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RESEARCH ARTICLE

Cash Conversion Cycle and Investment Cash Flow Sensitivity

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The purpose of this article is to investigate the effect of firms' cash conversion cycle on their investments' sensitivity to cash flows. Using the data of 167 energy companies from 2010 to 2019, we run dynamic panel regressions for the models based on the Euler equation. We employed a generalized method of moments (GMM) as the estimation technique. The analyses revealed two main results. The first is that there is investment cash flow sensitivity for the sample firms indicating the existence of financial constraints. The second is that the cash conversion cycle has a significant positive effect on investment cash flow sensitivity. To find out the effect of firm size, we also run the models by dividing the sample into small and large firms and found a significant difference between the two groups.

Keywords: Cash conversion cycle, investment cash flow sensitivity, Euler equation

JEL Codes: D25, G31, O16

Investment and financing decisions have been among the most important decisions faced by corporate managers. Modigliani and Miller (1958) claimed that these decisions are independent of each other because, under perfect capital market conditions, there would not be any difference between external sources of finance and a company's internally generated funds. As a result of this reasoning, capital structure and dividend policies are considered irrelevant. However, this view is based on unrealistic assumptions and challenged by many studies; even Modigliani and Miller (1961) revised later by including tax in their models. Several reasons make investment and financing decisions dependent on each other, such as information asymmetries, agency costs, and firms' ability to access capital markets. Myers and Majluf (1984) claimed that the presence of information asymmetries affects the cost of capital and, in turn, investment decisions; the cost of external sources of finance becomes higher than the cost of internal finance. Jensen (1986) argued that agency costs affect financing decisions because of the differences between the interests of managers and those of shareholders; managers are inclined to pursue their interests. In addition, the use of external finance performs a function as a controlling mechanism in agency problems. Therefore, the availability of internal funds has an important role in corporate investment decisions. Fazzari et al. (1988) conducted a seminal

work and argued that when a firm's access to external finance is restricted, the investment becomes sensitive to the availability of internal funds; therefore, they claimed that investment cash flow sensitivity could be a good indicator of financial constraints. Several studies found results supporting this view. Kaplan and Zingales (1997) opposed this argument, and they claimed that the financially least constrained firms have higher investment cash flow sensitivity. Their findings were also supported by many studies.

Debt financing has some advantages, such as tax relief due to the deductibility of interest expenses, but it also has disadvantages like increased financial risk and the potential threat of takeovers, among others. According to classical trade-off theory, there is an optimal level of gearing for firms. Firms may consider benefiting from the advantages of debt financing; however, it is healthier to generate and sustain internal funds from core operations. There are several measures of corporate liquidity, and one of the most commonly used is the cash conversion cycle. In this study, we analyze the effect of a firm's cash conversion cycle on its investment cash flow sensitivity.

The rest of the article is organized as follows: the next section provides a review of related literature, section 3 provides the details of the data and methodology, section 4 presents the results of the analyses, and section 5 concludes.

Literature Review

The existence and determinants of investment cash flow sensitivity have been investigated by many studies from different perspectives. The pioneering study on the topic was conducted by Fazzari et al. (1988), and they claimed that investment cash flow sensitivity has a positive relationship with financial constraints due to the difference between the costs of internal and external funds. A firm is considered financially constrained when it abandons profitable projects due to the cost of external finance, which is higher than that of internally generated funds. Fazzari et al. (1988) argued that investment cash flow sensitivity could be a good indicator of financial constraints. Many studies presented empirical results supporting this point of view in different countries, such as Hoshi et al. (1991), Kadapakkam et al. (1998), Kato et al. (2002), Shen and Wang (2005), Degryse and De Jong (2006), Cleary et al. (2007), Brown and Petersen (2009), Abel and Eberly (2011), Mulier et al. (2016), and Tran and Le (2017).

Kaplan and Zingales (1997) challenged this proposition and presented opposite results claiming that the least financially constrained firms have higher levels of investment cash flow sensitivity. This view has also been supported by several studies such as Cleary (1999), Hadlock and Pierce (2010), Chen and Chen (2012), Bhabra et al. (2018).

Some studies presented empirical evidence on the role of macroeconomic factors in the existence of financing constraints with respect to investment cash flow sensitivity, whereas some other studies reported firm-level determinants. Macroeconomic factors affecting financing constraints and investment—internal fund relationship directly or indirectly—might include financial development (Love, 2003), monetary policy (Masuda, 2015), exchange rates, and asset prices (Gupta & Mahakud, 2019), among others. Gupta and Mahakud (2020) investigated the impact of the macroeconomic condition on investment cash flow sensitivity and whether it is dependent on the firm size and group affiliation for Indian firms. They concluded that good macroeconomic condition reduces investment cash flow sensitivity, and the relationship is stronger in the case of small-sized and non-affiliated firms.

Most of the studies focused on the micro or firm-level factors affecting the relationship between investment and the availability of internal funds. Those factors include some financial indicators such as debt holdings (Ahiadorme, 2018), dividend payment (Xu & Xu, 2019, accrual quality (Chung et al., 2013) as well as some non-financial indicators such as corporate social responsibility (CSR; Samet & Jarboui 2017), internationalization (Lin et al., 2019), family ownership (Peruzzi, 2017), corporate governance (Francis et al., 2013; Ellouze & Cherif, 2020), institutional characteristics (Abdallah et al., 2020), cultural differences (Kashefi-Pour et al., 2020).

Ascioglu et al. (2008) examined the relationship between information asymmetry and investment cash flow sensitivity for U.S. firms. They found that the firms with high information asymmetries have greater investment-cash flow sensitivity, evidence of lower average scaled investment expenditures for constrained firms. Pindado et al. (2011) searched for the effect of family control on investment cash flow sensitivity for European firms. They found that

investment cash flow sensitivity is lower in the case of family-controlled firms. Gupta (2022) investigated how the chief executive officer's age (CEO) affects a firm's investment cash flow sensitivity for Indian firms for a period from 2005 to 2018 and found that younger CEO increases investment cash flow sensitivity or vice versa. This relationship is found to be stronger in the case of standalone firms and during periods of crises.

Attig et al. (2014) proposed that corporate social responsibility affects investment cash flow sensitivity through information asymmetry and agency costs. These two factors are among the determinants of corporate investment to the availability of internal funds.

Another important determinant in investment cash flow sensitivity might be the working capital management of firms because the management of working capital accounts may create positive or negative cash flows; depending on this, the firm may need external financing. Working capital is defined as the difference between current assets and current liabilities. Successful working capital management can be crucially important for the sustainability and survival of firms. At a moderate level, firms are expected to finance their non-current assets by using long-term sources of capital. Fazzari and Petersen (1993) argued that investments in working capital have a higher sensitivity to financial constraints compared to investments in fixed capital. In addition, working capital is reversible and can be easily adjusted by firms. Hill et al. (2010) presented that when firms have a greater capacity for internal financing and have easy access to capital markets, they keep a higher level of working capital. In addition, compared to fixed capital, it is easier and cheaper to adjust working capital in case of a negative shock to cash flow. Moreover, fixed investment's sensitivity to cash flow is higher for firms with low working capital than for firms with high working capital (Ding et al., 2013; Kwenda, 2015).

Bushman et al. (2011) claimed that investments in fixed and working capital are interrelated. They showed that firm growth and investment cash flow sensitivity primarily reflect the fundamental connection between these two types of investment.

Cash conversion cycle is one of the most important indicators used to measure the effectiveness of working capital management (Richards and Laughlin, 1980). It measures the number of days from the purchase of materials to the collection of receivables. It reflects the firm's policy about benefiting from credit extended by its suppliers and extending credit to its customers. It is also used to evaluate external fund needs (Tong & Wei, 2011). Even though the literature is inconclusive about the relationship between the cash conversion cycle and firm performance, in practice mostly, it is assumed that a shorter, even negative, cash conversion cycle is better. Considering the role of working capital management in the investment cash flow sensitivity relationship and the importance of the cash conversion cycle, we aim to investigate the impact of the cash conversion cycle on investment cash flow sensitivity. Most of the previous studies which included working capital management in the models of investment cash flow sensitivity used working capital as a dependent variable, and similar to fixed capital, those studies aimed to find out the sensitivity of working capital investment to the availability of internal funds (i.e., Fazzari & Petersen, 1993, Bushman et al., 2011). Different from the previous studies, we include the cash conversion cycle as an independent variable to find out the effect of working capital management on investment cash flow sensitivity.

Investment cash flow sensitivity and the effect of the cash conversion cycle might be different depending on the firm size. Some prior studies conducted analyses searching for the effect of firm size on investment cash flow sensitivity and financing constraints. Gertler and Gilchrest (1993) studied the imperfections in the monetary transmission mechanism and how credit flows respond to different types of borrowers. They found that smaller firms need to pay a higher premium for external finance sources due to a lack of collateral and higher bankruptcy costs. In another study using firm size as the proxy for capital market access, they found that smaller firms are more financially constrained because of several reasons, such as greater dependencies on intermediaries, incapability of issuing public debt, and the greater idiosyncratic risk they face (Gertler & Gilchrist, 1994).

In a recent study, Gupta et al. (2021) examined the impact of a CEO's education on investment cash flow sensitivity for Indian manufacturing firms by dividing the sample into categories per size and group affiliation. In this study, they presented new evidence that smaller firms are more financially constrained than larger firms and found a significant association between a CEO's education with investment decisions.

Hypotheses

Based on the discussion in the literature review, we develop three hypotheses:

H1: There is a significant investment cash flow sensitivity for the sample firms, indicating the existence of financial constraints.

H2: There is a significant positive effect of the cash conversion cycle on investment cash flow sensitivity.

H3: The effect of the cash conversion cycle on investment cash flow sensitivity is more (less) for small (large) firms.

Methodology

The previous studies on investment cash flow sensitivity adopted one or both of two methods, namely the Q model and the Euler equation model. In this study, we adopt the Euler equation model because of its advantages over the Q model. First of all, it does not require reliance on profitability measures that are based on firm market value, and also, it does not require the use of share price information and strong market efficiency. Secondly, it is not required to assume the linear homogeneity of the net revenue function. Euler equation approach has been used in many studies to investigate the impact of several factors on investment cash flow sensitivity (Laeven, 2003; Ratti et al., 2008; Chen et al., 2013; Tran and Le, 2017; Gupta & Mahakud, 2019).

The determinants of the firm's investments are investments in previous periods, cash flows, revenue, and total debt. The Euler equation can be stated in linear form as follows (Bond & Meghir, 1994) and this is the first equation we test for ICSF.

$$\left(\frac{I}{K}\right)_{i,t} = \beta_1 \left(\frac{I}{K}\right)_{i,t-1} + \beta_2 \left(\frac{I}{K}\right)^2_{i,t-1} + \beta_3 \left(\frac{CF}{K}\right)_{i,t-1} + \beta_4 \left(\frac{Y}{K}\right)_{i,t-1} + \beta_5 \left(\frac{D}{K}\right)^2_{i,t-1} + \varepsilon_{it} \quad (1)$$

where I is a net investment, K is capital stock at the beginning of the period, CF is cash flows, Y is revenue, and D is debt. Investment, cash flow, revenue, and debt are stated relative to the capital stock (K). This scaling functions as a control for heteroscedasticity that may potentially arise from size differences.

The second equation aims to test the effect of leverage on ICSF.

$$\left(\frac{I}{K}\right)_{i,t} = \beta_1 \left(\frac{I}{K}\right)_{i,t-1} + \beta_2 \left(\frac{I}{K}\right)^2_{i,t-1} + \beta_3 \left(\frac{CF}{K}\right)_{i,t-1} + \beta_4 \left(\frac{Y}{K}\right)_{i,t-1} + \beta_5 \left(\frac{D}{K}\right)^2_{i,t-1} + \beta_6 \left(\frac{CF}{K}\right)_{i,t-1} xCCC + \varepsilon_{it} \quad (2)$$

CCC refers to the cash conversions cycle and is calculated as the inventory holding period plus

Table 1. *Country and Industry Details of the Sample*

Panel A: Country details of the sample			**Panel B: Industry details of the sample**		
Country	No. of firms	%	Industry	No. of firms	%
India	21	12.6	Coal	31	18.5
Indonesia	20	12.0	Integrated Oil & Gas	9	5.4
Japan	27	16.2	Oil & Gas Drilling	1	0.6
Malaysia	10	6.0	Oil & Gas Exploration and Production	11	6.6
Russia	31	18.5	Oil & Gas Refining and Marketing	72	43.1
South Korea	17	10.1	Oil & Gas Transportation Services	6	3.6
Thailand	15	9.0	Oil Related Services and Equipment	24	14.4
Vietnam	26	15.6	Renewable Energy Equipment & Services	9	5.4
Total	167	100	Renewable Fuels	3	1.8
			Uranium	1	0.6
			Total	167	100

Table 2. *Variable Descriptions*

Investment (I)	Cash outflow for the purchase of property, plant, and equipment
Capital Stock (K)	Book value of property, plant, and equipment in the balance sheet
Revenue (Y)	Total sales revenue in the income statement
Cash Flow (CF)	Net cash flow from operating activities in the cash flow statement
Debt (D)	Book value of total debt in the balance sheet.
Cash Conversion Cycle (CCC)	Inventory holding period plus Receivables collection period minus Payables deferral period

the receivable collection period minus the payables deferral period. We used it as a dummy variable which takes a value of 1 if a firm's CCC value over the sample period is equal to or greater than the median of all firms in the sample, otherwise takes a value of zero. The assumption behind including CCC in the model is that cash generated from the firm's operating cycle is an important source of internal funds, and it affects investment cash flow sensitivity.

Data and Variables

The sample used in this study includes firms from the energy sector from several countries for an 11-year period from 2009 to 2019. Table 1 shows the country and sub-sector details of the sample.

The variables used in the empirical model are defined in Table 2.

Estimation Method

This study uses a dynamic panel data model, which produces better results in the existence of an endogeneity problem. The models developed include the first lag-dependent variable, and this case makes the models dynamic but, at the same time, causes an endogeneity problem. Ordinary least squares (OLS) produce biased results due to their exogeneity assumptions. Similarly, fixed effects may have a high correlation with the independent variables in the panel regressions with the fixed effects option. Due to those reasons, we used the generalized method of moments (GMM) system of estimators developed by Arellano and Bover (1995) and Blundell and Bond (2000). GMM estimators solve the problems mentioned; that is, they control for fixed effects by taking the first differences of the variables. They also solve the problems of heteroskedasticity and autocorrelation and also handle the endogeneity problem. There are several types of GMM estimators, difference GMM and system GMM, both can be run as one-step or two-step estimation. In this article, we used system GMM with two-step estimation, which increases the efficiency of the results, and the standard covariance matrix is robust to panel-specific autocorrelation and heteroskedasticity (Mileva, 2007). As the specification tests, we performed Arellona-Bond AR(1) test and AR(2) test for the serial correlation in error terms. Finally, we used Sargan test of over-identifying restriction to test the validity of instruments.

The Results of Analyses

This section presents the descriptive statistics and the results of statistical analyses.

Descriptive Statistics

Table 3 reports the descriptive statistics values for investment-related variables and the cash conversion cycle. I/K is the scaled value of the investment and ranges from 0 as the minimum to 1.729 as the maximum, with a mean value of 15.17 %; this shows that some companies do not make any new investments in some years, whereas some companies make new investments amounting to almost two times of their existing capital stock. Y/K is the scaled value of sales revenue and ranges from 0.049 as the minimum to 183.4 as the maximum, with a mean value of 6.164; this shows that some companies have very low levels of sales in some years, whereas some companies have higher amounts of sales reaching to 183.4 times of the capital stock. D/K is the scaled value of debt and ranges from 0 as the minimum to 9.7 as the maximum, with a mean value of 72.04%; this shows that some companies have no leverage in some years, whereas some companies have higher amounts of sales reaching to 9.7 times of the capital stock. CF/K is the scaled value of operating cash flow and ranges from -2.27 as

Table 3. *Descriptive Statistics.*

	I/K	Y/K	D/K	CF/K	CCC
Mean	0.1517	6.1640	0.7204	0.2822	39.4946
Median	0.1215	3.4375	0.5615	0.1940	28.9500
Standard Deviation	0.1472	11.0420	0.8424	0.5687	70.0744
Kurtosis	12.6649	103.7313	24.6077	21.9127	16.2598
Skewness	2.4164	8.4277	3.9349	3.4914	1.4087
Minimum	0.000	0.049	0.000	-2.270	-511.600
Maximum	1.729	183.4	9.7	5.265	650.1

the minimum to 5.265 as the maximum, with a mean value of 28.22%; this shows that some companies have negative operating cash flow more than double of their capital stock in some years, whereas some companies have higher amounts of operating cash flow amounting to more than five times of the capital stock. CCC is an inventory holding period plus receivables collection period minus payables deferral period in terms of days, with a minimum of -512 days and 650 days. Negative CCC shows that the total of inventory and receivable days is less than payables deferral days. Mean CCC is 39 days for the sample.

Table 4 shows the mean values for investment-related variables and CCC. Panel A shows the information across years, and Panel B shows it across countries. The mean value of I/K over the period of 2010–2019 has a declining trend, with 0.19 in 2010 and 0.13 in 2019. The relative amount of investment expenditure decreased. The mean value of Y/K also has a declining trend. The relative value of sales with respect to capital stock decreased over time, indicating a utilization problem. The mean of D/K has an overall decreasing trend, even though there was an increase in 2011. The decreases in the relative debt level indicate lesser financial risk for the companies. The mean value of CF/K, the relative level of operating cash flow, has fluctuations over the period, with ups and downs. The mean value of CCC has a stable trend around 40 days.

Mean values across the countries do not show large deviations from country to country, with some exceptions. Japan has the highest I/K and D/K values, whereas Thailand has the highest Y/K and CF/K values. For CCC, mean values are dispersed closely around 40 days; India has the longest CCC period with 42 days.

Regression Results

Table 5 reports the results for the regression of investments on cash flow which is modeled in Equation (1). The model has an overall or joint significance according to Wald statistics. The AR(1) and AR(2) tests indicate first-order autocorrelation but no second-order autocorrelation. To test the validity of the instruments, the Sargan test is used, and it produces a p-value that is higher than 0.05, showing that the instruments are valid. The coefficient of lagged dependent variable is positive and significant, implying a stable trend in the firms' investments, whereas the coefficient of the squared lagged dependent variable is significantly negative. The coefficient of the scaled sales variable is positive and significant, implying that increases in sales help increases investments. The coefficient of the scaled debt variable is significantly negative. This is an interesting result; normally, a positive relationship is expected between the level of investments and borrowings. The positive and significant coefficient of the scaled cash flow variable indicates financing constraints which is consistent with the findings of Fazzari et al. (1988).

Equation (2) is formulized to find out the effect of the cash conversion cycle on investment cash flow sensitivity. Table 6 reports the regression results for Equation (2). The results reveal a significant Wald test, indicating the overall and joint significance of the model variables. There is first-order autocorrelation but no second-order autocorrelation. An insignificant p-value of the Sargan test indicates that the instruments are valid.

Table 4
Mean Values of Variables

Panel A: Mean values of investment-related variables and CCC across years					
Year	I/K	Y/K	D/K	**CF/K**	**CCC**
2010	0.191	7.349	0.741	0.314	40.7
2011	0.193	7.848	0.844	0.317	41.8
2012	0.146	7.028	0.765	0.270	39.2
2013	0.162	7.137	0.752	0.260	36.1
2014	0.153	6.871	0.701	0.347	30.6
2015	0.149	5.084	0.691	0.275	34.3
2016	0.121	4.484	0.684	0.219	44.7
2017	0.130	4.904	0.686	0.276	46.2
2018	0.139	5.791	0.670	0.295	37.0
2019	0.134	5.142	0.671	0.249	37.0
Panel B: Mean values of investment-related variables and CCC across countries					
Country	I/K	Y/K	D/K	CF/K	CCC
India	0.168	6.679	0.865	0.285	42.2
Indonesia	0.146	6.836	0.787	0.308	39.9
Japan	0.186	7.280	0.814	0.298	40.2
Malaysia	0.139	6.290	0.728	0.262	34.7
Russia	0.139	5.490	0.679	0.278	41.0
South Korea	0.135	4.413	0.535	0.216	37.7
Thailand	0.153	8.194	0.628	0.353	39.4
Vietnam	0.137	4.801	0.676	0.258	37.5

Table 5. *Regression of Investments on Cash Flows*

	Coefficients	**Standards Errors**	**z**	
I/K (L1)	0.88304***	0.06161	14.33	Wald: 475.89***
I/K (L1SQ)	-0.87571***	0.08519	-10.28	AR(1): -5.901*** (p-value: 0.000)
Y/K (L1)	0.00436***	0.00120	3.63	AR(2): 0.189 (p-value: 0.8498)
D/K (L1SQ)	-0.00297***	0.00079	-3.76	Sargan: 68.799 (p-value: 0.1796)
CF/K (L1)	0.02251***	0.00407	5.53	No.of instruments: 65

****,**,*: Significance at 1%, 5%, and 10 % , respectively.*

The dummy variable, which is created according to the median value of the cash conversion cycle, is multiplied by the lagged cash flow, and it is included in the model to show the effect of the cash conversion cycle on investment cash flow sensitivity. The regression results revealed a positive significant coefficient for the CCC variable, indicating higher investment cash flow sensitivity for the companies with longer cash conversion cycles. Even though having a long cash conversion cycle is a working capital policy choice, a longer cash conversion cycle might also be considered a signaling factor of potential liquidity problems, especially if the company faces problems in turning over its inventories and in collecting receivables from customers. Such cases

Table 6. *Regression for the Effect of CCC on ICFS*

	Coefficients	Standards Errors	z	
I/K (L1)	0.88939***	0.06345	14.02	Wald: 480.57 ***
I/K (L1SQ)	-0.88616***	0.08764	-10.11	AR(1): -5.8717 (p-value: 0.000)
Y/K (L1)	0.00447***	0.00120	3.71	AR(2): 0.153 (p-value: 0.8785)
D/K (L1SQ)	-0.00292***	0.00078	-3.72	Sargan: 69.012 (p-value: 0.1749)
CF/K (L1)	0.01619***	0.00541	2.99	No.of instruments:66
CF/K (L1)*CCC	0.01576**	0.00908	1.74	

***, **, *: *Significance at 1%, 5%, and 10 % , respectively.*

Table 7. *Regression of Investments on Cash Flows for Small and Large Firms*

	Small firms			**Large firms**		
	Coefficients	**Standards Errors**	**z**	**Coefficients**	**Standards Errors**	**z**
I/K (L1)	0.68105***	0.03914	17.40	1.10862***	0.03940	28.14
I/K (L1SQ)	-0.66312***	0.04833	-13.72	-1.32421***	0.05930	-22.33
Y/K (L1)	0.00531***	0.00072	7.40	0.00968***	0.00143	6.75
D/K (L1SQ)	-0.00283***	0.00053	-5.29	-0.0019	0.00169	-1.13
CF/K (L1)	0.02388***	0.00290	8.24	0.01932***	0.00538	3.6
Wald: 1626.74***				Wald: 2494.63***		
AR(1): -4.6907*** (p-value: 0.000)				AR(1): -4.6208*** (p-value: 0.000)		
AR(2): 0.4598 (p-value: 0.6456)				AR(2): -1.1408 (p-value: 0.2540)		
Sargan: 59.1419 (p-value: 0.4703)				Sargan: 64.0132 (p-value: 0.3050)		
No.of instruments: 65				No.of instruments: 65		

***,**,*: Significance at 1%, 5%, and 10 % , respectively.

may give rise to investment cash flow sensitivity, and our findings support this reasoning.

Other variables in the regression based on Equation 2 produced similar results as in the first regression. Even though there are slight differences in the coefficients, all have significance with the relationships in the same directions.

In order to investigate the effect of firm size in both models, we divided the sample into two groups (small and large firms) and ran the analyses for each group separately. Table 7 reports the results for the regression of investments on cash flow, which is modeled in Equation (1) per group of small and large firms. The models for both groups are significant. The results revealed a difference in for scaled debt variable, which is not significant in the case of large firms.

Table 8 reports the regression results for Equation (2), which aims to find out the effect of the cash conversion cycle on investment cash flow sensitivity per groups of small and large firms. Both models have overall significance, and similar to the previous model, the scaled debt variable is the only difference between small and large firms, which is insignificant in the case of large firms. Regarding the effect of CCC, it is found to be insignificant in the case of small firms and significant at a 10% level in the case of large firms. More interestingly, the coefficient has a negative sign. The results for the whole sample produced a positively significant coefficient at a 5% level. This implies that firm size has a very important role in terms of financial constraints and also in the effect of CCC on investment cash flow sensitivity.

Table 8. *Regression for the Effect of CCC on ICFS for Small and Large Firms*

	Small firms			Large firms		
	Coefficients	**Standards Errors**	**z**	**Coefficients**	**Standards Errors**	**z**
I/K (L1)	0.68132***	0.04043	16.85	1.11046***	0.03782	29.36
I/K (L1SQ)	-0.66292***	0.05073	-13.07	-1.33242***	0.05609	-23.75
Y/K (L1)	0.00529***	0.00071	7.46	0.00975***	0.00146	6.68
D/K (L1SQ)	-0.00286***	0.00050	-5.69	-0.00206	0.00172	-1.21
CF/K (L1)	0.02191***	0.00408	5.37	0.02545***	0.00785	3.24
CF/K (L1)*CCC	0.00443	0.00624	0.71	-0.01204*	0.00832	-1.45
Wald: 1854.65***				Wald: 2530.72***		
AR(1): -4.6748*** (p-value: 0.000)				AR(1): -4.6547*** (p-value: 0.000)		
AR(2): .45805 (p-value: 0.6469)				AR(2): -1.1014 (p-value: 0.2707)		
Sargan: 59.1108 (p-value: 0.4715)				Sargan: 64.4867 (p-value: 0.2908)		
No.of instruments: 66				No.of instruments: 66		

****, **, *: Significance at 1%, 5%, and 10 % , respectively.*

Conclusion

In this article, we aimed to investigate the effect of firms' cash conversion cycle on their investment cash flow sensitivities by using the data of 167 energy companies from eight countries for a 10-year period of 2010–2019. Due to the fact that investments are affected by the prior period investments, we included investment lags in the models, making them dynamic models. We worked on two models: the first tested investment cash flow sensitivities of the sample firms, and the second tested the effect of cash conversion cycle. The models produced statistically significant results. The results of the first model imply that the investments of the firms are sensitive to the availability of cash flows. This finding presents evidence supporting Fazzari et al. (1988) and other studies on the same side; in other words, such a result indicates the existence of financial constraints. Secondly, the results showed that the cash conversion cycle has a significant positive effect on investment cash flow sensitivities. In other words, the firms with longer cash conversion cycles have higher levels of investment cash flow sensitivity. There are plenty of studies that searched for the effect of working capital management on firm performance, and a significant portion of those studies used the cash conversion cycle as the measure of working capital management. Some of those studies concluded that a longer cash conversion cycle improves financial performance, whereas others found the opposite. Moreover, having a long cash conversion cycle might be an intentional policy choice, or it might be a result of poor working capital management. Regardless of this situation, this article found that a longer cash conversion cycle is associated with higher investment cash flow sensitivity. This is not a surprising finding because the firms with shorter cash conversion cycles have better liquidity positions, and there will be less uncertainty in operating cash flows. However, the opposite will be the case for firms with a longer cash conversion cycle—there will be more uncertainty in operating cash flows, and as a result, it will lead to higher investment cash flow sensitivity.

In order to investigate the effect of firm size, we also run the models by dividing the sample into two groups: small firms and large firms. The results showed that there is only one difference between small and large firms in the first model, which is the scaled debt variable. Regarding the effect of the cash conversion cycle on investment cash flow sensitivity, there is a significant effect at a 10% level in the case of large firms, whereas it is insignificant for small firms. The signs of the coefficients of the variable showing the effect of CCC are opposite for the whole sample and for the divided sample. This implies the critical role of firm size in the analysis.

This study has focused on energy companies. Future studies may consider using a multi-sector sample, such as all non-financial companies. Even though the study used a 10-year period, future studies may cover longer

periods, and also may consider using dummy variables for crisis within the period covered.

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