

The Effect of Oil Prices on the Investments of Turkish Manufacturing Firms*

Petrol Fiyatlarının Türkiye’de İmalat İşletmeleri Yatırımları Üzerine Etkisi

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Abstract

Nowadays oil is the leading energy source in the world. Oil has got a critical importance on manufacturing, specially, in industrial areas. Whilst oil, directly or indirectly, composes the raw material of various products, it is also used as an energy source in running machinery in the manufacturing process. In the scope of this study it is researched that the effects of oil prices on business investments from the view point of manufacturing firms, operating in Turkey. In this study, international crude oil price data and some balance sheet and income statement data about the firms within the scope of work, are analyzed using the panel data analysis. The results of the study show that oil prices have an avoidant and statistically significant effect for the businesses operating in the manufacturing sectors in Turkey.

Keywords: Oil Prices, Firm Investments, Panel Data Analysis

Öz

Petrol günümüzün önemli enerji kaynaklarının başında gelmektedir. Petrol özellikle sanayi kollarını oluşturan işletmelerin üretim faaliyetlerini sürdürebilmeleri için kritik bir öneme sahiptir. Petrol bugün birçok farklı ürünün doğrudan ve dolaylı olarak hammaddesini oluşturmaktayken, üretim faaliyetlerinde yer alan ma-

kinelerin çalışmasında ise enerji kaynağı olarak kullanılabilir. Bu noktadan hareketle bu çalışmada, petrol fiyatlarının işletme yatırımları üzerine etkisi Türkiye’de faaliyet gösteren imalat işletmeleri açısından araştırılmıştır. Çalışmada uluslararası ham petrol fiyatları ile çalışma kapsamındaki imalat işletmelerine ait bazı bilanço ve gelir tablosu verileri birlikte kullanılarak panel veri analizi yöntemiyle analiz edilmiştir. Çalışmanın sonucunda Türkiye’de imalat sektöründe faaliyet gösteren işletmeler açısından petrol fiyatlarının işletme yatırımları üzerinde istatistiki olarak anlamlı ve negatif yönlü bir etkisinin olduğu ortaya konulmuştur.

Anahtar Kelimeler: Petrol Fiyatları, İşletme Yatırımları, Panel Veri Analizi

Introduction

Energy is an essential element to meet economic needs and to sustain social requirements. Today, energy is considered as one of the main input of almost all sectors. Most of the world’s energy requirements are provided by fossil fuel. Although other than fossil fuel there are alternative energy sources to replace oil, it is not possible to sustain the current energy needs. Because oil has the highest energy value amongst fossil fuel and because it is used in many sectors, primarily in transport, it continues to be the main energy resource in the world.

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Oil plays an important part in business investments. Oil is used in many sectors as raw material, intermediate goods and energy source, therefore, it can be said that oil is one of the effective factors on business investments. In this context, in relation to the international conjecture, constant volatility in oil prices are important elements to investments that performed by the businesses. Taking these factors into consideration, oil is one of the most widely studied subjects in international literature. The literature mostly concentrates on the effects of oil on economics. Despite that, it is striking that there are only a few studies conducted on the relationship between oil and business investments.

Edelstein and Killian (2007) researched the response of business fixed investments to changes in energy prices for US. They concluded that, with the exception of the mining industry, all other sectors have not been significantly affected by energy prices on fixed investments whereas energy prices played a significant role on fixed investments in the mining industry. Boloji and Boloji (2010) developed a survey to investigate the effects of oil prices on manufacturing companies in Nigeria. The survey results showed that most of the manufacturing companies in Nigeria depend on the use of petroleum products to run their daily production functions. The increase in oil prices has serious effects on the cost of the raw materials to use in manufacturing and the quality of the raw materials. Also, the survey showed that increases in oil prices reduce the demand and the level of production in the market and also cause a decline in the profit margin or return of the investments ratio. Lee et al (2011) conducted a study in the US about how changes in oil prices had an effect on business investments. The study shows that the growth rate of oil prices has a statistical significance in business investments in the long term. Also, during the time when there is an increase in oil price there is a decline in investments of companies both in the short term and the long term. Ratti et al., (2011) conducted research about how energy prices affect business in 15 European countries. The result of it show that the increase in the energy prices cause relevant decrease in continuation of investments. The energy price increase of 1% in the countries in the research caused an approximate 1.2% decrease in investments. When only the manufacturing industry is concerned, 1% increase in the energy prices depressed business investments approximately 1.9%. Henri-

ques and Sodorsky (2011) investigated how the volatility in oil prices affects the strategic investment decisions of US companies. The paper shows that there is no simple correlation between oil price volatility and the firm investments. On the contrary, because of the various options, which influence the others, it is more complicated. The paper shows that there is a U shaped relationship between company investments and oil price volatility. Drakos and Konstanou (2013) investigated the effect of oil prices on investment decisions among the manufacturing firms which operate in Greece. They show in the study that an increase in oil prices significantly reduces the tendency to invest in manufacturing firms. The paper also shows that an unwanted increase in oil prices considerably reduces the possibility of planned investments for the firms.

Data Set and Method

In the study, have been utilized the related information obtained from the firm's balance sheet and income statement can be accessed full information about 105 of 196 manufacturing firms registered to Public Disclosure Platform for the period 1998-2012 and international crude oil prices. Accordingly in the study for every firm within the scope of the research annual data¹ in regard to tangible fixed assets (TA), cash flow ratio (CFR), net sales (NS), total debts (TD) and number of employee (EMP) and international Brent oil prices (OIL) are used as the data set. As international oil prices are expressed in dollars, this study expressed the oil price in Turkish Lira based on the dollar to Turkish Lira historical exchange rate provided by the Turkish Republic Central Bank.

The study investigates the relationship between oil prices and business investments via the panel data analysis method. Panel data is a data set consists of a cross section dimension and a time section dimension. which means in panel data analysis time series data and cross section data are used together (Wooldridge, 2009, s. 10). Panel data analysis provides a rich environment from the point of prediction techniques and development of theoretical results. To clarify, researchers use the time series with cross section data so that they have an opportunity to be able to

1 Firm data between the years 1998-2008 were compiled from the official website of Istanbul Stock Exchange (BIST), Firm data between the years 2008-2012 were compiled from the official website of Public Disclosure Platform (KAP).

use the data when cross section or time series may not be used on their own. This provides researchers flexibility as it causes an increase in data quality and the amount of data also facilitates a series of positive results as a result of developing new prediction methods and having new results (Greene, 2012, s. 344-345).

One of the most important subjects to concentrate on in panel data analysis is to decide whether to use fixed or random effect. In order to decide there are 2 approaches available which are theoretical and empirical. The theoretical approach has an intuitive base; according to the theoretical approach when all elements included in the model (All of EU countries or all the cities in a country) it is better to use the fixed effects method. Otherwise (some EU countries, including some of the companies in Istanbul Stock Exchange-BIST 100 index) random effect model should be used (Balatagi, 2005, s.12-14). The empirical approach expresses that in order to be able make more valid predictions it is better to use the Hausman test². After the model is established as a fixed or random effect model, Hausman test is used to decide whether to use fixed effect estimator or random effect estimator. In this case, initially, the model is chosen according to the available data set and then determined the estimator that will be used in the model depending on Hausman test (Tatoğlu, 2012, s. 163). Random effects model, considering the available data set (not all of the data about manufacturing companies operating in Turkey couldn't be included in the model), has been used in this study.

There is an assumption in random effects model that there is no relationship between the variable about cross sections and descriptive variables, thus if a variable cannot be observed it requires to be considered as random. The random effects model expresses a

2 Hausman test includes the two Hypothesis as below:

H_0 : "There is no correlation between the explanatory variables and the error term"

H_1 : "There is a correlation between the explanatory variables and the error term"

According to the Hausman test results if the probability value is higher than 0,05, H_0 hypothesis is accepted and the random effects estimator (GLS) is used. If the probability value is lower than 0,05, H_0 hypothesis is rejected and the fixed effects estimator (Within) is used (Tatoğlu, 2012, s.180).

period when N number units as random are chosen from the mass and a sampling process which based on data collection process which is random. (Balatagi 2005, s.14) According to the random effects model, the changes that occur according to units or units and time are added on the model as a component of the error term. The general regression equation for random effects model is shown below (Wooldridge 2009, s.489):

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \dots + \beta_k X_{itk} + v_{it} \quad (1)$$

$$v_{it} = \alpha_i + u_{it}$$

$$i = 1, 2, 3, \dots, N$$

$$t = 1, 2, 3, \dots, T$$

In the equation 1, Y_{it} denotes dependent variable, X_{it} denotes K number independent or explanatory variables, β' denotes the coefficient of explanatory variables, U_{it} denotes remainings, α_i denotes heterogeneity and V_{it} indicates a composite error term. As it can be seen in the equations in the fixed effects model, heterogeneity is included in α_i constant whereas in random effects model it is considered as a component of error term ($V_{it} = \alpha_i + u_{it}$).

In the study, the data with regard to oil prices, net sales, cash flow ratio, total debts and number of employee are used as independent variables and the data with regard to tangible fixed assets are used as dependent variable. When chosen model and variables are considered the general predicted equation related to the model is shown as below:

$$LTA = C(1)*CFR + C(2)*LEMP + C(3)*LTD + C(4)*DLOIL + C(5)*LNS + C(6) + [CX=F] \quad (2)$$

As can be seen in the equation 2, tangible fixed assets, crude oil price, cash flow ratio, total debts and number of employee variables are included in the model after taking their logarithms. Because the cash flow ratio³ variable is calculated as proportional it is taken into account as normal in the model. The variables other than oil prices are included in the model in order to minimize the econometric problems such as

3 Cash Flow Ratio is calculated as below in relation to literature:

(Income before extraordinary items+depreciation and amortization)/total assets

specification error and the aggregation problem⁴and to be able show the effect of oil prices on business investments in a more reliable way. A similar situation exists in the studies conducted in the literature (Henriques and Sodorsky, 2011; Drakos and Konstantinou, 2013).

Findings

In the study, data about 105 manufacturing companies issued between 1998-2012 terms are analyzed with the panel data analysis method. At first Hausman test is conducted to determine whether to use random effects model estimator or fixed effects model estimator within the scope of the analysis.

To reiterate the point that is mentioned above, the Hausman test is conducted to decide whether to use fixed effects predictor or random effects predictor, after the model is established as random effects model. At this stage, the model is still random effects model, however, depending on H_0 hypothesis is rejected or not-rejected, the estimator can be fixed effect or random effect estimator.

When Table 1 is examined, as the probability value is smaller than 0.05 (5%) H_0 hypothesis is rejected, therefore, in order for the model to be consistent and efficient, fixed effects estimator must be used. Table 2 shows the empirical results the model applied after the Hausman Test results have been taken into consideration.

Table 1. Hausman Test Results

Hausmann Test	Chi-Square	Probability	Estimator to be used
	39,1461	0.0000	Within

When the data on Table 2 is inspected, it seems that 1575 observations have been made in relation to 105 manufacturers. R^2 value shows that independent variables can explain 90% of changes in dependable variables. Also F-statistics results point out the probability value of F-statistics is equal to zero ($p \leq 0,01$) therefore, it is observed that the model is significant as a whole within the 99% reliability.

When the data table is examined, it is observed that the oil price changes have an avoidant and statistically significant effects on business investments according to the empirical results obtained from the model. Hence, an increase of 1% in oil prices causes a 0.29% decrease in business investments.

⁴ Aggregation Problem is a conceptual problem, show up the case of using a single aggregated value for each individual value. Aggregation Problem can occur in different ways. For example, assets, liabilities, equities, income and expenses of multiple firms can be represented under a single parent through the consolidated financial statement. Although there is a single parent, every firm's use of the assets and the sources differ from each other. Because of that some firm characteristics that can affect the firm investments and differ from firm to firm, included the research model. Thereby the effects of these firm characteristics on firm investments can be brought under control. If a variable that can be effective on firm investments or dependent variable is ignored the research model it will cause the specification error and precarious results (Taşdemir, 2006, s.25-26; Drakos and Konstantinou, 2013, s.152).

Table 2. The Analysis Results

Variable	Coefficient	Standard Deviation	T-Statistics	Probability
CFR	-0,1080	0,1952	-0,5529	0,5804
LEMP	-0,1461	0,0567	-2,5775	0,0101**
LTD	0,4529	0,1276	3,5496	0,0004
DLOIL	-0,2904	0,0920	-3,1569	0,0016
LNS	0,6081	0,1051	5,7868	0,0000
C	-0,8408	0,6999	-1,2013	0,2298
Number of observation	1575			
Number of groups	105			
R²	0,90			
Durbin-Watson-St.	0,9317			
F-Statistics (Probability)	108,6446 (0,0000)			
Note: The effects are supposed to random in the model. Therefore random effects model has been used. Autocorrelation and heteroscedasticity problems are considered with the White test.				
*It's state that the coefficients are significant at % 1 level.				
** It's state that the coefficients are significant at % 5level.				

As was stated previously, oil is used in manufacturing industry as an energy source as well as a raw material and intermediate goods. For instance, the amount of energy consumed by the all sectors in Turkey is 25 million tons of oil equivalent (TOE) of which 18.2 million TOE is used in the manufacturing industry which is 72%. Most of the energy consumed in the sector belongs to the energy obtained from fuel consumption. While the manufacturing industry consumes approximately 4 million TOE electric energy, the remaining approximate 14 million TOE, 78%, is provided by the energy obtained by the fuel consumption. 4 million TOE (29%) of the energy obtained by the consumption of fuel is sourced by oil (<http://www.tuik.gov.tr>). Also, oil is used in various sectors of the manufacturing industry. For example, in the textile sector, petroleum based industrial polymers like synthetic fibers, lamination of woven fabric and in particular in yarn production. In addition to these, oil is also one of the important products to be used in fiber, glass and ceramic manufacturing, paraffin,

water proof cartons and paper production. Also, oil is used in petrochemical products, automotive, leather products, glass, textile and paper products as an input. 15% of the textile sector, 12% of the leather products and more than 50% of the paper industry contain petrochemical product (<http://immib.org.tr>). Under the guidance of this information it can be said that the findings which are obtained from the analysis in terms of the relationship between oil prices and business investments are natural.

Conclusion

Although oil is an energy source, it's also used in various areas such as raw materials and intermediate goods. These and other similar properties of oil make it a very strategically important commodity in the world economy. When its share in the energy market and its multidimensional usage is considered we can see that the oil is commercially the most vibrant commodity. Also oil is widely used in business. Oil is

used directly in manufacturing as well as indirectly as a raw material and additives. This study aims to show the effect of oil prices on business investments from the point of manufacturing firms operating in Turkey.

The findings of the analysis, in the scope of this work, showed that for the whole manufacturing sector there is an avoidant and statistically significant relationship between oil prices and business investments and the increase of 1% on oil price has an impact of 0.29% decrease on business investments. These findings obtained by analysis for the whole manufacturing sector, compatible with theoretical expectations and previously published literature.

As a result, oil prices have an important impact on business investments most of the manufacturing sectors in Turkey and also oil is a very important product for businesses in the manufacturing industry as raw material and interim goods as well as an energy source. Also, because oil is used as an energy source in order to operate machines which are used in the manufacturing industry and it is also used as a raw material and interim goods in numerous sectors, it possesses a hugely important place in commerce, therefore, the shared belief with the literature that many industrial branches continue to develop relying on oil is valid in Turkey as well.

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