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ANALYZING THE SPEED OF ADJUSTMENT OF THE CAPITAL STRUCTURE OF THE PETROLEUM COMPANIES AROUND THE WORLD

Glaucio Barros (COPPE-UFRJ)
glauciohenrick@ig.com.br
Heloisa Marcia Pires (COPPE-UFRJ)
heloisam@pep.ufrj.br

Since its inception the oil activity by its very nature is picky when it comes to capital management. Risk management due to the volatility of crude oil prices, the efficiency of companies and the choice of appropriate capital structure are ingredients for adopting essential financial strategies to the firm´s survival. Oil and gas companies make great investments and many risks are presents their core activity, therefore, analysis of the dynamic adjustment is a fertile field for research in the area of capital structure both in Brazil and other countries. This research verified the significant factors in the choice of the capital structure of the 54 oil and gas companies around the world and measured their speed of adjustment according to geographic region.We realize that although they are companies with operations spread around the world according to their location have different speeds of adjustment due transaction costs heterogeneous.

Keywords: Capital structure, dinamic trade off , speed of adjustment.

1. Introduction

The basis of the pioneering research on capital structure has been article of Modigliani and Miller in 1958 which showed that in perfect capital markets the choice of financing by equity or debt was indifferent and did not affect the company's value. However, their results were obtained through the assumption of free capital flows, efficient markets and no transaction costs, conditions that are far from economic reality. Later, these assumptions were ignored and research have become much more complex. For over fifty years theories have arisen in an attempt to explain how it would be possible to create a model that allows companies to find an optimal level of debt that maximizes its market value.

In the tradeoff theory, an optimal level of debt ideal balances the costs and benefits of leverage. According to Flannery (2006) there is a tradeoff similar to the decisions of speed of adjustment of the capital structure. While the target leverage balances the advantages and disadvantages of debt financing, the speed of adjustment costs rebalancing weighs against the high price of deviating from the same target. There are differences between the various studies about the speed of adjustment as a result of disregarding by most of the researchers, so premeditated or not, the challenges of an econometric analysis of capital structures. A lack of historical data, especially in countries where capital markets are not yet mature or governance policies are not working compromise the fidelity of many of the existing theories today .Researchers are still seek both to formulate theories that prove the existence of an optimal capital structure so as to reach a consensus on adjusting the speed of firms. Welch (2004) for example, finds no adjustment when firms suffer economic shocks; Fama and French (2002) and Kayham and Titman (2007) found very low speeds between 7 and 18%; Lemmon (2008) and Huang and Ritter (2009) estimated about 25% while Flannery and Ragan (2006) state that is situated on 34.4% and Getzmann (2010) found in Asia companies between 27 and 30%. Despite of many efforts speed adjusting found in different empirical studies lies in a range between 0% and 40% which is a significant difference to consider a single speed for all companies as basic premise in making models further than all the existing studies on adjustment speed is restricted to a large number of companies no matter what your industry and specific characteristics inherent in their operation type for example, aviation companies are typically more leveraged than steel companies and these differences imply different behaviors fit between industrial sectors .On our article seeks to clarify through the study of a specific sector (in the case of petroleum and gas) the behavior of these firms fit in relation to both advocated in the literature as compared to different regions in the globe in an attempt to enrich the discussion of the theories of capital structure by using subsamples as suggested by Graham (2011).

2. The characteristics and risks associated with the oil and gas industry.

The petroleum a hydrocarbon is a primary energy source of low substitutability presents demands for short and medium term inelastic to price changes, and percentage changes in prices imply comparatively minor variations in the quantities demanded. Currently the vertically and horizontally integrated firms that are able to manage the risks of exploration and production and investing in scale to the maintenance of a future cash flow make appropriate their operations viable and able to obtain financial returns.In summary, the risks associated with investments in activities related to the exploration and production of this segment are determined by the total capital available, the size and degree of integration between the companies, and the peculiar risks of this industry. In other words, investment decisions in the oil and gas industry, once implemented, are irreversible: the production of oil from a field or rig in activity does not retract. Moreover, with variations stable price levels (mean changes in levels of variation), provision is further influenced by the level variation of ongoing investment whose sequence motivates the rational development of previously discovered fields, but no infra-production structure, which can be performed or not according to the fluctuation of international oil prices and the way companies manage their economies of scale and integration around the globe .This is the reason why the choice of the oil and gas sector to study the speed of adjustment is their capital structures on a regional basis.

3. Methodology .

The model that we use in this study is the same used by Flannery (2006):

$$DRF^{*}_{i,t} = (\lambda\beta)X_{i,t} + DRF_{i,t-1}(1-\lambda) + \varepsilon_{i,t}$$

Where $(\lambda\beta)X_{i,t}$ is the set of exogenous regressors, with the error term $\varepsilon_{i,t} \sim N(0,\sigma^2)$

$$DRF = \frac{D_{i,t}}{D_{i,t}+E_{i,t}}$$

$DRF^{*}_{i,t} = \beta X_{i,t}$ where:

DRF = Debt Ratio of firm

β = coefficient vector

$X_{i,t}$ = vector of the characteristics of firms that influence the costs and benefits of operating with various leverage levels;

The table 1 shows the components of the feature vector and its influence on the speed of adjustment second Flannery. Remember that these characteristics can be altered if we take into account companies and industries operating characteristics and distinct funding.

Item	Formula	Speed of adjustment influence
Profitability (PRF)	$EBITDA/TA$ - Earning Before Expenses and Taxes / Total Assets	Increase
Market Book Ratio(MBR)	Price per share /Book value of equity per share or Market Capitalization /Book value of equity	Decrease
Tax shieds (DEP_TA)	DEP/TA Depreciation / Tota Assets	Decrease
Size (SZE)	Ln (TA) Natural Log of Total Assets	Increase
Tangibility (TANG)	FA/TA Fixed Assets / Total Assets	Increase
Dummy variable Research and Development (R.D)	R.D = 1 (if R&D – expense are available) R.D=0 (otherwise)	Decrease
Proportion of Research and development expenditure (R.D_TA)	DEP/TA Depreciation / Tota Assets $R.D/TA$ Research and Development expendidures / Total Assets	Decrease Decrease
Average oil and gas sector debt Ratio (IndMed)	IndMed	Increase
Dummy variable public risk rating (Rating)	Rating = 1 (if has known public risk rating) Rating =0 (otherwise)	Increase

Table 1 Speed of adjustment components and their influence

.Our sample consists of a set of 54 oil companies selected from the list of the largest oil and gas companies in the world The data were taken from Economatica software, Ycharts website and annual financial statements of companies with its consolidated annual financial statements published on the internet. Some companies such as Saudi Aramco and NIOC (National Iranian Oil Company) do not publish annual statements and are much less transparent in their financial decisions that other firms. All values used in the study were converted to U.S. dollars. Moreover, the explanatory variable Average oil and gas sector debt ratio (IndMed) was obtained from the website of Professor Aswath Damodaram. to perform econometric analysis of panel data we used the statistical software R.15.2 and the package plm to work with data from oil companies according to criteria that influence the optimal level of leverage. We performed an analysis of the model of Flannery (2006) with an unbalanced panel for the periods from 1999 to 2011 with a minimum of 25 and maximum of 54 companies, the largest balanced panel present in the unbalanced panel covering the period between the years 2005 to 2011 with 53 companies. Our analyzes with unbalanced panels cover the following geographic regions: Asia and Oceania, Europe, all the world and additionally all oil and bas firms with stocks or ADR (American Depositary Recepts) on New York Stock Exchange The methodology was the panel data through the Fixed Effects Models within; and Random Effects with the estimation methods applied in accordance with the observed variance., Models of dynamic panels Generalized Method Moments of Arellano and Bond and Systems of Generalized Method Moments of Blundel and Bond..In dynamic panel data, models there are temporal endogeneity because the lagged dependent variable in a period is correlated with the error term.. As is known in the literature, in the presence of endogeneity, estimations by OLS are biased and inconsistent.. Furthermore, Cameron and Trivedi (2005) demonstrates that traditional estimators of fixed effects are not consistent. This is because the lagged dependent variable at a time is correlated with the random and therefore the composition of the end of the error estimators .Consequently conventional random effects estimates deal with inconsistent.. Since the conventional estimators not observed effects are not consistent in the presence of endogeneity time in order to consistently estimate model such two obstacles must be overcome. First, it is necessary to remove the effects not observed and second, the temporal endogeneity needs to be treated properly. The first problems are solved using traditional estimators of dynamic data models, such as the Arellano-Bond estimator and the Blundell-Bond estimator. As is known, the estimator Arellano-Bond transforms the equation Flannery, and also leads to differences estimated by GMM using the lagged dependent variable in two, three or more periods as instruments. The problem with the Arellano-Bond estimator is that if the data has a large temporal persistence of these instruments based on lags of the dependent variable are weak instruments for the transformed equation. So, Blundell and Bond (1998) suggest the adoption of the system GMM (GMM system) as the estimation method, in which the system of equations is estimated in first differences and levels (Baltagi, 2008; Cameron and Trivedi, 2005; Blundell and Bond 1998). Florysiak and Elsas (2010) developed based on econometric studies of Loundermilk (2007) model specially tailored for dynamic unbalanced panel data and fractional dependent variables. Known as DPF estimator (Dinamic Fractional Panel) is a doubly censored Tobit estimator that allows the study of phenomena that can generate corner solutions with lagged dependent variables and heterogeneity not observed. Unfortunately was not possible using this tool for the analysis period of data was very short .Apparently due to the fact that the Tobit model is based on maximum likelihood methods it is more suitable for long panels (n> 30). .

4. Results

We found an average of two to three significant coefficients in all regions studied Due to the small amount of data, serial correlation and possible heteroscedasticity models not included in the static regressions analysis due to their low explanatory power of the models (on average r-square of 3 %). even adding other variables that we believe are significant as the annual variations in the price of a barrel of WTI oil and GDP. In practice, only the increase in the price per barrel WTI was significant but only when we use all 54 companies in unbalanced panels along with profitability, asset tangibility, size, debt ratio and the industry average annual proportion of spending on research and development in relation to fixed assets and unlike Gertzmann and Spremann (2010) found that the inadequacy of the model static panel data to oil and gas companies due to the fact no variables have shown significant. Probably heterogeneity among firms and regions studied caused this difference. By using the lagged variables and we include fixed effects of firms significantly increases the explanatory power to an r-square of 52% -84% for regressions stacked data (pooling) and 24% -42% for fixed-effects regressions. In general, the explanatory power of the regressions varies considerably between different datasets and regressors. This variation is due to the presence of fixed effects firms is an indication of degree of persistence in capital structures .The most efficient techniques for estimation in dynamic panels, based on Generalized Method of Moments are the values that provide the most robust and reliable results and we make the measurement of the coefficients and adjustment speed for Fixed Effects and Random (where applicable) for purposes of comparison .No results are detailed but we can make some considerations .A average speed of adjustment found in our 54 oil companies in the world, between 18% -64% in the sample of unbalanced panels, 11% to 29% in the unbalanced panel of firms listed on the New York Stock Exchange between 1999-2011; 34% -92% in the unbalanced panel of European companies during the period 2000 to 2011, 42% -110% in the unbalanced panel of Asia and Oceania during the period from 2000 to 2011.The results are showed in Appendix.

5. Conclusions

The difference in speeds of adjustment between the petroleum and gas firms among world regions shows that although most of the oil companies are firms with operations spread around the world, they are victims of transaction costs in their differentiated regions The results shows that firms operating in Asia or Oceania adjust their capital structures much faster than their own subsidiaries operating in Regions like North Sea and Russia or at joint ventures in the fields of the United States where its ADRs are listed on the New York Stock Exchange. Probably transaction costs and adjustments to their capital structures are higher in regions that have their capital markets more solids or where governance policies are stricter than in their owner regions. We believe fact that many of these companies are more credible both in their countries and in other regions facilitates maximizing their value through the issuance of shares or securities that would have a much greater acceptance of the general public than the same company on the NYSE with many others regional or world competitors and that in some development or emergent countries such industries are the mainstay of the GDP (Gross Domestic Product) and theirs governments would not hesitate to help them financially for that theirs debt and equity ratios provides sustainable operations while acquiring value. Despite of panel data from our study are small compared to studies with larger amounts of data such as those of Elsas (2010) believe that this research helps to clarify how firms adjust their capital structures and speed at which this occurs in an industry so full of uncertainties such as oil and gas.

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7. Appendix

Results of unbalanced panel data analysis with 54 companies around the world , (1999-2011)

Methods	OLS (pooling)	Fixed Effects (within)	Sys GMM (onestep)	Sys GMM (twosteps)
Intercepto	0,035 (0,502)			
DRF(t-1)	0,820 (0,000)***	0,432 (0,000)***	0,248 (0,014)*	0,369 (0,008)**
IndMed(t-1)	-0,034 (0,620)	-0,627 (0,361)	0,195 (0,09)Ψ	0,123 (0,329)
PRF	-0,090 (0,012)*	-0,243 (0,000)***	0,047 (0,774)	0,009 (0,946)
MBR	0,000 (0,909)	-0,001 (0,519)	-0,001 (0,690)	-0,000 (0,943)
DEP_TA	0,034 (0,642)	0,143 (0,146)	0,035 (0,757)	0,139 (0,103)
lnTA	0,003 (0,170)	-0,007(0,196)	0,012 (0,003)**	0,011 (0,031)*
TANG	0,010 (0,711)	-0,019 (0,604)	0,095 (0,183)	0,054 (0,541)
R.D_TA	0,073(0,598)	-0,265 (0,300)	0,770 (0,035)*	0,590 (0,200)
R.D	0,017 (0,153)	-0,025 (0,453)	0,059 (0,118)	0,047 (0,244)
Rating	-0,013 (0,175)		-0,027 (0,374)	-0,015 (0.667)
R^2	0,72	0,27		
R^2 ajust	0,70	0,24		
Sargan (p-value)			0,619	0,958
AR(1)			0,000	0,002
AR(2)			0,000	0,057
Speed of adjustment $(1-\lambda)$	**18%**	**57%**	**75%**	**64%**

(Ψ)- significant at 10%; (*) significant at 5% (**)significant at 1%

Source: Authors elaboration

Results of Unbalanced panel data analysis with 22 companies from New York Stock Exchange (1999-2011)

Methods	**OLS (pooling)**	**Fixed effect (intra-grupos)**	**Sys GMM (onestep)**	**Sys GMM (twosteps)**
Intercept	0,009 (0,927)			
DRF(t-1)	0,889 (0,000)***	0,540 (0,000)***	0,728 (0,000)***	0,713 (0,046)*
IndMed(t-1)	-0,117 (0,243)	-0,176 (0,096)Ψ	-0,015 (0,871)	-0,100 (0,544)
PRF	-0,109 (0,056)Ψ	-0,392 (0,000)***	-0,011 (0,924)	0,010 (0,955)
MBR	-0,005 (0,170)	-0,005 (0,184)	-0,008 (0,197)	-0,008 (0,413)
DEP_TA	-0,346 (0,061)Ψ	-0,363 (0,061)Ψ	-0,329 (0,086)Ψ	-0,297 (0,463)
lnTA	0,008 (0,078)Ψ	-0,016 (0,100)	0,010 (0,053)Ψ	0,011 (0,242)
TANG	0,055 (0,226)	0,059 (0,317)	0,083 (0,138)	0,080 (0,539)
R.D_TA	-0,049 (0,769)	-0,431 (0,085)Ψ	0,151 (0,561)	0,529 (0,608)
R.D	0,005 (0,788)	-0,003 (0,951)	0,019 (0,579)	0,038 (0,676)
Rating	-0,070 (0,145)		-0,082 (0,242)	-0.096 (0,344)
R^2	0,84	0,42		
R^2 ajust	0,80	0,36		
Sargan (p-value)			0,999	0,999
AR(1)			0,000	0,036
AR(2)			0,419	0,400
Speed of adjustment $(1-\lambda)$	**11%**	**46%**	**27%**	**29%**
(Ψ)- significant at 10%;	(*) significant at 5%	(**)significant at 1%		

Source: Authors elaboratio

Results of Unbalanced panel data analysis with 19 companies from Europe, (2000-2011)

Methods	OLS (pooling)	Fixed Effects (within)	Sys GMM (onestep)	Sys GMM (twosteps)
Intercept	0,197 (0,050)Ψ			
DRF(t-1)	0,663 (0,000)***	0,392 (0,000)***	0,083 (0,620)	0,085 (0,829)
IndMed(t-1)	0,062 (0,630)	-0,032 (0,798)	0,119 (0,623)	0,158 (0,646)
PRF	-0,134 (0,137)	-0,240 (0,026)*	0,071 (0,683)	0,162 (0,476)
MBR	0,004 (0,296)	0,000 (0,849)	0,008 (0,322)	0,003 (0,710)
DEP_TA	0,040 (0,870)	0,163 (0,630)	-0,088 (0,861)	-0,596 (0,626)
lnTA	0,002 (0,488)	-0,001 (0,867)	0,028 (0,001)**	0,029 (0,085)Ψ
TANG	-0,047 (0,419)	-0,030 (0,647)	0,054 (0,566)	-0,008 (0,936)
R.D_TA	-1,263 (0,169)	-0,993 (0,528)	-1,200 (0,253)	2,475 (0,507)
R.D	-0,039 (0,302)	-0,044 (0,530)	-0,054 (0,414)	0,010 (0,907)
Rating	-0,042 (0,061)Ψ		-0,156 (0,023)*	-0,233 (0,084)Ψ
R^2	0,60	0,24		
R^2 ajust.	0,56	0,20		
Sargan (p-value)			0,999	1
AR(1)			0,000	0,190
AR(2)			0,051	0,223
Speed of adjustment $(1-\lambda)$	**34%**	**61%**	**92%**	**92%**
(Ψ)- significant at 10%;	**(*) significant at 5%**	**(**)significant at 1%**		

Source: Authors elaboration

Results of Unbalanced panel data analysis with 09 companies from Asia and Oceania, (2000-2011)

Methods	**OLS (pooling)**	**Fixed Effects (within)**	**Sys GMM (onestep)**	**Sys GMM (twosteps)**
Intercept	0,333 (0,146)			
DRF(t-1)	0,588 (0,000)***	0,258 (0,015)*	0,426 (0,009)**	-0,104 (0,961)
IndMed(t-1)	-0,064 (0,681)	-0,141 (0,386)	-0,040 (0,792)	-0,792 (0,642)
PRF	-0,281 (0,020)*	-0,280 (0,089)Ψ (	-0,194 (0,116)	-0,807 (0,493)
MBR	0,003 (0,459)	0,002 (0,590)	0,000 (0,813)	0,001 (0,970)
DEP_TA	0,033 (0,685)	0,329 (0,008)**	0,046 (0,603)	-0,218 (0,667)
lnTA	-0,005 (0,597)	-0,022 (0,220)	0,010 (0,005)**	0,042 (0,018)*
TANG	-0,008 (0,902)	0,022 (0,847)	0,153 (0,099)Ψ	0,104 (0,911)
R.D_TA	0,791 (0,688)	2,591 (0,178)		
R.D	0,034 (0,306)			
Rating	-0,044 (0,064)Ψ		-0,002 (0,953)	0,055 (0,158) (
R^2	0,59	0,30		
R^2 ajust	0,52	0,24		
Sargan (p-value)			1	1
AR(1)			0,097	0,440
AR(2)			0,136	0,440
Speed od adjustment $(1 - \lambda)$	**42%**	**74%**	**58%**	**110%**
(Ψ)- significant at 10%;	(*) significant at 5%	(**)significant at 1%		

Source: Authors elaboration