

**FINANCIAL RISK ANALYSIS IN OIL & GAS SECTOR  
(A case study on Petrobras Oil And Gas Company)**

**Dissertation submitted to College of Management & Economic Studies for the partial  
fulfillment of the degree of**

**Integrated B.Tech (APE)+MBA(Upstream Asset Management)**

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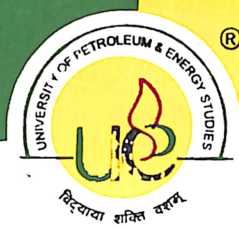
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**College of Management and Economic Studies**

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**UNIVERSITY OF PETROLEUM & ENERGY STUDIES**  
(ISO 9001:2000 Certified)

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This is to certify that dissertation report on financial risk analysis in upstream oil & gas industry completed and submitted to UPES ,Dehradun by Nikhi Singh in partial fulfillment of requirements awarded the Integrated B.Tech (APE)+ MBA (UAM) , bonafide work carried out by him under my supervision and guidance .

To the best of my knowledge and belief the work has been based on investigation made, data collected and analyzed by him and this work has not submitted anywhere else for any other university or institution for the award of any degree and diploma.

Mr. Bhanu Prakash

(Asth. Professor- department of finance)

## CERTIFICATE

This is to certify that the dissertation report on "**FINANCIAL RISK ANALYSIS IN OIL & GAS SECTOR**" completed and submitted by **NIKHIL SINGH** in partial fulfillment of the requirements for the award of degree of Masters of Business Administration (Oil and Gas Management), is a bonafide work carried out by him under my supervision and guidance.

To the best of my knowledge and belief the work has been based on investigation made, data collected and analyzed by him and this work has not been submitted anywhere else for any other University or Institution for the award of any degree.

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## DECLARATION

This dissertation report is entirely my own work. It has not been submitted in any previous application for a degree. All quotations in the report have been distinguished by quotation marks, and the sources of information specifically acknowledged.

Signed  
Nikhil Singh

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## PREFACE

Assessing and managing risks are essential functions for any organization, but they are particularly vital concerns for companies operating within the upstream sector of the oil and gas industry.

Even with the best seismic technology and geological expertise, exploration presents considerable uncertainty. Actuarial analysis is needed to project the life spans of discovered reserves and their market value over several decades. Extracting that oil or gas demands greater investment, additional expertise, and greater exposure to possible liabilities and compliance requirements. While international economic and political events increasingly affect all businesses, such issues have long been concerns for oil and gas companies.

There are five general types of risk that are faced by all businesses: *market risk* (unexpected changes in interest rates, exchange rates, stock prices, or commodity prices), *credit/default risk*; *operational risk* (equipment failure, fraud); *liquidity risk* (inability to buy or sell commodities at quoted prices); and *political risk* (new regulations, expropriation). Businesses operating in the petroleum, natural gas, and electricity industries are particularly susceptible to market risk—or more specifically, *price risk*—as a consequence of the extreme volatility of energy commodity prices.

Derivative contracts transfer risk, especially price risk, to those who are able and willing to bear it. How they transfer risk is complicated and frequently misinterpreted. Derivatives have also been associated with some spectacular financial failures and with dubious financial reporting. The Forex market behaves differently from other markets! The speed, volatility, and enormous size of the Forex market are unlike anything else in the financial world.

Today, Asian oil and gas companies are placing more emphasis on managing assets and streamlining business processes to maximize profitability. Although the price per barrel has increased dramatically in recent months, the industry remembers the downtimes in the '90s and is wary of the current high prices. Because of this, reserves in oil and money are being shored up. The challenge for Oil & Gas industry is to manage the political and other risks .

## Abstract

Prices of oil and gas skyrocketed during the past couple of years, with this trend reversing from the second half of 2008. The prevailing global recession has cut down oil demand and caused prices to plunge. Worldwide, oil companies are continually pressured to replace depleting oil reserves, which has become harder than ever to accomplish. Climate change and environmental concerns are further constraining companies' profitability in the industry. Consequently, oil companies' stocks have seen corresponding declines in value in 2008. During this period, the Brazilian national oil company, Petrobras, led a series of announcements of huge oilfields discoveries, which triggered substantial increases in the company's share price, however followed by a huge drop in the second half of 2008. This initiated the question whether Petrobras' stock price given by the market was its actual fair value, or it may have in fact been undervalued. Furthermore, the later developments in the petroleum industry, which challenged companies' profitability and returns, made it increasingly interesting to investigate the impact of all this on shareholders' value.

Thus, this paper's aim is to examine the potential of Petrobras to create shareholders' value and at the same time to determine the company's stock fair value at the end of 2008. For this purpose, this study uses the *top-down approach* to investing (Reilly and Brown, 2002). This approach allows investors to acquire important information on the attractiveness of the industry, its current and future outlook, as well as the insides of a specific company, before investigating its value. This is achieved by conducting a detailed strategic analysis of the industry and the company, ultimately aimed at the company's financial position and value creation capability. In general, the theoretical frameworks applied in this study cover different subject areas within *strategic management, finance, industrial economics and accounting*.

The findings of this study suggest that Petrobras' strengths by far outmatch its threats and enable the company to deliver value to shareholders in the long-run. The fact that Petrobras is a national oil company, with a privileged access to oil resources in Brazil, with technological leadership in deepwater and ultra-deep water exploration, significantly growing oil reserve base and a diversified portfolio of products, with an accent on biofuels, gives it competitive advantage in the industry and secures its value creation. By using DCF valuation methodology, we also established that the company's stock was indeed



undervalued by the market at the end of 2008, implicating that Petrobras' shares of stock are in fact a good investment.

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## **I. INTRODUCTION**

In 2008, crude oil hit prices never seen in the international market before (\$147/barrel at its peak). During the same period Petrobras, the Brazilian national oil company has led a series of announcements stating oil field discoveries, with emphasis on a gigantic offshore field named Tupi. This field is believed to contain at least 5-8 billion barrels of recoverable oil and would boost the country's total reserves by about 50%. The size of this discovery has not only surprised the company and Brazilian authorities, but the international community as well<sup>1</sup>. Brazilian officials have said other offshore fields could ultimately leave the country with 80 to 100 billion barrels of proven reserves, some of the largest on the globe. By comparison, Saudi Arabia, the largest owner of traditional oil reserves, is thought to have about 256 billion barrels. This has left room for suspicion that once Brazil becomes capable

of exporting oil in large quantities, it may join OPEC<sup>2</sup>.

Petrobras has also leading capacities and technologies in the area of ethanol and biodiesel production, which are likely to be relevant sources of fuel in the future. The green fuel technology is not something new in Brazil. The country has taken advantage of its vast fields of sugar cane plantations and strategically used the ethanol fuel technology to overcome the Oil crisis of the 70's, becoming energy self-sufficient. Nowadays, most cars produced in the country are equipped with hybrid motor engines, compatible to run efficiently either on ethanol or gasoline. As for biodiesel, lately, Brazil has been working to increase the production of raw materials used in its production and is already mixing biodiesel with diesel (produced from petroleum) for domestic sale. This suggests that not only Petrobras has the potential to become one of the most important players in the global oil industry, but it can also lead the green fuel revolution, which is yet to come<sup>3</sup>.

As a matter of fact, oil and gas demand are expected to start growing again in 2010, trend which is expected to last in the long run. This is driven by the recovery of the world GDP affected from the global economic crisis. In contrast, existing production only tends to decline, as oil companies are having difficult times to replenish their depleting oil reserves with new ones<sup>4</sup>. Even with significant energy efficiency improvements in consumption, demand is still expected to rise, especially with the accelerated growth seen in key developing countries, such as China and India. To meet projected demand, the oil industry will need to add some extra 80 million barrels a day to production by 2010 and the cost of that could easily reach \$1 trillion (Longwell, 2002).

In such a scenario, the discovery of large oil reserves, just as the ones recently announced by Petrobras, and the capacity of large-scale production of alternative fuel sources, obviously cause a profound impact on the industry's outlook, the company holding the reserves, as well as the country where these belong to. In addition to this, if we add the world's concerns towards global warming and climate changes, legally-binding regulations on greenhouse gases' emissions and environmental treaties, it becomes evident that the oil industry is faced with a huge set of challenges.

Therefore, this paper will attempt to make a strategic analysis of Petrobras, ultimately aimed at its financial position and shareholders' value, also considering the company's international and geostrategic perspective. The *need* for this kind of analytical project comes

as a result of the latest developments affecting the global oil industry and Petrobras, but also of the company's internal events that caused significant fluctuations in its stock price.

### **1.1. Problem Statement**

The oil & gas industry has a peculiar business model that combines technology, political relationships, experienced personnel, environmental protection and economics (based on economies of scale) in the high-risk pursuit of a finite but vital commodity. This model imposes major challenges on profitability of companies in this industry. They must assure that newly discovered resources are used in economical and sustainable manner, where technology and cost efficiency are key aspects. Technology is also relevant in overcoming the fact that new supplies are getting located more and more distant from consuming markets. That's especially true for gas and offshore oil resources (*Petrobras Annual Report 2007*).

In Petrobras' case, the new oil reserves are located offshore in ultra-deep water, beneath a very thick layer of salt that no other company has ever attempted to exploit before. Moreover, Petrobras has also found difficulties in supplying natural gas to thermal power plants, especially since its fields in Bolivia were quasi-nationalized. For such reasons, one should be very careful when assessing the profitability of an oil company. For example, after the announcement of Tupi's discovery, Petrobras' share price grew instantly by 26%. However, in less than a week, the company announced poor results, with operating profit down by 22% compared with the same quarter in the year before (2006)<sup>5</sup>, causing the share price to drop.

The attention given to climate changes, the worldwide depletion of oil resources, the decreasing oil demand of developed economies and the huge variations of the oil price during last year have challenged the petroleum industry and companies, making it increasingly interesting to investigate the impact of all this on *shareholders' returns*. Additionally, the significant fluctuation of Petrobras' stock price during late 2007 and 2008, and its relatively low value at the end of 2008, initiated the question whether the share price given by the *market* was the actual fair value of Petrobras' stock at the end of 2008, or it may have possibly been undervalued!

As a consequence, our goal in this paper is to determine *Petrobras' profitability and value*

*creation capability*, arriving at the company's *stock fair value* at the end of 2008; thereby, taking into consideration the trends of the oil & gas industry as well as the company's general capacity to stay competitive in it. From here, the principal problem can be synthesized into:

→ *What is the potential of Petrobras to create shareholders' value, now and in the future? And, what was its stock fair value at the end of 2008?*

Getting at Petrobras shareholders' value and its fair stock price is first going to take us through different strategic and financial analyses of the industry and the company. In greater detail, this research is going to address:

- discussions of the appropriate models for industry analysis and valuation of a company's stock,
- strategic analyses of the company and the petroleum industry,
- market conditions and future development of oil and gas prices
- OPEC and cartel theory
- financial overview of the company and valuation of its stock

In this context, the study in front of us will attempt to give answers to other important questions that will in the end help collect the details for answering the principal problem. These questions are:

Based on Porter's industry analysis framework, how is the competitive situation in the industry influencing the ability of companies to sustain profitability?

- How are the current conditions in the oil and gas markets and the future prospects of demand and supply, along with the expected future oil and gas prices going to impact Petrobras' future profitability?
- What are the positive and negative aspects for Petrobras/Brazil of the possible Brazilian participation in OPEC?
- What is Petrobras' strategic approach and how does the company create value throughout its value chain?
- How are Petrobras' strengths, weaknesses, opportunities and threats influencing its value?
- What is the current state of Petrobras' financial position and how does it compare to the peers in the industry?

## 1.2. Methodology

In this report, it's found necessary to conduct both *qualitative* and *quantitative research*, using predominantly secondary data, which is covered by published articles, company annual reports, financial agencies reports, books and general economic magazines. The qualitative part of the analysis will take most of this research, however with the goal to help us understand the aspects in the final- quantitative part (the financial analysis). The type of analysis structured in this way is known as a *top-down approach* within investment and financial theory. This approach allows investors to acquire important information on the attractiveness of the industry, its current and future outlook, as well as the insides of a specific company, before investigating its value (Reilly and Brown, pg.544). In general, the theoretical frameworks applied in this study cover different subject areas within *strategic management, finance, industrial economics and accounting*.

In that direction, the first qualitative part of the research will focus on the industry. Industry strategic frameworks will be used to depict the conditions prevailing in the global petroleum industry. To investigate the business environment and the factors affecting the industry. How the competitive situation in the industry influences the ability of companies to sustain profitability is going to be examined by *Porter's five forces model* for industry competition analysis. *Cartel theory* and models will be applied to investigate the determination of global oil prices and the impact on these if Brazil joins the cartel of oil exporting countries - OPEC. A survey of the market conditions in the oil & gas markets, as well as expected developments of these commodities' prices is also going to be applied.

In the second part of the qualitative analysis, the focus will be put on Petrobras strategic approach. Here, using the *SWOT framework* is going to help us understand how the company's strengths, weaknesses, opportunities and threats are influencing its value. Furthermore, the inside of Petrobras' value creating process will be revealed using the *Value Chain* framework.

In the last - quantitative part of this research the emphasis will be put on the financial analysis of Petrobras. The historic development of Petrobras' share price, as well as its profitability, liquidity and solvency ratios compared to peers are going to be investigated. The most important part though will be the valuation of Petrobras' stock by using the

*Discounted Cash Flow (DCF) analysis.* Not only this method will be elaborated in detail, but we are also going to be using other valuation techniques for comparison reasons, i.e. *Multiples. Sensitivity and scenario analyses* as part of the quantitative research are going to be applied, too.

The selection process and the discussion of the previously stated theoretical models and frameworks are presented in detail in an upcoming section. In general, this paper is structured in the following way:

- In Section I we are: discussing and selecting Industry Analysis frameworks and Valuation methods;
- In Section II (Petroleum Industry Strategic Analysis) we are: conducting PESTEL and Industry competition analysis (Porter's five forces); analyzing oil and gas markets, and determining expectations on oil & gas prices developments; evaluating Cartel theory and opportunities for Brazil of joining OPEC;
- In Section III (Petrobras Strategic and Financial Analysis; Valuation of Stock) we are: introducing Petrobras in greater detail; investigating its strategic approach, value chain and SWOT; analyzing Petrobras' financial ratios and fluctuations of its share price; determining the stock fair value by the DCF method and applying multiples; discussing and comparing the fair & market given stock values
- In the last pages of this paper we outline the conclusions of the research.

### **1.3. Delimitations**

The main focus of this research will be put on the petroleum industry. The natural gas will not be distinguished as a separate industry throughout the qualitative research, and most of the analysis on oil will be considered to hold for gas too. Thus, oil and gas will be considered as the same industry. This is due to the fact that gas is mostly found together with oil and oil companies in focus are at the same time producers of gas. However, natural gas will receive individual focus when trying to estimate its supply & demand, and price developments.

'Oil & gas industry', 'oil industry' or simply 'the industry' will consider large, vertically-integrated (i.e. from upstream to downstream) national and international oil companies (NOCs and IOCs). The decision for this was based on the fact that the company in focus of



this study, Petrobras, represents such an integrated oil company. However, we are mainly going to stay focused on the upstream operations in the analysis, as around 50% of Petrobras' business belongs to this segment<sup>6</sup>. The following figure depicts the different functional areas of the industry that are going to be taken into account:



The distinction between the two types of companies (NOCs and IOCs) is that *national* are fully or majorly state owned companies with a privileged access to oil resources in home countries. NOCs are for example: Petrobras (Brazil), Aramco (Saudi Arabia), Gazprom (Russia), StatoilHydro (Norway), Pemex (Mexico), etc. *International* oil companies, on the other hand, are majorly privately owned, and are present worldwide. Some of the biggest IOCs are: ExxonMobil, Royal Dutch Shell, BP, Chevron, ConocoPhillips and Total S.A. Another typical form of oil companies are the *oilfield service companies*<sup>7</sup>, which are not subject of analysis in this research. They rather appear as suppliers of the oil companies in this paper.

In this study, we will act as external analysts with no access to internal information. This is not ideal, as we would prefer to have a lot more financial data on the company, especially one that refers to future projections. However, the assumptions we will make should be reasonable so that the final results and conclusions are close to reality. The time span covered in the research incorporates the last couple of decades of the 20<sup>th</sup> century, but it also goes one decade into the future (the qualitative analysis).

Information beyond the first half of 2009 (31.06) will not be considered.

## 1.4. Selection of Valuation Methods and Strategic Analysis Frameworks

### 1.4.1. Valuation Methods

Choosing the right valuation method is of exceptional importance, as it is directly influencing the stock value. The determination of the *fair value* of Petrobras' stock is an important issue in this study, as we doubt the value given by the market. Different valuation approaches produce different results and thus, picking the most accurate and reliable one is essential. The following section is going to discuss and describe the most widely used valuation approaches and methods;

**Market Valuation Methods** The market valuation methods are known as *relative valuation*

methods (also multiples methods) because they are assigning a value to a company or asset by studying the prices of similar companies/assets, which have been traded in a market. These methods derive the value of a company by the price of comparable companies. The comparison between the companies is made by looking at some standardized variables, such as earnings, dividends, cash flows, sales and net tangible assets, or ratios derived by these variables, i.e. price-earnings ratio (P/E), price-to-book (P/B) and price-to-sales ratio. The companies that are being compared have similar operating and financial characteristics and in most cases come from the same industry. The market valuation method thus assumes that the value of other companies is applicable to the company in question (Palepu et al., 1997, Ch.7).

**Book Value Based Methods** Based on accounting techniques, these methods value a company by its book value. Essentially, the book value of a company is its equity, which is derived by subtracting the assets by the liabilities. Other approaches based on the accounting techniques are the liquidation and the replacement method. The liquidation value of a company is the total amount one would receive by selling the various assets of a company separately. The replacement value of a company is the total amount one would have to pay if they were to replace all of the company's assets in order to start a new company with the same earning power (Palepu et al., 1997, Ch.7).

**Income Based Valuation Methods** Income-based methods are by far the most popular valuation approaches among analysts and investors. There are several income-based methods, out of which four will be discussed here, i.e. *the discounted cash flow model*, *dividend discount model*, *EVA model* and *the earnings-capitalization model*.

*Discounted cash flow model (DCF)* is an approach that derives the value of a company by discounting its expected future cash flows by the company's risk-adjusted rate of return or the estimated cost of capital. The model employs detailed multiple year forecasts of the cash flows, which are based on historic performance and future expected developments. It is essential that these forecasts are as accurate as possible as they are directly influencing the accuracy of the valuation. Furthermore, precise discount rate is calculated for each period, which takes into account risk and historic volatilities (Fernandez Pablo, 2002, pg.24-47). Analysts and investors tend to frequently use this model because it relies solely on the company's cash flow rather than on accounting based earnings, which can be misleading.

Additionally, the method has a close link to economic theory and competitive strategy and is rather straightforward to implement (Koller et al., 2005, pg.101). Based on these aspects, the DCF will be the main approach in the determination of Petrobras' stock value and will be described in detail in the valuation process of the company.

**Dividend discount model (DDM)** is a procedure for valuing the price of a stock by using predicted dividends and discounting them back to present value. In order to employ this method, in addition to expected dividends, other factors such as the cost of equity and the equity of the company must be estimated as well. The idea is that if the value obtained from the DDM is higher than what the shares are currently trading at, the stock is undervalued. This method is only applicable for companies that pay out dividends (Miller and Modigliani, 1961). The equation for this model is:

$$\text{Value of Stock} = \frac{\text{Dividend per share}}{\text{Discount Rate} - \text{Dividend growth rate}}$$

**Economic value added (EVA)** has been developed as an alternative to the DCF model. In short, EVA is the net operating profit (after taxes) minus a charge for the opportunity cost of all capital invested in a company. In other words, it is an estimate of the economic profit, or the amount by which earnings exceed or are less than the required minimum rate of return that shareholders could get by investing in other companies of comparable risk (Stewart, 1991). The basic formula for EVA is:

$$\text{EVA} = \text{NOPAT} - \text{WACC} * \text{Capital employed}$$

**Earnings capitalization method** is an income-valuation approach that determines the value of a company based upon present value of estimated future earnings or profit, discounted by the capitalization rate (cap rate). The capitalization of earnings is particularly useful when the future earnings can be predicted easily and accurately;

$$\text{Value} = \frac{\text{Earnings in Future Years}}{\text{Discount Rate} - \text{Growth rate}}$$

**Real Options** Real options are yet another possible valuation method. They stand out as superior from the rest of the valuation approaches, because they explicitly capture the value of flexibility. Real options place value to management's ability to react to future events and new information or to changing market conditions. Regular DCF analysis, on the other hand, does not fully incorporate the value of flexibility. What it uses is adjustment of the discount

rate or the cash flows, which do not properly account for changes in the risk over the project's life and fail to appropriately adapt the risk adjustment (Amram and Kulatilaka, 1999). There are different types of real options, such as: growth options, options to abandon, options to defer, options to alter or expand, etc.

In '*Schlumberger on real options in oil and gas*', Bailey (2005) discusses the applicability of real options in these industries. The oil industry deals with characteristics that are ideally suited for real options, i.e. large capital investments, uncertain revenue stream, often long lead times to achieve these certain cash flows, uncertainty in the amount of potential production, numerous technical alternatives, political risk and market exposure. Consequently, real options have a natural place in the oil industry management-decision-making process. Real options are able to capture the presence of uncertainty, limited information and the existence of different, but valid, development scenarios. What follows is how they fit in the different stages of the development of oil fields (Bailey, 2005, pg.44-49);

- *Exploration and appraisal*: Extent of investments needed in acquiring seismic data? Extent of risk sharing (contract partnerships)? Number of exploration wells to delineate the field?;

- *Development*: Number, location and order of wells to be drilled? Complexity of producers wells (deviated/horizontal)? Number of platforms, and if offshore: floating or permanent? Type of interventions: routine or work-over? Number and location of injectors? Size of processing facility? Need of new pipeline?;

- *Production*: More unswept areas that can still be exploited? Need to divest part or the entire asset to other companies? Need for further seismic data? Options to extend the life of a field? Re-entering wells to improve their performance?;

- *Abandonment*: Ultimate abandonment cost? Environmental cost of closing down?; etc.

In spite of this enormous usefulness that real options can find within the oil industry, they only seem to be excellent for evaluating different projects, but are rather unpractical in determining the value for the whole company! As shown above, the process of extracting oil is made up of a number of different options. At every step of the way, there is an option, or a strategic choice to be made. However, when looking at the company as a whole, the number of options becomes tremendous. Another drawback is that we do not possess the necessary information to perform a sound real option analysis due to confidentiality reasons of the company. However, the biggest difficulty comes from the fact that real options theory is not

fully developed in direction of valuing entire companies; modeling and valuing real options is far more difficult than valuing and modeling standard cash flows. It may also be that the bundles of assets and opportunities that companies own cannot be practically valued as options.

**1.4.2. Evaluation and Selection of Valuation Methods**

After having described and discussed the different valuation methods, the step that follows is to compare them and choose the one(s) that best suits our analysis. A range of criteria can be used in the evaluation, where we will mostly rely on Copeland & Keenan (1998). The table below gives an overview of the major differences between the models, where the comparison is made upon five criteria, i.e. risk-adjustment, multi-period perspective, capturing flexibility, based upon cash flow and practicability/feasibility;

**Table 1. → Comparison of Valuation methods**

	<b>Risk-adjusted</b>	<b>Multi-period</b>	<b>Captures Flexibility</b>	<b>Cash flow-based</b>	<b>Practicability</b>
Discounted Cash Flow	Yes	No	No	Yes	Yes
Adjusted Present Value	Yes	No	No	Yes	Yes
Real Options	No	Yes	Yes	No	No
Monte Carlo Simulation	Yes	Yes	Yes	Yes	Yes
Black-Scholes	No	No	Yes	No	No
Binomial	No	No	Yes	No	No
Market Comparison	No	No	No	No	Yes
Cost of Sales	No	No	No	No	Yes
Adjusted Present Value	Yes	No	No	Yes	Yes
Real Options	No	Yes	Yes	No	No
Monte Carlo Simulation	Yes	Yes	Yes	Yes	Yes
Black-Scholes	No	No	Yes	No	No
Binomial	No	No	Yes	No	No
Market Comparison	No	No	No	No	Yes
Cost of Sales	No	No	No	No	Yes

<i>Market Value</i>	(✓)	×	×	×	✓
<i>Book Value</i>	×	×	×	×	✓
<i>Income Based</i>	✓	✓	×	✓	✓
<i>Real Options</i>	✓	✓	✓	✓	×

Partly sourced from Copeland and Keenan (1998)

As seen from the table, the *multiples (market value methods)* are relatively unreliable. They do not look at a multi-period, are not cash flow-based, nor capture flexibility. However, they are very practical and easy to use and understand. With these methods it is also possible to incorporate risk adjustments, which theoretically though, do not hold. Kaplan and Ruback (1995) on the other hand, conclude that estimates made by future *income methods* are far more precise than outputs from multiples. Equally, Frankel and Lee (1996) conclude that 'the EVA method predicts the variation in the stock market far better than the multiples'. The major difficulty using multiples is to find appropriate comparable businesses and indicators. However, the multiples are often and widely utilized among investors because of their feasibility.

The *book value methods* are scoring lowest from the ones discussed above. They only seem to be simple and functional, but are undependable based on the other criteria. They are also not applicable for companies with more than just tangible assets (Hawawini, 2001). Book value methods rely on accounting techniques, which usually differ across countries, and data in statements, very often, may be subjectively influenced by accountants or management (the cases of Enron and Worldcom).

As already mentioned, *income based methods* are defined by researchers as far more realistic and reliable than for example the market (multiple) methods. Namely, a strong correlation has been found between DCF valuation and the actual market value of companies (Copeland et al., 2000). As the table above suggests, income based methods are risk-adjusted, take into account multi-period perspective, are cash flow-based and are practical for valuation of companies. The only drawback is that they don't capture flexibility as good as real options. When comparing the different models within the income based valuation, the finance literature argues in favour of the DCF approach (Copeland et al., 2000). What makes this method especially popular among analysts and investors is the fact

that it is straightforward to carry out, rather reliable and not affected by accounting methods. All this makes us to be in favour of the DCF and to adopt it as the main valuation tool in our analysis.

A lot has been said previously on *real options* and the pros and cons of using them in valuation. They are indeed the most sophisticated tool in valuation, but unfortunately aren't developed in a way to be suitable in valuation of entire companies. This is the reason why we are not going to implement them in the valuation of Petrobras stock.

Osmundsen et al. (2005) in their '*Valuation of International Oil Companies*' argue that oil companies are primarily valued by the use of multiples and income based methods. Citing Damodaran (2002), they state that relative valuation (multiples) is widespread for the oil industry as it requires 'far fewer explicit assumptions than the exhaustive DCF valuation', it is easier to present and reflects the current mood of the market. This encourages us to briefly use multiples as a supplement to the main valuation method.

Based on the discussion above, the conclusion is that the DCF appears to be the most suitable method for estimating the stock value of Petrobras. Additionally and as a supplement, multiples analysis will be also applied briefly, but only for comparing Petrobras to its peers in the industry and not for the determination of its fair value.

se will ultimately impact Petrobras' profitability and value creation.

### **III. PETROBRAS: STRATEGIC AND FINANCIAL ANALYSIS; VALUATION OF THE STOCK**

Following the analyses conducted at the Macro- and Industry-levels, this section refers more specifically to Petrobras, or the *Company level*. Here, in addition to a strategic analysis of the company, we are also going to conduct a financial analysis, along with a valuation of Petrobras' stock.

#### **3.1. Company Profile**

Despite the fact that by now we have drawn a certain picture of Petrobras in its business environment and the industry, we still need to give a general depiction and introduction of the company in a greater detail.

*Petroleo Brasileiro S.A.*, or simply Petrobras, is the national petroleum company of Brazil. It is an *integrated oil and gas* company that engages in the exploration, production, refining and sale of crude oil and other energy fuels. More specifically it operates in four business areas, i.e. Exploration and Production (oil and gas exploration, development and production in Brazil), Downstream (refining and distribution of oil products through its BR retail network or wholesalers), Gas and Energy (gas transmission and distribution, electric power generation using natural gas, renewable energies and biofuels) and International (oil and gas exploration & production, and downstream activities outside Brazil). Besides being the largest energy company in Brazil, Petrobras is also present in 27 countries worldwide, among which Argentina, Bolivia, Peru, Mexico, the US, the UK, Portugal, Turkey, Angola, Nigeria, Iran and China<sup>57</sup>.

Even though the company ceased to be Brazil's oil monopoly in 1997, it remains a rather significant oil producer, with an average daily hydrocarbons production of 2.176 million barrels of oil equivalent per day (mboe/d) during 2008. Most of the oil produced that Petrobras refines, sells and transports through its downstream segment, supplying almost the entire country with refined petroleum and gas products. While 90% of Petrobras oil and gas reserves come from Brazil, the company controls oil and energy assets in 18 countries in Africa, North and South America, Europe and Asia. It invests in concession rights to explore deep water fields, such as the ones in West Africa and the Gulf of Mexico. The oil reserves are the company's most important assets, totaling \$135.5 billion<sup>58</sup>. Petrobras has been the world leader in the development of advanced technology for ultra-deep water oil production, outpacing bigger rivals such as ExxonMobil, BP and Chevron Texaco. In the past few years, it made significant discoveries of deep-water oil fields in the Santos Basin, out of which Tupi distinguished as one of the largest discoveries in decades. Other mega-fields discovered in the same basin are Jupiter, Carioca and Bem-te- vi<sup>59</sup>.

In addition to this, the company also produces petrochemicals and fertilizers. Particularly, it works on developing green energies, such as biodiesel and ethanol fuel. The opportunity for ethanol is especially big, as Brazil is the biggest producer of ethanol globally (with a third of the world output), also offering one of the cheapest productions. In spite of this, biofuels will only account for 1% of Petrobras' income for the period 2008-2012<sup>60</sup>.

When it comes to the company's results, Petrobras saw record profits in 2008. Net income increased by 53% over 2007, from R\$21,512 to R\$32,988<sup>61</sup>. This was mainly due to higher oil prices during 2008, but also as a result of increasing production and demand in the country. Investments also continued to increase in 2008, marking an almost 18%



increase over 2007.

Petrobras is a semi-public company, i.e. the majority of the company's stock belongs to the Brazilian State (55.7%)<sup>62</sup>. The privately held shares are traded on the Brazilian stock exchange BM&F Bovespa, but also on the New York Stock Exchange. The Brazilian government's majority stake in Petrobras has an important impact on investors, as it gives the right to control the company's finances and operations. The company's performance is also tied to the government's stability. However, having a preferential treatment with the Brazilian government has allowed Petrobras to have little competition in the home market and to maintain its market share throughout the years.

Due to its international business activities and the presence of the international majors in the exploration sector in Brazil, Petrobras' peers in the industry are not only national oil companies (such as China National Petroleum Company, National Iranian Oil Company, Petroleos De Venezuela SA, Saudi Aramco, Petronas, etc.), but also the supermajors, such as Exxon Mobil, Total S.A., Royal Dutch Shell, BP, Chevron and ConocoPhillips. Among the players in the industry, Petrobras ranks in the first 5 based on *market capitalization*<sup>63</sup>, after ExxonMobil, but in front of BP, even though it has lower earnings per share (EPS) compared to both companies (→ Check Appendix C for comparison among these companies). Petrobras also ranks among the top 10 oil companies when it comes to Return on Investments (ROI), Operating Margin and Revenue Growth, but it's not in the first 10 companies based on the size of Revenues (→ Appendix C).

Finally, what is also important to mention about Petrobras is that since 2006 it's been listed in the *Dow Jones Sustainability Index*, which lists environmentally and socially responsible investors, an important global sustainability reference. The company is also recognized as the largest sponsor of arts, culture and environmental protection in Brazil, especially in initiatives of whale conservation. In addition, Petrobras has been acknowledged as one of the most reputable companies in the world, subscribed to the United Nations Global Compact, being part of the most transparent and sustainable companies globally, and having a leading brand in South America<sup>64</sup>.

### **3.2. Petrobras Strategic Approach**

The company's competitive strategies are its response to the situation in the competitive environment. These are important, as with the implementation of the right competitive strategies, the company can sustain its positive growth and high rates of return- the two most important value drivers (Koller *et al*, 3<sup>rd</sup> edition, pg.157). According to Porter (Reilly

and Brown, pg.545), a company can either position itself to deflect the effect of the competitive forces in the industry (*defensive strategy*)- through investing in technology that will lower production costs or through increased advertising and creating a strong brand; or it will use its strengths to affect the competitive forces in the industry (*offensive strategy*). Both, the defensive and offensive competitive strategies can incorporate *low cost* and *differentiation strategy*.

The analysis of the competitive environment has shown that Petrobras operates in a highly competitive industry, as a result of the difficulty of companies to replace their drying oil reserves, the slowing growth of the industry and the lack of product differentiation. However, due to the fact that Petrobras is a state oil company with a privileged access to Brazil's oil reserves and a dominant position in the home market, it possesses certain competitive strengths that have also influenced its corporate strategy. Petrobras *Strategic Plan (2009-2013)* reveals most of the company's strategies and plans in the following years and is the only secondary source that can help us identify what types of strategies Petrobras is pursuing<sup>65</sup>. The general impression from this report is that Petrobras has set a rather aggressive strategy in the five coming years, with a vision of becoming one of the five largest integrated energy companies in the world (publicly traded), by the end of the next decade (2020). Essentially, Petrobras' proactive strategy to develop the pre-salt Santos basin and invest around \$174.4bn (the world's largest for a corporation) in the coming years, speaks of the *offensiveness* of the strategic approach it has chosen. Within this offensive strategy, it is also evident that the company is mostly pursuing *differentiation* approach, which is seen through the fact that it is specializing in deep-water and ultra-deep water exploration, and that it is devoting a lot of attention and resources to biofuels R&D and production. At times however, a *competitive cost* strategy is also in the focus of the company. The Strategic Plan furthermore reveals important information of the development of certain financial parameters of the company, which will help in the determination of the company's stock value, in the DCF analysis.

**E&P** When looking at the oil *exploration and production* segment (E&P), the two most important features defining the offensiveness of Petrobras' strategy are the fact that the company is pushing hard to develop the pre-salt cluster- offshore oilfields in the Atlantic (and thus increase production and exports substantially, maintaining a reserves-to-production ratio of 15 years), and the fact that it is also engaging in deep-water oil E&P elsewhere in the world, utilizing its unique expertise in the field.

In this respect, Petrobras' plan is to invest \$104.6bn in E&P, of which \$92bn in Brazil and the rest internationally, through 2013. This has the potential to increase the total production of the company to 8.8% per year until 2013, and at around 7.5% for the period up until 2020. By the end of this period, production is expected to reach 5 mmb/e/d and proven

reserves to stand somewhere between 25-30 billion barrels oil equivalent, all of which should make Petrobras the 5<sup>th</sup> largest oil company in the world (→Check Appendix D for graph of production and reserves expectations). Furthermore, half of the money spent in R&D went to exploration and production in 2007, and Petrobras was the top second company in the energy sector by the amount spent in research and development. Petrobras' R&D activity allows it to develop technologies for ultra-deep water oil exploitation, to improve oil recovery (also from existing fields) and extend useful lives of oilfields, and also to optimize production costs. Based on the finding & development (F&D) cost figures for 2007, Petrobras was among the first seven companies in the world, with the lowest F&D costs per barrel (under \$15), making it very competitive.

Petrobras also practices an offensive strategy when it comes to utilizing its unique expertise in ultra-deep water E&P *outside of Brazil*. The company engages proactively wherever there are such opportunities worldwide, which allows it to benefit from its know-how on a global scale. These areas have a major potential for Petrobras and its portfolio, as here the company possesses competitive advantage in terms of operating, technical and technological skills. The focus regions are mainly West Africa, the Gulf of Mexico and South America, but also other oil-important regions worldwide.

**Biofuels** The other important characteristic differentiating Petrobras from the other major oil producers is the fact that the company is devoting lots of resources in biofuels and has an explicit goal of becoming a global leader, especially in the fields of *ethanol* and *biodiesel*. The latest Strategic Plan suggests investments of \$2.8bn in biofuels, of which the major part goes to ethanol (84%) and the rest to biodiesel. Petrobras is also dedicated in R&D of biofuels, trying to develop technologies allowing the production of biofuels from residual biomass, (such as the H-Bio biodiesel production from vegetal oil, which is Petrobras' breakthrough). This shows Petrobras' understanding for the long-run perspective of the energy industry.

*Ethanol* is the most important biofuel produced by the company, which supplies 1/3 of the world's market for ethanol and has a 30-year experience in the production of this energy. The importance of this fuel is yet to increase, especially worldwide, with significant increases in global demand, where the company's exports are expected to increase by 40% per year, from 1.08 mm m<sup>3</sup> in 2009 to 4.23 mm m<sup>3</sup> in 2013. Not only is Petrobras one of the biggest suppliers of ethanol on a global scale, but it is also operating with a significant

competitive advantage of having one of the cheapest productions in the world. Namely, Brazil boasts of cheap production of different grains used in the production of ethanol, among which especially important is the sugar cane, with the highest energy output/input ratio (ranging from 4 to 7 times higher than for other grains)<sup>66</sup>.

Petrobras' ethanol strategy suggests that most investments will go to export logistics, mainly in new pipelines and marine terminals, which is essential for securing greater international presence. The strategy is to develop ethanol-fuel international markets, which will definitely open new opportunities for Petrobras. In addition, the offensive ethanol strategy also implies investments in the domestic production chain and infrastructure, and in ~~research of new technologies~~ for ethanol production. From the early 70ies, when Petrobras started developing and producing ethanol in order to reduce the oil-import-dependence of Brazil (when the first oil crisis hit the world), through the *current* attractiveness of this energy as an environmentally-friendly fuel, the company also sees a great potential of ethanol in the generation of hydrogen in the *future*, which is increasingly used in transportation around the world.

Apart from ethanol, *biodiesel* is also given special attention among biofuels, with \$450mn worth of investments. Biodiesel is a relatively new biofuel, which production began in 2005 in Petrobras' plants. Plants are mainly opened in the Northeast region due to the proximity to the grain plantations, the raw material for biodiesel generation. Petrobras is mainly focusing on the Brazilian market for biodiesel and expects production to increase by almost 18% per year until 2013. However, capitalization of opportunities in overseas markets is also part of the strategic approach.

In addition to the previously discussed two main strategies, which differentiate Petrobras from the majority of oil companies worldwide, the company has also set particular strategies for its other business activities;

**Downstream** In the *downstream* business segment, Petrobras' strategy is to expand its integrated operations, particularly in refining, sales, logistics and distribution in Brazil and abroad, focusing on the Atlantic Basin. The main goal is to significantly increase the refining capacity in order to meet newly planned exploration and production quotas of oil, so that balance between the E&P segment and the refining capacity is maintained. Therefore, the downstream segment is going to receive investments of \$47.8bn, of which 73% for refining only. Furthermore, the company is aiming to continue developing its products' and services' portfolio according to customers' needs and preferences, making the Petrobras brand

preferred choice among them. Developing commercial and logistics partnerships is also crucial part of the downstream-business strategic approach, especially in expending presence in target markets.

Domestic demand for different oil products is expected to rise at 3% through 2013. Hence, the company's strategy is to increase production of petrochemicals as well, by capturing synergies within its system. The company also expects to improve the quality of oil products, such as gasoline and diesel, contributing to the reduction of emissions of harmful gases. Investments in the downstream segment in general, are expected to accumulate higher value-added products in the company's portfolio. When it comes to refinery *throughput* capacity and operational *costs* Petrobras is not performing very well. In fact, it belongs to the group of companies with low throughput and is not very cost competitive. These issues are addressed in its latest *Strategic Plan*, where the investment decisions in this segment are expected to improve the company's competitiveness and refinery throughput.

**G&E.** The strategy for the *gas & energy* segment (G&E) is with a focus on Brazil and South America. Here, Petrobras aims to further develop and lead the natural gas and electric energy markets in Brazil, on an integrated basis. Enhancing integrated operations throughout the whole value chain is believed to improve profitability in this segment. Domestic demand is also expected to increase substantially, by 6% on average through 2013. For the period 2009-2013, G&E investments are expected to amount \$10.6bn, out of which \$8.2bn for natural gas and \$2.4bn for energy sector. These investments should allow for diversified and more flexible supply of gas, and integration of the gas network in the country, with possibilities of reaching international markets. The company's goals for the longer run are also to capitalize on the opportunities for generation of electricity from biomass, oil products and natural gas. Petrobras' proactive strategy in this field furthermore suggests that the company is putting emphasis on playing a more significant role in the energy integration of South America.

Finally, Petrobras' strategic approach is to create a differentiated image by aiming at becoming a benchmark for social and environmental responsibility, and reference for sustainable development. In this respect, the company has been sponsoring cultural, artistic and environmental events and projects in Brazil; has been engaged in developing

sustainable business models and overall sustainability in the energy sector, such as in technologies, mitigation of global climate changes, but also in local communities; and states that it is dedicated to a capital discipline, where asset portfolios are managed efficiently and returns on capital employed are maintained at high levels.

The general conclusion after investigating Petrobras' strategic approach is that it is mostly acting *offensively* in the pursuit of becoming one of the five largest integrated energy companies in the world. This statement was supported by the fact that the company is undertaking one of the biggest CAPEX taken by a company, with the purpose of acquiring a more dominant position in the global energy market. By investing in its unique expertise and competitive advantage in deep-water oil exploration and biofuels production, Petrobras is safeguarding long-run returns on capital and essentially, shareholders' value.

### 3.3. Petrobras Value Chain

Through the Value Chain framework, a company is seen as 'sequential processes of value-creating activities', which allows an investor to understand the foundations of a company's competitive advantage - the base for value creation (Dess et al. 2004, Ch.3). Porter's value chain distinguishes between two sets of activities performed by the firm, i.e. primary and support activities. The first set of activities is directly involved in the creation of value, whereas the second set are activities that support the primary activities, and they influence value by the impact they have on the first activities (i.e. administration, HR management, technology development and procurement).

In addition to Porter's Value Chain, certain authors, such as Davis (2006) propose the use of two other value configuration frameworks for the oil industry, i.e. the *value shop* and the *value network*. Davis (2006, pg.91,92) suggests that while the value chain is suitable for the analysis of companies that deliver value by transforming inputs into goods, the value shop is appropriate for companies that deliver value by solving a customer's problem; the value network, on the other hand, for companies that deliver value by mediating between customers. These two analytical models may better suit the companies operating solely in the different functional areas in the oil industry, such as in the case of the oil service companies in the *upstream industry*, which provide problem-solving services for other companies in the industry. Namely, Davis (2006, pg.97) proposes two views of the upstream oil industry, i.e. one as problem-solving and one as manufacturing petroleum. The first one

is solving the problem of finding, developing and producing petroleum for different nations, whereas the second one involves companies that produce and sell petroleum. In the later, 'the acquisition of prospective assets (oil), exploration for petroleum and development of discoveries represent support activities'. This is exactly how we see the exploration and development functions of Petrobras' value chain. Hence, in the case of Petrobras, we find the value chain by far the best framework (among the three), as the company appears to be the ultimate manufacturer and marketer of hydrocarbon and biofuel *products*. Namely, our understanding of the overall oil industry (even when looking at the upstream oil industry) is as a manufacturing industry, and not a problem-solving one.

Throughout its value chain, Petrobras is not only involved in exploring and developing oil fields, it also engages in the production, transportation, refinement, distribution and marketing of oil/gas and biofuel products, which are overall better explained by the conventional value chain analysis. Here is a possible value chain for Petrobras:

**Graph 9. → Petrobras' Value Chain**



So how does Petrobras create value and how is competitive advantage built throughout the company's value chain?!

Petrobras believes that most of its value is captured from the fact that it operates as an integrated oil company, where the integration of business activities enables it to capture substantial value added. In its Strategic Plan, Petrobras states that it intends to further expand its integrated operations in refining, commercialization, logistics and distribution of oil and petrochemical products, mainly in Brazil. The idea is to capture synergies within the value chain from the vertical integration of operations in the different energy segments. Petrobras furthermore estimates that the returns on capital employed (ROCE) are significantly higher for *integrated* oil companies than they are for *upstream players* or *refiners*. These percentages varied from 5 to over 10 for the period 1995-2007. For instance, the ROCE for integrated oil companies was at around 27%, whereas it was only around 17% for both upstream companies and refiners in 2007 (*Petrobras Strategic Plan '09-'13*, pg.65).

*Vertical integration theories* are in fact in favour of these claims by the company. One such theory is the Transaction cost theory (Coase, 1937), which explains the reason for the

existence of multinational companies. Namely, multinational companies arise because companies tend to internalize transactions for which transaction costs are high in the market. By carrying out these transactions within one company instead of different independent companies, transaction costs can be reduced. Most common transactions costs that occur in the market are: search and information costs, bargaining and decision costs, and policing and enforcement costs. Yet another theory that supports the fact that integrated companies can capture significant synergies from vertical integration is the Double mark-ups theory. It states that vertically 'integrated companies can generate substantial efficiency gains by eliminating the double mark-up problem that arises from sellers exercising market power in the upstream industry and buyers exercising market power in the downstream industry' (Hendricks Kenneth, 2007). Namely, for vertically integrated companies, such as Petrobras, gains are to be ripped off when there are no powerful suppliers to impose huge mark-ups on intermediary products they are selling.

In the creation of value, when looking at the individual functional areas (which we are only going to look at some of them), the exploration and development segments seem to play an essential role, as they are responsible for locating oil and preparing oilfields for production. Oil companies deliver most of their value from the oil assets' licenses they possess, and the greater in quantity these assets are, the larger the value of the companies. Thus, the most important value driver within this segment for an oil company is the choice of the 'right' concessions for exploitation. For Petrobras though, this doesn't seem to be the overall most important value driver, as the company's main reserves of oil come from its home country, where it possesses privileges. However, Petrobras is increasingly sourcing value from its international operations and choosing the right partners and the most promising oil basins is essential for its future value creation. It is also important to note that with its enormous CAPAX intended for developing the oil fields off the shores of Brazil, Petrobras cannot achieve it on its own. It is inevitable that it forms partnerships with institutions and other companies, for which well established reputation is needed in attracting quality partners. Luckily Petrobras has been working on its reputation in the past decade and this is in fact one of its major competitive advantages. Examples of partnerships in the exploration segment are the ones in the Campos basin for instance, where the company's partners are some of the supermajors, Repsol/YPF, ChevronTexaco, and Shell<sup>67</sup>.



Petrobras' another major competitive advantage in the upstream industry is the deepwater-drilling expertise. Deepwater drilling is very peculiar, because of the long lead time in obtaining rigs (which are in limited numbers worldwide) that are designed to cope with high seas, can identify oil and gas deposits as much as six miles below the ocean surface and can reach miles under water and rock. However, Petrobras seems to be acting aggressively in this respect and according to Rigzone.com, it is already leasing about 80% of the world's deepest-drilling offshore rigs<sup>68</sup>. This will probably increase costs for other oil companies that use these kinds of rigs (such as BP, Chevron, ExxonMobil and Shell), as they struggle to get to the limited units of rigs<sup>69</sup>.

To secure the realization of its Strategic Plan (2009-2013), Petrobras is contracting suppliers of goods and services needed to develop the pre-salt basin, *in advance*. The idea is to take advantage of economies of scale that will be generated and as a result to be able to negotiate prices and make beneficial long-term agreements either by competitive bidding programs or strategic partnerships<sup>70</sup>. This is naturally expected to secure value creation in the future. Partnerships are also part of the company's strategy not only with suppliers, but ~~also with competitors in the industry~~. Such an example is the one with the Norwegian state oil company- Statoil, which covers exploration, production and biofuels areas<sup>71</sup>. As already stated, partnerships are also formed with other energy companies and banks, such as the ones from China.

Another interesting primary activity in the company's value chain to look at is refining. The main strategy here believed to create value is to integrate refining and petrochemicals production (→Check Appendix D for a depiction of Petrobras' Integrated Activities). Refining and petrochemical integration hedges both segments against profitability cyclical performance, mitigating financial risks. Furthermore, higher production scale can allow for lower costs in operations and better competitiveness<sup>72</sup>, and the plan to diversify into higher value added petrochemical products will definitely push up returns. Such a new integrated subsidiary is COMPERJ, which is expected to contribute to Petrobras value chain through: expanding the domestic petrochemicals market, capturing synergies of existing infrastructure in the region and improving the trade balance of oil, oil products and petrochemicals<sup>73</sup>. Additionally, there are also projects for new refineries that will increase the oil production capacity by 1200 thousand b/d; these include Guamaré, Abeu e Lima,

Premium I-MA and Premium II-CE<sup>74</sup>.

The other downstream functional areas, such as transportation, distribution and marketing, are also playing essential role as building blocks in the company's value chain and value creation. In this respect Petrobras invests in the oil and gas pipelines' infrastructure, its own ships fleet, service stations throughout entire Brazil, but also in relationships with industries, thermoelectric companies, airlines and vehicle fleet companies.

Finally, technology development is also one of the central value creation processes in the Petrobras' value chain jigsaw. Even though theoretically considered as a support activity, technology is a fundamental competitive advantage of the company. Since 2002, Petrobras has been developing technologies that have allowed for increased success rates of finding new deepwater oil fields. Without the continuous development of technology, the complex and ultra-deep water reserves of oil would be infeasible to exploit. And not only has the development of deepwater oil exploration technologies been in the center of the company's interest, but also the development of new technologies for the petrochemical segment. The development of technologies is also performed in partnerships with Brazilian and foreign universities<sup>75</sup>. Additionally, Petrobras' perspective goes a bit further when it comes to technology development. It endeavors to help form technology companies in order to make the industrial and service sectors in Brazil more competitive, through its Technological Incubator Program. With joint venture capital, so called 'incubator' firms are formed, which are expected to come up with new ideas, products and solutions for the industry, of which Petrobras for instance can possibly benefit<sup>76</sup>.

To sum up; Petrobras' ability to create value comes essentially from the fact it operates as an integrated oil company, meaning it is in position to take advantage of the synergies arising from the vertical integration of operations. Supported by sophisticated technologies, some of which unique to its field of oil exploration, Petrobras creates most of its value from the exploration concessions rights. Partnering at the different stages of the value chain with universities, suppliers, competitors and clients, also enables the company to generate value.

### **3.4. SWOT - Strengths, Weaknesses, Opportunities and Threats**

After analyzing the company's strategic approach and value chain, we can finally determine Petrobras' SWOT, which will help depicting important determinants for value creation. The company's strengths, weaknesses, opportunities and threats will reveal relevant aspects as to the ability of the firm to create value. In general, the strengths and weaknesses are

regarding the firm's internal abilities/disabilities, whereas the opportunities and threats have to do with external circumstances and conditions (Reilly and Brown, pg.547). Table 6 summarizes Petrobras' SWOT aspects that we have identified for the company. A discussion of these follows thereafter;

**Table 6. → Petrobras SWOT**

<b>→ Strengths</b>	<b>→ Weaknesses</b>
<ul style="list-style-type: none"> <li>- advanced technological know-how for deepwater and ultra-deep exploration</li> <li>- significant and growing reserve base</li> <li>- domestic market dominance</li> <li>- diversifying portfolio of products</li> <li>- significant and cheap production of biofuels</li> <li>- prominent reputation</li> <li>- R&amp;D in biofuels</li> </ul>	<ul style="list-style-type: none"> <li>- higher marginal costs in deep-water production</li> <li>- no sufficient internal funds to finance exploration projects</li> <li>- not sufficient number of drilling rigs</li> <li>- natural gas transportation infrastructure not interconnected</li> <li>- aging workforce, difficulties in attracting new workers and shortage of specialized candidates</li> </ul>
<b>→ Opportunities</b>	<b>→ Threats</b>
<ul style="list-style-type: none"> <li>- huge new oil reserves from undeveloped oil fields in the Atlantic Ocean</li> <li>- becoming a major exporter of oil</li> <li>- Leveraging deep-water expertise internationally (e.g. Gulf of Mexico and West Africa)</li> <li>- forming partnerships with other oil companies for new exploration opportunities</li> <li>- main operations in a fast growing, emerging economy</li> <li>- generate electricity from natural gas, oil products and biomass</li> <li>- natural gas infrastructure connection and expansion</li> <li>- strengthening position through acquisitions</li> </ul>	<ul style="list-style-type: none"> <li>- volatility of oil and gas prices</li> <li>- exchange rate risk</li> <li>- global economic crisis/recession</li> <li>- Brazilian political and economic conditions</li> <li>- possible price controls by government</li> <li>- political stability elsewhere, as well as nationalization of property abroad, imposition of restrictions on hydrocarbon exports, fluctuation of local currencies, unilateral institutional contractual changes</li> <li>- domestic and foreign environmental and health regulations/restrictions</li> <li>- dependent on Brazilian government for concession rights to develop and operate oil fields</li> <li>- pending litigations and arbitrations</li> <li>- increases in prevailing market interest rates</li> <li>- debt rating cut (by S&amp;P)</li> </ul>

**Strengths** One of the principal competitive advantages, the company has, is the technological know-how for deepwater and ultra-deep exploration. Compared to other global corporations, Petrobras is undoubtedly the market leader, with 23% of the global deepwater production in 2007 (→Check Appendix C: Deep-water Production by Global Corporations – 2007). Due to the depth of the offshore oil fields the company operates, it

has been able to develop technologies that can exploit hydrocarbons from such depths, which hasn't been done before. This capability not only enables Petrobras to exploit the Brazilian offshore fields, but the company can also benefit in applying this know-how elsewhere in the world, such as the cases of the West African coast or the Gulf of Mexico.

Another very important strength, from which Petrobras sources most of its returns, is the fact that Petrobras has domestic market dominance. Not only is the company the major owner of concession rights for oil fields exploration and production in Brazil, but it also dominates the refining and transportation of oil and gas in the country. The hydrocarbons production averaged 2.4 mmb/d in 2008, it is expected to pass 2.5mn in 2009, and is strategically projected to rise to around 3.3mn and over 5mn in 2013 and 2020, respectively<sup>77</sup>.

One of the basic strengths, which secure the business and value for an oil company, is the reserve base. Thanks to its discoveries made in the last couple of years, Petrobras has secured itself a Reserve Replacement Index of 18.2 years as of December 31, 2008, or proved reserves of 15.08 billion barrels of oil equivalent. These are definitely going to provide for lasting and sustainable growth in production, and are going to allow for scale economies and better control of future expenses<sup>78</sup>.

What is also important and appears as a particular strength is the fact that Petrobras engages proactively in the development and production of biofuels. Having the fact that renewable energies are going to play a significant role in the fuel transportation market in the future on a global level, Petrobras' engagement in this field is especially important. It is already producing a third of the world's output of ethanol and is more competitive than the American one, for instance. Petrobras' strengths also come from the company's strong R&D activity within the field, where its H-Bio (Vegetable oil hydrogenation) process represents a technological breakthrough, yielding biodiesel<sup>79</sup>.

Finally, the company's prominent reputation due to its social and environmental responsibility can hold as a particular strength and can provide for the company's long run value creation.

**Weaknesses** The company's internal disabilities constitute its weaknesses. They mainly relate to the financial incapability of Petrobras to finance expensive exploration projects on

its own. Petrobras' investment plan of \$174.4 billion for the period 2009-2013<sup>80</sup> is rather massive, and thus requires foreign investors' involvement. In times of financial/credit crisis when it's become more difficult to raise funds, and where the company's debt rating has been lowered to a grade of BBB- from BBB as of recently (by S&P), it is going to be challenging for Petrobras to achieve its investment goals and boost hydrocarbons output as initially planned. So far however, the company has managed to make agreements with few Chinese banks and energy companies, which are going to finance the development of Petrobras' offshore oilfields in exchange for future guaranteed supplies of oil, as a response to the rising Chinese demand for energy. Some of these entities are the China Development Bank, the China National Offshore Oil Corp. and SINOPEC Shanghai Petrochemical Company<sup>81</sup>. Petrobras is also seeking foreign investments elsewhere in the world, such as in the US and the Middle East.

Another internal weakness facing Petrobras is the fact that deepwater and ultra-deep water extraction requires higher marginal costs, when compared to oil produced from conventional fields, for instance. This is especially critical when oil prices are down, as then the company's margins decrease substantially. Petrobras, on the other hand, expects cost of oil production from the pre-salt layer to be relatively cheap, even though as seen in the *Petrobras Strategic Plan (2009-2013)* these costs are higher than the production of conventional oil, but cheaper than the oil produced from heavy oil and bitumen sources, or from oil shales.

Yet another weakness that impedes the company to create profit and value is the fact that the natural gas transportation infrastructure is not interconnected within Brazil. This has disabled the deployment of the Brazilian inland gas reserves and thus Petrobras' natural gas profitability. Of course, it is to Petrobras to build and develop this network, as the company is nearly a monopoly in the supply of gas in the country.

Petrobras also does not possess a sufficient number of drilling rigs needed to support future exploration, production and development activities. Availability of existing rigs is finite and so is shipyard capacity to build new ones. Thus, the insufficient size of the drilling rig fleet that the company currently has is a weakness for future oil exploitation.

Finally, issues concerning Petrobras' workforce may impede the realization of projects and strategic plans, which also represent a weakness for the company. Namely, the situation is that the current workforce is aging, there appear to exist difficulties in attracting new workers and especially specialized/educated ones.

**Opportunities** External conditions that can increase the value of the company in the long run represent its opportunities. Naturally, the main and most significant opportunities for Petrobras arise from the huge new oil reserves still not fully developed in the Atlantic Ocean, which can turn Brazil into a major oil exporter. Out of the projected \$174.4 billion of investment spending for the period until 2013, around 60% (or \$104.6bn) is planned for the Exploration and Production segment, which speaks of Petrobras' determination to seize these opportunities for a significant oil production expansion. In fact, the company is determined to become one of the top five oil producers in the world<sup>82</sup>.

Leveraging deepwater expertise (developed in Brazil) internationally can open sound opportunities for Petrobras. As the leader in this field, the company can benefit from further engagement in oil extraction from the biggest offshore oil areas, such as the Gulf of Mexico and West Africa. The West African subsea salt layer is identical to Brazil's, so even though already present there, Petrobras has the opportunity to advance its opportunities in these regions.

New opportunities can also arise from partnerships with other oil companies worldwide in the exploration of oil. Not only is this a unique opportunity for Petrobras to participate in oil exploiting in some regions, such as the Middle East, but with presently more restrictive credit markets, this may be the only opportunity for participation in most projects.

By expanding and interconnecting natural gas infrastructure, and by increasing domestic electricity generation from natural gas and biomass, the company expands its opportunities in the wider energy sector and may even change the negative profitability trend in this business sector (Gas & Energy).

**Threats** A special attention should be put on the company's external forces that continuously threaten its growth and profits. It must be noted that there is a significant number of aspects which can be considered threats in the oil industry.

First, there is the significant volatility of oil and gas prices in the world markets, as was the case in the previous year, when the global oil price dropped from \$147 in the middle of 2008 to only \$35/barrel by the end of the year<sup>83</sup>. Substantial declines in crude oil price will certainly have negative effect on Petrobras business, operations and financial condition, as well as the value of its proved reserves. Moreover, low oil prices have the potential of reducing Petrobras' exploration efforts and hurting its investment plans, because deepwater

oilfields require rather expensive technology. This is a serious threat, as Petrobras' deepwater fields are the greatest asset and value creation opportunity the company has. Second, exchange rate risk or currency fluctuations can also pose a threat towards Petrobras' financial condition and operational results. This is due to the fact that most of Petrobras' revenues are in *reais* (the main market for the company's products is Brazil- around 74% of revenues) and a big part of its liabilities are in foreign currencies (mostly in US dollars). Thus, the impact of the exchange rate of the *real vs. the dollar* in particular, is significant and any appreciation of the dollar against the *real* will have an adverse effect for the company. In the last few years, before the financial crisis (until 2007), the *real* had been appreciating against the dollar due to improvements of the macroeconomic conditions and the reduction of political risk in Brazil, and this was a positive trend for Petrobras<sup>84</sup>. However, a significant reversal in this trend followed starting 2008, which has posed a significant threat for Petrobras' profitability<sup>85</sup>.

Third, the global economic crisis/recession, which also had its impact on Brazil, as already mentioned previously had a negative influence on the company due to decreased demand for energy sources and difficulties in obtaining loans.

Forth, Brazilian political and economic conditions, in general, have an immense direct significance on the company's business. The federal government's policies condition markets and prices of securities, and may negatively affect different economic parameters or aspects of the society, which Petrobras is dependent on, i.e. inflation, exchange control policies, social and price (in)stability, energy shortages, interest rates, liquidity of domestic capital and lending markets, tax policies and other political, social and economic factors. Specifically, Petrobras may suffer by certain initiatives that advise the increase in taxation on the upstream oil activities<sup>86</sup>.

Furthermore, in case the Brazilian government were to decide to reinstate control over oil prices due to market instability or conditions alike, these are likely to adversely affect Petrobras' results of operations. These controls were the practice until January 2002, where not rarely were domestic oil prices below prevailing prices in the world market<sup>87</sup>.

Sixth, political instability in the regions of operation, as well as nationalization of property, imposition of restrictions on hydrocarbon exports, fluctuation of local currencies, unilateral institutional contractual changes, can all threaten the company's profitability and value creation. Substantial risks, related to the company's international operations, can particularly occur in Latin America, West Africa and the Middle East, which are considered politically, economically and socially unstable. If any of the risks listed above materializes, Petrobras may not be in position to achieve its strategic goals in these countries and its financial outlook will certainly suffer. Among its international operations, Argentina accounts for the largest share with 43.3% of the total international crude oil & gas production and a

third of the international proved oil & gas reserves (December 2007). The Argentine government has established export tax rates for crude oil, natural gas and oil products, which have adversely impacted Petrobras' results, for instance. Operations and proven reserves in Bolivia and Venezuela have also suffered due to nationalization measures in the oil and gas sector taken by these countries' authorities<sup>88</sup>.

Seventh, domestic and foreign environmental and health regulations/restrictions have become more stringent in the recent past and may result in increased liabilities and increased capital expenditures. New laws and regulations, some of which relate to climate change as well, are very likely to eat up part of the company's other strategic investments. Any substantial increase in expenditures for compliance with environmental regulations and the reduction in strategic investments are likely to have an adverse material effect on Petrobras' financial position.

Eighth, Petrobras is also dependent on the Brazilian government for concession rights for developing and operating oilfields. Brazilian laws do not allow companies to own oilfield reserves, but instead grant concession rights for their operation and exploitation. Therefore, if the Brazilian government were to restrict or prevent Petrobras from exploiting the crude oil and natural gas reserves, the company's ability to generate income will be negatively impacted.

Yet another threat for Petrobras appears to be the pending litigations and arbitration processes against it, which may cost the company much time and money spent. Currently, Petrobras is a party in numerous legal proceedings relating to civil, administrative, environmental, labour and tax claims that are filed against it. All these claims may involve substantial amounts of money and other remedies.

Finally, increases in market interest rates and the recent debt-rating cut of the company by the Standard & Poor's, leaves Petrobras vulnerable when it comes to financing its operations<sup>89</sup>. The company's total debt consists of structured finance, export credits, trade financing and other similar financing methods, whose funding depends on floating rate instruments. Furthermore, the company is not part of any derivative contracts or other arrangements to hedge against the risk of an increase in interest rates, meaning in case of market interest rates rise (the LIBOR) its financial expenses will inevitably increase<sup>90</sup>.

In conclusion, apart from the company's numerous threats which can derail Petrobras' strategic investment plans and value creation prospects, it is apparent that the company



possesses significant advantages found in the advanced technological know-how in deepwater exploration, exceptionally growing reserve base, Brazilian market dominance, a diversifying portfolio of products with accent on renewable energies, and profound opportunities that can be harnessed in the domestic market and internationally, with the possibility of becoming a major exporter of oil. This makes us confident to assert that Petrobras' enormous value potential is likely to be materializing in the future.

### 3.5. Financial Parameters Overview

Before conducting the DCF analysis, it is essential to understand the historic *financial* performance of Petrobras. The financial condition of the company will be assessed by briefly looking at the profitability, liquidity and solvency ratios, compared against a peer group. The peers are carefully chosen to consist of firms that are mostly similar to Petrobras' operations. We are also going to outline the historic development of Petrobras' stock price and explain the events/reasons for its significant fluctuations during the past couple of years.

#### 3.5.1. Ratios

**Profitability ratios** The profitability ratios assess the business's ability to generate earnings compared to the expenses occurred. Having a higher value than the competitors and the industry average is an indicator that the firm is doing well. Some profitability ratios are for instance EBITD (profit) margin or returns on equity (ROE). Based on the basic indicator of the company's financial performance- EBITD (Earnings Before Interest Tax and Depreciation), Petrobras is one of the leaders, with a significantly higher ratio than the other majors in the industry (almost twice as much as BP for instance). This indicates that the company is more profitable and thus competitive than the peers. BG Group, however, is the absolute leader here with a ratio more than twice as high as the industry average.

**Table 7. → Profitability ratios: Petrobras, Peers and Industry average**

	Petrobras	BP	Chevron Corp.	ExxonMobil	Hess	BG Group	Industry
<b>EBITD*</b>	29.78	15.31	18.10	19.94	17.04	47.57	17.22
<b>ROE*</b>	29.58	25.03	27.55	33.96	21.16	28.00	23.47

\* five years average

Source: <http://www.reuters.com/finance/stocks/ratios>

Yet another ratio describing the company's profitability relative to its peers is the Return

on Equity (ROE), which measures how much profit a company generates with the money invested by shareholders. In this case, Petrobras is again performing better than the chosen peers; however the difference here is lower than it was the case with the EBITD. ExxonMobil is the leading company based on the ROE ratio.

**Liquidity ratios** These ratios determine the company's financial strength or its ability to pay off its short-term debt obligations. The higher the ratios are, the larger is the margin of safety that the company possesses to cover the short-term debts. Common liquidity ratios are for instance the current ratio (current assets/current liabilities) and the quick ratio (current assets – inventories/current liabilities). The current ratio should be greater than 1, which indicates positive working capital. The quick ratio shows how truly liquid and flexible the available working capital is. Here, Petrobras is doing worse than its peers and the industry average. Its quick ratio indicates that it can only cover 78 per cent of the following years' expected liabilities. Johnson (1992) suggests that healthy oil companies should have current ratios at about 1.2 and quick ratios of only slightly less. Only BP has lower liquidity ratios than Petrobras in the table below:

**Table 8. → Liquidity ratios: Petrobras, Peers and Industry average**

	Petrobras	BP	Chevron Corp.	ExxonMobil	Hess	BG Group	Industry
<b>Quick ratio</b>	0.78	0.72	1.11	1.05	0.81	1.02	0.85
<b>Current ratio</b>	1.06	0.96	1.37	1.31	0.96	1.09	1.17

Source: <http://www.reuters.com/finance/stocks/ratios>

**Solvency ratio** This ratio measures the company's ability to meet long-term debt, or how likely a company will be to continue meeting its debt obligations. This ratio is calculated

$$\text{Solvency ratio} = \frac{\text{Net Income After Taxes} - \text{Depreciation}}{\text{Total Liabilities}}$$

The lower the ratio is, the greater the probability that the company will default on its debt obligations. Analysts consider solvency ratios greater than 20% to be financially healthy. Below are presented the derived ratios for Petrobras and its peers:

**Table 9. → Solvency ratio: Petrobras and Peers**

Petrobras	BP	Chevron Corp.	ExxonMobil	Hess	BG Group
0.35	0.24	0.45	0.50	0.27	0.33

\* 2008 numbers

Source: <http://www.reuters.com/finance/stocks>

Petrobras ability to meet long-term debt seems to be in line with its peers, as it has an average solvency ratio in the group. However, ExxonMobil and Chevron seem to be in a much better position when it comes to the distance from a possible default.

Arriving to a conclusion about its financial condition, Petrobras appears to be a rather profitable company, distinguishing itself from the majority of its peers. Petrobras is also showing relatively solid solvency ratio, meaning it is going to be in position to meet its long-term debt obligations. On the other hand, the company does not seem to be very liquid, or it may need to borrow in order to meet short-term debt obligations. The huge expected investments for the purpose of developing oil and gas fields will require significant borrowing by the company, which may deter the financial position of Petrobras in the medium run, but hopefully it will push up income and returns in the long run.

### 3.5.2. Historic Development of Stock Price

Petrobras' stock is mainly listed on the Sao Paulo Stock Exchange (Bovespa) and New York Stock Exchange (NYSE), but also on the Madrid and Buenos Aires stock exchanges. The common shares listed on both the Bovespa and NYSE are a good indicator of the company's value fluctuation throughout the years. Petrobras' historic share price development in USD on the NYSE and in BRL (Brazilian Real) on the Bovespa is shown in Appendix E. Here, we are going to look at the dollar share price, as we are also going to use dollar numbers in the DCF analysis. This outline of the historic price, will allow us to understand the events that led to the large fluctuations of Petrobras' stock in the last couple of years.

**Graph 10. → Petrobras' historic share price (USD)**



Source: <http://finance.yahoo.com>

From the graph above, what is evident is that the share price crossed \$20 only in 2006 and was fluctuating below \$30 until the middle of 2007. The picture changes significantly after this period where in less than a year, the stock price increased by 150%. The first increase in the stock price for the period Sep. 11-Oct. 17 2007, was at around 30%, which occurred due to the collapsing value of the dollar and the rising oil prices, which in turn have increased the value of Petrobras' proven oil reserves and thus the value of its share. What followed was another significant price increase of 25% (to \$55) that occurred in only one day (Nov. 7), as Petrobras announced the discovery of one of the biggest oilfields in decades, Tupi. Tests on the Tupi field showed that the field held between 5 and 8 billion barrels of oil equivalent, in which Petrobras holds 65% stake. After a rapid fall in the share price due to lack of further information about the Tupi field, the stock price rose again by 17% in January 2008, where the company announced another significant discovery of oil in the same basin where Tupi was found. Until mid 2008, the stock price showed some rapid increases due to several factors; first, it was the opening of the first biofuel plant; second, the S&P upgraded Brazil's investment rating, which spurred increased investments in large Brazilian corporations and Petrobras could expect to have its BBB- corporate credit rating upgraded; third, on May 21, Petrobras confirmed the recovery of light oil in the subsalt cluster, however without further specifications. On this day the stock price stood at \$75.19, a record since the IPO.

In the half-year period that followed, the stock price plunged to around \$15 in November 2008. This was mainly due to the continuous decrease in oil prices, coupled with the overall global economic and financial crisis, which caused disastrous results on Wall Street. Petrobras share price on Dec.31 2008 stood at \$24.3. Starting 2009, the share price has been on an upward slope again. The main increase of around 24% occurred in early February when Petrobras announced its plan to increase oil and natural gas production at a rate of 7% annually until 2020, therefore undertaking a 5-year investment plan worth \$174bn intended for developing the new offshore oil and gas fields. Further increases in the period that followed were due to announcements of profits, which were 58% higher for 2008

(compared to 2007), but also due to the acquisition of 60% stake in Petrobras de Valores Internacional de Espana SL<sup>91</sup>.

Was the financial crisis and plunging oil prices in 2008 the only culprits for the tremendous share price drop (by more than 200%) in just half a year!? Or there was also a correction effect to the initial significant increases in the price, which were only investors' overreactions to the noteworthy oil discoveries announcements?! Due to the significant fluctuations of the share price in 2008, a question arises whether the *market* share price was the actual fair value of Petrobras' stock in the end of 2008, or whether the stock may have actually been undervalued!? With the DCF analysis we are going to try to answer this question, i.e. attempt to determine the fair value of Petrobras' stock.

### 3.6. Valuation of Petrobras' Stock

#### 3.6.1. DCF Analysis

The second part of the problem defined in this research was to investigate whether the market was accurately valuing Petrobras' stock in the end of 2008. The *DCF Analysis* is a model which in fact inspects the stock market sanity, i.e. whether the market is paying too much or too little for a particular stock. The analysis of the company stock is also the final step of the *top-down approach* to investing, as suggested by Reilly and Brown (pg.544). Here, we first represent some of the formulas used in the valuation process, mostly sourced from Copeland et al., (Ch.8, 2000).

##### 3.6.1.1. Equations

The value of the company's equity equals:

$$\text{Equity Value} = \text{PV of FCF during projected period} + \text{PV of Terminal Value}$$

Briefly, the first part of the equation seeks to determine the present value of the free cash flows (FCF) during the explicitly forecasted period, whereas the second part seeks to determine the present value of the Terminal Value, which represents the perpetual future cash flows, occurring beyond the projected period:

$$V_{\text{TV}} = \frac{\text{Net Income}_{\text{ROIC}} \left(1 - \frac{g}{\text{ROIC}}\right)}{\text{WACC} - g}$$

where  $g$  is the expected perpetual growth in the company's Net Income and  $ROIC$  is the

Return on Invested Capital, calculated as:

$$\text{ROIC} = \frac{\text{Operating Income (1 - T)}}{\text{Invested Capital}}$$

Total Assets – Cash – Noninterest bearing Current Liabilities

The last parameter in the formula for the Terminal Value is the weighted average cost of capital (WACC). The WACC is one of the most important factors in the DCF model. It encompasses the riskiness of the cash flows, or the risk that every investor faces in the company. Apart from its usage in the Terminal Value formula, it's also used for discounting the FCF in the process of deriving the present value (PV) of the free cash flows. The WACC equation is the cost of each capital component multiplied by its proportional weight:

$$\text{WACC} = D/V K_d (1 - T) + E/V K_e$$

In the valuation process, the PV of FCF will be derived by multiplying the FCF with a discount factor, derived from the WACC:

$$\text{Discount factor} = 1 / (1 + \text{WACC})^t$$

Furthermore, as shown in the WACC formula, the weighted average cost of capital is dependent on the debt to value and equity to value ratios, as well as on the cost of debt ( $K_d$ ) and the cost of equity ( $K_e$ ). There are variety of ways of calculating the cost of debt ( $K_d$ ) and the cost of equity ( $K_e$ ), depending on different authors. However, after a small research, the most appropriate equations when conducting a valuation for a non-US company come from Damodaran (2004, *Valuation: The Big Picture*), but also from Pratt et al. (1996).

$$\text{Cost of debt } (K_d) = \text{Risk-free rate} + \text{Country default spread} + \text{Company default spread}$$

The *risk-free rate* is the rate of return for risk free investments, for which normally a short-term US Treasury bill is used as proxy. However, the short term bill has a 'shortcoming that its maturity doesn't match the anticipated investment horizon of most equity investors. It is much more volatile than longer-term Treasury rates and the yield may not reflect longer-term inflation expectations. Therefore, most valuation analysts use the 20 year US Treasury bond as the risk-free component for estimating the cost of equity' (Pratt et al., 1996). This is what we are also going to use in our calculations. The *country default spread*, which is determined based on the credit rating of the country, measures the premium for default risk of that country. In the same manner, the *company default spread* is estimated based on the credit rating of the company.

For the cost of equity ( $K_e$ ), there are few approaches to estimating it (Damodaran, 2002, pg.97-108 and Damodaran, 2004). *Approach 1* suggests that every company in the country is equally exposed to the country risk, from here:

$$\text{Cost of equity } (K_e)_1 = \text{Risk-free rate} + \text{Beta (US risk premium)} + \text{Brazil risk premium}$$

*Approach 2* suggests that the company's exposure to country risk is similar to its exposure to other market risk, where:

$$\text{Cost of equity } (K_e)_2 = \text{Risk-free rate} + \text{Beta (US risk premium} + \text{Brazil risk premium)}$$

And *Approach 3* states that firms have different exposures to country risk, based upon the proportion of revenues coming from domestic sales, from here:

$$\text{Cost of equity } (K_e)_3 = \text{Risk-free rate} + \text{Beta (US risk premium)} + \% \text{ of domestic sales} * \text{Brazil risk premium}$$

In our calculations, we have chosen to follow *Approach 3*, due to the fact that Petrobras is exposed to Brazil's risk only with the portion of its domestic sales, and this is also the approach that Damodaran (2004) uses when determining Petrobras' WACC for 2004.

In the equations above, the *Beta* ( $\beta$ ) measures the volatility or the systematic risk of a security (or portfolio), in comparison to the market as a whole. For example, if the beta is greater than 1, the security's price will be more volatile than the market. The *country risk premium* is the premium that stocks have historically earned over riskless securities in a country, and it includes the risk from unexpected economic and associated political events:  $\text{Country risk premium} = \text{Country default spread} * (\sigma_{\text{Equity}} / \sigma_{\text{Country Bond}})$ .

The first step of the valuation process of Petrobras' stock was to set up a spreadsheet with historical data inputs ranging from 1999 to 2008, which are needed for the calculation of the FCF. This data was of significant importance when forecasting different items for the projection period of 10 years, also when the forecasts were done through Crystal Ball Predictor. Literature suggests that the FCF are derived from *net income*, to which *depreciation/amortization* is added and *changes in working capital* and *capital expenditures* are subtracted (Damodaran, 2002, pg. 491; Fernandez, 2002, pg.41; Copeland et al., 2000, pg.108). In the real world, sometimes, slight differences may exist from what theory



suggests, or the calculation of FCF may also differ among companies.

Petrobras' free cash flows were derived by subtracting Capital Expenditures (CAPEX) from Cash from Operating Activities. The Cash flows from Operating Activities, on the other hand, were obtained after adding Depreciation/Amortization, Adjustments to Income and Changes in Working Capital to Net Income (→ Look at Spreadsheet details in Appendix G)<sup>92</sup>. Net Income, by itself, requires several steps, which include variety of items. First, Revenue is deducted by Cost of Revenue and Operating Expenses in order to derive Operating Income. Net Interest Income and Other is subtracted from Operating Income to obtain Earnings Before Taxes. And, after deducting Income Taxes and finally adding back Minority Interest, Net Income is reached.

After calculating the FCF for the past decade, data is forecasted for the next 10 years-period chosen in the analysis. The Industry Competition Analysis, the estimated Oil and Gas prices, the company's Competitive Strategy, Value Chain and SWOT, have all contributed to understanding the future financial outlook of Petrobras and more specifically, to make realistic projections of several of its financial parameters. However, for most of the items in the Spreadsheet we possess no information on their future possible developments, which is why we are going to rely on Crystal Ball Predictor. It projects data based on the historical developments in the different parameters.

In the Spreadsheet, there are 12 items to be forecasted; these include: Revenue, Cost of Revenue, Operating Expenses (Selling/General/Administrative, R&D and Other Operating Expenses), Net Interest Income and Other, Tax Rate, Minority Interest, Depreciation/Amortization, Adjustments to Income, Changes in Working Capital and Capital Expenditures (→ Check Appendix G). Naturally, Petrobras' financial statements (Statement of Income and Statement of Cash Flows) appear with more items in comparison to the ones in the Spreadsheet. However, due to their large number and at the same time, insufficient amount of information for each and every single one, we have grouped several items under one item. This has enabled us to focus on the most important parameters and make more realistic forecasts about these.

### 3.6.1.2. Forecasts

**Revenue Forecasts** When forecasting the next ten years of Petrobras' revenue, we are going to take into consideration mainly the historical revenue data for each product that the company sells. Furthermore, helpful source of information for the estimation of the future revenues will be the rate of increase in world oil prices and consumption (and its derivatives), Petrobras' sales volumes and its production capacity, for the period ranging 2009-2019. The first step taken in the Net Operating Revenue forecasting was to look at Petrobras' Financial Statements in order to see which products were mainly responsible for the company's revenue generation. Effectively, there are eight products whose respective sales are the main generator of revenues for the company. These products are categorized according to the market they were being sold in, or as displayed below:

#### Domestic Market Revenue<sup>93</sup>

Diesel (Distillate Fuel Oil)

Motor Gasoline

Residual Fuel Oil

Naphtha

Liquefied Petroleum Gases

Jet Fuel

Natural Gas

#### Exports Revenue

Crude Oil

Oil Derivates

Historical Revenue data for each of these items was found back to 2004. The procedure used to forecast the future revenue was to multiply the previous year's revenue by the estimated annual revenue increase rate for each item respectively. This is shown in the equation below:

$$\text{Current Year's Revenue} = \text{Previous Year's Revenue} * (1 + \text{Annual Revenue Growth})$$

As for the historical revenue data found for each product, the following table shows the average annual increase for the period of 2004-2008, and also, the increase for the last two reported years. These calculations are made based on annual changes in the data:

**Table 10. → Revenue growth for different products (historical)**

<b>Product</b>	<b>Avg. 2004 - 2008</b>	<b>2006-2007</b>	<b>2007-2008</b>
Diesel	17.12%	37.87%	21.06%
Motor Gasoline	15.80%	32.83%	16.19%
Residual Fuel Oil	13.80%	39.59%	24.85%
Naphtha	9.52%	37.27%	8.84%
Liquefied Petroleum Gases	4.17%	36.11%	16.08%
Jet Fuel	14.81%	25.83%	34.30%
Natural Gas	20.03%	39.02%	45.11%
Other	35.44%	-32.56%	31.88%
Crude Oil	30.79%	39.76%	37.86%
Oil Derivates	11.20%	46.07%	3.42%

The high increase in Revenue figures for the period of 2006-2007 reflects the good economic momentum in Brazil at the time. However, for the period of 2007-2008, the revenue growth is lower. That mostly reflects the impact of the global financial crisis to the country's economic activity and consequently to the company's results. Growth in revenue, however, is expected to return to 2006-2007 levels as the country recovers from the financial crisis and later even to surpass those levels as in the near future Petrobras' production capacity is expected to increase significantly. This is as a consequence of the beginning of production in the subsalt fields and as Brazil's economic growth is expected to experience intense acceleration (as a consequence of a government's plan to forge high growth in a short period of time).

As stated in the beginning of this study, the approach used for deriving a fair value for Petrobras is the *top-down approach*, where qualitative data and analysis provide the analyst with basic knowledge about the company and the industry, which enables him to project numbers in a logical manner. After projections about the individual items are made, the next step will be to perform a *Monte Carlo Simulation*, adjusting the forecasted data quantitatively. This process will give a confidence interval to every projected number, thus assuming that the projected number could also be any other value around its respective confidence interval. Subsequently, when all the calculations are made and the fair value of the stock is derived, this final result will actually be a set of numbers normally distributed around a mean with its respective variance. In brief, this mean will actually be the most probable fair value of the stock, and the variance will be a good measure of the degree of uncertainty over this value.

We devote the following section to an item-per-item description on how the individual projections were made;

### ***Domestic Market Revenue***

***Diesel*** The increase in Diesel Revenue is mostly related to the increase in the Brazilian GDP, which reflects the use of more diesel in thermoelectric power stations, in infrastructure works, mining and civil construction. Also, the decrease in imports of the product and the decrease in production of other rival companies influence this trend. As Diesel Revenues are related to economic growth, the rates are lower for 2009 and 2010 (30% and 35% respectively) because those are the years that Brazil will be recovering from the impact of the financial crisis. From 2011, the growth rate reaches slightly beyond the 2007-2008 levels, reflecting the accelerated economic activity in the country and the increase in Petrobras' production capacity. From 2014 ahead, revenue rises incrementally by 15%, a rate slightly lower than the average revenue growth between 2004 and 2008;

<b><i>2008-2009</i></b>	<b><i>2009-2010</i></b>	<b><i>2010-2011</i></b>	<b><i>2011-2012</i></b>	<b><i>2012-2013</i></b>	<b><i>2013-2014</i></b>
30%	35%	40%	40%	40%	15%

***Motor Gasoline*** The increase in Gasoline Revenue is also positively influenced by economic growth, where more people in the country are becoming able to purchase motor vehicles, thus increasing the consumption of gasoline. As the increase of revenue for gasoline is dependent on the same factor as diesel's revenue, here we use the same logic from above to estimate the rate for this product. Thus, we give a smaller rate (27%) for 2009 and 2010, and a higher rate (35%) for the period between 2011 and 2013, reflecting the high economy growth and production. From 2014 ahead, again we have an incremental rate (10%), which is slightly below the historical average rate;

<b><i>2008-2009</i></b>	<b><i>2009-2010</i></b>	<b><i>2010-2011</i></b>	<b><i>2011-2012</i></b>	<b><i>2012-2013</i></b>	<b><i>2013-2014</i></b>
27%	27%	35%	35%	35%	10%

***Jet Fuel*** The increase in Jet Fuel Revenue is a result of the expansion of the tourism sector in Brazil, which in turn results in expansion of the airline industry in the country. From the historical data, this rate does not seem to get much influenced by the financial crisis, and indeed, tourism activity in Brazil was a sector that didn't suffer much from the crisis.

Therefore, we chose to keep the constant growth rate (35%) during the period of 2009 and

2013 (a rate which is almost equal to the 2007-2008 rate), as this sector has good growth potential in the near future. From 2014 ahead, an incremental rate is given;

2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014
35%	35%	35%	35%	35%	7%

**Natural Gas** The increase in Natural Gas Revenue is mostly related to the increase in the volume of sales caused by the higher supply and disposition of gas, due to the increase in production and the operation of new gas pipelines. According to Petrobras' projections, the national *demand* for gas stands at around 5% per year until 2015 and decreases to 2.4% thereafter, until 2019. During this period, gas *prices* are constant at 2.75%, but a sharp drop of 23% is expected in 2009. Because of this drop in price, and the instability in historical revenue growth for this product, we have estimated a revenue growth rate of 25% until 2015 (close to the 2004-2008 average), and a rate of 10% thereafter, as a result of the demand decrease by half;

2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014
25%	25%	25%	25%	25%	10%

**Residual Fuel Oil, Naphtha and Liquefied Petroleum Gases** The global demand for these products is on a decrease. On a national level they also seem to have a negative weight on the company's overall domestic sales of oil products. The historical revenue increase rates for this items does show clear patterns, as the rates vary widely from year to year. For this reason, and because not much data was available for these items in Petrobras' statements, in the forecasting process we will simply use the average growth rates from the historical period of 2004-2008. These rates are 13.8%, 9.52% and 4.17%, for residual fuel, naphtha and LPG, respectively.

#### **Exports Revenue**

**Crude Oil** The increase of Crude Oil Exports Revenue is mostly related to the increase in the production capacity of the company and international consumption of oil. As Petrobras' production capacity is expected to rise significantly through 2014, and demand for oil is expected to remain at a high level, we estimated a constant rate of 45% for this item up until 2014, and an incremental rate of 17% thereafter;

<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>	<b>2011-2012</b>	<b>2012-2013</b>	<b>2013-2014</b>
45%	45%	45%	45%	45%	17%

**Oil Products** The rate of exports of oil products is not only connected to the national production capacity of Petrobras and the international demand for these products, but also to the international production capacity of the company. Petrobras' international operations consider fields and refineries, which the company owns and which account for the major part of the company's international sales of oil products. However, most of these assets are located in troubled regions, prone to natural disasters and human conflicts. Lately, the volume sales of these products have been impacted by such aspects. Consequently, historical revenue growth data for these items also does not show a clear pattern, as the rates vary widely from year to year. Therefore, again, we have chosen to use an average growth rate from the period of 2004-2008, i.e. 11.2%.

**Costs and Expenses Forecasts** After discussing the projection process of each of the Revenue items, in this section, we are going to describe the forecasting process of each of the items that come *below* Revenue, which can be found in the main DCF analysis spreadsheet. Before doing that, it is relevant to point out few things. First, that the Cost of Revenue and all the items classified as Operating Expenses are directly influenced by the volume of sales and consequently correlated with the revenue's amount. Namely, we have found it practical to estimate these items as a fraction of Revenue, i.e. certain percentage of revenue. Second, during the period 2009-2013, Petrobras plans to spend \$174.4bn in the expansion of its operations and assets, which will inevitably impact all other cost items. A more detailed explanation for each particular item follows below;

**Cost of Revenue** This item includes the direct costs attributable to the production of the goods sold by a company. This amount includes the materials cost used in creating the goods along with the direct labour costs used to produce the good. It excludes indirect expenses such as distribution costs and sales force costs. It mostly includes Exploration costs (drilling costs) and costs related with pumping, refining and storing of oil and its derivatives. These costs are relatively high in the case of Petrobras as most of its oil production concentrated offshore at very high depths. With higher costs associated with the exploration of the subsalt fields, we believe that these costs will increase, and over the next ten years will remain between the 60% - 70% bracket;

2009	2010	2011	2012	2013	2014-2019
63%	65%	65%	65%	65%	62%

**Selling, General and Administrative Expenses** The main factors influencing these expenses are the increase of the work force of the company, mutual international agreements, distribution costs, as well as outsourcing of consulting, auditing and data processing. It is also believed that this trend will increase even sharper in the future, as Petrobras extends its capabilities in the near future. For instance, the company is already outsourcing massively and also increasing its work force for the excavations of its recently discovered fields, for the operation of its newly acquired refineries and also for the expansion of its ethanol exports. Our estimates for the forecasted period are:

2009	2010	2011	2012	2013	2014	2015-2019
7%	9%	9%	9%	9%	9%	7.5%

**Research & Development** Research & Development is one of the means by which Petrobras can experience future growth by developing new technologies and processes to improve and expand its operations. Recently, with the discovery of the Tupi field, which lies in the subsalt layer at an extremely high depth, the company needs to invest more in R&D in order to be able to drill and pump oil out, as this hasn't been done before by any other oil company. Thus, Petrobras is expected to undertake major R&D expenditures until 2014.

From here, we have made projections, which are twice as high as the historical rates of R&D;

2009	2010	2011	2012	2013	2014-2019
2%	3%	4%	4%	4%	1.7%

**Other Operating Expenses** This item gathers all the expenses related to the devaluation of inventories, oscillation in price of commodities, safety, environment & health expenditures, general charges, contractual fines and exploration costs (write-offs of dry wells; increase of drilling of wells). This trend is also increasing over the course of the years, as the company is expanding its operations. Consequently, we have projected rate increases substantially

higher than those during the historical period;

2009	2010	2011	2012	2013	2014-2019
------	------	------	------	------	-----------

15%                      15%                      15%                      15%                      10%                      8.5%

**Tax rate** Over the years, the tax rate shows an average of around 30%. The Brazilian government has made some efforts to reduce Corporate Taxes, however, some tax cuts are usually offset by other increases. Such is the recent case of the abolition of the CPMF (Provisional Contribution on Financial Activities), which was offset by the increase in the IOF rate (Tax on Financial Operations), but also the increase in taxes abroad, especially those levied on dividends and loans. After all, we expect this rate to decrease slightly over time, thus, using historical data, we were able to forecast figures (by using Crystall Ball) as follows:

2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
30%	29.84%	29.64%	29.44%	29.25%	29.05%	28.85%	28.65%	28.45%	28.25%

**Net Interest Income and Other, Minority Interest,**

**Depreciation/Amortization, Adjustments to Income, Changes in Working**

**Capital** All of these items have been estimated solely by using quantitative methods with *Crystal Ball Predictor*, based on

historical data. This is due to the fact that not much information is publically available on the future possible developments of these items, for us to be able to make reasonable projections. Thus, we will rely on the tool's forecasts, as these items don't have a significant influence on the final results of the DCF anyway.

**Capital Expenditures (CAPEX)** This item captures the expenses incurred by the company in upgrading physical assets, such as property, industrial facilities or equipment. It is this item that captures Petrobras' strategic plan of investments of \$174.4bn in operations and assets for the next five years. Thus, Capital Expenditures are on a highly increasing trend for the period of 2009-2013. *Petrobras Strategic Plan 2009-2013* gives some clues of the development of these expenses for 2009 and 2010, i.e. 28.000mn for 2009 and 35.000mn for 2010. We have estimated the remaining Capital expenses for the prevailing 3 years, of 35.000 each. For the period thereafter, we believe the CAPEX to be lower, or we have taken the approximate average from the historical period and used for this remaining period, i.e. 20.000mn per year<sup>94</sup>;



2009	2010	2011	2012	2013	2014-2019
28.600	35.000	35.000	35.000	35.000	20.000

### 3.6.1.3. Estimating Cost of Capital (WACC)

After calculating the company's free cash flows, the next step is to calculate the weighted average cost of capital (WACC), the factor needed for discounting the FCF. WACC is only calculated for the basic year (2008), from which discount factors are calculated for each successive year for the projection period.

**Cost of debt** The first element of the WACC is the Cost of debt:  $K_d = \text{Risk-free rate} + \text{Country default spread} + \text{Company default spread} = 4.36\% + 3\% + 1.75\% = 9.11\%$ . The 20 year US Treasury bond was taken as a proxy for the Risk-free rate and equals 4.36%<sup>95</sup>. Brazil's default spread over the US, in the end of 2008/beginning of 2009 stood at 300 index points or 3%<sup>96</sup>, whereas Petrobras' default spread, based on its credit rating was estimated to be 1.75% (Damodaran, 2004, *Valuation: The Big Picture*, pg.34).

**Cost of equity** The second element used in the WACC equation is the Cost of equity:  $K_e = \text{Risk-free rate} + \text{Beta (US risk premium)} + \% \text{ of domestic sales} * \text{Brazil risk premium} =$

$4.36\% + 1.5 (4\%) + 0.64 (4.5\%) = 13.24\%$ . The new parameters used here are: the company's beta, for which we used the average beta for 2008 (from Reuters' financial website<sup>97</sup>); the US risk premium, which is the average equity risk premium in the United States for the last five decades and as suggested by Damodaran (2004, *Valuation: The Big Picture*, pg.24) is about 4%; Brazil risk premium, which was 4.5% in the end of 2008/beginning of 2009<sup>98</sup>; and the share of domestic sales in Petrobras' revenues, which was calculated as the average for the past few years and equals 64%<sup>99</sup>.

**Cost of capital** For the calculation of WACC, the Debt to Value and Equity to Value ratios are also needed<sup>100</sup>. The D/V ratio equals 30.6% (27351/89260) and the E/V ratio equals 69.4% (61909/89260), meaning the company has 30.6% of debt financing and 69.4% of equity financing. Finally, Petrobras'  $\text{WACC} = \text{D/V } K_d (1-T) + \text{E/V } K_e = 30.6\% * 9.11\% * (1 - 34.3\%) + 69.4\% * 13.24\% = 11.02\%$  (→ Check Appendix G: Deriving WACC).

### 3.6.1.4. Estimating Stock Fair Value

Estimating the company's cost of capital enables the derivation of each of the discount factors for the 10 years projection period (→ See *Table 11*. below).

After the Present Value is calculated (by multiplying each of the FCF for the 10-year period with the appropriate discount rate), the Terminal Value is also determined and added to this number. The Terminal Value (value of the perpetual cash flows) depends on: the expected perpetual growth in the company's net income ( $g$ ), which is calculated as the average of the historic and projected growth of the net income (28.18%); the net income in the year after the explicit forecast (127.092mn) (→ Check Appendix G); the return on invested capital (ROIC), which was derived by using parameters from the 2008 annual report (16.59%)<sup>101</sup>; and the WACC (11.02%). From here, the **Terminal Value** =  $[127.092 (1 - 28.18\%/16.59\%)] / (11.02\% - 28.18\%) = \underline{\underline{\$517.269mn.}}$

The total Enterprise Value (D + E as of 2008 end) equals the sum of the PV of the annual FCF and the PV of the Terminal Value, or \$342.075mn (→ See *Table 11*. below). The enterprise DCF method values the equity of the company as the value of the company's operations, less the value of its debt. Therefore, the total value of debt for 2008 is subtracted from the Total Enterprise Value to obtain the Value of Equity. We have derived Petrobras' Value of Equity at \$314.724 million, for the end of 2008. Since at this time there were 8 774 076 740 shares of Petrobras' stock outstanding<sup>102</sup>, the value of the company's stock equaled \$35.87 per share.

### 3.6.1.5. Monte Carlo Simulation

*Monte Carlo Simulation* is a problem solving technique used to approximate the probability of certain outcomes by running multiple trial runs, called simulations, using random variables<sup>104</sup>. In practice, the simulation calculates numerous scenarios of a model by repeatedly picking values from the probability distribution for the uncertain variables and using those values for the derivation of the final output in form of a probability distribution. In the case of a DCF analysis, every uncertain forecasted number in the DCF appears as a probability distribution instead of a fixed number. The final result of the DCF (the share value) will also be a probability distribution of possible results originated from the numerous trials. In summary, the Monte Carlo simulation process goes through the following steps:

1. Specifying probability distributions for each of the key inputs that underlie the cash flows and the parameters of the distributions (the average and the standard deviation, if it is a normal distribution; or for instance, the worst-case, the likeliest case and the best- case scenario in case if it is a triangular distribution).
2. After numerous repeated simulations, one should have a distribution for the final result (the share value), where the distribution mean is picked as the share value and the standard deviation of the distribution can be used as a measure of risk in the further analyses.

**Setting Input Assumptions** Input Assumption is the official name given to the uncertain values in the analysis that will be assigned a distribution of values and take part in the simulation. In the case of our analysis, the uncertain values are all the numbers that have been forecasted. For instance, the items in the DCF Analysis that were taken as Input Assumptions are highlighted in green.

In the forecasting process, the variables that affect the Revenue are characterized as *systematic shocks*. Systematic shocks are effects that are stochastic in nature and unknown in the future. The increase in revenue growth due to the acceleration of national economic activity is such an example. We predict that revenue will increase due to acceleration of economic activity; however we cannot affirm with 100% certainty that this acceleration will take place and that its effect on revenue will be as expected. Hence, the analyst must have a sound overall knowledge and experience about the economic trends in the industry in question and the company as well. This justifies the importance of making the previous research on the characteristics of the economic and competitive trends in the industry and the company itself. In short, the analyst must have the capability of translating qualitative assumptions into quantitative data.

**Revenue Growth Rates and Operational Costs** The forecasted percentages taken as inputs for the simulation were the ones related to Diesel, Motor Gasoline, Jet Fuel, Natural Gas and Crude Oil as to Revenue Growth Rates; And Cost of Revenue, Selling/General/Admin. Expenses, Research & Development and Other Operating Expenses as to Operational costs. These variables are the Critical Success Factors, meaning that they have a significant impact on the final result. Conventionally, Critical Success Factors are set to be normally or log-normally distributed.

In our case, the probability distribution assigned to these forecasted distribution was the Lognormal Distribution. A variable might be modeled as log-normal if it can be thought of as the multiplicative product of many independent random variables each of which is positive. For example, in finance, a long-term discount factor can be derived from the product of short-term discount factors. The log-normal distribution is widely used in situations where values are positively skewed (where most of the values occur near the minimum value), like in financial analysis for security valuation or in real estate for property valuation. It is a continuous probability distribution.

In the case of Residual Fuel Oil, Naphtha, Liquefied Petroleum Gases, as they can assume negative rates, varying widely over the mean average, the probability distribution assigned to these rates was the Normal Distribution. Here, a high standard deviation was given in order to capture the wide variations of values around the mean.

In addition to the revenue growth rates and operational costs, other input assumptions taken into the simulation were the forecasted values for *Net Interest Income and Other, Minority Interest, Depreciation/Amortization, Adjustments to Income, Changes in Working Capital, Tax Rate and Capital Expenditures*. These variables do not have a significant impact over the final result; however they are quantitatively forecasted values with an uncertain nature. Hence, they will be included in the simulation. In the case of Tax Rate and Capital Expenditures, the log-normal distribution was chosen. The other items, with historical data which did not follow a clear pattern, were assigned the triangular distribution. Here, in more detail, the forecasted value would be the likeliest outcome, and the lowest and highest value from the historical series would be the left and right limits of the distribution's confidence intervals, respectively.

The WACC has been also included in the simulation, and it is too a Critical Success Factor. We assigned a log-normal distribution to it and set the parameters so that it varies only 1% positively and negatively.

**Output from the Simulation** In effect, the Monte Carlo simulation was run over the entire Excel Spreadsheet, including all the input assumptions discussed previously, at once. The simulation performed a total of 100.000 trials, meaning that 100.000 share values were derived from multiple combinations of the input assumptions. The outcome statistics of the simulation over the share value is given in Appendix G: Monte Carlo Simulation Output. The simulation performed returned values normally distributed around a *Mean* of \$36.7, varying

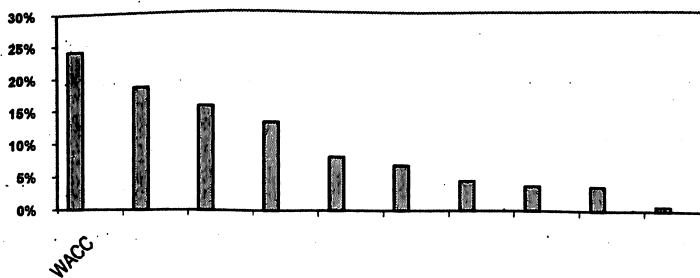
between the *Intervals* of \$31.99 and \$41.79 at a 95% certainty level, with *Standard Deviation* of \$2.87.

The fact that the Mean of the distribution is closely approximated to the final Share value obtained by the DCF analysis (in Excel: DCF Analysis spreadsheet) indicates that the input assumptions' distributions and parameters were set appropriately.

The standard deviation and the intervals are the most important pieces of information from this process, because they give a clear view over the uncertainty around the final share value and provide a reliable range on where the share value can vary. Thus, if on one hand we cannot affirm 100% consistently that the share value was exactly \$36.70, on the other we can state with considerable certainty that the fair value of the stock was somewhere between \$31.99 and \$41.79.

**Sensitivity Analysis** The sensitivity analysis chart shows how much a given input assumption affects the share value. The overall sensitivity of a forecast to an input assumption is a combination of two factors: the model sensitivity of the forecast to the input assumption and the input assumption's uncertainty. To determine the model sensitivity, the various relationships between the forecast cell and the input assumption cells are analyzed algebraically. These relationships include all of the formulas in the spreadsheet that link the assumption cells to the forecast cell. Calculating these complex relationships could be a difficult and time-consuming task without a program like Crystal Ball. During the simulation, Crystal Ball ranks the assumptions according to their importance to each forecast cell. Sensitivity charts display these rankings as bar chart, indicating which assumptions are the most important or least important in the model. The graph below is a summary of the input assumptions that mostly contribute to the variance of the share value distribution. In other words, those are the items that mostly influence the final value of the stock in the DCF analysis:

**Graph 11. → Share Price Sensitivity to Input Assumptions**



Diesel  
 Cost of Revenue  
 Other  
 Crude Oil  
 Capital Expenditures  
 Other Operating Exp.  
 Tax Rate  
 Selling/General Admin  
 R&D

As expected, the WACC variation has the most significant effect over the share value. It has a negative impact of 24% over the share value. The second item mostly affecting the share value is the Diesel Revenue with a positive effect of 18.4%, third is the Cost of Revenue with a negative impact of 15.6, while the aggregation of all other input assumptions accounts for a positive effect of 13.2%. The items that mostly affect the share value *positively* are the Revenues related to the sales of Diesel and Crude Oil. This was also expected, as the sales of these products are the major composer of the company's total revenues. The WACC as usual, is the highest negative effect over the company's share value, followed by the Cost of Revenue, which in the case of Petrobras, is responsible for the subtraction of more than half of its total Net Operating Revenue.

In conclusion, In conclusion, the figures we obtained by the sensitivity analysis are in accordance with our expectations and theory. Once again, this proves the consistence of the estimations and the model itself, thus arguing in favour of the accuracy of the estimated fair value of the stock.

After taking into account the uncertainties of the different forecasts for the following decade, by using the *Monte Carlo* simulation tool, we could derive the optimal stock value per share of \$36.7, slightly different than the bottom line in *Table 11*. This last value we have defined as the *fair or intrinsic* value of the company's stock. The DCF analysis was in fact a model for determining the company's fair/intrinsic value. It therefore enables to inspect the stock market sanity, or whether the market was accurately valuing a certain stock. Even though, we are not that naïve to believe that we have derived the absolute and most accurate *fair* value of Petrobras' stock for the end of 2008. This is due to the fact that the DCF required a great amount of assumptions and projections of the most vital financial parameters of the company, which introduces a great uncertainty in the analysis. However, even though this is true, the detailed and profound qualitative analysis performed of the company's operations, business environment and the industry, have enabled us to understand Petrobras' potential to create shareholders' value, now and in the future, and to

be able to ration whether the market stock value appeared fair or not. Consequently, we can claim that the company's shares of stock were, and are, a good investment.

When comparing the stock value/share derived by the DCF method and the stock value given by the market, there is an obvious difference. While the stock market valued Petrobras' share of stock at \$24.3, we have obtained a value of \$36.7 at the last day of 2008; a difference of 12.4. This requires further discussion and explanation as to why investors were viewing Petrobras' value rather differently than we view it. What were the possible reasons for the stock's undervaluation by the market?! Was it only an overreaction to the discouraging economic conditions and oil prices prevailing in 2008?!

To discuss these doubts and questions we devote few pages in the end of this section.

### 3.6.2. Multiples

In addition to the DCF, we are supplementing our valuation analysis with multiples, as these can be easily utilized for comparisons among companies. The two most widely used valuation ratios are the P/E and EV/EBITDA, which we are going to look at here. The Price to Earnings multiple (P/E) - the ratio between the Market Value per Share and the Earnings per Share (EPS), is basically the company's share price to its per-share earnings. It shows how much investors are willing to pay per dollar earnings.

The Enterprise multiple (EV/EBITDA), however, takes also into account the company's debt, and looks at the company as a potential acquirer would. The nominator in this fraction (EV) captures the market cap, plus debt, minority interest and preferred shares, minus total cash and cash equivalents. The Enterprise multiple is useful when making transnational comparisons among companies because it ignores the distorting effects of individual countries' taxation policies and is useful for finding attractive takeover candidates.

In the table below, we present the two multiples for Petrobras, its peers and the industry;

**Table 12. → Multiples: Petrobras, Peers and Industry average**

	Petrobras	BP	Chevron Corp.	ExxonMobil	Hess	Industry
P/E	10.97	13.88	8.60	11.29	24.19	6.4
EV/EBITDA	3.72	3.80	3.31	4.60	4.13	-

\* past 12 months Source: <http://www.reuters.com/finance/stocks/ratios>; [www.wikinvest.com](http://www.wikinvest.com)

Based on the first ratio, when compared to its peers, Petrobras belongs to the lower-middle P/E group. Aside from Chevron Corp., all other peers show higher P/E ratios. While some of the company's peers have significantly higher P/E ratios (such as Hess with more than twice the ratio of Petrobras), the industry average stands much lower, at only 6.4. As the share price in this ratio is given by the market, and we've been questioning the fairness of Petrobras' valuation by the market, we cannot take this value for granted. A lower ratio may indicate that the company is in fact undervalued, something which is confirmed when looking at the market share price and the stock value we have derived as fair.

Similarly as for the P/E ratio, the EV/EBITDA also places Petrobras in the lower-middle group among the chosen companies. The gap here is however not very wide as it was the case with the P/E ratio and Petrobras stands much closer to its multinational peers, which is a good indicator. Namely, EV/EBITDA is a more reliable multiple when comparing companies and it incorporates less market given parameters, which may be misleading. However, here again, a lower ratio may indicate that the company is actually undervalued by the market. This undervaluation will be analyzed further in the next section of this chapter.

### **3.7. Discussing Market Valuation and Total Shareholders Returns**

Our suspicion in the market valuation fairness of Petrobras' stock proved correct. By using the DCF analysis, we could establish that the market was undervaluing the company's share stock price at the end of 2008. Here, we will try to find and explain the reasons for this occurrence.

Empirical evidence has shown that investors, in principal cannot possibly have perfect information about the company or they may at times introduce irrational and illogical decisions when making investments (which is supported by Behavioural Finance theory). Both these aspects can significantly influence the market value of a stock, and cause a gap between this value and the actual intrinsic (fair) value of a company's stock.

It wasn't until the second half of 2007 that Petrobras' stock price started showing significant increases and fluctuations. It was in this period that the market spotted Petrobras due to the announcements of significant oilfield discoveries and from a relative obscurity the company was brought together in the group of major oil companies. Petrobras' stock showed impressive results increasing by around 150% in just one year. The period



that followed, with a drop in the share price by more than 200% in just half a year, investment analysts describe as 'reality check' and finally 'more mature outlook on Petrobras'. This suggests that initial announcements of new oil discoveries may have been too euphorically received by investors and they have in fact overreacted to nonetheless the noteworthy oil discoveries<sup>105</sup>. Namely, for a period of time, a lack of information concerning these discoveries occurred, which sent strong negative signals to investors. Analysts at the time were also harsh and critical on the substantial increases of the company's stock price, especially due to the lack of factual information about the new oil fields. Furthermore, they showed absolute pessimism when it comes to the start of a large scale production from these fields, i.e. their estimates were that this will not occur within the next 10 years, a long period in which a lot of risks can come on the horizon (global GDP and energy demand, Brazilian political risk, etc.). Moreover, huge resources, in terms of capital and operating expenses are needed for the development and production of the sub-salt fields. This will indeed force Petrobras to make enormous borrowings<sup>106</sup>.

Additionally, another factor that had an undoubtedly negative effect on Petrobras' value in the second half of 2008 was the plunging oil prices, along with the global financial crisis and disastrous results on the stock exchanges in Brazil and the US. This was claimed as the single most important reason for the sharp share price drop by the company's CEO<sup>107</sup>. Even though Petrobras peers' shares showed a decrease and correlation with the company's share price, their drop was incomparably smaller (→ Check Appendix E: Petrobras' share price Growth compared to Peers). Thus, this could not be taken as the main reason for the significant fall in Petrobras value by the end of 2008. On the other hand, it can hold as a proof that the company's stock was in fact undervalued by the market.

Some financial websites (Bloomberg)<sup>108</sup> were also looking at the company's cash flows to explain the sharp stock value decreases. Namely, oil prices and the global credit crisis have been putting pressure on Petrobras to focus investments on projects that produce as much cash as possible. Higher operating expenses of the new oilfields are yet another factor that has been putting additional pressure on the company's cash flows.

Another aspect that may also be used as an explanation of the unfavourable market valuation of Petrobras' stock is the fact that Brazilian authorities were considering the creation of a new, fully-state owned oil company that would have ultimate control over future sub-salt blocks which have not yet been auctioned off. This would eventually disfavour Petrobras and its opportunity to capture a bigger stake in the untapped oilfields

with enormous potential. However, the creation of such a company has only been an idea, of which there is nothing concrete to this date, and knowing Brazilian liberal and open-market policies in the last decades, we would want to believe that the creation of such a company will not occur.

Finally, a very important reason as to why the market was as skeptic about Petrobras' value is the fact that Petrobras is after all a government-controlled company with a nonprofit social agenda. For such companies, the bottom line results are not always a top priority. Analysts also believe the company used to drain cash reserves to pay dividends in the past, but is not going to pursue with such a policy. Namely, paying large dividends while at the same time taking out massive credit lines to cover its CAPEX is simply not logical. However, this shouldn't be seen as a negative aspect, due to the simple fact that by investing the money in projects that will generate continuous inflows of cash flows in the future, the value of the company's stock will appreciate and the returns to shareholders will be ultimately greater, than by receiving high dividends

Another negative impact on the share value due to the majority stake of the Brazilian government in the Petrobras' stock is that the company's performance is tied to the government's stability. Moreover, Petrobras future concession rights of oil and gas fields in Brazil depend on the government's decisions. Investors view this as a drawback.

All of these aspects can be the possible reasons or the mix of causes that made investors value Petrobras' share at only \$24.3 on the last day of 2008. The pessimistic view of investment analysts about the initial substantial increases in the company's share price, coupled with the disastrous results of the world financial markets and low oil prices, seem to be the most significant causes of the enormous drop in the stock value of the company. Even though we can agree that investors may have exaggerated when initially pushing up Petrobras' share price due to the oilfields discoveries, we believe there was an unfounded undervaluation in the end of 2008. In fact, we can confirm what we stated in the beginning of this section, that investors do not always have perfect information about a company and they may also be acting irrationally in the market. This is essentially true as after the initial announcements (which weren't backed up with factual information about the new sub-salt fields), as time passed by, Petrobras *did* reveal its strategic plan with all the details on how much resources it plans to put to work and how it plans to finance these projects. It has been

also proving the potential and reserves of the oilfields discovered, and it has even recovered the first oil from the Tupi reservoir<sup>110</sup>. Thus, when looking at the company's long-term potential and profound growth opportunities given by the growing oil reserves, the significant plunge in its share price that occurred in 2008 appears unfounded.

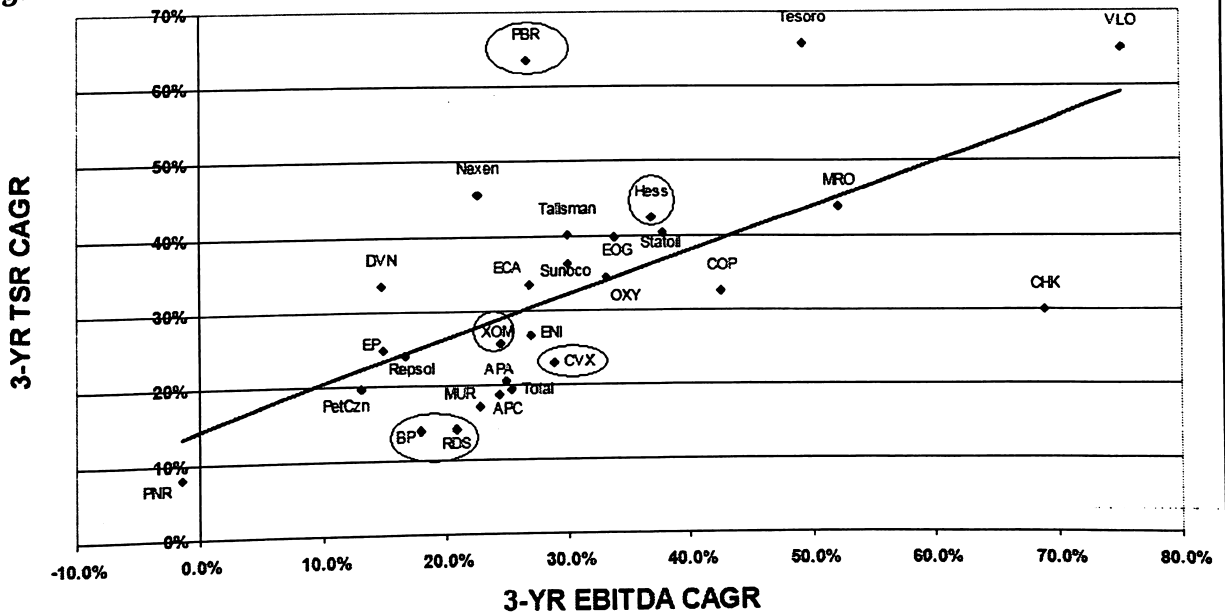
The following section will further explain why we believe the company's stock price was undervalued by the market, by looking at its *total shareholders returns*.

### **3.7.1. Petrobras Shareholders Returns**

So far, we have tried to explain what the possible reasons were for the market to value Petrobras as it did. Here, we are going to look at the company's total *shareholders returns* in order to validate our conclusions that Petrobras' stock was indeed undervalued by the market. Total shareholders returns capture the total returns of a stock to an investor, including capital gains from the stock price appreciation and dividends.

Ross and Attari (2008) advise that the ability of a company to create shareholders' value comes from the growth in the company's operating cash flows (or EBITDA) and the proportion of these cash flows that the company reinvests as capital expenditures in growth projects. This is the central and most important aspect that explains why Petrobras' value is obviously underestimated by investors. Namely, as seen from Petrobras' annual statements of income, its cash flows from operating activities have been growing by 30% and the company's CAPAX by 25% per year on average, in the past decade. In fact, Petrobras' strategic plan to invest \$174.4 billion, of which the major part in the development of new oil&gas fields talks about the enormous returns that are expected from these investments. This will secure the creation of significant shareholders' value in the years to come. Ross and Attari (2008) suggest that there is a relationship between total shareholders returns (TSR) and EBITDA growth for a group of energy companies, including Petrobras. Here, we reproduce their findings in the graph below:

**Graph 12. → Total Shareholders Returns (TSR) vs. EBITDA growth**



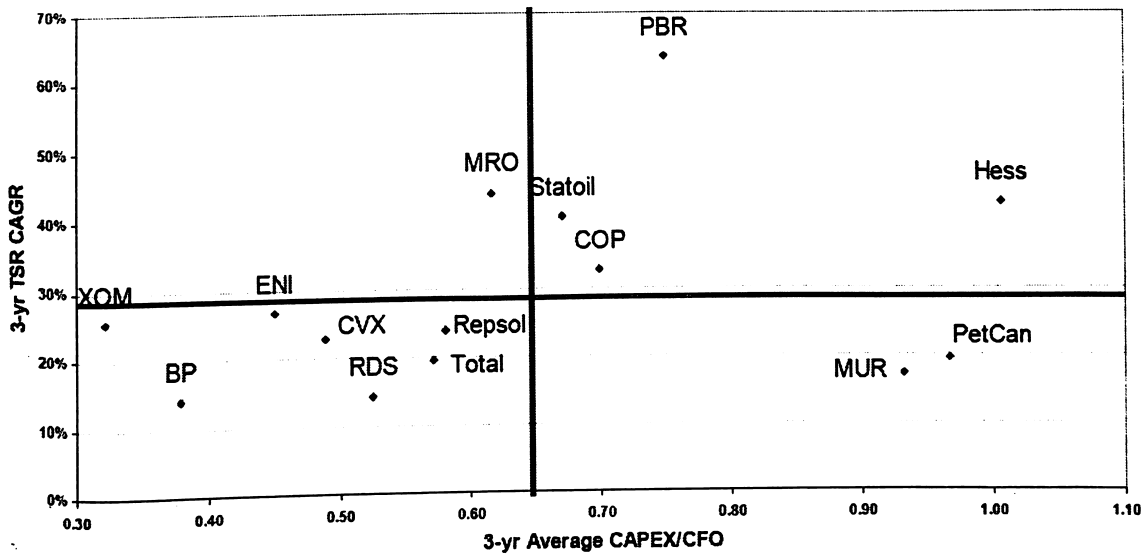
\* CAGR: Compound Annual Growth Rate

Source: Ross Chris, Attari Mukarram. 2008 (Winter), *Discovering shareholder value in terra incognita* (Copy)

This figure represents Petrobras among a variety of oil (energy) companies and peers<sup>111</sup>, which we have been comparing Petrobras to in this paper. Petrobras here is an obvious outlier when compared to most of the other companies in the industry. Based on the TSR, the company stands significantly higher than its peers (denoted with circles), at around 63%. For instance, companies such as BP and Royal Dutch Shell have shareholders' returns of less than a third of those of Petrobras. When compared upon EBITDA, however, Petrobras belongs to the group of the majority of companies.

Another parameter based upon which Petrobras distinguishes itself from the majority of oil companies is the CAPEX/CFO, or the proportion of Cash Flows of Operating activities that the company reinvests in capital projects. In their paper, Ross and Attari (2008) assign greater value to companies that are using a significant proportion of their operating cash flows for capital investments, which will eventually generate future growth in cash flows. Ross and Attari again, show a connection between a company's CAPEX/CFO and its TSR, i.e. 'all the companies with below-average reinvestment rates achieved below-average total shareholders returns, and the companies that were putting more of their cash flows to work in good projects achieved stronger TSR'. The reproduced graph below (Ross and Attari) shows this pattern:

**Graph 13. → Total Shareholders Returns (TSR) vs. Reinvestment Rate**



Source: Ross Chris, Attari Mukarram. 2008 (Winter), *Discovering shareholder value in terra incognita* (Copy)

As already mentioned, Petrobras here again stands aside from most of the other oil companies and delivers substantial value to shareholders. These figures of the company and its profoundly outstanding performance in terms of shareholders' value should talk about the great potential of Petrobras and they definitely contradict the low stock price given by the market at the end of 2008.

However, Ross and Attari advise that the market may be punishing companies, despite their capturing of opportunities, whenever companies are not delivering on their promises due to poor execution. Massive investments in human capital should increase the capacity of companies to undertake large and complex projects, and eventually increase their capability of delivering value to shareholders. This is essential for Petrobras as well.

## IV. CONCLUSION

Our aim with this paper was to investigate the potential of the Brazilian national oil company to create shareholders' value, and at the same time, to determine its stock fair value at the end of 2008. The interest for such a study came as a result of the challenging times which the oil industry and Petrobras have been facing in the past year (i.e. huge fluctuations of the oil price, global depletion of oil resources, climate changes concerns, decreasing demand of oil of developed economies), coupled with our concerns over the

fairness of Petrobras' stock market value. The later came of interest after the discovery announcements of huge oilfields in the Atlantic caused significant variation of the corporation's stock price, with indications of a possible undervaluation of the stock by the end of 2008.

In this research, before the actual valuation of the stock, we have conducted different strategic and financial analyses of the company's operations, along with the business environment and the industry, following the *top-down approach* to investing, as suggested by Reilly and Brown (2002);

The macro-level political, economic, socio-cultural, technological, environmental and legal factors appear to be of great importance in shaping the oil industry's development and are ultimately influencing the value of companies operating in it. The petroleum industry is essentially dependent on oil reserves which are exhaustible and at the same time owned by states around the world. In addition to governments, OPEC too can exert significant market power, as it controls 2/3 of the world oil reserves. Other political risks such as instability, nationalization of property, terrorism, civil conflicts, strikes, wars, etc. can also have significant adverse impact on the industry. The oil industry is largely driven by the world's economy growth and technological developments. As prices are determined globally and oil is traded in dollars, buyers and sellers around the world are affected by exchange rates and the value of the dollar, which has been very volatile in the past years. Advanced technologies in this industry mean a profound positive impact on the long-term sustainability of companies. Petrobras, for instance, sources its competitive advantage from its technological leadership in ultra-deep water oil extraction. As time passes, socio-cultural factors change and the preferences for different energies too. Even though at the time being, oil and gas are by far the most widely used energy fuels without a direct threat, as more environment-friendly fuels are developed and the cost of their production is reduced, the picture is going to get less favourable for oil producers. Environmental restrictions and regulations will favour and give priority to greener energies, threatening oil corporations in the long run. Legal factors, such as current and proposed fuel specifications, emission controls and climate change programs under a number of environmental laws will ultimately have a significant effect on the production, sale and profitability of many companies.

Based on the analysis from the Porter's industry framework, in general, the oil industry

characterizes with high rivalry, deriving from the fact that the majority of companies here are in the race to replace their drying oil reserves. The biggest problem for the oil companies comes from the fact that oil producing countries, which appear as suppliers of the basic ingredient for the industry, practice protectionist and restrictive policies towards foreign companies. Big-country consumers/buyers of oil can also exert bargaining power in the industry. A negative trend in the demand of big industrialized economies in fact has taken place, due to the global economic crisis as well as a shift to other energy fuels. All of this suggests a downturn in the companies' sustainable profitability. However, the picture is much more favourable for national oil companies, such as Petrobras. Petrobras, for example, has a privileged access to oil resources in its home country- Brazil. It is the dominant company here, engaging in production of other alternative fuels (biofuels) in addition to oil, and is one of the leaders in deep-water petroleum extraction. All of this ensures competitive advantage over its competitors and sustainable value for shareholders. However, being an international player, Petrobras' profits are too, vulnerable to the threats and bargaining power coming from the other entities in the industry.

The most important external factors influencing the value of Petrobras are the future prospects of oil & gas demand and supply, as well as the future development of oil & gas prices. So far, Petrobras has been deriving most of its revenues from its domestic market, but it is expected that the company starts exporting large amounts of oil in the following decade, becoming a major exporter of oil. Therefore, we have also looked at and used international crude oil and oil products figures in the analysis and valuation. The world demand of oil in developed countries is either decreasing or increasing only slightly in the coming decades. Latin America and Brazil on the other hand, have undoubtedly increasing demand figures, where the average growth through 2015 is around 2.5% and for the period through 2030 around 1%. Oil price is of crucial importance for the profitability of companies in the industry. In the analysis, we have used the *International Energy Outlook (2008)* three possible oil price scenarios through 2030, i.e. reference, high and low price scenario. Due to the high volatility of the oil price in the past, the three scenarios give a rather large range of over \$100/barrel by 2030. By using Monte Carlo Simulation we have incorporated this volatility in the projection of Petrobras' revenues for the following decade. Natural gas is the second major business area of Petrobras, which has been unprofitable in the past. However, as long as Petrobras decreases the

dependency on Bolivian and imported gas (which have caused losses) and manages to increase the proportion of domestic production by taking advantage of progressive technology in natural gas exploration, the picture can turn positive, having the fact that natural gas prices have increased substantially in the past and are only going to follow that trend in the future. Gas prices in Brazil are expected to increase by 2.5% on average per year for the period of 2012-2020, whereas demand is increasing at around 5% until 2015 and 2.4% until 2030.

Upon the discovery of the huge amounts of oil off the Brazilian coast, speculations arose of the possible Brazilian participation in OPEC -one of the biggest and most successful cartels that ever existed. On one hand, if the country receives a significant role within the cartel, it can be in position to affect prices and marketing of oil worldwide, acquiring substantial power in one of the most influential international organizations. Playing solo, on the other hand, will mean that Brazil can supply as much oil as it pleases at given prices, making independent decisions for its petroleum industry and most importantly- supporting the free market. Shortly, by staying out of OPEC, Brazil can rip all the benefits of a significant oil producer, without the limitations of belonging to the cartel, in turn free-riding on the cartel.

When looking at the company's strategic approach, it is evident that Petrobras is mostly acting offensively in the pursuit of becoming one of the five largest integrated energy companies in the world. This statement was supported by the fact that the company is undertaking one of the biggest CAPEX taken by a corporation, with the purpose of acquiring a more dominant position in the global energy market. By investing in its unique expertise and competitive advantage in deepwater and ultra-deep oil exploration and biofuels production, Petrobras is safeguarding long-run returns on capital, and essentially, shareholders' value.

Throughout its value chain, Petrobras is not only involved in exploring and developing oil fields, it also engages in the production, transportation, refinement, distribution and marketing of oil/gas and biofuel products. As a result, the company's ability to create value comes essentially from the fact it operates as an integrated oil company, meaning it is in position to take advantage of the synergies arising from the vertical integration of operations. Supported by sophisticated technologies, some of which unique to its field of oil exploration, Petrobras creates most of its value from the exploration concessions rights.



Partnering at the different stages of the value chain with universities, suppliers, competitors and clients, also enables the company to generate value.

The company's strengths, weaknesses, opportunities and threats furthermore revealed relevant aspects of the ability of the firm to create value. What is apparent is that the company is faced with a set of numerous threats that come from the external environment; to name few: volatility of oil and gas prices, exchange rate risk, global economic crisis/recession, Brazilian political and economic conditions, possible price controls by the government, increases in prevailing market interest rates, credit rating cut (by S&P), etc. In spite of all these threats, which can derail Petrobras' strategic investment plans and value creation prospects, it is apparent that the company possesses significant advantages found in the advanced technological know-how in deepwater exploration, exceptionally growing reserve base, Brazilian market dominance, a diversifying portfolio of products with accent on renewable energies, and profound opportunities that can be harnessed in the domestic market and internationally, with the possibility of becoming a major exporter of oil.

Before conducting the DCF analysis, we also found it important to assess and understand the historic *financial* performance of Petrobras, compared to its peers. We looked at different ratios and the historic share price of the company. Based on the ratios, the company appears to be rather profitable, distinguishing itself from the majority of its peers. Petrobras is also showing relatively solid solvency ratio, meaning it is going to be in position to meet long-term debt obligations. On the other hand, it does not seem to be very liquid, or it may need to borrow in order to meet short-term debt obligations. The huge expected investments for the purpose of developing oil and gas fields will require significant borrowing, which may deter its financial position in the medium run, but hopefully it will push up income and returns in the long run. The substantial fluctuations of the corporation's stock price that started in the second half of 2007, and the evidently low price at the end of 2008, raised doubts of the objectivity of the market valuation of the stock and of a possible undervaluation, at the end of the year. By using DCF valuation, we attempted to clear these doubts and determine the fair value of Petrobras' stock.

Theory suggests that the DCF method of valuation is the most suitable and conceptually correct method for valuing a company, which uses future free cash flow projections, discounted (by a discount rate) to arrive at a present value. The value is derived by

discounting forecasted free cash flows for an explicit period, to which a terminal value after the explicit period is added, and finally, total debt subtracted. This leaves Petrobras with a stock value per share of \$36.7 at the end of 2008. This intrinsic value did not equal the market value of the company's share at the end of the year (\$24.3), which confirms our doubts that the market was underestimating the stock value. The multiples valuation analysis gave the same indications.

Finally, we tried to explain why the corporation's stock price could have been undervalued by the market. What we could identify as possible reasons for this was that initially, the new oil discoveries announcements may have been too euphorically received by investors and they have in fact overreacted to these announcements. As these weren't backed up by further information about the new oilfields for a period of time, investment analysts showed pessimism to the initial substantial increases in the company's share price. On top of that, world financial markets showed disastrous results and the oil price was plunging. The combination of all of these, in our belief, was the cause for the enormous drop in the market stock value of the company, which was unjustified. Here is why we find this to be unjustified; first, Petrobras *did* reveal its strategic plan with all the details on how much resources it plans to put to work and how it plans to finance these projects; second, it has been also providing proofs of the reserves of the oilfields discovered, and it has even recovered the first oil from Tupi; third, after all, investors may not always have perfect information about the company and they may also be acting irrationally in the market. Thus, when looking at the company's long-term potential and profound growth opportunities given by the increasing oil reserves, the significant plunge in its share price that occurred in 2008 appears unfounded. Eventually, we used Petrobras' total shareholders returns (in comparison to its peers) in order to validate our conclusions that the company's stock was indeed undervalued by the market. The company's shareholder's returns (TSR) were significantly higher than the majority of companies in the industry. Petrobras' TSR in fact stood at around 63% for the past 3 years, much higher than its peers.

To sum up; this study gave a complete strategic, financial and valuation analysis in the oil industry, more specifically investigating strategically the Brazilian national oil company, its value creating potential and fair stock price. Petrobras' strengths in technological know-how of deepwater exploration, substantially growing reserve base, Brazilian market dominance, and diversifying portfolio of renewable-fuels products, makes us confident to assert that

Petrobras' enormous value potential is likely to be materializing to shareholders in the long-run, making its stock a good investment.

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