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Relationship between Financial Leverage and Firm Growth in the Oil and Gas Industry: Evidence from OPEC

Seyed Mohammad Javadi [a*], Abbas Alimoradi[b], Mohammadreza Ashtiani[c]

[a] Assistant Professor, Accounting Department, Petroleum Faculty of Tehran, Petroleum University of Technology, Iran. Email: javadi@put.ac.ir
[b] Assistant Professor, Accounting Department, Petroleum Faculty of Tehran, Petroleum University of Technology, Iran. Email: alimoradi@put.ac.ir
[c] MA in Oil & Gas Economics, Petroleum Faculty of Tehran, Petroleum University of Technology, Iran, Email: m.ashtiani.1361@gmail.com

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ABSTRACT

Recent theories of firm dynamics emphasize on the role of financial variables as determinants of firm growth. Most of the technical literature shows that there is a positive relationship between financial leverage and firm growth. The purpose of this paper is to examine whether such relationship exists among oil and gas companies within the Organization of the Petroleum Exporting Countries (OPEC). Data were collected from the selected members of the OPEC. The collected data was then analyzed using the Arellano and Bond (1991) GMM method and Sargan test. The results showed a significant and positive relationship between financial leverage and firm growth which is in line with the technical literature. This research contributes to the body of knowledge by examining a specific and important sector within several different countries. It shows the current theory is not affected by industry or country.

1. Introduction

The relationship between capital structure and growth of a company has been subject of a long-standing debate over within the discipline of accounting and financial management disciplines. Although a capital structure appropriate to one specific firm is not necessarily suitable for other firms from other industries or sectors, but the investigation of capital structure mixture helps to determine and control the leverage that will improve companies' performance in their environments.

A growing firm is defined as: "A company which is growing at a rapid pace compared to its peers or to the broad economy. However, there is no hard-and-fast rule to define the growth of a firm.

Harris and Raviv (1991) recognized four broad categories of underlying elements which affect a firm's level of leverage. First, there is an agency attitude stating that an assumed capital structure is determined by the inter-dynamics of numerous groups of stakeholders who claim the firm's assets. Second, managers with high levels of individualism may select lower liability to maximize achievements and increase their reputation. The internal relationships is alleviated by capital structure decisions through simplified signaling between interested parties. Third, the theory of business enterprise implies that mixture of capital structure of a firm is affected by company's characteristics, such as its strategy, products, market, and resources available. Finally, competitions on financing with the aim of taking control of a firm is a determining factor.

* Corresponding Author

2. Financial leverage and growth opportunity

It is important how leverage and firm growth are correlated and capital structure mixture can help alleviate possible conflicts amongst stockholders and managers in an agency (Stulz, 1988). Prior literature has found relations between leverage and other variables in the corporate setting. For example, according to Harris and Raviv (1991), leverage is directly related to firm size, fixed assets, non-debt tax shields, as well as firm value, while it is negatively associated with features such as advertising expenditure, profitability, volatility, and the possibility of bankruptcy. Some studies have even shown a negative connection between leverage and growth opportunities over its impact on cash flow (Jensen and Meckling, 1976; Stulz, 1988).

Naturally, both positive and negative features of debt financing are specified for all firms. However, McConnell and Servaes (1995) assert the predominant effect of debt financing is a role of accessibilities of investment opportunities faced by that firm. Or for "high-growth" organizations with many growth opportunities, negative effects are predominated. As the debt payment decreases funds, managers are forced to pass on positive NPV projects. On the other side, for "low-growth" organizations with limited growth opportunities, positive effects of debt dominate as it restricts the fund accessible for managers to follow investment activities with value damaging nature. This result proposes that depending on perceived future growth determined by Tobin's Q, leverage changes growth in a different manner.

3. Literature review

There is a wide range of theoretical and empirical literature related to the capital structure (leverage level) in a firm and its relationship with other firm specifications. Some of researchers showed that there is a dependency structure between financial and economic markets (Awan et al., 2010).

Modigliani and Miller's (1958) study has contributed significantly to the theoretical framework of finance literature (Abor, 2005). They proved that capital structure in the absence of tax is irrelevant to the firm value. Their proposition (I) is built on the assumption of a perfect market where there is no tax and bankruptcy costs.

Five years after announcement of proposition (I), Modigliani and Miller (1963) revised their conclusion about the relationship between a firm value and its mixture of liability and equity, and the capital structure. They realized that a tax shield can be created by using liability.

Debt financing results is a decrease in the firm's tax expense. In this regard, they recommended that a perfect capital structure for a firm is the one that solely uses debt, but not equity. This is identified as "MM Proposition (II)'.

Donaldson (1961) by using the pecking order theory conducted a qualitative research and interviewed 25 big US companies. He concluded that management strongly intends to use internal funds of the firm if available and accessible and does not prefer to use external sources of capital structure. In this condition, internal funds and debt tools are chosen for financing. In summary, this theory implies that firms consider all existing financing techniques to choose the least expensive one.

The trade-off theory sheds light on the effect of resources on a firm's decision of picking debt or equity to finance its projects. It suggests that a company uses liability if it has a great amount of tangible assets (well liquidation value) and has ability to choose equity if a substantial share of the firm's assets is intangible (Harris and Raviv, 1991). Furthermore, the trade-off theory expresses that the benefits are accessible through tax liabilities, despite the vital threat of bankruptcy. It recommends firms to provide and control optimal debt–equity ratios (Graham, 2000).

Graham (2000) argued that a normal firm might double its tax benefits by supplying liability securities until the marginal tax benefit starts to decline. He showed that how tax benefit advantage motivates a firm to use debt financing approach. Product market factors, low asset collateral, growth options and planning for future costs results in conservative debt issuance.

Hung et al. (2002) discovered an indirect association between high leverage and company performance, for example profit margin, in Hong Kong stock market. Hovakimian, et al. (2001) examined the hypothesis that "firms tend to move toward a target debt ratio when they either raise new capital or retire or repurchase existing capital". Most of their concepts of capital structure choice came from the trade-off theory, which asserts there is a trade-off between the costs and interests of liability and financing equity.

Aivazian et al. (2005) examined the impact of financial leverage on firms' investment decisions in Canada's stock market. They found that "leverage is negatively related to investment and this negative effect is significantly stronger for firms with low growth opportunities than those with high growth opportunities".

Huynh and Petrunia (2010) studied the effects of age and leverage on firm growth. They argued that empirical examination of the relationships between financial variables and determinants of firm growth was difficult. They used a set of administrative data from a Canadian manufacturing firm and found that leverage and finance size as financial factors can affect growth rates of new firms.

Poblete and Grimsholm (2010) investigated internal and external factors hampering SME growth in Thailand. There were a number of constraints to SME firm growth. They found some internal factors such as poor management, lack of skilled labor and little investment on R&D.

Mazhar and Nasr (2010) showed the choice of liability or equity might vary from one organization to another due to each firm's specific conditions. Corporations pick different sources of fund. Bistrova, et al. (2011) detected indications in support of the pecking order theory. Their study exhibited a negative association between the amount of debt and capital profitability. Hereafter, organizations should not use external sources if they can provide internal cash funds.

Rahaman (2011) in a study entitled: "access to financing and firm growth" used a sample of quoted and unquoted firms to evaluate the effect of financial structure on firm growth. Results were statistically significant and quantitatively important. He concluded that in the presence of external financing constraints, firms rely more on internal funds to finance growth, but the effect of internal financing on firm growth decreases with an increase in the firm's access to an external bank credit facility.

Bei and Wijewardana (2012) investigated the relationship between financial leverage and firm growth and financial strength in Sri Lanka. They argued that financial leverage is a factor that contributes to the determination of financial growth.

The above mentioned studies provide a nutshell of the literature in this area. However none of them has focused on a specific sector, particularly the oil and gas. Furthermore. They were conducted in a country and had not investigated the phenomenon among different countries.

4. Data collection

Table 1 below has provided information of the companies and countries which financial data for the pur-

Table 1: Summary of selected oil and gas companies in OPEC

No.	Company	Country	Source	No.	Company	Country	Source
1	Abadan Petro	Iran	www.codal.ir	19	Alco	Saudi Arabia	www.gulfbase.com
2	Fanavaran Petro			20	Appc		
3	Farabi Petro			21	Chemanol		
4	Kermanshah Petro			22	Gasco		
5	Kharg Petro			23	Kayan		
6	Khorasan Petro			24	Nama		
7	Pardis Petro			25	Nic		
8	Petro Indus			26	Petrochem		
9	Shazand Petro			27	Petrorabigh		
10	Shiraz Petro			28	Sabic		
11	Zagros Petro			29	Sipchem		
12	Abar	Kuwait	www.gulfbase.com	30	Spco		
13	Energyh			31	Yansab		
14	Gpi			32	Dana	UAE	
15	Ikarus						
16	Ipg						
17	Marin			33	Taqa		
18	Napesco						

pose of the study were extracted from. They are 33 companies from four members of the OPEC which have created the final sample of the research.

There are currently thirteen members in the OPEC. They are Iran, Saudi Arabia, UAE, Kuwait, Algeria, Angola, Ecuador, Indonesia, Iraq, Libya, Nigeria, Qatar and Venezuela. Two countries (Angola and Ecuador) from the OPEC had no stock exchange market and consequently there were no data available for them. As a result, they have been removed from the sample. Furthermore, there were four countries (Venezuela, Algeria, Iraq and Libya) which had stock exchange markets but did not have oil and gas companies. In fact, oil and gas projects in these countries are operated by foreign and international companies. Finally, other three countries were also omitted from the sample, because of the lack of enough data for analysis.

5. Research hypotheses

The research hypotheses were derived and developed from Wu (2013). After an in depth consideration and investigation of the related literature, the following research hypotheses were selected and developed.

Most of the previous research about the capital structure and growth measures show a meaningful but negative relationship between financial leverage and firm growth (see for example; Lang et al. (1996) and Rahaman (2011)). Therefore, the first hypothesis of the research is formed as:

Hypothesis 1: There is relationship between financial leverage and firm growth.

On the other hand, capital structure literature implies that firms with valued growth opportunities are expected to have relatively low level of debt. Such claim is also supported by many studies such as Rahaman (2011) who showed with high Tobin's Q (as a sign of high growth opportunities) firms are likely to issue equity rather than debt or bonds when raising fund. Furthermore, Lang et al. (1996) and Hurme (2010) found that the correlation between financial leverage and firm growth measure is more intensive for firms with limited investment opportunities, i.e. low Tobin's Q firms. For high Tobin's Q firms (whose great growth opportunities are acknowledged by external investors) underinvestment problem caused by debt extension is less than other firms. So, the next research hypothesis is made as below:

Hypothesis 2: Financial leverage affects firm growth measure differently compared to Tobin's Q firms.

High Tobin's Q firms are expected to exhibit less correlation between financial leverage and growth measures than low Tobin's Q firms.

According to Lang et al. (1996) the expected effects of financial leverage on firm growth should be weaker amongst large firms than their smaller peers. As a firm enhances and increases in size and matures over years, it gains more access to capital markets and stock exchanges. Such firms can present themselves to stockholders and potential investors. Thus, firms with high external financing options in hand can finance their growth in one way or another and despite smaller companies are less limited by their level of leverage. Therefore, growth opportunities in large firms are supported by creditors. So:

Hypothesis 3: Leverage affects firm growth differently based on firm size.

Based on such expectation, the correlation between leverage and firm growth measures is expected to be stronger amongst smaller companies.

6. Research Model and Methodology

The main pooled data set of this study consists of oil and gas firms whose activities are focused in OPEC. Foreign companies' data have been collected from gulfbase website *(gulfbase.com)* (GCC stock market) and for the Iranian companies from *codal.ir* (Tehran Stock Exchange official website for publication of companies' data) as well as *Rahavard Novin* database. The *Gulfbase website* was used to retrieve data for stocks traded in Stock Exchange markets of the Persian Gulf countries.

The research statistical population included companies active in the oil and gas industry from the OPEC members. Since the research is solely concentrated on one single industry, so there is no bias over industry differences. Those companies remained in the sample which had at least five years data for all variables of the research model. Convenience sampling was used for this study. The convenience sampling is in fact a non-probability sampling technique which selects subjects and samples based on their convenient accessibility, data availability, and proximity to the researcher.

The basic model of this research which is adopted from Rahaman (2011) is as follows:

$$Yit = \alpha + \beta Yit\text{-}1 + X`\ it\text{-}1\ \theta + Z`it\text{-}1\ \delta + \mu it$$

Symbols and proxies of the research model are defined in Table 2.

In the above mentioned model, dependent variable is the "firm growth" in a specific period "Y". On the right hand side of the equation; "X" is the "control variable"

Table 2: tails of Regression Formula

Symbol	Description	Proxy
Y_{it}	Dependent variable	Firm growth
α_1	Intercept	-
α_2	The coefficient of lag dependent variable	-
Y_{it-1}	1 year lag dependent variable	Firm growth in 1 year ago
$X`_{it-1}$	Control variables vector	Cash, Age, Capital expenditure
α_3	Coefficient vector of control variables	-
$Z`_{it-1}$	Independent variable	Firm leverage
α_4	Coefficient vector of independent variable	-
α_5	Coefficient vector of moderator variable	
W	Moderator	Tobin's Q , Size
α_6	Coefficient vector of dummy variable	
D	Dummy variables	Country, Business Cycle
μ	Error term	-

and "Z" represents the "firm leverage", and finally "μ" is the "error term" in the regression model. It should be mentioned that the above basic model has been modified and adjusted for this research. The conceptual model (framework) of the research is illustrated in Figure 1 below.

Research hypotheses and regression techniques are summarized in Table 3.

7. Research Variables

As it is illustrated in Figure 1, five types of different variables (dependent, independent, control, moderator, and dummy) are used in the research model. They are described and explained in the following.

7.1. Dependent variable

Sales growth is one of the growth measures. A growing company has a great capability to increase its sales and revenue beyond the industry average over a sustained period of time. A company is not classified as a growing firm on the basis of one-time surge in revenues; rather, growth has to be established over a number of years. Sales growth is a continuous variable measured by dividing sales in year 1 by sales in year 0.

$$\text{Sales growth (1)} = \frac{\text{sales (1)-sales (0)}}{\text{sales (0)}}$$

7.2. Independent variables

This paper sets out to investigate the relationship

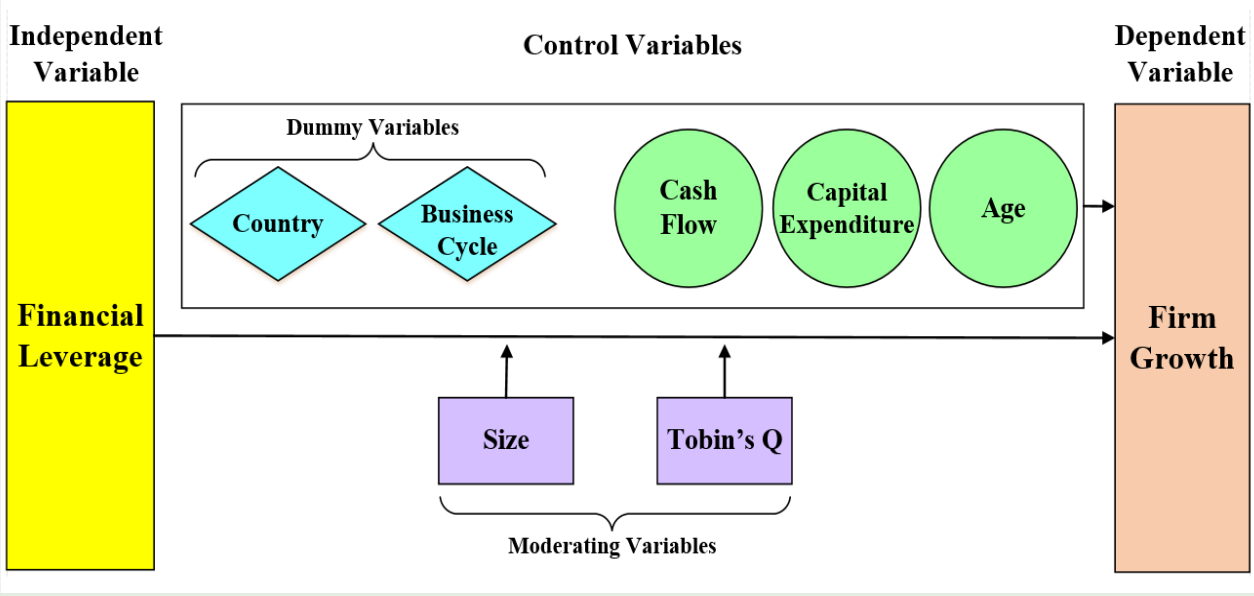

Figure 1: Conceptual model (framework) of the research

between firm's financial leverage and growth; thus, it is important to clearly justify the choice of leverage. It has been defined here as the ratio of the book value of both short-term and long-term debt to the book value of total assets. This definition is taken from Rahaman (2011). The reason for using book value rather than market value is to avoid from incorporating too much recent changes in the firm's equity values, which reflects market expectation of firm growth.

$$\text{Leverage}=\frac{\text{BV (Debt)}}{\text{BV (Total Assets)}}$$

7.3. Control variables

In order to precisely investigate the relationship between leverage and five growth measures, it is important to control various factors that may have impacts on the growth measures. The impacts of these variables are controlled and omitted from the model.

Cash flow is a continuous variable that measures the availability of internal funds for investment. Net interest expenses in year 1 is added back to raw cash flow of year 1 to form the net interest expense in order to remove effects of a given level of leverage. Cash flow is standardized through dividing it by total assets of year 0.

$$\text{Cash } flow\ (1)=\frac{\text{Raw Cash flow (1)+Net interest expenses (1)}}{\text{Total assets (0)}}$$

Capital expenditure affects net investment growth measures indirectly and capital expenditure growth measures directly. Thus, it should be added to the multivariable regression as a control variable.

Capital expenditure is a continuous variable calculated by dividing capital expenditure in year 1 by fixed assets in year 0.

$$\text{Capital Expenditure (1)}=\frac{\text{Capital expenditure (1)}}{\text{Fixed assets (0)}}$$

Age: Increasing literature in economics and finance discusses that firm age is an important element of its performance variability. On average, small firms are younger than large firms, and their lack of understanding of business rules of game, industry specifications and competitions. Firm age in this study is calculated as a proxy of the number of years that a firm has been active in the sector since its establishment. It is obvious that distribution of small firms age, stochastically dominates distribution of large firms age. In fact, small firms are, on average, younger than large firms (Rahaman, 2011).

7.4 Dummy variables

Since the data set under consideration consists of four different sovereign nations with vastly different accounting, cultural and legal background, it is important to control potential differences due to country origin of a particular observation.

Country is a binary variable for each of the four countries included in the data sample. The "1" value for a particular country indicates that the data relate to the normal year(s). Otherwise the value is 0.

Business cycles affect the firm growth and may result in a relationship with leverage if the firm has less debt at the same time (Wu, 2013). So, economic cycle is a binary variable indicating the general categorical economic environment of an observation to be either "abnormal" or "normal" (Wu, 2013). There have been volatilities in the oil prices during years 2006-2011. On the other hand, there has also been a challenging credit crunch and global recession that could affect results of the research. So this study should neutralize the effects of such confounding variable(s). The dummy variables receives a value of 1 if data is gathered from normal years. Abnormal years refer to the stock bubble and recession years (2010-2011), whereas normal years cover the intermediate years (2012-2014).

8. Data analysis

The Arellano and Bond (1991) GMM estimator omits the firm-fixed effects via first-differencing and employs lagged levels of the dependent variable and the predetermined variables as well as differences of the exogenous variables (Xit-1) as instruments in the situation

Table 3: Summary of hypotheses and formula

No.	Hypotheses	Formula
1	There is relationship between financial leverage and firm growth.	$Y_{it} = \alpha_1 + \alpha_2 Yit\text{-}1 + \alpha_3 X`it\text{-}1 + \alpha_4 Z`it\text{-}1 + \alpha_6 D` + \mu_{it}$
2	There is relationship between Tobin's Q and firm growth.	$Y_{it}=\alpha_1+\alpha_2 Y_{it-1}+\alpha_3 X`_{it-1}+\alpha_4 Z`_{it-1}+\alpha_5 W`_{it-1} * Z`_{it-1}+\alpha_6 D`+\mu_{it}$
3	There is relationship between size of the firm and firm growth.	$Y_{it}=\alpha_1+\alpha_2 Y_{it-1}+\alpha_3 X`_{it-1}+\alpha_4 Z`_{it-1}+\alpha_5 W`_{it-1} * Z`_{it-1}+\alpha_6 D`+\mu_{it}$

of no second-order autocorrelation in the εit.

GMM is a strong estimator therein. It is different from the Maximum Likelihood Estimation (MLE) as it does not need evidence for precise distribution of disturbances. In practice, many well-known and popular estimators in econometrics can be considered as special cases of GMM. For example, the Ordinary Least Squares (OLS) estimator can be seen as a GMM estimator, based upon the settings that each right-hand side of variables is uncorrelated to the residual.

Advantages of application of the dynamic GMM panel model are as follows:

1) Endogenous problem that occurs when an independent variable is correlated to the error term in the regression model is simply solved in dynamic panel data models rather than in static models (ÇOBAN, 2014).

2) Reduction or elimination of collinearity in regression model; using lagged and dependent variables causes collinearity being removed.

3) Static variables removal over time. This method leads to the removal of many variables that get static over time, causing bias in the regression estimation (Baltagi, 2008).

4) Dynamic panel data estimation is more appropriate in cases where time dimension is smaller than firm dimension, and also some factors affect dependent and explanatory variables. This is likely to be the case in regressions of leverage on growth.

With regard to the brief explanation, the GMM method was considered to be the best estimator for this study.

9. Empirical Results

Determination of the relationship between explanatory variables is done by correlation coefficient matrix.

Table 4 shows the correlation coefficients of the explanatory variables employed in the study.

10. Panel-based unit root test

Recent literature suggests that panel-based unit root tests have higher power than unit root tests based on individual time series. In statistics, a unit root test examines whether a time series variable is non-stationary and that possesses a unit root. The null hypothesis is generally defined as the presence of a unit root and the alternative hypothesis is either stationary, trend stationary or explosive root depending on the test applied. In this study Fisher unit root test has been employed. Fisher-type (Choi 2001) tests have the same null hypothesis as all panels containing a unit root. The results are shown in the Table 5.

Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality. As shown in Table 5 P-value is less 0.05. So the data involved in this research are stationary.

Similar to any other instrumental variable estimators, for GMM estimator to be identified, there must be at least the same number of instruments as parameters in the model. Cash, capital expenditure and age are instrument parameters in the empirical model. If there are

Table 4: Correlation Coefficients matrix of variables

Covariance Correlation	AGE	CAPEX	CASH	GROWTH	TOBIN	SIZE	LEVERAGE
AGE	200.6065 1.000000						
CAPEX	0.347896 0.186850	0.017281 1.000000					
CASH	-0.277308 -0.210267	-0.000738 -0.060303	0.008670 1.000000				
GROWTH	0.419032 0.065501	0.004180 0.070392	-0.003144 -0.074750	0.204009 1.000000			
TOBIN	0.197251 0.025191	0.0000057 0.0000783	0.018526 0.359881	0.067630 0.270836	0.305648 1.000000		
SIZE	-3.446167 -0.241130	-0.000126 -0.000951	0.009678 0.103004	0.024124 0.052931	0.112812 0.202223	1.018185 1.000000	
LEVERAGE	0.359876 0.106299	0.001136 0.036149	-0.003363 -0.151105	0.000365 0.003380	-0.023352 -0.176709	0.090118 0.373634	0.057135 1.000000

more instruments than parameters, the value of the optimized objective function will be greater than zero. In fact, the value of the objective function, termed J-statistic, can be used as a test of over-identifying moment conditions.

In this study thirty three firm-year data in a period of five years from 2012 to 2016 were collected and used. So the total number of observations were equal to 165. Table 6 shows descriptive statistics for variables employed in the research.

As shown in Table 6, the average of firms leverage equals 0.503, meaning capital structure of companies is divided equally between debt and equity.

Average of the firm growth equals 0.86 indicating that companies had suitable growth rate during 2010-2014. One of the main reasons for this growth rate is the lag dependent variable in model, which might have affected the growth rate.

Table 5: Summary of panel unit root test

Variable - series	Method	Statistic	Prob.*
Leverage	PP - Fisher Chi-square	111.845	0.0004
Tobin's Q	PP - Fisher Chi-square	88.7319	0.0221
Size	PP - Fisher Chi-square	157.557	0.0000
Growth	PP - Fisher Chi-square	138.751	0.0000
Cash flow	PP - Fisher Chi-square	116.818	0.0001
Capital expenditure	PP - Fisher Chi-square	162.950	0.0000

*sig. level: 0.05

11. Findings and interpretation of the first hypothesis

The empirical results are shown in Table 7. Since the P-value of J-statistic is less than 0.05, therefore the regression model is valid. The coefficient of leverage and its P-value were 6.131861 and 0.0440 respectively. Therefore, null hypothesis is rejected that means in spite of what have been stated in literature, the relationship between financial leverage and firm growth is significant and its value is positive. The first hypothesis of this research claimed that there is a relationship between financial leverage and firm growth. Additionally, the relationship between leverage and growth measure is expected to be positive. It was adopted and built based on the most previous studies. However, the results of this research shows that the relationship between financial leverage and firm growth is significant and not negative. It is worth mentioning that some studies (such as Bei and Wijewardana, 2012) have found a positive relationship between financial leverage and firm growth. On the other hand, one unit increase in financial leverage can increase firm growth by 6.131861 units in terms of sales growth. So, an increase in leverage or more usage of debts in firms' capital structure has a significant and positive relationship with the growth of the firms as well as their sales growth.

Based on these findings, it can be concluded that oil and gas firms should use more leverage to increase their operations and income, and make greater returns. This conclusion confirms theoretical literature believing that financing debts is cheaper than equity and that debts generate tax shield, so this factor can be desired by firms to get more liabilities.

12. Normality test of residuals

Jarque-Bera is a statistic test for testing whether the

Table 6: Descriptive Statistics of Variables

Description	Leverage	Growth	SIZE	AGE	Tobin	Cash	Capital Expenditure
Mean	0.503227	0.86328	6.602172	21.91	1.358654	0.079476	0.054791
Median	0.5097	0.158042	6.81851	19	1.206457	0.050056	0.002692
Standard deviation	0.241222	5.375635	0.994022	13.82	0.600418	0.092759	0.134892
Max	0.9599	62.35561	8.531531	51	3.865479	0.677338	1.232297
Min	0.003086	-0.98936	4.212667	2	0.528017	0.000693	0

series is normally distributed. The statistic test measures the difference of skewness and kurtosis of the series with those from normal distribution.

Under the null hypothesis of a normal distribution, the Jarque-Bera statistic is distributed as Chi-2 with two degrees of freedom. The "reported probability" is the probability that a Jarque-Bera statistic exceeds (in absolute value) the observed value under the null hypothesis. A small probability value leads to rejection of null hypothesis of a normal distribution. The histogram and normality test of residuals is shown in Figure 2 below. If the residuals are normally distributed, the histogram should be bell-shaped and the Jarque-Bera statistic should not be significant. As shown in Table 7, P-value of Jarque-Bera is less than 0.05, meaning that the original variables themselves are not normally distributed. But according to the Central Limit Theorem (CLT), when independent variables are added, their properly normalized sum tends toward a normal distribution; meaning that the residuals distribution of the research is normal.

Table 7: Summary of first hypothesis test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GROWTH(-1)	-0.158271	0.087611	-1.806512	0.0750
LEVERAGE(-1)	33.82861	14.05959	2.406134	0.0440
CASH(-1)	0.721869	0.836004	0.849270	0.0818
CAPEX(-1)	0.192726	1.842196	0.104618	0.0170
AGE(-1)	2.203584	4.857509	0.453645	0.2514
Country	Included			
Effect specification				
Cross-section fixed				
S.E. of regression	1.739322	S.D. dependent var		0.542831
J-statistic	10.16962	Sum squared resid		220.8427
Prob(J-statistic)	0.041903	Instrument rank		12

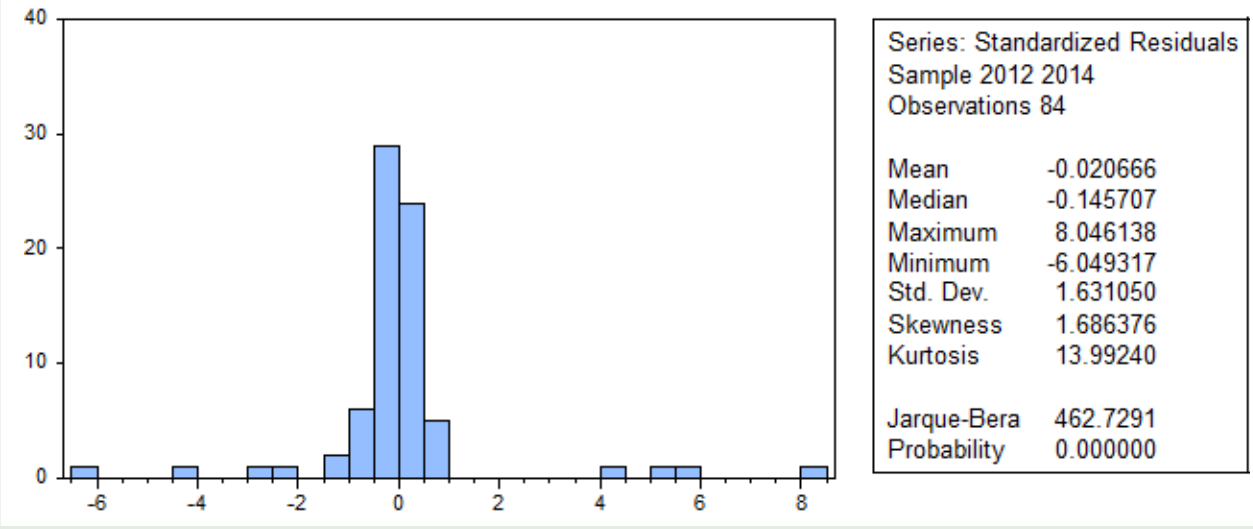

Fig. 2. Histogram and normality test of residuals

13. Findings and interpretation of the second hypothesis

In the second research hypothesis, impact of growth opportunities on the relationship between financial leverage and firm growth was reviewed. For this purpose, the Tobin's Q was entered in the regression model as a moderator variable and formed an individual row in the output table, as displayed in previous sections.

The second research hypothesis asserts that financial leverage affects firm growth measure differently compared to Tobin's Q firms. High Tobin's Q firms are expected to exhibit less positive correlation between financial leverage and growth measures than low Tobin's Q firms.

Summary of the results is shown in Table 8 below. The results showed that P-value of J-statistics is less than 0.05, so the empirical model is valid, and Tobin's Q is the variable that can affect the relationship between financial leverage and firm growth. The P-value is 0.0248 which means that Tobin's Q is significant in the model as a moderator variable. Also, null hypothesis can be rejected. One of the main underlying reasons can be tendency of shareholders to increase funds for firms with suitable growth opportunities.

Based on this result, Tobin's Q is statistically significant in the model. And sales growth for oil and gas firms are related to Tobin's Q and these firms cannot ignore Tobin's Q for their growth. This may be true for the high added-value oil and gas in value chain.

Empirical literature of finance confirms the findings of this study. The results show that Tobin's Q firm is the most important variable in firm growth. High Tobin's Q firms have more correlation between financial leverage and firms' sales growth. Therefore, firms with high Tobin's Q should be more sensitive to financial leverage than those with low Tobin's Q. In such companies a slight change in financial leverage causes considerable changes in their growth.

14. Findings and interpretation of the third hypothesis

In the third hypothesis another important variable was introduced as the firm size. So "size" of firm was entered in the regression model and had an individual row in the output table. Similar to the previous hypothesis, the firm size is a moderator variable in this hypothesis. According to this hypothesis, Leverage affects the firm growth differently based on the firm size. Besides, the correlation between leverage and firm growth measures are expected to be stronger for smaller companies.

The positive correlation between financial leverage and firm growth measures is expected to be more prevalent amongst smaller companies. So, it was expected that both coefficient of leverage and firm size were sig-

Table8: Summary of the second hypothesis test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GROWTH(-1)	-1.117724	50.51365	-0.022127	0.0024
LEVERAGE(-1)	-31.76762	15.44829	-2.056732	0.0162
CASH(-1)	-136.0738	2089.214	-0.071919	0.0847
CAPEX(-1)	23.40168	1197.295	0.021945	0.0045
AGE(-1)	44.78404	2241.536	0.019979	0.1841
TOBIN(-1)*LEVERAGE(-1)	-57.31944	28.33942	-2.022167	0.0248
Country	Included			
Cross-section fixed				
Mean dependent var	0.159590	S.D. dependent var		0.551575
S.E. of regression	26.76929	Sum squared resid		48728.47
J-statistic	14.70105	Instrument rank		12
Pro. (J-statistic)	0.021903			

nificant. Table 9 given below presents summary of the results.

As it is seen in Table 9, the P-value of J-statistic is less than 0.05. It means GMM model is valid and so other results are explained. But the P-value of the firm size is not less than 0.05 (0.1866) so the coefficient of size is not significant, and size is not significant in GMM model at significance level of 0.05. Therefore, the size is not a significant variable in the relationship between financial leverage and firm growth and cannot affect this relationship. As a result, the null hypothesis is not rejected and size of the firms, unlike Tobin's Q, is not a moderator variable in this model.

One of the main underlying reasons is that most of the firms in oil and gas industry have a large number of assets and their sizes are big (high values). Consequently, the firm size is not an important variable for creditors in decision making. These firms are initially big.

Considering this result, growth of oil and gas firms is not related to the firm size. So, these firms can ignore total assets in this regard. This statement might also be true about those oil and gas firms that highly need investments that cannot affect their growth, too.

Table 10 below, summarizes results of testing the

Table 9: Summary of the third hypothesis test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GROWTH(-1)	-0.139576	0.058713	-2.377234	0.0201
LEVERAGE(-1)	18.51148	42.13718	0.439315	0.0217
CASH(-1)	-0.194296	6.715540	-0.028932	0.0770
CAPEX(-1)	1.352689	4.808630	0.281304	0.0793
AGE(-1)	1.794807	4.064549	0.441576	0.1601
SIZE(-1)*LEVERAGE(-1)	-2.888064	10.62706	-0.271765	0.1866
Country	Included			
Effects Specification				
Cross-section fixed				
Mean dependent var	0.153658	S.D. dependent var		0.542831
S.E. of regression	0.783883	Sum squared resid		44.24197
J-statistic	15.521012	Instrument rank		12
Prob. (J-statistic)	0.018903			

Table 10: Summary of testing research hypotheses

No.	Research hypothesis	Results	Conclusion
1	H_0: There is not relationship between finan cial leverage and firm growth. H_1: There is relationship between financial leverage and firm growth.	H_0 is rejected	There is relationship between financial leverage and firm growth
2	H_0: Financial leverage does not affect firm growth measure differently with different Tobin's Q firms. H_1: Financial leverage affects firm growth measure differently with different Tobin's Q firms.	H_0 is rejected	Tobin's Q affects relationship between financial leverage and firm growth.
3	H_0: Leverage does not affect firm growth differently given different firm size. H_1: Leverage affects firm growth differently given different firm size.	H_0 is not rejected	Size does not affect relationship between financial leverage and firm growth.

above three mentioned research hypotheses.

15. Sargan test

The Sargan–Hansen test or Sargan's J test is a statistical test used to examine over-identifying restrictions in a statistical model. Its test statistic can be computed via residuals of instrumental variables regression by constructing a quadratic form based on the cross-product of the residuals and exogenous variables. The Sargan–Hansen test of over-identifying restrictions should be performed routinely in any over-identified models estimated by instrumental variables techniques. Instrumental variables techniques are powerful, yet if a strong rejection is encountered for the null hypothesis of the Sargan–Hansen test, the validity of estimates should be seriously doubted.

Davidson and MacKinnon (2004) suggest that multiplying the number of observations by the uncentered R2 from regression of the residuals of the GMM (instrumental variables estimator) equation on the set of instruments (0.04) is equivalent to the Sargan statistic. In the present research it equals (84*.0.04=3.36). A scalar called Sargan statistics has been created in Eviews (Davidson and Mackinnon, 2004).

Degrees of freedom are equivalent to the number of over-identifying restrictions (number of instruments minus the number of regressors). A quick chi-square test in Eviews showed that P-value of statistic equals 0.2059. Since this P-value is greater than 0.05, it means that null hypothesis is not rejected. So, the list of instruments validity is acceptable.

16. Conclusion

The results of this study showed that the relationship between financial leverage and firm growth is significant and positive. More precisely, one unit increase in financial leverage can increase the firm growth by 6.1318 units in terms of sales growth. So, increase in leverage or the use of more debts in firms' capital structure has a significant and positive relationship with their growth.

A reason may be that, from viewpoint of firm owners, accessible growth opportunities are more unstable and riskier. Therefore, they tend to turn to lenders and creditors. Another underlying reason would be restrictions of issuing new equity stocks. It should be noted that previous studies have been mostly conducted in the U.S. and European countries that have more efficient stock exchange markets than the OPEC context. It is argued that providing funds in the U.S. and European markets is simpler and more convenient compared to the OPEC. Therefore, firms in the U.S. and European countries are more able to increase funds because of their economic conditions.

In conclusion, oil and gas firms should use more leverage to grow in their operations. This finding is in line with theoretical literature believing that financing debts is cheaper than equity and also that debt generates tax shields.

This study shed a light on the debate by using cross country data in the one of the challenging sector, i.e. oil and gas. Previous studies are limited to one country, especially the U.S. (see for example Rahaman, 2011 and Hurme, 2010). A dummy variable was used to overcome the country problem in the model.

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Appendix: Summary of the research variables.

Table 11: Summary of Variables

Variable	Variable	Type	Definition
Dependent	Sales growth	Continuous	Measures the growth of sales volume
Independent	leverage	Continuous	Relative amount of debt a firm carries in relation to its total assets for any given year
Control	Cash flow	Continuous	Cash flow gross of net interests payments divided by total assets the year before
	expenditures	Continuous	Capital expenditure divided by fixed assets the year before
	Age	Continuous	The number of years a firm has been active in the business sector since its incorporation.
Moderator	Tobin's Q	Continuous	Measures the growth opportunities faced by a particular firm, the ratio of sum of book value of debt and market value of equity to the replacement costs of the firm assets
	Size	Continuous	The logarithm of a firm's Total Assets from its balance sheet
Dummy variables	Economic	Binary	Economic cycle dummy for either abnormal or normal Years
	Country	Binary	Country dummy for each country included