaplan and Zingales (1997, 2000) critique that, the sensitivity of investment to cash flow is nothing more than an indication of an increase in the set of profitable investment projects, since cash flow represents investment opportunities. Gugler’s (2003) proposal to utilize corporate governance features as a way of avoiding this problem has been used by some researchers (e.g. Chen et al., 2013) and this is the approach adopted by this study as well. This study utilizes information on the ownership structure of the firms as a corporate governance mechanism in the analysis of the investment and cash flow relationship, given that ownership identity is prioritized in the literature on corporate governance (e.g. Jensen and Meckling, 1976).

The study defines ownership structure in line with Jensen and Meckling (1976) to include equity and debt holdings, and investigates the moderating effect of debt holdings on the
investment cash flow sensitivity. High debt holdings should increase bankruptcy costs, hence increasing the sensitivity of investment to cash flow. However, Jensen (1986) argues that the existence of debt in the firm’s capital structure acts as a bonding mechanism for company managers, therefore, compelling managers to disgorge cash flows to meet debts covenants and obligations. Thus, high levels of leverage can potentially reduce the investment cash flow sensitivity. By employing the Euler equation investment framework and the dynamic panel system GMM estimation technique, this study considers answering two questions: as observed in other studies, is corporate investment of Ghanaian listed firms sensitive to internal funds? Is the sensitivity affected by debt holdings?

The study makes significant contributions to literature. First, the study investigates whether the widely reported positive investment and cash flow relationship can be observed using data from a frontier market, specifically Ghana. Thus, this study helps to determine whether the stylized facts about investment and cash flow relationship from studies of mostly developed countries are portable across markets/countries. In addition, the study attempts to investigate whether debt claims moderate the sensitivity of investment to cash flow. This issue is of interest, particularly because of lack of empirical investigation even though theoretical arguments by Jensen and Meckling (1976), Myers (1977) and Jensen (1986) present the case that debt holdings can potentially affect the investment and cash flow relationship.

The rest of the paper is organized as follows: Section 2 surveys the literature and provides an overview of existing evidence on the investment cash flow sensitivity. In Section 3, we discuss the methodology employed, model specification and the estimation technique. Section 4 provides a description of the data. Section 5 presents and discusses the main results. Summary of the study and some concluding remarks are made in Section 6.

2. Cash constraints, managerial discretion and the investment cash flow sensitivity

Extant literature has investigated and reported the responsiveness of corporate investment spending to internal funds. Fazzari et al. (1988), Hoshi et al. (1991), Bond and Meghir (1994) and Moyen (2004) have all investigated and documented the sensitivity of investment to internal funds. Researchers of investment and cash flow relationship have not left out the task of identifying what drives the relationship. Among others, Fazzari et al. (1988), Whited (1992) and Mizen and Vermeulen (2005) allude to the role of financing constraints faced by firms.

Some researchers have also taken up the theme of investigating the role of corporate governance in driving this relationship. Existing literature examines whether ownership structure of firms considered as a corporate governance mechanism, explains the investment – cash flow relationship. Goergen and Renneboog (2001) examine the nexus between ownership structure and the investment cash flow sensitivity, and find that ownership concentration affects the role of liquidity constraints in the investment and cash flow relationship. Using a panel of 240 UK listed companies during the period 1988–1993, they report that large institutional investors contribute effectively in reducing the investment – cash flow relationship.

Gugler (2003), in his study, uses a sample of non-financial Austrian firms and reports divergent results for family and state controlled firms. He documents that, the investment cash flow sensitivity exhibited by family controlled firms is consistent with the liquidity constraint propositions, while the positive response of investment to internal funds for firms under state control is explained by managerial discretion for over-investment. He posits that the evidence in support of each hypothesis is directly related to the governance structure of the firm. While family owners “seem” to be unwilling to lose control over their companies, hence, the reluctance to issue under-priced equity to finance investments, the ultimate owners of state controlled firms (the citizens) are just weak monitors.
Pawlina and Renneboog (2005) argue that block holder monitoring should reduce agency costs, and hence the investment cash flow sensitivity; and for insider ownership, there should be an initial inverse relationship with investment cash flow sensitivity “due to better alignment of interests and lower agency costs.” Using data on firms listed on the London Stock Exchange, they document that the observed investment cash flow sensitivity is mainly underpinned by agency problems. While insider ownership relates with the sensitivity in a non-monotonic way, outside block control can reduce investment’s sensitivity to cash flow through effective monitoring. They report as well results consistent with the asymmetric information theory: the sensitivity relates inversely with ownership of financial institutions (these institutions appear to lessen the information asymmetric problems in capital markets).

Wei and Zhang (2008) hypothesize that the investment cash flow sensitivity should decrease as the level of large shareholders’ cash flow rights increases. Using data from eight East Asian emerging markets during the period 1993–1996, they find evidence in support of the over-investment hypothesis caused by agency costs of free cash flow. Particularly, they find that the investment cash flow sensitivity relates inversely with the cash flow rights of the largest shareholders. Pindado et al. (2011) extend the work of Wei and Zhang (2008) and examine whether ownership structure of family firms impacts the investment cash flow sensitivity in the Euro zone. Their study finds that family control plays a moderating role in the investment – cash flow relationship and this role is non-monotonic. Pindado et al. (2011) report further that the presence of second large shareholders affects the sensitivity for family firms either via “monitoring (in the case of non-family second block holders), or collusion (in the case of family second block holders).” Similarly, Sitthipongpanich (2017) concludes that the investment cash flow sensitivity decreases with family ownership even though this relationship is non-monotonic.

Chen et al. (2013) conjecture that “if ownership concentration and specific classes of shareholders” cannot effectively monitor managerial discretion, then a significant relationship between investment spending and cash flow is expected. Using data of Chinese listed firms during 1998–2004, they find no monotonic relationship between shareholder concentration and investment cash flow sensitivity. They interpret this result to be indicative of financial constraint effects rather than corporate governance issues. However, their results for different shareholder classes seem to be driven by corporate governance arguments. In another study on China, Ding and Qian (2014) document that the positive investment cash flow sensitivity indicated for state owned firms can be explained by the free cash flow hypothesis, while the cash constraints arguments account for the observed investment cash flow sensitivity exhibited by non-state companies.

Peruzzi (2015) examines the influences of family ownership on the investment and cash flow relationship for a sample of Italian small- and medium-sized enterprises (SMEs), and reports that family owned firms exhibit heavier dependence on internal funds for corporate investment purposes, than firms managed and controlled by non-family individuals. Peruzzi (2015) concludes that the high investment cash flow sensitivity exhibited by family controlled firms is an indication of the financing constraints faced by these firms. Makina and Wale (2016) analyze the factors accounting for the positive investment cash flow sensitivity, using data on manufacturing firms listed on the Johannesburg Stock Exchange. Their analysis reveals that agency costs reasons offer little explanation for the observed relationship between investment and internal funds, relative to explanations centered on asymmetric information problems.

Riaz et al. (2016) examine the financial constraints hypothesis, and report that cash constrained firms exhibit higher investment cash flow sensitivity than their counterparts with relatively less financial constraints. Their study finds a monotonic relationship between investment cash flow sensitivity and the level of financial constraints. Samet and
Jarboui (2017) investigate the possible influences of corporate social responsibility (CSR) on the investment and cash flow relationship. They report that CSR performance enhances the firm’s access to the capital markets; thus, lessening the responsiveness of investment to internal funds.

Jensen (1986) contends that the existence of debt in the firm’s capital structure acts as a “bonding mechanism” for company managers. He emphasizes that by issuing debt, managers contractually bind themselves to pay out future cash flows; a discipline he believes is unachievable through dividends. Easterbrook (1984) provides evidence in support of this argument when he posits that, external capital market monitoring brought to companies by debt financing, forces managers to eschew personal utility maximization in favor of value maximizing strategies. Indeed, Lang et al. (1996) present empirical evidence of an inverse relationship between growth and leverage for firms with low Tobin’s \( Q \). This implies that personal utility maximization programs and growth corporate objectives are not pursued by managers of levered firms with low investment opportunities (as represented by low Tobin’s \( Q \)). This lends credence to the important disciplinary function that debt performs in such companies.

The findings relating to the impact of ownership structure on the investment cash flow sensitivity have been interpreted largely within the perspective of agency cost and corporate governance considerations. Literature has proposed that information asymmetries of listed firms are smaller on average due to the listing and reporting requirements of stock exchanges (Oliner and Rudebusch, 1992), and Beck et al. (2006) expect that firms that are listed on a stock exchange, face lower financing obstacles. Even though ownership structure is defined to include share and debt holdings (see Jensen and Meckling, 1976), extant research only investigates the effect of shareholding structure on the sensitivity of investment to cash flows, neglecting the potential role of debt in the investment and cash flow relationship. This current study builds on prior literature and examines the moderating role of debt holdings in the investment and cash flow relationship.

3. Methodology

The model

Three approaches: the neoclassical model, the \( Q \) model and the Euler equation model are mostly used in extant literature in testing the investment – cash flow relationship. Jorgenson’s (1963, 1971) neoclassical investment model sets off with the optimization problem of the firm. Jorgenson posits that the firm’s investment behavior is premised on the determination of the optimal capital stock. The optimal capital stock is yielded as the firm engages in profit maximization in each period. Thus, the firm invests and reaches the point where the marginal productivity of its capital equals the real rental cost of capital, which is determined by the cost of owning the capital (Jorgenson, 1971). Jorgenson (1971) argues that there are no adjustment costs and the capital stock will adjust instantaneously and fully to the optimal capital stock. Jorgenson’s neoclassical model assumes that the capital stock is fully utilized and that the economy attains full employment where prices of labor and capital are perfectly flexible.

The neoclassical model of investment assumes no adjustment costs and that the firm does not gain by delaying the acquisition of capital. The model further assumes that capital is homogeneous and can be bought and sold or rented at a given rate of interest in a perfectly competitive market (Jorgenson, 1971). The neoclassical investment model is hugely criticized. For example, Mueller (2003) contends that Jorgenson’s investment theory is in fact a capital theory and not an investment theory since the model’s assumption of immediate and full adjustment of capital to the desired capital stock essentially eliminates the investment function. Again, it appears investment decisions in the neoclassical model are not forward looking, particularly with the preposition of full and immediate adjustment, which is doubtful in the real world.
According to the $Q$ model (George et al., 2011), a firm’s investment is mainly determined by expectations of future profit opportunities, usually estimated by Tobin’s $Q$, which is the ratio of the market value of assets to its replacement value. The $Q$ is a ratio between the market value of a firm’s existing capital stock and the current cost of replacing same capital stock; therefore, an investment project that adds more to the firm’s market value than its costs to undertake will be profitable. Thus, investment is likely to be higher when the market values a firm’s capital higher than the cost of replacing that capital stock (Bond and Meghir, 1994). The $Q$ model has been adjusted (e.g. George et al., 2011) to include the availability of internal funds as an additional determinant of investment.

The use of $Q$ is premised on the proposition that future investment opportunities can be captured by equity market participants, who are also forward looking. The $Q$ model is first criticized for its error in measurement (Carpenter and Guariglia, 2008). The average $Q$ is the preferred choice in empirical studies in lieu of the marginal $Q$ (the ratio of marginal revenue product of capital to its marginal cost). However, the convex adjustment cost contains much importance to a firm’s investment decision and is reflected in the Marginal $Q$ (Gyeke-Dako, 2007). For these two measures to be equivalent, Hayashi (1982) posits that extreme conditions of perfectly competitive product market and linear homogeneity among others would have to be met. The use of $Q$ in the presence of information asymmetries in capital markets, introduces unparalleled evaluation of future investment opportunities between insiders and outsiders. Unlike insiders, suppliers of external funds are unable to accurately assess firms’ investment opportunities due to the problem of information asymmetries, which causes gaps in the information sets available to the firm’s insiders and outsiders. $Q$ will, therefore, only capture outsiders’ evaluation of opportunities (Carpenter and Guariglia, 2003).

Indeed, the theoretical definition of marginal $Q$ implies that it should embody the effects of all factors influencing investment. Thus, any significant effect of internal funds on investment might simply be because cash flow is correlated with the insiders’ evaluation of opportunities, and (Kaplan and Zingales, 1997) may just reflect investment opportunities which are not captured by Tobin’s $Q$. Also, Bond and Meghir (1994) posit that the measures of $Q$ would be subject to error if the suggestions that “stock market prices are too noisy, or they display excessive volatility” relative to the primary values of companies, hold.

The main alternative to the $Q$ model, the Euler equation for investment is costs of adjustment model and (Kaplan and Zingales, 1997) is not a function of Tobin’s $Q$, and therefore, is not “affected by its mismeasurement.” The Euler equation model exploits the relationship between investments in successive time periods and includes total sales, cash flows and total debt as other determinants of a firm’s investment (George et al., 2011). Investment spending is potentially aimed at increasing or replacing the capital stock. In using the Euler equation to obtain an empirical model for testing the investment cash flow sensitivity, Bond and Meghir (1994) argue that further investment when the capital stock is below optimal will be profitable; hence (Chen et al., 2013) a firm must over time string its investment spending to attain “the optimal profile of capital stock.” The Euler equation is based on the idea of value maximization over an infinite time, and thus, the time profile of investment is influenced by (Chen et al., 2013) expected future profits, adjustment costs, bankruptcy costs and product market structure.

**Empirical specification**

Following Bond and Meghir (1994), we utilize a dynamic investment model derived from the Euler equation to perform our tests:

$$\frac{(I)}{K}_{it} = \beta_1 \left( \frac{(I)}{K}_{i,t-1} \right) + \beta_2 \left( \frac{(I)}{K}_{i,t-1} \right)^2 + \beta_3 \left( \frac{Y}{K} \right)_{i,t-1} + \beta_4 \left( \frac{D}{K} \right)_{i,t-1}^2 + \beta_5 \left( \frac{CF}{K} \right)_{i,t-1} + \epsilon_{it}, \quad (1)$$
where $I/K$, $Y/K$, $D/K$ and $CF/K$ stand for investment, income, debt and cash flow relative to the capital stock, respectively. The subscripts $i$ and $t$ represent the firm and time, respectively, while $\varepsilon_{it}$ represents the error term. The coefficient on the lagged investment rate is expected to be positive. The inclusion of the squared term of the lagged investment rate relaxes the assumption of no adjustment cost, and therefore, account for the cost of adjustment when changing the capital stock. Cost of adjustment could connotate planning, training and installation costs and perhaps the disruptions to the normal production process due to incorporation of new capital equipment. The model expects the coefficient of the lagged investment variable to be negative and less than one in absolute value. The lagged income term ($Y/K$) controls for imperfect competition and its coefficient is expected to be positive. Under the assumptions of imperfect competition, firms will increase investment as the optimal level of the income/capital ratio increases. The squared lagged debt term ($D/K$) controls for the possibility of bankruptcy resulting from an increase in debt levels. High levels of leverage lead to higher probability of bankruptcy as well as increasing the costs associated with a bankruptcy event (Chen et al., 2013). Thus, the coefficient of the debt term is expected to be negative. The theoretical model expects that the coefficient on the cash flow variable should be negative under the assumption that the firm can raise as much finance as it desires (Bond and Meghir, 1994). The dependent and independent variables have all been scaled by their respective period’s capital. This, according to Chen (2008), can control for possible heteroscedasticity due to differences in firm size.

We assume that the error term, $\varepsilon_{it}$ follows a one-way error component model suggesting:

$$e_{it} = \mu_i + \omega_{it},$$  \hspace{1cm} (2)

where $\mu_i$ is time-invariant specific firm characteristics and accounts for any unobservable individual-specific effect that is not included in the regression model. The term $\omega_{it}$ represents the remaining disturbance, and varies with the individual firms and time. Judson and Owen (1996) argue that fixed effects are generally more appropriate in instances where the individual effects represent omitted variables that are highly likely to be correlated with the other regressors, and in situations where the panel data are less likely to be a random sample from a much larger universe. These arguments identify substantially with the nature of our sample.

Some studies (e.g. Chen et al., 2013) adopt the approach where the sample is split according to ownership characteristics and then examine if the cash flow effects are different across the sub-samples. An equivalent and perhaps a more direct approach may be to estimate the model for the entire period and employ the interaction of the cash flow with a dummy variable representing ownership characteristic. This direct approach is used in this study. Also, by this direct approach, the sample size is preserved, which otherwise would not be the case if the sample were split into sub-samples according to debt characteristics.

Thus, the regression specification used to examine the effect of debt claims is as follows:

$$\left( \frac{I}{K} \right)_{it} = \beta_1 \left( \frac{I}{K} \right)_{i,t-1} + \beta_2 \left( \frac{I}{K} \right)_{i,t-1}^2 + \beta_3 \left( \frac{Y}{K} \right)_{i,t-1}$$

$$+ \beta_4 \left( \frac{D}{K} \right)_{i,t-1}^2 + \beta_5 \left( \frac{CF}{K} \right)_{i,t-1} + \beta_6 \left( \frac{CF}{K} \right)_{i,t-1} \times DEBT + \varepsilon_{it}. \hspace{1cm} (3)$$

Debt is a dummy variable set equal to 1 if a firm’s average total debt ratio is equal to or larger than the median total debt ratio of firms over the sample period. Otherwise, it is equal to zero. The median criterion follows a similar approach used in literature (e.g. Degryse and de Jong, 2006; Chen et al., 2013). The regression coefficient $\beta_6$ in Equation (3) captures the influence of debt claims on the responsiveness of firms’ investment to cash flow.
If internal funds are a significant determinant of the firms’ investments, then the coefficient of the cash flow variable would be positive. This will imply corporate governance failures or/and cash constraints issues. The study expects to see the effects of cash flow on investment to vary according to the different debt levels.

Estimation technique

This study follows a dynamic panel data model. In a dynamic investment model such as the Euler equation, investment depends on its own past realization(s). The presence of the lagged dependent variable gives rise to endogeneity problems. The past realization of investment is likely to be correlated with the fixed effects present in the error term. This violates exogeneity assumptions necessary for the consistency of Ordinary Least Squares (OLS) estimators. Again, time-invariant firm characteristics (fixed effects) may be correlated with the explanatory variables.

The endogeneity problem can usually be dealt with by using instrumental variables estimation (two-stage least squares or 2SLS). But the 2SLS estimators are only efficient if the errors are homoskedastic. Again, even though the 2SLS may avoid endogeneity among regressors, it fails to absorb unobserved heterogeneity (Stock and Watson, 2003). Thus, this study applies the dynamic panel system GMM technique to report results expected to be free from estimation biases. Unlike the first differenced GMM, Blundell and Bond (2000) explain that the system GMM produces significant reductions in finite sample bias by exploiting additional moment conditions. Also, Roodman (2006) argues that since the orthogonal deviations technique maximizes the sample size it is more appropriate for panels with limited sample size. Given the study’s limited sample size, the preferred estimation technique is the dynamic panel system GMM. Mileva (2007) documents that using the system GMM increases efficiency. Roodman (2006) argues further that the dynamic panel system GMM involves additional assumptions, which requires that changes in the instrumenting variables are uncorrelated with fixed effects; an assumption he believes is a prerequisite to the validity of the additional instruments in system GMM. The study would report results for the two-step estimation. Mileva (2007) contends that in the two-step estimations, the standard covariance matrix is robust to panel-specific autocorrelation and heteroskedasticity.

Several specification tests are applicable, and therefore would be carried out. The validity of the instruments used was tested by reporting the Hansen test statistic. The Hansen test statistic is a standard diagnostic used in GMM estimation to evaluate the validity of the instruments. It is asymptotically distributed as a $\chi^2$ with its degrees of freedom as the number of instruments less the number of parameters. The test would be performed under a null hypothesis of valid instruments and valid over-identifying restrictions. A rejection of the null hypothesis implies that the required orthogonality conditions are not satisfied by the instruments, either because they are being incorrectly excluded from the regression or are not truly exogenous. Tests of serial correlation in the error terms would be performed by employing Arellano-Bond AR(1) and AR(2) tests. Chen and Lee (2017) explains that in the dynamic panel system GMM estimation, the residual terms of the first difference equation must be correlated in the first-order test but not in the second-order, to ensure that all the lags of the dependent variable and other instrumental variables are strictly exogeneous. The null hypothesis of the AR(1) test is that there is no first-order autocorrelation while the AR(2) test is under the null that there is no second-order autocorrelation.

4. Data description

Data source

The study uses the financial and ownership data of firms listed on the GSE (from www.annualreportsghana.com). The sample period covers the period 2007–2013. The study
selects firms for which complete data are available for all years. The sample consists of a balanced panel of 27 firms.

**Variable definitions**
The definitions used in the construction of the variables are as follows.

**Investment-related variables**
Capital stock \((K)\) is defined as the book value of fixed assets as shown in the balance sheet.

Investment \((I)\) is defined to be consistent with Chen *et al.* (2013) and equals the cash outflow for the purchase of new fixed assets and other non-current assets as shown in cash flow statements.

Total income \((Y)\) measures the firm’s income and is equal to the total sales/revenue obtained from the firm’s income statement.

Cash flow \((CF)\) is defined as the sum of operating profit before interest and taxes, depreciation of fixed assets and amortization (consistent with George *et al.*, 2011) and is obtained from the firm’s cash flow statement.

Debt \((D)\) is defined in line with George *et al.* (2011) and equals the book value of total debt and is obtained from the firm’s balance sheet.

**Debt financing variables**
The other variable used for the analysis include leverage ratio and is equal to the ratio of total debt to total capital. The total debt is irrespective of the term and total capital is the sum of total debt and total equity and are all obtained from the firm’s statements of financial position.

5. **Empirical results**

**Descriptive statistics**
Table I presents some descriptive statistics for the sample of 27 firms over the period 2007–2013. New investments for the period averaged around 18–36 percent of the period’s capital stock. Bond and Meghir (1994) report an average investment around 9.5 percent for 626 UK listed firms for the period 1971–1986 while Chen *et al.* (2013) report an average investment around 15–28 percent for 786 Chinese listed firms over the period 1988–2004. These high rates of new investments by Ghanaian listed firms considerably explain the high capital stock growth rates observed over the period. But for the decrease experienced by all the variables in 2009, the investment-related variables generally exhibited upward trend.

<table>
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<tr>
<th></th>
<th>(I/K)</th>
<th>(Y/K)</th>
<th>(D/K)</th>
<th>(CF/K)</th>
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<td>12.27</td>
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<tr>
<td>Mean 2011</td>
<td>0.26</td>
<td>5.93</td>
<td>13.01</td>
<td>1.14</td>
</tr>
<tr>
<td>Mean 2012</td>
<td>0.26</td>
<td>5.29</td>
<td>13.35</td>
<td>1.15</td>
</tr>
<tr>
<td>Mean 2013</td>
<td>0.36</td>
<td>5.46</td>
<td>14.39</td>
<td>1.35</td>
</tr>
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</table>

Table I. Descriptive statistics of investment-related variables
movements over the period. Thus, investments, sales, debts and cash flows relative to fixed
assets generally trended upward over 2007–2013.
Higher investment was generally associated with increases in debts and sales. This may
suggest that firms’ capital expenditures were largely financed by debts, while hikes in sales
were largely accounted for by increases in investments. Between 2007 and 2008 and
between 2009 and 2010, higher cash flows were associated with declining investments,
otherwise investment increased with cash flows. Generally, investment increased with cash
flow, suggesting a positive investment cash flow sensitivity.

Regression results
In this section, we present our regression results. All estimations were by the dynamic panel
system GMM specifications developed by Arellano and Bover (1995) and Blundell and Bond
(2000). The results reported are for the two-step estimations. \((I/K)_{it}\) is the dependent variable
in each model. Instruments for first difference equation are the “IV-style” instruments and
include all the explanatory variables except the lagged dependent variable while the lagged
dependent variable is specified as a “GMM-style” instrument. However, in estimating the
model specified in Equation (3), the squared term of the lagged investment variable was
excluded from the instrumental variables since its inclusion rendered the instruments
invalid. The \(F\)-statistic is a test for the joint significance of the independent variables. Also,
AR(1) and AR(2) are tests of first-order and second-order autocorrelation in the residuals,
respectively. Finally, the Hansen statistic is a test of the over identifying restrictions. The
regression results show that the instruments are valid while there is a first-order
autocorrelation, but no second-order autocorrelation.

Regression of investment on cash flows
We first estimated the model outlined in Equation (1). In Table II, the study reports the
estimates for Equation (1). The results indicate that the estimated coefficients are largely
consistent with the structural predictions by Bond and Meghir (1994). The coefficient on the
lagged dependent variable is positive and significant. Second, the coefficient of the squared
investment lagged term is negative, and significantly less than \(1\) (in absolute terms) as
implied by the model specifications. Moreover, the output coefficient is positive and
significant. This is consistent with the presence of imperfect competition in the product
market (Bond and Meghir, 1994). However, contrary to Bond and Meghir (1994) and

<table>
<thead>
<tr>
<th>Coefficient</th>
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</thead>
<tbody>
<tr>
<td>((I/K)_{it}) ((-1))</td>
<td>0.6438*** (0.0882)</td>
</tr>
<tr>
<td>((I/K)_{it}) ((-1))</td>
<td>-0.6178*** (0.04937)</td>
</tr>
<tr>
<td>((Y/K)_{it}) ((-1))</td>
<td>0.0086*** (0.0015)</td>
</tr>
<tr>
<td>((D/K)_{it}) ((-1))</td>
<td>0.0001*** (0.00002)</td>
</tr>
<tr>
<td>((CF/K)_{it}) ((-1))</td>
<td>-0.0027*** (0.0009)</td>
</tr>
<tr>
<td>(F)-statistic</td>
<td>3039.21</td>
</tr>
<tr>
<td>((p)-value)</td>
<td>0.00</td>
</tr>
<tr>
<td>AR(1) test</td>
<td>-1.95</td>
</tr>
<tr>
<td>((p)-value)</td>
<td>0.05</td>
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<tr>
<td>AR(2) test</td>
<td>-0.72</td>
</tr>
<tr>
<td>((p)-value)</td>
<td>0.47</td>
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<tr>
<td>Hansen</td>
<td>19.40</td>
</tr>
<tr>
<td>((p)-value)</td>
<td>0.15</td>
</tr>
<tr>
<td>Instruments</td>
<td>19</td>
</tr>
</tbody>
</table>

Table II.
Regression of investment
on cash flows

Notes: Standard errors are in parentheses. ***Stand for significance at 1 percent level
Chen et al. (2013), the debt coefficient is positive and significant. This result may suggest the “non-separability” between investment and borrowing decisions rather than “the tax-bankruptcy cost explanations” espoused by Bond and Meghir (1994) for their negative coefficient. Thus, firms finance high levels of investment by borrowing.

The major discrepancy between the findings of this study and majority of the previous studies (e.g. Bond and Meghir, 1994, George et al., 2011; Chen et al., 2013) is the negative coefficient found for the cash flow variable. The finding of this study is, however, consistent with the basic theoretical structure of the Euler equations for investment. Bond and Meghir (1994) explain that under the assumption that the firm can raise as much finance as it desires at a given cost, the theoretical model implies that the cash flow coefficient be negative. An exception to this assumption and a positive coefficient on the cash flow term may reflect liquidity constraints. Indeed, it may also reflect non-optimizing behavior by managers (Hines and Thaler, 1995).

This finding suggests that Ghanaian listed firms face relatively lower financing obstacles or/and less severe corporate control problems, in the sense that increases in cash flow (internal funds) are not expended on capital investments before they are exhausted. Perhaps, capital investments are largely financed by debts, especially given the positive relationship between investment and debts. This confirms prior findings by Abor (2005) that about 86 percent of the firms listed on the GSE employ debt in their capital structure. Stock market listing on average should result in smaller information asymmetries of listed firms due to the listing and reporting requirements of stock exchanges. Also, listed firms have access to perhaps relatively low-cost source of finance that may reduce the sensitivity of their investment to cash flow fluctuations. Hence, the potential minimal information asymmetry effects and transaction costs for listed firms might account for the generally negative and statistically significant association between cash flows and investments of Ghanaian listed firms. Listed firms face lower financing obstacles and accordingly should exhibit lower investment cash flow sensitivities. This result is consistent with the findings of Oliner and Rudebusch (1992) and Beck et al. (2006).

Also, listed firms reasonably face less severe corporate control problems and this might account for the significantly negative link between cash flows and investments for firms listed on an exchange. Indeed, Lel et al. (2013) allude to the important governance role stock markets play. They document that the information production and monitoring role of stock markets improves corporate control and governance. The important governance function of equity markets helps to mitigate agency problems. The tendency and discretion of managers to invest internal funds is reduced by the improved governance associated with stock markets; consequently, reducing the responsiveness of investments to cash flow variations. Thus, for firms listed on the stock exchange, there is an improved corporate control; hence, reducing managerial waste of internal finance on less productive investments, and ultimately accounting for the negative effects of cash flow on investments for such firms.

The effects of debt holdings on investment cash flow sensitivities

The study considers the influence of debt claims on the sensitivity of investment to cash flows by estimating the model outlined in Equation (3). Table III presents results of the effects of debt claims on the sensitivity of firms’ investment to cash flows.

The coefficient is significantly positive for firms with high debt holdings. This provides evidence in support of the cash constraint hypothesis. From the liquidity constraints perspective, firms with relatively high debt are always in danger of under-investment due to the costs of raising new finance (Stulz, 1990). Leverage has its associated costs, mainly bankruptcy costs. Thus, as much as firms undertake higher levels of investment by borrowing, high levels of debt holdings increase the cost of external finance; and therefore,
decreasing access to external funds. Although tax advantages may make debt financing attractive at low levels of borrowing, the probability of bankruptcy arises with increasing debts and the presence of bankruptcy cost makes debt finance increasingly expensive. Thus, firms with high debt holdings have high investment cash flow sensitivities. Essentially, this result implies that high debt holding firms may face higher costs of venturing into external capital markets and may under-invest or even forego investments particularly in the presence of little or no internal funds. This result indicates that high debt lowers the financial flexibility of firms and poses substantial risks of being under-funded. For high debt holding firms, cash flow plays an important role in alleviating their credit frictions.

6. Conclusions
In this paper, we use data for a sample of 27 Ghanaian listed firms during the period 2007–2013, and investigate the sensitivity of firms’ investment to the availability of internal funds. We utilize the Euler equation investment framework consistent with Bond and Meghir’s (1994) dynamic investment model. Aside examining whether cash flow effects on firms’ investments depict financial constraints underpinned largely by information asymmetry problems, the study investigates also whether statistically significant positive responsiveness of investments to cash flows may be driven by corporate governance issues. The study utilizes information on the ownership structure of the firms and examines the effects of debt claims on the sensitivity of investment to cash flows.

The results of this study indicate that the cash flow variable has a negative coefficient. Thus, the investments of Ghanaian listed firms are not significantly dependent on internal sources of funds. This is not particularly surprising as listed firms are expected to meet fewer difficulties in raising external finance or/and face less severe corporate governance problems; therefore, reducing managers’ tendency and discretion to invest internal funds. However, the results for the debt characteristics indicate that there is a significantly positive influence of cash flows on investment. The study applies the theoretical and empirical predictions to be able to identify whether this result is more likely to be due to corporate governance problems or financial constraint problems. The study believes that such result is an indication of the impact of financial constraint arguments than managerial discretion hypothesis. Thus, firms with high debt holdings exhibit higher

<table>
<thead>
<tr>
<th>Coefficient</th>
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<tbody>
<tr>
<td>((I/K)_{i,t-1})</td>
</tr>
<tr>
<td>((I/K)_{i,t-1}^2)</td>
</tr>
<tr>
<td>((Y/K)_{i,t-1})</td>
</tr>
<tr>
<td>((D/K)_{i,t-1})</td>
</tr>
<tr>
<td>((CF/K)_{i,t-1})</td>
</tr>
<tr>
<td>((CF/K)_{i,t-1}\times) Debt</td>
</tr>
</tbody>
</table>

F-statistic | 179.84 |
AR(1) test | -1.84 |
(p-value) | 0.07 |
AR(2) test | -0.38 |
(p-value) | 0.71 |
Hansen | 18.11 |
(p-value) | 0.15 |
Instruments | 19 |

Notes: Standard errors are in parentheses. **, ***Stand for significance at 5 and 1 percent levels, respectively
investment cash flow sensitivity, indicating severer difficulty in raising external funds to finance their investments.

The findings of this study imply that high debt firms experience lower financial flexibility and stand the risk of being under-funded. High debt holding firms may face higher costs of venturing into external capital markets and may under-invest or even forego investments, particularly in the presence of little or no internal funds, which at a macro level, would translate into lower investments and economic growth for the country. This current study can be extended in several other directions. One such direction is to investigate the role of internal finance in the investment decisions of firms that do not have access to the stock market. It will be particularly interesting to analyze differences in the sensitivity of investment to internal funds, according to the extent to which firms have access to the stock market. Future research should investigate further the idea that variables that affect cash holding abilities or/and affect the cost of raising external finance may also influence corporate investments’ sensitivity to internal funds.

References


**Further reading**


Corresponding author
Johnson Worlanyo Ahiadorome can be contacted at: worljohnson@gmail.com

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