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A comparative study of the impact of sanctions on the oil and cement companies listed in Tehran Stock Exchange: Forecasting and Future Trends

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Abstract: Imposing sanctions can have several malicious effects on a developed or developing economy and Iran is not an exception to this matter. The main purpose of this paper is to determine whether imposing oil sanctions have a significant impact on oil, gas and petroleum companies' capital structure or not. Furthermore, a comparison between oil industry and cement industry and a prediction of oil companies' capital structure trend are conducted. The most innovative aspect of our study is to evaluate the influence of sanctions on a firm-specific variable rather than macroeconomic level. To address this problem, we investigate oil and cement companies listed in Tehran Stock Exchange from 2006 to 2018. The leverage ratio indicating capital structure, sanction dummy variable and ROA, tangibility of assets, capital market return, economic growth and inflation rate are dependent variable, independent variable and control variables, respectively. The data are obtained from companies' financial statements and we use OLS regression to estimate our equations. The results indicate that the 2012 oil sanctions against Iran affect the oil companies' leverage ratio negatively and the future trend reveals that the share of equity in capital structure will increase. Moreover, we inspect no significant relationship between oil sanctions and cement companies' capital structure. Therefore, government policymakers should plan strategies to lift or limit the oil sanctions and oil corporate managers should find some reasonable routes for balancing their companies' capital structure to exploit debt financing benefits.

1. Introduction

Imposing sanctions on a country and its economic influences are among the most debatable issues in under sanction countries. Economic sanctions are commercial and financial penalties applied by one or more countries against a targeted self-governing state, group, or individual and can be used for achieving domestic or international purposes (Lin, 2016). Imposing sanctions can affect the whole target economy via declining GDP per-capita, losing markets and investment opportunities to competing countries and restricting choices of goods for domestic consumers (Neuenkirch and Neumeier, 2015). Several economic sanctions have been imposed against different countries like the US embargo on Cuba, Russian sanctions against Ukraine and Georgia and United Nations sanctions on Somalia.

There is broad literature about the impacts of sanctions on macroeconomic variables but little is known about how they can affect firm-specific level. On the other hand, macroeconomics and

microeconomics are intertwined and their reciprocal relationship is inevitable. Therefore, in this research, we intend to fill in this gap.

Logically, the sanctioning country or organization seeks the main industry of sanctioned economy and hits the core. After the victory of the Islamic revolution in Iran, many sanctions have been imposed by disparate countries and organizations. Iran's economy is majorly based on oil and petroleum; hence prohibiting Iran to sell oil and its derivation will possibly have malicious effects and can even paralyze the whole economy. We aim to discuss briefly the history of oil sanctions against Iran.

The first oil sanction against Iran went back to 1950 which was ordained by Great Britain as an answer to the nationalization of the oil industry. In 1995, the US government took action by which it banned American oil companies to invest in oil and gas projects in Iran and it broke up the commercial relationship with Iran, unilaterally. In 2012, some countries led by the US put on a new oil sanction against Iran to prevent or restrict Iran's nuclear program. The sanctioning countries aim to deprive Iran of oil revenue and to oblige Iran to cooperate with the international community to disambiguate its probable military nuclear program. This sanction was followed by instruments like sanctioning purchase or purchasers, oil tankers insurance and banks and its goal was to dissuade purchasers from buying Iran oil and persuade them to buy from other suppliers. Consequently, in March 2012, Iran oil exports decreased to below two million barrels a day and almost a quarter of Iran oil platforms became inactive.

The aforementioned 2012 oil sanction is considered in the present study as the historical origin for sanction. The reactions of oil, gas and petroleum companies to this action convinced us to conduct this research. A significant sign of these reactions is corporate financing decisions. As we mentioned above, almost all previous studies investigate the relationship between sanctions and macroeconomic indices. We aim to find out this connection at the microeconomic level. Corporate capital structure is managers' instrument by which they can signal so many important things. As a result, we intend to know whether imposing oil sanctions influences oil, gas and petroleum corporates' capital structure or not.

In the following section, we discuss the theoretical background and literature review about sanctions and their impacts on economies, capital structure, theories and the factors that influence it and some previous researches about oil, gas and petroleum companies. In the research data and methodology section, we provide our study data, econometric method and our model in detail. In the results section, the estimation results of econometric equations can be seen and eventually in the conclusion and discussion section, we argue about the results of our study, develop the conclusions and propose our findings.

2. Literature Review

Capital structure means the combination of debt and equity for financing a firm's operation and growth. The theories that are highly accepted about capital structure are Trade-off theory, Pecking-order Theory, Signaling theory and Market timing theory. In the following, we explain each of these theories.

The trade-off theory commenced from studies of Modigliani and Miller (1958) and Modigliani and Miller (1963). This theory expresses that capital structure reflects the balance between debt tax benefits and bankruptcy costs. The main idea in this theory is that firms should determine debt and equity in the capital structure via a trade-off between benefits and costs. The trade-off theory hypothesis is that if a firm finances all its activities through debt, it would be very beneficial for it; but the bankruptcy risk of using debt doesn't permit firms to do so. Firms following this theory have a capital structure target and move slowly toward this (Myers, 1984). Myers and Majluf (1984) are pioneers of the Pecking-order theory. The key element in this theory is information asymmetry inside and outside of firms (Baker and Martin, 2011). According to the Pecking-order theory firm's internal sources of financing are preferable in comparison to external sources and if a firm is obliged to harness external sources of financing, it prefers debt. As a result, the priority of financing sources is earnings, debt and equity, respectively. Myers and Majluf (1984) explained that managers who aim to maximize

their firm's value, forbear from external financing via equity; considering their more information against shareholders and external investors. In the Pecking-order model to avoid adverse selection problems and losing value, firms with high quality tend to finance their activities using internal sources. They don't intend to perform their high-quality by changing capital structure. The Signaling theory demonstrates models in which capital structure acts as private signals (Ross, 1977). According to this theory, if high quality firms' managers with valuable investment projects or low bankruptcy risk issue debt for financing, the market will discover it, reacts positively to debt issuance and this prompts to increase their share's price; Whereas, the market reaction to equity issuance will be negative. Making a decision about equity issuance depends on market circumstances. This idea with the studies of Baker and Wurgler (2002) creates Market timing theory. This theory emphasizes that adverse selection is different at different times. It means that in the inconvenient economic conditions, firms don't issue equity; in the normal economic conditions they start it and in the economic booms, there is an acme for equity issuance. Empirical results of Bayless and chaplinsky (1996) and Baker and Wurgler (2002) represented that there is a positive relationship between equity issuance and the business cycle. However, it is necessary to consider that despite studies that confirm a significant relationship between high market-to-book value with low debt issuance like Frank and Goyal (2004), high expected inflation would cause debt issuance to be cheap and increase the share of debt in the capital structure (Oztekin, 2015). In addition, in the existence of inflation, it is possible to undervalue the share because of investors' inflation illusion and this leads to enhance financing via debt (Ritter and Welch, 2002).

Regarding factors influence capital structure, there are many studies each of which introduces some effectual factors. For instance, Parsons and Titmam (2008) demonstrated tangibility of assets, non-debt tax shield, growth, monopoly, industry classification, size, fluctuations and profitability as factors affecting leverage. De Jong et al. (2007) investigated firm-specific and macroeconomic factors affecting leverage ratio in 42 countries (some developed countries and some developing countries). The results showed that the capital structure of different countries is dissimilar and macroeconomic factors have both direct and indirect effects on leverage. Nevertheless, they introduced tangibility of assets, business risk, firm size, tax, growth, profitability and liquidity as firm-specific variables and countries' financial regulation, shareholder and creditors' legal regulation, being bank-based or market-based of the financial system, development level of debt and equity market, investment formation and GDP growth as macroeconomic variables of capital structure. Frank and Goyal (2009) conducted analogous research on the US pubic stock firms from 1950 to 2003 that the results evinced industry debt median, market-to-book value of assets, tangibility of assets, earnings, logarithm of assets and expected inflation to have a relationship with capital structure. It was also performed that firms with dividend strategy have a lower inclination to finance via borrowing. Baker and Martin (2011) explained tangibility of assets, firm size, growth opportunities, profitability, cash volatility, industry classification, tax considerations, debt rank of the firm and debt market, equity market and macroeconomic conditions as determinants of capital structure. In this trend, Oztekin (2015) studied capital structure in 37 countries and declared firm size, tangibility of assets, industry leverage ratio mean, profitability and inflation the most important and significant factors influencing capital structure.

In the realm of previous researches on the capital structure of oil, gas and petroleum companies, Emeh and Okoli (2015) studied the capital structure of oil and gas companies listed in Nigeria Stock Exchange from 1990 to 2012. The results indicated a significant effect of profitability, tangibility of assets, tax shield, size, growth opportunities and earning volatility on capital structure. Shambor (2017) in an endeavor to find the determinants of capital structure in oil and gas companies, analyzed data of 346 companies included in OILGSWD from 2000 to 2015. It was evinced that tangibility of assets, profitability, size, liquidity and tax shield have a significant relationship with leverage; while there was no relationship between leverage and growth.

On the other hand, there is a wide range of researches developed the literature on the impact of sanctions on macroeconomic variables. For instance, Farzanegan and Hayo (2018) used 2001-2013

Iranian-province-level data to affirm that international 2012 sanctions had a significantly stronger negative impact on the shadow economy than they had on the official GDP growth rate. Barkhordari and Jalili (2018) found that the US sanctions in 2012 had a significant impact on the increasing exchange rate of Iran. Ghorbani Dastgerdi et al. (2018) investigated the nexus between economic sanctions and inflation in Iran and the results indicated that economic sanctions increase the expected inflation and prompt higher inflation. Nademi et al. (2018) evinced that Iran sanctions have some direct and indirect impacts on the economy. The macroeconomic variables directly increased by the sanctions are exchange rate, the gap between official and market exchange rate and exchange rate fluctuations. On the other hand, the unemployment rate and inflation rate are indirectly raised by increasing the gap between official and market exchange rates as a result of imposing sanctions. In an attempt to study stock market volatility under sanctions, Goudarzi (2014) showed that the Iranian stock market has not been influenced by the sanctions. Furthermore, the results of Ankudinov et al. (2017) indicated that for almost all sector indices of Russian market return, there was a statistically significant relationship between them and the imposed sanctions but it did not lead to a structural break. Garshasbi and Yousefi (2016) evaluated the effects of Iran sanctions on macroeconomic variables via indexing sanctions and found the direct impacts only on the economic growth rate.

As we mentioned before there are so few studies about the nexus of sanctions and firm-specific level variables. In this milieu, Kordlouie et al. (2018) aimed to investigate the impact of sanctions on the cost of capital for Tehran Stock Exchange companies. They concluded that 2010 sanctions did not have a significant effect on firms' cost of capital. Additionally, Vladislav et al. (2020) analyzed the factors affecting the profitability of Russian enterprises active in the manufacturing industry from 2012 to 2016 in the time of sanction and crisis and introduced some different influencing factors for different subcategories.

3. Data and Methods

In the present study, we consider leverage ratio as the dependent variable, dummy variable of sanction as the independent variable and some control variables according to previous researches. Our control variables are ROA, tangibility of assets (firm-specific factors), capital market return, economic growth rate and inflation rate (macroeconomic factors). Moreover, many financial variables are influenced by themselves with a lag. To consider the role of time and to avoid the possible endogeneity, we include leverage ratio with one lag of time to our independent variable. Our statistical society is oil, gas and petroleum companies listed in Tehran Stock Exchange that their financial data is flawless during the study period (2006-2018). The research method harnessed in our work is regression analysis via Ordinary Least Square. Data gathering was conducted by observing financial statements of mentioned companies and macroeconomic data of Iran. Defining variables can be seen in table 1.

Table 1. defining variables

Variable	Measurement Criterion	Label
leverage	total debt/total assets	Lev
sanction dummy variable	0 for 2006-2011 and 1 for 2012-2018	Dummy
ROA	gross profit/total assets	ROA
tangibility of assets	fixed assets/total assets	Tan

capital market return	(market return in current year- market return in previous year)/market return in previous year	Cap_Market_Return
economic growth	yearly economic growth	Eco_Growth
inflation rate	yearly inflation rate	Inf_Rate

Moreover, a data summary of the variables is provided in table 2.

Table 2. Data summary of variables (oil, gas and petroleum companies)

Variable	Number of Observations	Mean	Standard Deviation	Maximum	Minimum
leverage	143	0.553835	0.194974	0.969692	0.108760
sanction dummy variable	13	-	-	-	-
ROA	143	0.272558	0.167318	0.642599	-0.2266
tangibility of assets	143	0.382975	0.205363	0.938626	0.035056
capital market return	13	0.314124	0.40703	1.077122	-0.20982
economic growth	13	1.976923	5.051756	12.5	-7.7
inflation rate	13	18.5426	8.800902	34.7	8.736908

Source. corporates' financial statements and Central Bank of Iran

Our main question is whether the 2012 oil sanctions against Iran have a significant impact on oil industry capital structure decisions or not. To address this question, we define the econometric equation as follows:

$$Lev_{it} = \alpha_i + \beta X_{it} + u_{it}; i = 1,2,\dots,n, t = 1,2,\dots,n, \tag{1}$$

Where Lev_{it} is the dependent variable of company i in year t, α_i is the intercept, β is the independent variables coefficient vector, X_{it} is the independent variable vector of company i in year t and u_{it} is the error term.

First of all, for regression analysis of panel data, we conduct the unit root test in order to check data stationery at firm-specific level. For this aim, we use Levin, Lin & Chu method. The null hypothesis is lacking data stationery. The results are demonstrated in table 3.

Table 3. the results of unit root test via Levin, Lin & Chu method (oil, gas and petroleum companies)

Criteria / Variable	T-Statistic	Probability	Test Result
leverage	-2.30983	0.0104	stationery proof

sanction dummy variable	-	-	-
ROA	-2.22593	0.0130	stationery proof
tangibility of assets	-5.40966	0.0000	stationery proof
capital market return	-7.98884	0.0000	stationery proof
economic growth	-7.23907	0.0000	stationery proof
inflation rate	-1.52019	0.0642	at first difference

Previous studies evinced that the determinants of capital structure in different industries are different. Harris and Raviv (1991) mentioned that the leverage ratio for companies active in a similar industry is alike and for companies active in dissimilar industries is different. This fact stimulates us to find out if oil sanction has an impact on the corporate capital structure of other industries. As a sample, we attempt to answer the same question of our study for the cement industry. The cement industry is a principal industry because it is a major raw material for construction which is a high-value determinant of Iran's economy. So, we want to know whether oil sanction also influences the capital structure of corporates active in cement industry as a mother industry or not.

To address the above question, we conduct the same implementation for the cement industry. Therefore, the OLS equation is as equation 1.

Defining variables is the same as those in table 1. The data summary of variables is indicated in table 4.

Table 4. Data summary of variables (cement companies)

Variable	Number of Observations	Mean	Standard Deviation	Maximum	Minimum
leverage	169	0.562010	0.167009	0.999067	0.166645
sanction dummy variable	13	-	-	-	-
ROA	169	0.244530	0.138099	0.727888	0.014896
tangibility of assets	169	0.455854	0.209337	0.892203	0.088455
capital market return	13	0.314124	0.40703	1.077122	-0.20982
economic growth	13	1.976923	5.051756	12.5	-7.7
inflation rate	13	18.5426	8.800902	34.7	8.736908

Source. corporates' financial statements and Central Bank of Iran

Furthermore, the results of unit root test can be seen in table 5.

Table 5. the results of unit root test via Levin, Lin & Chu method (cement companies)

Criteria Variable	T-Statistic	Probability	Test Result
leverage	-5.41366	0.0000	stationery proof
sanction dummy variable	-	-	-
ROA	-11.7834	0.0000	stationery proof
tangibility of assets	1.02703	0.8478	at first difference
capital market return	-7.98884	0.0000	stationery proof
economic growth	-7.23907	0.0000	stationery proof
inflation rate	-1.52019	0.0642	at first difference

Next, we use the cointegration test to know whether there is a long-term relationship between dependent and independent variables or not. For this purpose, we use the Kao cointegration test. The null hypothesis in this test is the absence of cointegration. The results are shown in table 6. In tables 6 to 8, the first and the second rows indicate the test result for oil companies and cement companies, respectively.

Table 6. the result of Kao test

Criteria Test	T-Statistic	Probability	Test Result
Kao	-2.479826	0.0066	cointegration proof
Kao	-1.637910	0.0500	cointegration proof

Now, to estimate the regression model, it is necessary to conduct F Limer (Chow) test to determine whether we utilize pooled data or panel data analysis. The null hypothesis is using pooled data analysis. The results are presented in table 7.

Table 7. the result of F Limer test

Criteria Test	T-Statistic	Probability	Test Result
F Limer	6.481157	0.0000	panel data analysis proof
F Limer	3.055564	0.0018	panel data analysis proof

After indication of utilizing panel data analysis, we implement the Hausman test to specify estimation with random effects model or fixed effects model. The null hypothesis is using the random effects model. The results are shown in table 8.

Table 8. the result of Hausman test

Criteria Test	T-Statistic	Probability	Test Result
Hausman	0.000000	1.0000	random effects model
Hausman	0.000000	1.0000	random effects model

4. Results and Discussion

4.1. Regression Phase

The results of estimating equation for oil, gas and petroleum companies and cement companies are shown in tables 9 and 10, respectively.

Table 9. the results of estimating equation 1 (oil, gas and petroleum companies)

Variable	Coefficient	T-statistic	Probability	Result (95%)
leverage (-1)	0.742973	17.37444	0.0000	accepted
sanction dummy variable	-0.080603	-4.794647	0.0000	accepted
ROA	-0.441355	-7.315229	0.0000	accepted
tangibility of assets	-0.244776	-4.629279	0.0000	accepted
capital market return	-0.066160	-3.569539	0.0005	accepted
economic growth	-0.001524	-0.984854	0.3266	rejected
inflation rate	0.001431	1.631533	0.1053	rejected
R-squared=0.815346				

As indicated in table 9, sanction has a negative and significant effect on oil, gas and petroleum companies' leverage ratio.

Table 10. the results of estimating equation 1 (cement companies)

Variable	Coefficient	T-statistic	Probability	Result (95%)
leverage (-1)	0.750742	18.70465	0.0000	accepted
sanction dummy variable	0.009814	0.778631	0.4374	rejected
ROA	-0.292427	-5.240632	0.0000	accepted
tangibility of assets	-0.031385	-1.044858	0.2978	rejected
capital market return	-0.018488	-1.335203	0.1839	rejected
economic growth	0.000684	0.964263	0.3365	rejected
inflation rate	0.003182	2.723994	0.0072	accepted
R-squared=0.786781				

As indicated in table 10, sanction has not a significant effect on cement companies' leverage ratio.

4.2. Forecasting Phase

In this part of the study, our purpose is to predict the capital structure trend in oil, gas and petroleum for the next period according to our regression model. In order to achieve this objective, we want to examine whether our model is reliable for forecasting or not. In other words, our intention is to test our predictability of the obtained model. Thus, we re-estimate equation 1 in the period of 2006 to 2017 and forecast leverage ratio for 2018 and calculate RMSE for determining the prediction error. The results of re-estimation are provided in table 11.

Table 11. the results of re-estimating equation 1 for oil, gas and petroleum companies from 2006-2017

Variable	Coefficient	T-statistic	Probability	Result (95%)
leverage (-1)	0.714585	15.23632	0.0000	accepted
sanction dummy variable	-0.074967	-4.342203	0.0000	accepted
ROA	-0.499476	-7.601588	0.0000	accepted
tangibility of assets	-0.258642	-4.443987	0.0000	accepted
capital market return	-0.062096	-3.265136	0.0014	accepted
economic growth	-0.001436	-0.800475	0.4251	rejected
inflation rate	0.001579	1.470178	0.1443	rejected
R-squared=0.798697				

Now in table 12 the forecasted and the real amounts of corporates leverage ratio are brought together and RMSE is calculated.

Table 12. comparing 2018 forecasted and real values of leverage ratio for oil, gas and petroleum companies and calculated RMSE

Forecasted Leverage Ratio	Real Leverage Ratio
0.379208	0.377594
0.305825	0.274656
0.448577	0.332688
0.711007	0.718613
0.502482	0.510103
0.420022	0.636117
0.557451	0.664377
0.427612	0.401783
0.368014	0.305837
0.603346	0.603725
0.258474	0.208362
RMSE=0.085118	

Source. corporates' financial statements and present study

The calculated RMSE, considering our data range, is acceptable and our forecast is admissible. Consequently, we can predict the capital structure trend for 2019 and 2020 with the results shown in table 9.

We harness the estimated equation for oil, gas and petroleum companies from 2006 to 2018. Initially, we forecast the significant independent variables indicated in table 9 according to their 2006 to 2018 trends. Then, we predict our dependent variable by placing our forecasted values in the regression we had achieved. Table 13 shows the results of the prediction.

Table 13. forecasting leverage ratio in 2019 and 2020

Forecasted ROA	Forecasted Tangibility of Assets	Forecasted Capital Market Return	Forecasted Leverage Ratio
0.380387	0.414155	0.493112	0.299328
0.411802	0.387199	0.518681	0.231175
0.494158	-0.036760	0.493112	0.259065
0.530263	-0.083140	0.518681	0.264106
0.311540	0.196971	0.493112	0.384803
0.319318	0.177214	0.518681	0.386898
0.246120	0.184724	0.493112	0.447796
0.239714	0.163009	0.518681	0.472311
0.292803	0.219007	0.493112	0.422957
0.307938	0.191023	0.518681	0.416888
0.305192	0.098444	0.493112	0.555649
0.295798	0.086209	0.518681	0.546488
-0.062590	0.694462	0.493112	0.494873
-0.085480	0.719754	0.518681	0.514537
0.404493	0.184092	0.493112	0.268664
0.393827	0.174097	0.518681	0.268488
0.568698	-0.077300	0.493112	0.274970
0.591238	-0.133890	0.518681	0.261431
0.426631	0.038047	0.493112	0.437641
0.443121	-0.005020	0.518681	0.416121
0.445198	0.229647	0.493112	0.199212
0.481449	0.173718	0.518681	0.178308

Note. The upper and lower numbers in each cell indicate forecasted values for 2019 and 2020, respectively.

5. Conclusions

The results of our study reveal that Iran's 2012 oil sanctions affect oil companies' leverage ratio negatively and do not have a significant impact on cement companies leverage' ratio. Conclusively, we hit two birds with one stone. We disclose that not only oil sanctions have a direct relationship with oil companies' capital structure and have nothing to do with cement industry financing policies, but also the capital structure of companies with different industries have different determinants. This conclusion supports Harris and Raviv (1991).

To explain how oil sanctions affect oil companies' leverage ratio, we can flashback to previous researches. Iran's economy is majorly based on oil, gas and their derivations and in the time of sanction exposure, the intention of the government to produce and sell oil will be at the highest level. Therefore, oil companies will need to be financed. On the other hand, we have mentioned that imposing sanctions

increase the exchange rate and it has happened in Iran as well. This phenomenon is beneficial for export companies that their revenue is in currencies more powerful than Rial and it enhances their profitability and investors will be attracted to them. Moreover, Iran's capital market return showed a significant escalation and many people were convinced to participate in Tehran Stock Exchange. As a result, these investors were encouraged to purchase oil companies' shares. So, because of cooperating these factors, the share of equity in financing decisions has increased and oil sanctions have had a direct negative and significant impact on oil companies' capital structure.

Furthermore, our forecasting results indicate that the leverage ratio will be decreased in 2019 and 2020. The mean of studied oil companies' leverage ratio in 2018 is 0.452911. Nevertheless, we predict that it will be dropped to 0.367723 and 0.359705 in 2019 and 2020, respectively. Therefore, it can be observed that the share of equity in oil companies' capital structure will be continually increasing.

This study has some proposals for both corporate managers and macroeconomic policymakers. According to the results, the share of debt financing in oil companies' capital structure is decreasing. Therefore, they will be deprived of debt financing benefits and this will be a negative point for both oil companies and the banking system as the main creditor of Iran's economy. As a result, policymakers should be aware of this threat and plan some strategies to lift the oil sanctions. Our research builds a bridge between microeconomics and macroeconomics. We suggest investigating the effects of sanctions on other firm-specific factors like corporates profitability or studying these impacts on other industries rather than oil and cement industries. It can be conducted via other econometric or even machine learning methods.

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