

Cash Flow Sensitivity Analysis of Energy Companies¹

Enerji Firmalarının Nakit Akış Duyarlılığının Analizi

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ABSTRACT

If financial markets are efficient, companies can easily access finance. However, due to market frictions in financial markets, it is often not easy to find suitable financing sources for investments. As a result of the market frictions, the growth of national economies slows down. In this study, this problem will be addressed for energy companies. In other words, we examine whether energy companies are faced with financial constraints using the data of energy companies in 13 selected countries between the years 2010-2021. The results show that cash flows created by energy companies in 7 countries are effective in financing their investments. High cash flows and increased investments resulting from fluctuations in energy prices may also indicate that companies exhibit excessive investment behavior due to agency problems. On the other hand, all stakeholders need to make timely investments in the energy sector compared to other industries to support energy policies and increase social welfare.

Keywords: Energy Investments, Investment, Investment Cash Flow Sensitivity, Financial Constraint.

Öz

Finans piyasalarının etkin olması durumunda firmalar en uygun finansman koşullarına rahatlıkla ulaşabilmektedirler. Ancak finans piyasalarında var olan piyasa sürtünmeleri yüzünden yatırımlar için uygun finansman kaynağı bulmak çoğu zaman kolay olmamakta ve bunun sonucunda ülke ekonomilerinin büyümeleri yavaşlamaktadır. Bu çalışmada temel olarak yukarıdaki problem enerji firmaları için ele alınmış, bir başka ifade ile bu firmaların finansal kısıtlar ile karşı karşıya olup olmadığı tespit edilmeye çalışılmıştır. Seçilmiş 13 ülkede yer alan enerji firmalarının 2010-2021 yılları arası verileri kullanılarak yapılan çalışmada 7 ülkede bulunan enerji firmalarının yarattıkları nakit akışlarının bu firmaların yatırımlarının finansmanında etkili olduğu sonucunu ulaşılmıştır. Burada yaratılan nakit akışlarına duyarlılık finans ve ekonomi literatüründe firma düzeyinde finansal kısıtlara işaret etmektedir. Enerji fiyatlarındaki dalgalanmalar sonucu ortaya çıkan yüksek nakit akışları ile artan yatırımlar, firmaların vekalet problemleri nedeniyle aşırı yatırım davranışı da gösterdiğine işaret edebilir. Diğer taraftan enerji politikalarını desteklemek ve toplum refahını artırmak için diğer endüstrilere oranla enerji sektöründe yatırımların zamanında yapılması tüm paydaşlar açısından son derece önem taşımaktadır.

Anahtar Kelimeler: Enerji Yatırımları, Yatırım, Yatırım Nakit Akış Duyarlılığı, Finansal Kısıt.

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1. INTRODUCTION

Today, energy is seen as the lifeblood of individual and social welfare as well as economic activities. In recent years, high energy prices, especially due to the fluctuations in oil prices, create difficulties for economies, and on the other hand, offer new opportunities. For example, while the price of Brent oil per barrel was 23.64 US dollars in January 2000, it increased to 112.51 US dollars in 2012, resulting in free cash flows for the oil industry. These cash flows, which emerged due to overvalued oil prices, were converted into new investments by companies. It has emerged as an important problem how much the new investments that emerged with these cash flows contribute to the value of the companies.

The investment behavior of the companies plays an important role in the financial system of a country's economy. However, the financing of these investments is also an extremely important issue. In cases where financial markets are efficient, companies can easily reach the most suitable financing conditions. However, due to the frictions experienced in the financial markets, it is often difficult to find suitable financing sources for investments, and as a result, the growth of the country's economies slows down (Islam and Mozumdar, 2007). For this reason, the investment and the financing resources used by the companies for their investments have an important place in the finance literature.

In terms of financing investments, it is also important to have access to the source of funds for companies. When companies use high-cost external funds with financial constraints, it poses an obstacle in evaluating investment opportunities. For this reason, companies that have access to external resources depend on internal resources, in other words, cash flow, to finance their investments. In terms of these companies, it is thought that the use of internal resources will cause them to not evaluate the investment opportunities that may occur in case of cash insufficiency.

The focus of the present study is to understand the financial constraint of energy companies. In other words, it has been tried to determine whether energy companies are faced with financial constraints. In the study conducted by using the data of the energy companies in selected countries between the years 2010-2021, it will be tried to reveal to what extent the cash flows created by the energy companies are used in the financing of the investments of these companies. While the sensitivity to the cash flows created here points to the financial constraints at the firm level in the finance and economics literature, there may be different situations for energy companies. Increased investments along with high cash flows resulting from fluctuations in energy prices may also indicate that firms exhibit excessive investment behavior due to agency problems. On the other hand, due to the vital importance of the energy sector, the public incentives received by the companies in the industry can remove the financial barriers to making their investments. In summary, in this study, the existence of financial constraints for energy companies was tried to be determined and recommendations were made for future studies.

2. LITERATURE

Firms finance their investment projects using various financing sources. These sources include external financing (debt and equity) and internal financing (cash flow). Financing from external sources (banks and capital markets) depends on the characteristics of the firms, namely the financial performance of the firms due to the risk-averse nature of financial institutions, the associated risk, and assets. Access to and cost of external financing is a major barrier to the growth of firms, as well as financial markets in general.

In economies where financial markets are underdeveloped, the cost of external funds for firms is often higher than the cost of internal funds due to market frictions and asymmetric information problems. In these markets, high external costs, and the difficulty in accessing suitable funds lead companies to their internal resources. For this reason, companies will be more dependent on the resources they create in financing their investments and thus will not be able to catch growth opportunities. This situation, which is called financial constraint, makes the realization of investments highly dependent on the internal fundraising capabilities of the companies.

Firms that have difficulties in accessing external resources and that have a higher cost of external resources than internal resources are called financial constraints in the literature. The issue of financing constraints has been in the finance literature for a long time. Existing literature has tried to identify the causes and effects of financial constraints, but the debate on the measurement of financial constraints has not yet ended.

Although many methods have been developed in the literature on this subject, the cash flow sensitivities of investments (ICFS), developed by Fazzari, Hubbard, and Peterson (FHP hereafter, 1988), is the most widely used approach to measure financial constraints. According to this model, the cash flow variable is added to the Q Investment Model to test whether companies have financial constraints. The sensitivity of cash flows to investments is interpreted as an indicator of financial constraint. In other words, the significant cash flow variable in the estimated model shows that the firms make their investments in the periods when they generate cash flow, and this type of dependence on their internal funds can be interpreted as a measure of the financial constraints of the firms. FHP (1988) revealed that financially constrained firms resort to domestic financing more when making investment decisions due to more costly external financing, and they also found that investment is sensitive to balance sheet variables that measure liquidity.

Financing decisions and investment decisions vary depending on whether the financial systems of the countries are efficient or not. Modigliani and Miller (1958) showed that investment and financing decisions are independent of each other in efficient markets, that is, financing decisions do not affect investment decisions. Pawlina and Renneborg (2005), on the other hand, argued that this assumption put forward by Modigliani and Miller in inefficient markets would not be valid and financing decisions would be

effective on investment decisions. Market friction in inefficient markets forms the basis of the concept of financial constraint. The elimination of these frictions will also remove the financial constraints of the companies, and accordingly, the companies will be able to make all their investments with a positive Net Present Value, and thus economic growth will accelerate. Considering that market friction is caused by ineffective market mechanisms, it can be said that these disruptions will disappear with developments in financial markets.

After the FHP (1988) study, the cash flow sensitivity of investments in different markets was analyzed to determine whether companies have financial constraints (see Moyen, 2004; Lian and Cheng, 2007; Ağca and Mozumdar, 2008; Pál and Kozhan, 2009; Bond and Söderbom., 2009; Pindado, Requejo, and Torre, 2011). However, it is seen that different priority criteria have been introduced for grouping companies as financially restricted or non-financially restricted companies (see Fazzari, Hubbard, and Petersen, 1988; Kaplan and Zingales, 1997; Almeida et al. 2004; Beck et al., 2006; Hadlock and Pierce, 2010). In this grouping process, for example, FHP (1988) takes the payout ratio as a predetermined criterion and classifies firms with low dividend payouts as firms with financial constraints and firms with high dividend distribution rates as firms without financial constraints. He explained that the reason for this is that companies that do not pay dividends have difficulties in accessing external resources, and therefore they want to use these own resources as internal funds. Firms that do not have difficulty accessing external resources will continue to pay dividends.

Unlike FHP, Kaplan and Zingales (1997) examined the companies in 5 groups according to the level of financial constraint, using the footnotes in the company annual reports in addition to the periods and data used by Fazzari, Hubbard, and Petersen (1988). It has been observed that the sensitivity of investments of constrained firms to cash flow is less than firms without financial constraints. The authors of the study argued that looking only at the sensitivity of investments to cash flow is not a good indicator when examining financial constraints. Firms experiencing financial difficulties will prefer to finance their investments by finding external sources of funds, since they will use their existing cash assets to pay off their debts instead of making new investments, and it will be a more difficult decision to postpone their investments. Therefore, the authors concluded in the study that investments are less sensitive to cash flows for financially constrained firms. In addition, in this study, they also mentioned that the sensitivity of investments to cash flows in companies without financial constraints may be because company managers use internal financing resources instead of using external funding sources. In addition, findings supported by Ericson and Whited (2000) and Alti (2003), reveal that firms with fewer financial constraints have higher investment-cash flow sensitivity. Because, if cash flows are information for investment opportunities, firms with fewer financial constraints will be able to direct their investments to emerge investment opportunities more quickly.

Almeida, Campello, and Weisbach (2004) examined the effect of costly external resources on the financial policies of firms. Instead of the sensitivity of investment to cash flow, they have discussed the sensitivity of cash-to-cash flow by dividing firms

into two groups financial constraints and non-financial constraints. The findings prove that the cash flows of firms with financial constraints are sensitive to cash, and these firms tend to have cash in their hands because they have problems accessing external resources. Supporting the findings, the study by Denis and Sibilkov (2010) reveals that firms with financial constraints holding more cash have higher investment levels. Thus, it is thought that firms with financial constraints, who tend to have cash in their hands, can evaluate their investment opportunities in a shorter time.

In summary, if companies have problems accessing external funds and/or if the cost of external funds is higher than internal funds, financial constraints will negatively affect companies' investments. Firms that depend on internal funds for the financing of their investments will either postpone their investments or completely abandon their investments in case of insufficient internal resources. This will cause economies to have lower growth figures. The main purpose of this study is to investigate whether energy companies operating in different countries have financial constraints. Considering the support given by the country's governments to energy investments in recent years, the increase in investments in the energy sector, and the impact of energy investments on the welfare of societies, it is important to investigate the financial constraints of these energy companies.

3. THE MODEL AND THE PROPOSED ESTIMATOR

The sample of the study covers energy-related companies that are listed in 13 selected countries: namely, Australia (AUS), Canada (CAN), Chile (CHL), France (FRA), Germany (GER), Israel (ISR), Italy (ITA), Norway (NOR), Poland (POL), Sweden (SWE), Turkey (TUR), England (UK) and the United States of America (USA). We use Global Industry Classification Standard (GICS) 1010 code, which is frequently used in international scientific studies to identify the energy sector. GICS 1010 code consists of electricity, coal, oil, natural gas, producing new energy resources, and other energy-related companies. The sample period spans between 2010 and 2021, and the data obtained from the Refinitiv Eikon database.

Three types of data sets are subject to analysis in the field of statistics. The first of these is called the cross-section data set which the variables in the data set have no time dimension, only the unit size is more than 1. The second data set is the time series data set which the variables do not have a unit size but only a time dimension. The last dataset is the panel dataset, also called longitudinal data, which combines these two datasets. This data set is a data set that contains both unit and time dimensions.

The use of panel datasets has some advantages over other datasets. Firstly, panel data analysis methods have the power to control heterogeneity between units. Secondly, in the panel data method, the number of observations is much higher because there is both unit and time dimension. Thirdly, in panel data analysis methods, the multicollinearity problem between the variables is reduced to a lesser extent. Lastly, it also allows analysis of data where the time dimension is short, or the unit size does not have all the data (unbalanced panel) (Gujarati, 2003).

It is possible to examine panel analysis methods in two groups static and dynamic models. In models known as static panel models, or in other words, fixed and random effects models, the lagged values of the variables are excluded. As the reason for this, Greene (2012) stated that the inclusion of the lag of the dependent variable in the model increases the correlation between the error terms and the dependent variable, thus violating the assumption of the white noise error term (White Noise Errors). This means that the results obtained will be inconsistent. Cameron and Triverdi (2005) stated that in this case, it is more appropriate to use mediator-variable models instead of static panel

For the dynamic panel method to be preferred over the static panel method, it must meet certain conditions. Roodman (2009) listed these conditions in his study as follows. Firstly, our data set must have a small number of times and many unit sizes ($N > T$). Secondly, the dependent variable must have a significant relationship with its lagged values. Thirdly, it must be a linear function. Also, the dynamic panel method can be used if the arguments are not completely exogenous.

Since the prerequisite which is a significant relationship with the dependent variable's own lagged values was not met in the dataset in this study, the static panel model was used in the analysis instead of the dynamic panel model.

We consider the following model in our study:

$$Y_{i,t} = \beta_0 + \beta X_{i,t} + \lambda_t + \mu_{it} \quad (1)$$

$$i = 1, \dots, N \text{ and } t = 1, \dots, T$$

Here, i is the unit dimension of the equation and t is the time dimension of the equation. Y_{it} is the dependent variable, and X_{it} is the independent variable vector. Here, β_0 is the constant term and λ_t represents the unobservable time effect.

In this study, we use the time dimension dummy variable one-way fixed effects model because of the Hausman test ($\chi^2=273.68$, $\text{prob} > \chi^2=0.000$). The one-way time effects model can be estimated using the least squares method with dummy variables. A dummy variable is derived for each period and added to the model as an explanatory variable. In order not to fall into the dummy variable trap, $T-1$ dummy variables are included in the model (Tatoğlu, 2018: 133).

In this study, the cash flow variable was added to the model known as the Q model in the literature as an internal fund variable. In addition, the model was revised by adding the Market-to-Book Ratio (PTOB) variable instead of the Tobin Q ratio because of the missing company-based data. The parameter of the cash flow variable indicates whether the firms have financial constraints. The revised Q model to consider internal funds is as follows:

$$\frac{I_{it}}{K_{i,t-1}} = \alpha + \beta_1 * PTOB_{i,t} + \beta_2 \left(\frac{CF_{it}}{K_{i,t-1}} \right) + \varepsilon_{it} \quad (2)$$

The variables used in the model and their definitions are as follows:

I = Capital expenditures from Cash Flow Statement

K = Total Assets showing capital stock

PTOB = (Market Value / Book Value)

CF = Represents cash flows from operating activities from the cash flow statement.

Statistically significant cash flow variable indicates that firms face financial constraints due to imperfect capital markets (Gallego and Loayza, 2000; Fazzari et al., 1988). In other words, a positive and significant β_2 coefficient means that the firm has financial constraints, while its statistical insignificance emphasizes that there is no financial constraint.

Table 1 shows the descriptive statistics of the data used in the analysis. When we look at the cash flow variable, which is the main variable of the study, it is seen that the average is positive in 5 of 13 countries. In the study, it is seen from the descriptive statistics table that the countries with the highest number of firms are the United States and Canada.

Table 1. Descriptive Statistics

	AUS	CAN	CHL	FRA	GER	ISR	ITA	NOR	POL	SWE	TUR	UK	USA
I/K													
N	1,182	2,616	227	193	580	199	260	510	166	146	184	716	3,147
Mean	0.219	0.124	0.054	0.076	0.056	0.067	0.051	0.099	0.071	0.083	0.084	0.061	0.098
Std. Dev.	2.102	0.157	0.045	0.079	0.069	0.141	0.054	0.155	0.047	0.128	0.142	0.091	0.103
CF_K													
N	1,183	2,595	217	183	563	196	256	520	172	157	161	726	3,083
Mean	-0.294	-0.061	0.148	0.056	-1.137	-0.524	0.064	-0.31	0.614	-0.05	0.099	-0.05	-0.122
Std. Dev.	2.634	1.061	0.588	0.176	19.355	4.848	0.081	6.039	0.116	0.391	0.305	0.599	14.570
PTOB													
N	1,254	2,760	228	230	622	207	266	535	178	159	185	752	3,687
Mean	1.683	1.434	1.318	1.653	1.552	1.632	1.630	1.279	1.012	1.842	1.397	1.417	1.549
Std. Dev.	0.919	0.944	0.687	0.996	0.917	0.920	0.743	0.929	0.737	1.059	0.700	1.013	0.936
<i>I/K ratio of investment to total assets, CF/K ratio of cash flow to total assets, PTOB ratio of market value to book value</i>													

After the descriptive statistics table, the regression model in equation 2 was estimated separately for each country using the static panel data method to find an answer to the main research question of the study, whether there are financial constraints in the energy companies in the sample of selected countries. Table 2 presents the analysis results as well as diagnostics tests. When we examine the results of the analysis, it is obvious that the cash flow variable CF/K, which shows the financial constraint in AUS, CHL, ISR, SWE, TUR, UK, and USA are positive and significant. On the other hand,

the coefficient of the CF/K variable in 6 countries was found to be statistically insignificant for 6 countries.

Table 2. Results

Variables	AUS	CAN	CHL	FRA	GER	ISR	ITA
CF/K	0.013** (0.043)	0.0005 (0.875)	0.099** (0.046)	0.116 (0.115)	0.041 (0.101)	0.235*** (0.003)	-0.031 (0.515)
PTOB	0.081*** (0.000)	0.029*** (0.000)	0.037*** (0.000)	-0.013 (0.333)	0.007* (0.079)	0.009 (0.571)	0.012** (0.014)
Constant	0.067 (0.232)	0.117*** (0.000)	-0.012 (0.471)	0.089*** (0.002)	0.060*** (0.000)	0.990** (0.042)	0.045*** (0.000)
F-Value	3.49*** (0.000)	14.78*** (0.000)	2.33** (0.011)	2.35** (0.011)	4.03*** (0.000)	1.64* (0.094)	1.82* (0.051)
Wald	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Variables	NOR	POL	SWE	TUR	UK	USA	
CF/K	-0.029 (0.405)	0.034 (0.285)	0.205*** (0.000)	0.320*** (0.000)	0.011* (0.089)	0.0003** (0.040)	
PTOB	0.009 (0.386)	0.013** (0.049)	0.014 (0.362)	0.023** (0.026)	0.004 (0.353)	0.016*** (0.000)	
Constant	0.056* (0.078)	0.067*** (0.000)	0.055 (0.297)	0.077*** (0.007)	0.050*** (0.000)	0.103*** (0.000)	
F-Value	1.85** (0.041)	2.83*** (0.002)	4.20*** (0.000)	8.78*** (0.000)	3.12*** (0.000)	22.31*** (0.000)	
Wald	0.000	0.000	0.000	0.000	0.000	0.000	
<i>The probability values of coefficients are shown in parentheses, ***0.01, **0.05, and *0.10 refers to the level of significance.</i>							

In other words, energy companies in Canada, France, Germany, Italy, Norway, and Poland do not have any financial constraints. The fact that the PTOB variable is significant indicates that the financial markets work efficiently in the countries and that the financial markets have insufficient information in the countries where it is insignificant. In addition, F values indicate the accuracy of the model support the analysis.

4. CONCLUSION

The problem of access to energy resources, energy production, and energy supply has always been on the agenda. In this context, the importance of energy investments and companies operating in this industry is increasing day by day. To meet the increasing energy needs, the energy resources in the world must become more accessible, efficient, and effective. This expands the responsibilities of energy companies even more. With the developments in the world economy, the growth in energy demand creates new investment pressure on energy companies. To ensure energy supply, which is an indispensable resource for society and industry, it is important to identify the obstacles to the development of energy companies and to determine policies to eliminate them, for the realization of sustainable development.

In this study, we investigate whether energy companies have financial constraints. We implement a static panel data model with time dimension dummy variables. The sample includes 13 selected countries around the world. The results of the analysis indicate that the energy companies operating in 7 of the 13 countries (AUS, CHL, ISR, ITA, SWE, TUR, UK & USA) have financial constraints. On the other hand, for the remaining 6 countries in the sample, which are Germany, France, Italy, Poland and Norway, and Canada, the effect of cash flows on investments was insignificant, in other words, it was determined that companies operating in these countries were not dependent on their cash flows to finance their investments. The results indicate that energy companies in Germany, France, Italy, Poland and Norway, and Canada do not have financial constraints. This situation in these countries, 5 of which are European countries, may be due to the investment incentive policies in these countries.

The energy shortage and security problems, which have gained importance in recent years, have brought energy companies to a key position in overcoming energy problems. Supporting the investments that energy companies may have positive effects on society and business life. Thus, governments should work on the financing of energy companies. In this regard, supporting the systems that will enable energy companies to access financial resources more easily and maintaining the existing supportive policies should be the main objectives of the policymakers.

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