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Master in Business Program

PERFORMANCE OF INTERNATIONAL OIL COMPANIES AND NATIONAL OIL COMPANIES: A COMPARATIVE ANALYSIS

Master's Thesis by the 2nd year student
Concentration — International Business
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ЗАЯВЛЕНИЕ О САМОСТОЯТЕЛЬНОМ ХАРАКТЕРЕ ВЫПОЛНЕНИЯ ВЫПУСКНОЙ КВАЛИФИКАЦИОННОЙ РАБОТЫ

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АННОТАЦИЯ

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Описание цели, задач и основных результатов	Цель исследования изучить и сравнить поведение международных и государственных нефтяных компаний во время падения цен на нефть и газ. Первая глава исследования содержит теоретический основу для сравнения эффективности международных и государственных компаний, действие теории принципала-агента в этих компаниях и обзор предыдущих академических дискуссий по теме. Вторая глава содержит методологию проведенного эмпирического исследования. Третья глава содержит результаты эмпирического исследования и их обсуждение. Исследование 46 компаний показало, что в целом международные и государственные нефтяные компании вели себя похожим образом, но были и некоторые различия во период падения цен на нефть и природный газ.
Ключевые слова	Нефть и газ, международная нефтяная компания, государственная нефтяная компания

ABSTRACT

Master Student's Name	Alexey Krasnopeev
Master Thesis Title	Performance of international oil companies and national oil companies: a comparative analysis
Faculty	Graduate School of Management
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Academic Advisor's Name	Garanina Olga Leonidovna
Description of the goal, tasks and main results	The goal of the research is to explore and compare the behavior of international and national oil companies during oil and natural gas prices decrease. The first chapter provides the theoretical background for the international and national oil companies' performance comparison, principal-agent theory in those companies and previous academic discussions on the topic. The second chapter provides the empirical research methodology design. The third chapter provides the empirical research results and discussions. The study of 46 companies demonstrated that NOCs and IOCs behave mostly similarly but there are some differences as well during oil and natural gas prices decrease.
Keywords	Oil and gas, national oil company, international oil company

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INTRODUCTION

Global market economy is based on a competition of all types of companies from all over the world. There are two main types of companies operation on the market: international and

national oil companies (IOCs and NOCs). They differ in the ownership structure, since national oil company has the government as a major shareholder and international oil company does not.

National oil companies control the majority of the oil and natural gas resources on the planet, so they are very important players on the market, so it is necessary to know how they behave in both stable and shock market situations. In 2014 the world faced such a shock, when the oil and natural gas prices declined significantly.

The goal of this research is to explore and compare the performance of the international and national oil companies during that shock by exploring their performance over that year. To achieve the goal it is necessary to do the following:

- Explore the differences of the IOCs and NOCs and how principal-agent theory works in those companies;
- Explore how the productions change, reserves change, headcount change and capex change influence the revenue change;
- Compare the performance of the IOCs and NOCs over one year of operation using those five performance indicators: productions change, reserves change, headcount change, capex change and revenue change.

1. COMPANIES IN OIL AND GAS INDUSTRY

1.1. International and national oil companies definitions

Global oil industry is one of those industries that work throughout the borders. The oil is being produced and sold all over the globe, since the need in fuel is typical for all countries. Because of that, companies from all countries compete on the same global oil market.

Broadly, oil industry constitutes of “upstream” and “downstream” segments. Upstream sector main activities include exploration and production (E&P). Because segment players usually come across of oil and gas together, both are comprised in the upstream segment of the industry. Downstream operations include refinery, distribution and marketing. Two segments are connected with various meanings of transport, naming such activity as “midstream”. The transportation of oil is made with pipelines, tankers, trucks of railway tank cars. Natural gas is transported from the extraction field to the distribution system in the pipeline. In there is a need in intercontinental gas transportation, it gets liquefied (LNG) and shipped in marine tankers and then goes through regasification procedure. Company that operates in both upstream and downstream segments is called vertically integrated. (Van Vactor 2010).

Both national and international oil companies are companies involved in oil and gas production that have different ownership structure: national oil company (NOC) is being owned and controlled by national government (more than 50% of shares), while international oil company (IOC) is being mostly or exclusively privately-owned (Linde 2000; Stevens 2004). According to its name, IOC is strong enough to operate in several countries (at least in two of them), while NOC is not necessarily does that, although it uses such opportunities if it has any. The industry also has small players, that are public or private and operate only within one country and could produce oil and gas together or one of them. However, if a company has a government stake but of such size so that government does not have full control over the company, it is considered as international oil company. NOCs are the most outstanding feature of government activity in the industry, so that the power concentrated in those firms could be a good indicator and example of the government intervention into the economy. It is necessary to notice that government involvement can also be in other forms but not just share ownership of enterprises. Naturally, there is a big number of mechanisms and policies available to countries’ governments – a continuum of governance mechanisms (Laffont and Tirole 1993) – to define the forms and extent of government involvement (Wolf 2009).

Historically, such economic sectors like postal services, railways, telecommunications, energy and water were usually state-owned. While a lot of companies in those economic sectors are or were natural monopolies and potentially can face serious economic problems, the energy industry is government controlled because of the political reasons, such as high rents, economic importance, national security and employment supporting (Wolf 2009). Because of that, both

society and government think that those firms are too important to be allowed to work on the market without state control (Robinson 1993).

Initially, most national oil companies were used as keepers of home country's oil industry and resources, by working instead of international oil companies or by operating together with them (Stevens 2004). Domestic oil industry is extremely important for many countries in the world, because it significantly influences economic, social and political spheres of countries' lives. It also brings big share of GDP, state profit and foreign exchange revenues to the countries that export oil. On the other hand, countries that import oil have quite big share of foreign exchange expenses (Wolf 2009). Oil consumption taxation brings a lot to fiscal revenues, or sometimes, oil consumption subsidies lead to huge fiscal deficits (McPherson 2003).

Back in 1970s so called "OPEC revolution" and wave of nationalization of oil companies was caused by concerns that IOCs had support of foreign "imperialistic" states and their governments in opposition to countries of operations' state interests. (Grayson 1981; Hartshorn 1993) A lot of nations that had high shares of oil industry' revenues in total state revenues wanted government control over the oil industry and thought that legislative or regulatory procedures would not be enough. Nationalistic concerns together with low development of the business environment that were often seen in many developing countries resulted in appearance of private domestic enterprises working in the home countries oil industries (Linde 2000).

In addition to this, similar opinions – governments should more actively interfere in solving of social and economic problems – started to appear in developed countries. The fact that oil companies are controlled by the governments gives the public assurance that surplus profits from the oil production and sale redirect to citizens and their needs and provides the confidence of the public in ability to control such an important thing as gasoline and other oil products prices (McPherson 2003). At the same time, oil importing countries took foundation of many national oil companies very seriously, as a matter of concerns of possible insecurity of oil and oil products supply, power imbalance in the politics with advantages of oil exporting countries. NOC also give state an inside view on the oil industry (Grayson 1981), helping to get over the information imbalance that appears between the state and private parties in the oil industry, because otherwise it might lead to the country's inability to properly control the state of the industry and effectively regulate it (Wolf 2009).

1990s were a decade distinguished by instability and volatility of oil prices, which resulted in an increased number of mergers and consolidations in the oil industry around the world, which, in turn, resulted in a structural move in the oil industry still happening even nowadays. In 1998 Exxon and Mobil signed an agreement to merge and establish ExxonMobil

(Independent 1998). Four years later Conoco Inc. and Philips Petroleum Co. also merged together and founded ConocoPhilips (CNN Money 2001), In 2013 Russian Rosneft acquired a joint venture of Tyumenskaya Neftyanaya Kompaniya and BP – TNK-BP for $55 billion, thus becoming world's biggest publicly traded producer of oil (Reuters 2013).

Table 1 2014 Petroleum Intelligence Weekly "World's Top 50 Oil Companies"

Rank	Company	Country	Rank	Company	Country
1	Saudi Aramco	Saudi Arabia	26	Statoil	Norway
2	NIOC	Iran	27	Pertamina	Indonesia
3	CNPC	China	28	ConocoPhilips	US
4	ExxonMobil	US	29	ONGC	India
5	PDVSA	Venezuela	30	Libya NOC	Libya
6	Shell	Netherlands	31	CNOOC	China
7	BP	UK	32	Kazmunaigas	Kazakhstan
8	Gazprom	Russia	33	PDO	Oman
9	Rosneft	Russia	34	Repsol	Spain
10	Chevron	US	35	Ecopetrol	Colombia
11	Total	France	36	Uzbekneftegas	Uzbekistan
12	Petrobras	Brazil	37	Novatek	Russia
13	KPC	Kuwait	38	Anadarko	US
14	PEMEX	Mexico	39	Devon Energy	US
15	Sonatrach	Algeria	40	Apache	US
16	Lukoil	Russia	41	BG	UK
17	Adnoc	UAE	42	Socar	Azerbaijan
18	QP	Qatar	43	Occidental	US
19	Sinopec	China	44	Chesapeake	US
20	Petronas	Malaysia	45	BHP Billiton	Australia
21	INOC	Iraq	46	CNR	Canada
22	Eni	Italy	47	Suncor	Canada
23	NNPC	Nigeria	48	EOG	US
24	EGPC	Egypt	49	YPF	Argentina
25	Surgutneftegas	Russia	50	OMV	Austria

Source: Petroleum Intelligence Weekly 2014

Such huge mergers are a serious challenge for national oil companies. According to 2014 Petroleum Intelligence Weekly "World's top 50 oil companies" rating (table 1), which is based on six operational criteria such as liquids and gas outputs, liquids and gas reserves, product sales and refining capacity, roughly 40% of the companies in the list are private companies, while the other 60% are national (state-owned) oil companies.

During 2000s oil prices were generally growing, reaching the peak in 2008, followed by a dramatic drop caused by the world's financial crisis. However, first half of the 2010s oil prices were very high (figure 1), giving huge revenues to oil producing companies, thus enabling them to engage in developing costly projects and allowing to feel really good. But in middle of 2014

oil prices started to significantly decrease because of the oil overproduction, which started a new era of low oil prices, making companies to cut costs and leave capital intensive projects.

Figure 1 Brent crude oil historical prices for January 1, 2000 – December 31, 2015, US$/BBL

Source: ICE

However, natural gas prices were fluctuating a lot in the 2000s, also suffering a huge decrease because of the 2008 economic crisis. The first half of the 2010s the world spent with more stable but lower than in 2000s gas prices (figure 2), anyway giving high revenues to the producers, but in 2014 natural gas price started to decline, significantly dropping in the end of the year. The decline continued in 2015, thus also starting an era of low natural gas prices.

Figure 2 Natural gas historical prices for January 1, 2000 – December 31, 2015, US$/MMBTU

Source: NYMEX

1.2. Principal-agent problem in oil and gas companies

Principal-agent theory (also called agency theory) was introduced by Ross and Mitnick in 1973 (Mitnick 2013). This theory is devoted to finding solutions to two issues that might arise in the agency relationships. The agency relationship is a relationship between two or more parties

when one, specified as the agent, acts for, on behalf of, or as representative for the other, specified the principal, in a certain set of decision making situations (Ross 1973).

The first issue is the agency problem that appears when goals of the principal and agent are opposite or not the same and verifying the actions of the agent is hard or expensive for the principal. In other words, the principal is not able to verify that the agent's actions are appropriate. The second issue is the problem of risk sharing that appears when the principal and agent have different views and opinions on the risks, so that they might act differently. The theory is focused on the analysis of the contract defining the relationships between the principal and the agent, thus trying to specify the most suitable terms and conditions based on the assumptions about persons (for example, persons' own interests, risk avoidance), organizations (for example, contradiction of members' objectives) and information (for example, information could be sold and bought). In other words, agency theory reflects the relationships of the principal and the agent that are involved in collaborative activity, but have differing goals and differing positions on risks (Eisenhardt 1989).

Comparing the decisions of NOCs and IOCs, the IOC supposedly maximizes the present value of expected future profits at the required rate of return which is determined by the market. Since one of the goals of publicly listed company is maximizing its value, IOC might ignore potential controversies over the different goals of shareholders and managers. However, quite a lot of evidence supports the hypothesis that companies' managers maximize firms' value most of the time, so that many of the institutional features of shareholder-owned firms can be considered as mechanisms of owners' effective control of managers (Hartley and Medlock 2008).

More precisely, principals benefit from being able to have additional signs (other than the payoff) that demonstrate agents' actions, as Holmstrom (1979) showed. For example, it can be a reason for strict financial reporting and accounting. Moreover, Holmstrom (1999) demonstrates that managers obtain a stimulus to work better because of the competition in the managerial labor market, so that better performance can be strengthened by having compensation policy that ties salary and performance by giving shares or share options. Company's leverage might also encourage managers for maximization of profits (Harris and Raviv 1991). Growth in leverage enlarges the managers' share of equity and puts their interests together with interests of the shareholders. In addition to this, managers might suffer a lot from bankruptcy because, for example, their managing knowledge and skills are overvalued. Managers can be made to use company's cash flow to decrease the probability of bankruptcy by bigger debt service payments. Consequently, it can keep managers from using firm cash flow for their own interests and goals (Hartley and Medlock 2008).

Politicians play a role of shareholders in state controlled companies. Although they usually do not get any residual money flows right from the enterprise, politicians' goals contain political benefits originating from inflow of additional money to the Treasury. Politicians can also have power over the decisions within NOC about production, employment, and pricing and receive support from certain interests. There are two very important features of a state-owned enterprise:

- state-owned company's debt is ensured by the state government;
- residual ownership claims may only be given to another party with enterprise's end of being state-owned. (Hartley and Medlock 2008).

These features influence the principal–agent conflict and, consequently, company's goals and decisions. Specifically, being state-owned gives the firm assurance that it would be "bailed out" if it faces serious financial problems (Hartley and Medlock 2008).

Laffont and Tirole (1991) demonstrate that state-owned enterprises managers could lose their job because of wrong decisions, like their colleagues in private companies. They could also have to work with audited accounts or under formal control systems similar to those used in private companies. However, while private company's shareholders can look at the company's shares' market value, politicians have no such measurement to estimate the performance of a state-owned company. In addition to this, politicians probably could be interested in more sophisticated performance criteria than just company's market value, which could help to increase complicity and decrease effectiveness in the NOC reporting requirements (Hartley and Medlock 2008).

Laffont and Tirole (1991) also write that if shareholders suffer loss of wealth if managers do not work well, politicians could lose their jobs. Nevertheless, politicians and private company investors have different time periods of planning. Because of having more short-term goals, politicians could use return to capital of the NOC for other things rather than reinvestment in resources, even though it is likely to hurt national oil company's future profitability. On the other hand, private company investor thinks about the shares' sale values that depend on the future profitability of the NOC. Due to this fact, shareholders have a serious reason to stimulate managers to make better trade-off between current income and future profitability (Hartley and Medlock 2008).

Overall, there are many institutional features helping to control the principal–agent issues of companies. State-owned enterprises often do not have many of those features. Politicians have information which is inferior comparing with the information gained from the stock prices. As a result, state-owned enterprises' managers are probably overlooked less well than private

companies' managers. Consequently, goals of the state-owned companies are expected to demonstrate managerial privilege to a bigger extent than in case of a private companies (Hartley and Medlock 2008).

Even though NOC can potentially face of managerial efficiency, it can become more preferable than IOC due to its ability to control other inefficiencies for exploring oil fields, especially in developing countries. Firstly, big private upstream player is able to monopolize the home country market. Secondly, developing transport infrastructure and hiring local workers can have a positively affect public image because roads (asphalt and rail) and ports are also being used by other parties (governments and businesses). So, since private enterprise can have poor investments into those objects, a state-owned enterprise might be managed with an order to increase investments thus to receive additional social benefits. Thirdly, production royalties and taxes taken for mineral resource "rents" redistribution in favor of country's citizens can at the same time impose significant efficiency losses which could be lowered in case of operation of NOC (Hartley and Medlock 2008).

Another justification for state ownership of enterprises could be that the politicians care not just about operational efficiency, but about other things. For example, politicians can promote special employees of the same interests as they have to high ranked positions or make decisions in favor of certain people or influential groups when deciding which projects would receive investments, even if such decisions contradict with economic efficiency. The groups that are able to have influence over politicians usually vary from one country to another depending on such factors as political system, social and ethnic diversity, and of course the geographical location of the oil resources within the country's territory. There are two groups that are usually favored by the politicians:

- home country consumers of oil and products of oil refinery;
- employees or other suppliers of various resources or materials to the national oil company (Hartley and Medlock 2008).

The first group (home country consumers) can receive cheap oil and oil products as a way of resource rent sharing. The second group (employees or domestic suppliers of various materials) can be an influential group, able to raise political pressure on vital issues connected to their own wealth. Politicians then may step back and thus increase their political support, for example, by hiring too many employees (having an excessive level of employment) in the national oil companies. Moreover, managers may have a positive point of view on excessive level of employment because managing a company with higher headcount might make the

managers more prestigious, also increasing the production costs together with excessive level of employment would result in growth of money under their control (Hartley and Medlock 2008).

Also, national oil company is more likely to have a higher discount rate than international oil company. Politicians controlling the national oil company as well as shareholders controlling the private oil company would like the NOC to produce bigger revenue. NOC's profit flows to the Treasury and allows politicians to accumulate power by increasing spending or reducing other taxes. At the same time, both politicians and shareholders of private companies would care about current and future profits. Nevertheless, politicians are expected to discount future profits more seriously. In addition to this, NOC managers might want to have a higher rate of return than private oil companies' managers. Even though managers of the private enterprises have approximately equally strong reasons to work so that to increase share prices or avoid share prices decrease or stop share prices dropping, if the NOC has no established and properly measured goals, it influences state sector positively and negatively in a more asymmetrical way. In case the wrong decision resulted in mistake is made, company spends resources for recognizing that mistake and penalties for those who is discovered to be responsible, but in case of success, it could be significantly more difficult to recognize and praise responsible persons. Because of that, managers of the NOC try to avoid risks as much as possible and even greater than private companies' managers (Hartley and Medlock 2008).

NOCs were initially established as governments' instruments, evolved into important self-sufficient players, put between the state and generally foreign oil companies (Waelde 1995). States and their national oil companies are stand-alone players that could have same goals and interests, but usually they have different opinions. Principal trade-off, often met in various countries, is located between state control over the NOC and company's ability to successfully follow its business goals (Wolf 2009). There is an opinion that trade-off is a no-win situation: NOC could follow its own objectives that are probably would result in takeover of the state, or the state successfully keep its national oil company from working effectively (Stevens 2004).

Eller, Hartley and Medlock (2011) state that some company's effectiveness analyses that were exploring principal-agent paradigm demonstrated that company's ineffectiveness is likely to happen if existing control system is not enough or not properly working to prevent managers (or agents) from achieving their own goals at expense of the shareholders (or principals). Institutional features of private companies, like shares that could be bought and sold, are suggested to seize threat and bankruptcy threat help connect and unite goals of managers and shareholders. At the same time, lack of such features in state-owned enterprises might be a reason of relative ineffectiveness of NOCs. Moreover, if private company's shareholders want

management to increase company's value, politicians that control state-owned companies usually have less clear goal of political support's increase. So, any actions and policies supporting that goal probably have negative effect on company' effectiveness (Eller, Hartley and Medlock 2011).

National oil companies operate not only according to shareholder value maximization plan. Since state controls national oil companies, firm's value maximization could be forced to compete with other state-promoted goals. Besides, the influence of the governments over national oil companies varies around the world. NOCs in more developed countries like Statoil in Norway and Petronas in Malaysia, usually pursue more commercially oriented strategy than, for example, Nigerian National Petroleum Company (NNPC) and Petroleos de Venezuela (PDVSA), which have state goals substituting the commercial ones to a significant extent so that those firms operate under strong pressure and strict control in order to make inflow of funds to the state budgets maximal (Pirog 2007).

State uses NOCs for wealth redistribution. Subsidized gasoline prices reduce energy price to the common population, develop transport infrastructure, and protect home country economy from the harmful effects of fluctuating global oil prices, but, on the other hand, they contribute to extremely huge losses of potential benefits of the NOCs. Low gasoline prices supported by the governments encourage demand increase, corruption, ineffective use of oil, and arbitrage-based smuggling schemes. The larger fuel consumption at home country market results in reduction of export and decline of supply to the global market thus making prices in the oil-importing countries grow (Pirog 2007).

States also use national oil companies for stimulating economic development of domestic economy. Some countries have their oil industry being first to cooperate with international companies on exploration, production and development of the oil within the country. Due to this fact, oil industry may be the first to bring innovations or new technologies to the country or improving national legislation in accordance with the international legislation, or implementing international accounting and financial standards. National oil companies might be also made to sell subsidized oil products to certain economy sectors considered as important for countries' economic development strategies (Pirog 2007).

State governments could also use national oil companies as a foreign policy instrument, for example, in making an alliance with other countries' national oil companies. Oil is one of the most important commodities of the global economy and trade, and its production and use can build and maintain strategically important relationships (Pirog 2007).

One of the most important and sensitive topics in every country's national interests is energy security, which is also included in the NOCs agenda. One of the goals of NOCs is keep

customers from getting critical of the national oil company in order to provide security of the demand. However, sometimes technologies make this type of strategy hard to follow. A continuous relationship of the oil exporter and importer might end as investment in some specific projects that participate in the production or use of the country's oil. Also, sometimes NOC's energy security plans are connected with security of supply. Countries' security of supply means having a diverse set of producers and oil supply inflows security. Sometimes oil supply security means having certain rights for the oil supply (Pirog 2007).

Although majority of the national oil companies in countries with huge reserves work in upstream segment, some of them are trying to become truly vertically integrated oil companies. From the economic point of view, vertical integration lets the national oil company to seize the funds received from production and sale oil products. When PDVSA bought US based Citgo, it brought refining and retail marketing opportunities for Venezuelan oil. Also demand security was strengthened because of gaining a share in the huge US gasoline market. Sometimes national oil companies might enter the markets not available to them before. National oil companies might also diversify and reduce risks by vertical integration. Since oil price is fluctuating nowadays and money may flow to various parts of oil production and supply chain under various market conditions, vertical integration of the NOCs may strengthen the opportunities and ability to generate revenue in different economic situations (Pirog 2007).

At the same time, because of the high capital expenditure in the industry (next paragraph contains more detailed view on capital expenditure in the industry) national oil companies can go public, as Russian Rosneft did in 2006. It might be a very good option for the industry players if they want to start developing expensive projects, since the IPO helps to attract money for expanding the operations (Draho 2004). However, going public is not really popular option for the NOCs: 4 out of 5 companies from the 2014 Petroleum Intelligence Weekly "World's Top 50 Oil Companies" (table 1) are private NOCs.

1.3. Oil and gas companies performance indicators

Since oil and gas production business focuses on extracting the limited resource, there are two very important performance indicators of each company: reserves that company have and the production.

According to 2015 Eni World Oil and Gas Review, at the end of 2014 global oil reserves were equal to 1659372 million barrels, 79% of which is national oil companies' share, which increased significantly for the last 15 years, when in the end of 2000 NOCs controlled 74% of world's oil reserves, which were equal to 1239374 million barrels. More specifically, global oil reserves are presented in the table 2 below.

Table 2 Global oil reserves by region in 2014

Region	Crude oil reserves, million barrels	NOCs' share, % of region's
North America	213931	47
Latin America	338423	96
Europe	12453	2
Russia and CIS	118281	88
Middle East	802509	97
Africa	125765	62
Asia - Pacific	48010	47

Source: Eni World Oil and Gas Review, 2015.

Despite the fact that international oil market's main players are national oil companies that have a considerable market share and the biggest ones of those are united in a cartel (OPEC) that has more than 40% market share (Bloomberg 2015), international oil market is still could be considered as competitive since there are many sellers (not only NOCs) and many buyers from all over the world (Jaffe and Soligo 2007).

At the same time, in the end of 2000, global natural gas reserves were equal to 158983 billion cubic meters, 77% of which were controlled by NOCs. 15 later, in the end of 2014, the global gas reserves grew to 201771 billion cubic meters, having the share of NOCs increased to 79%. More specifically, global natural gas reserves are presented in the table 3 (Eni World Oil and Gas Review 2015).

Table 3 Global natural gas reserves by region in 2014

Region	Natural gas reserves, billion cubic meters	NOCs' share, % of region's
North America	12088	4
Latin America	7979	82
Europe	5078	1
Russia and CIS	64637	97

Middle East	80480	91
Africa	14478	77
Asia - Pacific	17031	38

Source: Eni World Oil and Gas Review, 2015.

So, since most of the oil and gas reserves are owned by national oil companies, some concerns about international oil companies' future were raised. Ability to explore and work on oil field in different parts of the world significantly influences IOCs' future and reasons for their mergers with each other. Besides, international oil companies cannot work in some areas or in cooperation with companies that belong to nations under any kind of sanctions levied by, for example, United Nations or the US, like it was not possible for international oil companies to operate in Iran because of political tension and situation improved after sanctions were lifted in 2015 (Forbes 2016). So this is where national oil companies have advantages over the international oil companies, since they belong to the state and their operation is mostly defined by political negotiations (Jaffe and Soligo 2007).

So, some IOCs (especially so-called "big five" – BP, Chevron, ConocoPhillips, ExxonMobil and Royal Dutch Shel which together with Total and Eni make a group known as "supermajors") are included in the biggest oil production companies' global ratings and possess significant assets (and money) which they easily can invest in production development (Jaffe and Soligo 2007).

Companies with significant market shares have control of the oil future price by controlling the rate of capacity growth, but only when the oil demand is growing faster than production capacity. Another way of influencing the oil price is reduction of production levels: because the oil demand is inelastic and the supply is provided by non-OPEC countries in the short term, short reduction of production level influences the oil price a lot. Consequently, if the demand is growing and the powerful players use this strategy of limitation of oil production, the oil price inevitably would grow. Since there are also many companies that are not OPEC members, their activity might be targeted at increasing their own productions and thus market shares. However, most of those companies are smaller than OPEC-members, so they cannot affect the price significantly alone. But there are usually many companies that invest a lot in oil exploration and production that together with those several huge international oil companies might affect the oil price very strongly. Exactly these things happened after 1973 oil shock when huge growth in non-OPEC production and sales, especially form the North Sea and Prudhoe Bay, helped to make oil prices go down (Jaffe and Soligo 2007).

As 2015 Eni World Oil and Gas Review reports, in the end of 2014 global oil production was equal to 89080 thousand barrels/day, 64% of which were done by NOCs. In the end of 2000, NOCs produced 62% of global oil production, which was equal to 75186 thousand barrels/day. A detailed global oil production is presented in the table 4.

Table 4 Global oil production by region in 2014

Region	Daily oil production, thousand barrels/day	NOCs' share, % of region's
North America	16012	1
Latin America	10401	80
Europe	3562	4
Russia and CIS	13828	83
Middle East	28523	88
Africa	8556	67
Asia - Pacific	8119	70

Source: Eni World Oil and Gas Review, 2015.

At the same time, in the end of 2014 global natural gas production was equal to 3474,46 thousand cubic meters, 49% of which were done by NOCs. 15 years earlier, in the end of 2000, NOCs produced 42% of global oil production, which was equal to 2457,57 thousand cubic meters (Eni World Oil and Gas Review 2015). More detailed global natural gas production is presented in the table 5.

Table 5 Global natural gas production by region in 2014

Region	Natural gas production, billion cubic meteres	NOCs' share, % of region's
North America	880,24	1
Latin America	225,69	70
Europe	272,37	2
Russia and CIS	831,92	85
Middle East	565,84	79

Africa	189,34	69
Asia - Pacific	509,05	51

Source: Eni World Oil and Gas Review, 2015.

Saudi Arabia, the world's biggest oil producer (through its national oil company Saudi Aramco), plays a role of key oil price regulator, by increasing or decreasing oil production, thus decreasing or increasing oil prices respectively in the world to the certain levels set up by OPEC or to levels that follow country's national interests. At the same time, international oil companies look at the revenues they generate so that to bring as much as possible to their shareholders. In addition to this, it is very important for the international oil companies to reinvest enough of their revenues to exploration of new oil fields, growth of oil and gas reserves and production, because IOCs sometimes do not completely replace their reserves and consequently are slowly eliminating long term assets, that might lead to a reduction in production in future (Jaffe and Soligo 2007).

Since private enterprises' main target is maximization of share prices, companies' managers could achieve that target with organization of production process in such a way that company earns money in both current time period and future time period. Another option for managers is to invest wisely in order to use the discovered opportunities and increase enterprise's rate of return. In addition to this, managers could also try to work on production efficiency improvement in order to decrease costs and raise profitability of the company. It should bring positive effect to customers since the shortages of the products are eliminated and products are available at the lowest possible price. Shareholder value of oil industry players is connected to company's oil resources value and could be increased by proper management of production, exploration, and development activities in order to help the market work continuously (Pirog 2007).

Thus for the facilitation of company's long term survival it is necessary to replace reserves constantly. If the oil firm wants to grow, it must increase the oil production and sales to satisfy growing needs in oil in developing countries and in industrialized countries as well. Achieving effectiveness in every part of the production chain results in both costs reductions and in production processes developments and improvements (Pirog 2007).

Because of the having relatively small reserves, IOCs would compete severely for the access to new oil fields, particularly when the oil prices stay high for quite a long period (Jaffe and Soligo 2007).

In 2014 oil and natural gas prices drop resulted in serious exploration and production (E&P) spending reduction (figure 3), according to Barclays E&P Outlook (2015).

Figure 3 Worldwide E&P capital spending by company type/region

($mm)	2013A	2014A	2015E	2013-2014 %	2014-2015 %
North America Spending	$176,612	$194,090	$125,754	9.9%	-35.2%
Middle East	34,777	40,180	42,550	15.5%	5.9%
Latin America	73,934	76,553	69,901	3.5%	-8.7%
Russia/FSU	48,211	44,320	35,491	-8.1%	-19.9%
India, Asia & Australia	108,111	106,370	91,360	-1.6%	-14.1%
Europe	45,788	45,770	35,314	0.0%	-22.8%
Africa	23,383	25,726	20,916	10.0%	-18.7%
Majors (International)	104,946	100,897	84,487	-3.9%	-16.3%
NAM Independents (International)	15,172	14,635	11,250	-3.5%	-23.1%
Other E&P (International)	4,045	5,127	4,166	26.7%	-18.7%
International Spending Total	$458,367	$459,578	$395,435	0.3%	-14.0%
Worldwide E&P Spending:	$634,979	$653,669	$521,189	2.9%	-20.3%

Source: Barclays Research and Company Reports

Note: The regional breakout assumes companies spend primarily in their home region

Source: Barclays research and company reports, 2015.

Global reduction of spending for exploration and production in 2014-2015 was 20,3% comparing with previous year. North American E&P spending reduction was even more – 35,2%, while just international spending reduction was 14% (Barclays 2015).

Nowadays every company in the oil industry works on the contractual agreements with other companies that have certain specializations. Since the IOCs are becoming to operate more and more like general contractors, controlling the work of many sub-suppliers doing exploration, seismic activities, drilling, data analysis, supplying drilling equipment and teams, etc. Big IOCs also work like banking organizations, supplying the money for new greenfield projects development in severe and harsh conditions (like technological, climate or geographical) and their managerial and organizational capabilities to control and help to maintain the operations required by those projects (Jaffe and Soligo 2007).

Because of that, NOCs might also consider this type of doing business very effective and useful or they might understand that are capable to undertake all those activities on their own. Last decade IOCs had little success in avoiding huge costs overruns on giant projects in Kazakhstan, Sakhalin or the Middle East, which means that NOCs could become unsure about the IOCs benefits. In addition to this, more and more industry experts are getting skeptical about such huge companies' future if nowadays the average size of new discoveries is reducing. Also, since small upstream oil companies have lower expenses than their big competitors filled with

bureaucracy, they could have advantages in exploration and development of the small oil fields (Jaffe and Soligo 2007).

NOCs and IOCs also have differences in such aspects as non-commercial goals, underground assets, operational profile and taxation.

Use of standard performance measurements, and specifically profitability, provide untrue results, because the majority of the state-owned enterprises have goals other than profit maximization (Bozec, Dia and Breton 2006). As for the companies working in competitive markets, Boardman and Vining (1989) claim that if such basic social benefits are internal to the company (like excessive level of employment), they can only be reached at a cost of losing social welfare. If the benefits are external to the company (like constructing of social infrastructure), then financial performance comparison could at least demonstrate the real prices of those activities. However, some countries provide monopoly status to their NOCs (often considered as a compensation for non-commercial commitments), which can result in the market power and huge monopoly earnings (Wolf 2009).

Amount of available resources is a key characteristics defining performance of any exhaustible resources industry. Oil resources existence, access to and moving out simplicity, extraction rate and cost of production differ in every oil field and country. A considerable number of NOCs is known to be monopolies having huge resource reserves. Even if NOCs and private oil companies compete nowadays inside the country, the state-owned enterprises have usually primary access to the most valuable resources like oil fields or refinery plants. But not everything about quality of assets is reasoned by geology or geography, there are also investments, research and development and management. A conclusion about management's performance could only be made with clearly separating those things one from another (Wolf 2009).

Different segments of the oil industry (upstream and downstream) differ in terms of capital and personnel requirements, price volatility, competitiveness level and overall profitability. According to EY, in 2010 average return on capital employed for the upstream was equal to 20% and for the downstream just 8% (EY 2010).

Johnston (2007) showed that state' share in upstream taxation is about 40-90% in different countries, resulting in huge differences in the companies' payed taxes. In addition to this, some governments have equal taxes for both NOCs and private oil companies and some use different and sometimes unclear rules. This to a significant extent depends on the state and power balance of state government and national oil company – so that this special tax regime for the

NOC might be soft or severe. The situation could get more sophisticated if monetary transfers between state and NOC for social provision, fuel subsidies and so on exist (Wolf 2009).

Non-commercial goals, underground assets and operational profile are very important characteristics to be taken into account when comparing companies in the oil industry. Also, OPEC membership is supposedly could show that state involvement might have the political nature, retail gasoline price could demonstrate whether fuel subsidies exist which would be an example of non-commercial obligation. It is also important that all of above mentioned factors are company-specific and usually do not change in time (Wolf 2009).

Al-Mazeedi (1992), Gochenour (1992) claim that operational inefficiency of NOC is caused by technical and managerial underperformance. They also state that IOCs during the period of high oil prices of 1970-1985 managed to restructure and develop effectiveness capabilities by investing hugely in research and development, while NOCs did not do that. NOCs are blamed for excessive level of employment and above-average salaries (Waelde 1995). They also usually hire people because of family or tribal ties and religion instead of looking at skills, experience and performance (Al-Mazeedi 1992). McPherson (2003) also names often seen absence of competitors for NOCs and mechanisms of corporate governance, the distorting essence of gasoline subsidies, and conflict of interest in the home country oil industry arising from the fact that NOCs in many countries helps to develop, implements and controls industry policy while being incredibly powerful industry player (Wolf 2009).

Many countries look forward to simplifying and making working conditions better. So, there are two obvious option of doing that: liberalization – allowing the competition to exist, and privatization – changing the owner of the company from state to private. However, state's wish to control the national oil companies does not connect well with competition itself. Moreover, there are strong clashing groups inside of a public company (like management, employees or unions) that have a stimulus to force the appearance of competition. But groups having clear interest in such competitive environment (like potential new market players and consumers) usually are not successful in winning in those situations. Commercialization, however, is an internal process of enterprises devoted to concentrating on effectiveness and profitability, can be reached separately from liberalization and privatization, but still there are crucial useful connections (Wolf 2009).

First, market liberalization is widely used as a policy instrument in case of existing market power limitations or effectiveness insufficiency both caused by the poor competition or its absence. The last situation considers liberalization's objective as larger extent of commercialization of the industry (Vickers and Yarrow 1988). Second, start of company's

privatization frequently leads to firm's commercialization (Wolf 2009). Quite often commercialization is necessary to increase privatization's attractiveness to private investors. Concentrating on commercialization means limitations introduction to non-commercial goals and activities of the company, but introduction of these limitations without changing ownership is usually hard to make (Horn 1995). Kikeri, Nellis and Shirley (1992) write that attempts to change state-owned companies into private ones without changing ownership were made by almost all developing countries since 1970s. The progress was not great and generally the implementation was going hard and slowly, so that these actions were not always accomplished and attempts were slowing down and finally stopping right after the issue that was a reason for such a change disappeared (Wolf 2009).

However, Wolf and Pollitt (2008) write that NOCs' performance could be improved by some partial privatization. It happened in countries where partial privatizations were supported by governments' measures to increase competitive position for the NOCs and keep those performance improvements, like it happened in Norway, where the government controlled the industry by having shares in two oil national oil companies – Statoil and Norsk Hydro, and by so-called "State Direct Financial Interest" – SDFI, which was though used by Statoil on behalf of the government. So, when Statoil was partly privatized in 2001, Norwegian government also sold some SDFI assets to Statoil thus to increase its competitive position on international market (Wolf 2009).

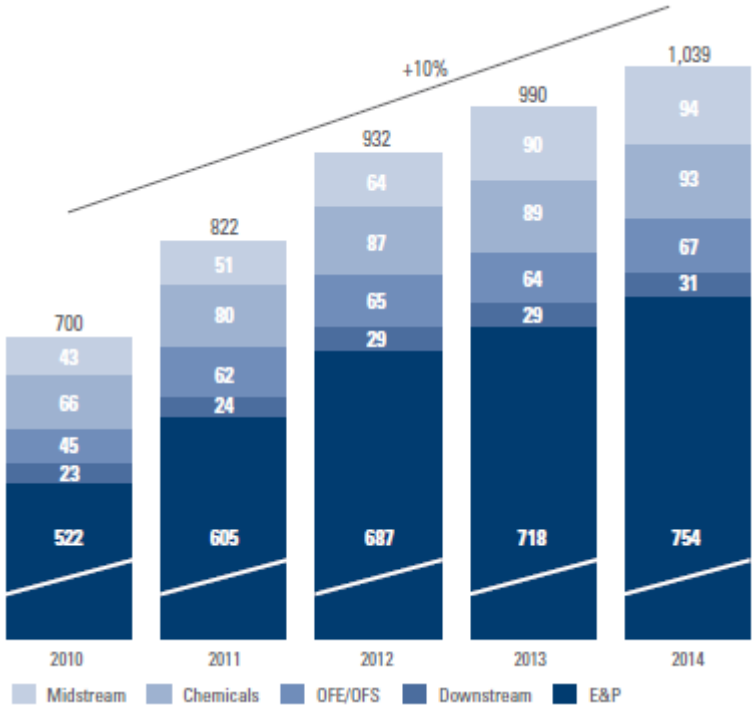
For the upstream segment, the most vital issue is the ownership of the ground beneath the surface (subsoil). For example, the US government allows private ownership for subsoil (Mommer 2002). If the subsoil is publicly owned, government could either give a monopoly to one certain company, or to introduce a licensing system to let several companies participate. Allocation mechanism and fiscal terms are important characteristics of a licensing mechanism since they define access and state part of profits. Government can naturally use the licensing mechanism as a tool for controlling and building industry structure – just by making decisions about the frequency and magnitude of the licensing agreements (auction or negotiated deal), by establishing certain financial incentives or by setting the rules like obligatory government involvement. If the government is willing to take part in the oil industry directly – either as the monopolist or as a license provider, it is possible to do that in the form of corporation or public bureau (Horn 1995). State-owned enterprises are definitely met more often in the oil industry – because of the fact that consumption is easy to measure, marginal costs cannot be neglected and demand price elasticity is high enough (Peltzman 1989) – which provides the opportunity to introduce private shareholders through the privatization (or partial privatization). Even without

being privatized, NOCs can attract private partners either as service providers or as joint-venture partners at the exploration and production levels (Wolf 2009).

However, the difference between IOCs and NOCs is not always obvious because some companies that used to be NOCs (like BP or Total) went through full or partial privatization, so that after that they work somewhere similar to the companies that were always private. Also there are companies like Statoil or Petrobras that despite being partially privatized sometimes demonstrate work in governments' interests (Jaffe and Soligo 2007).

All of the above mentioned government structures, apart from subsoil ownership, could also be applied to downstream segment. Since taxes in both upstream and downstream are very high and contain sector-specific taxes, it is also an important mechanism of rent redistribution and government participation – even in the relationships of state and its NOCs, since taxes significantly define the degree of the NOCs' independence (Wolf 2009). In other words, since state-owned and privately-owned oil companies are not mutually exclusive, no contradictions arise if they work together. Oil and gas projects are very capital intensive, have long accomplishing time and are indeed risky (Stevens 2005). Figure below represents the rise of the global capital expenditure spending of publicly traded companies in 2010-2014. It is seen that for those 5 years capital expenditure were growing and the most of the capital expenditure were spent on the exploration and production activities – more than 70% each year throughout 2010-2014.

Figure 4 Global 2010-2014 capital expenditure spending trends of public companies, US$ billions.



Source: AlixPartners, 2015.

Specifically in the upstream oil companies usually arrange a partnership with each other to share risks and financing requirements and to strengthen each other's skills. Since the industry become mature, the reasons for risk diversification could get even more obvious. Although there is no threat of running out of hydrocarbons in the near future (Lynch 2004; Watkins 2006; Greene, Hopson and Li 2006), the most of the onshore and shallow-water offshore fields are exhausting and new projects, like deep-water offshore or remote fields with severe climate and absence of infrastructure, will become more technically challenging and expensive to operate. NOCs – IOCs relationships often were unfriendly, and some of those problems could easily be followed back to the nationalization discussions in the 1970s. More recently, even when OPEC' members – NOCs suggested allowing foreign participation in upstream projects, the IOCs frequently were going down due to unsatisfactory returns. Considering future challenges, a much more tight cooperation could be not just preferred, but required (Marcel 2006).

1.4. Previous studies on comparison of international and national oil companies

Comparison of public and private firms can be influenced by structural differences of the companies, such as operational activity, non-commercial goals, or the oil density, which all must

be taken into account. There were two basic research designs made in order to find whether private or state-owned oil companies have better performance:

- research comparing samples of state-owned companies with samples of (different) private companies;
- research targeted at privatization over time, made as case study, single-industry or single-country study or cross-industry cross-country study (Wolf 2009).

Both designs are closely tied: static supremacy of private companies is required to the success of privatization, but it is not enough, because privatization is a dynamic process and it could contain significant changes apart from the ownership, like political, regulatory and organizational changes (Villalonga 2000).

While a considerable amount of studies give evidence supporting private ownership, Villalonga (2000) argues that many studies are not trustworthy as the comparisons are weakened by methodological difficulties. So, choosing suitable measurement variables is one problem, when another problem is that there are interconnected and non-separable results of ownership, competition and regulation (Vickers and Yarrow 1988). Moreover, suitable groups of companies for the comparison are hard to find – a lot of countries and industries have only a small number of or even no suitable firms with both types of ownership. Also, ownership itself might be sophisticated – due to the existing system that has both political and performance objectives (Megginson and Netter 2001).

Since private international oil companies face difficulties in gaining access to big oil and gas reserves, NOCs' control over oil resources is likely to grow. So it is important to know if NOCs would behave the same as IOCs both in times peace and calamity and crises and shocks happening in the global oil market (Hartley and Medlock 2008).

In order to describe systematic behavior variations of a NOC and an IOC, Hartley and Medlock (2008) built a model of NOC working and developing that demonstrates NOC trying to maximize revenue inflow from the production of such an exhaustible resource as oil at the same time being influenced by the side goals of politicians. NOCs' behavior reflects all of the events happened with companies at any moment of time and under any circumstances. However, NOCs average performance in the long run is likely to demonstrate effects of being owned and controlled by the state government rather than shareholders (Hartley and Medlock 2008).

Their model shows two basic features of national oil company:

- NOC must give evidence of extracting an exhaustible resource change comparing current and future periods.

• NOC, comparing with IOC, has different owners, or principals, who have different goals, so that the previously mentioned principal–agent paradigm is critical to justification of the extended number of objectives of NOC, comparing to IOC (Hartley and Medlock 2008).

They proposed a general goal for the NOC that can demonstrate a combination of the goals of managers and politicians. Specifically, the NOC must compare profitability (giving money to the Treasury) and benefits to consumers and suppliers of various resources, for example, labor (Hartley and Medlock 2008).

Boardman and Vining (1989) looked at the financial performance and efficiency of the 500 largest non-American production companies in 1983. They discovered that state-owned and mixed (having both government and private shareholders) companies are less profitable and efficient than their private competitors and those companies with mixed ownership do not outperform state-owned enterprises. Another research of Boardman and Vining (1992) devoted to studying Canadian state-owned and private companies, shows the same results as well, but opposite to their first study, firms with mixed ownership are found to be more profitable than state-owned enterprises. Dewenter and Malatesta (2001), using the same design as Boardman and Vining (1989), compare the differences in profitability, labor intensity, and debt levels of private and public enterprises of the Fortune Magazine 500 largest international companies reported in 1975, 1985 and 1995. Looking at the firm's location, industry, size and business-cycle influence, they provide serious evidence that private firms are much more profitable, less labor-intensive and demonstrate lower levels of financial leverage.

Opposite to those results, Caves and Christensen (1980) and Martin and Parker (1995) suggest that there is no obvious supremacy of private companies. Instead, those researches claim that the key factor of company's efficiency is market competition and that therefore public and private companies are equally efficient if operating under competitive conditions (Wolf 2009).

There are not so many comprehensive empirical analyses, mostly because of absence of data on national oil companies, which are usually characterized as nontransparent (a significant number of NOCs are not publicly listed, thus, there is no available information on their performance). However, Al-Obaidan and Scully (1992) explore the efficiency and performance of 44 international private and state-owned oil companies (observed between 1976 and 1982), using Aigner-Chu frontier, stochastic frontier analysis (SFA) and Gamma frontier analysis. Looking at multinationalism and operational integration, they show that state-owned companies are just 61% to 65% as efficient as private companies.

Two other researches are based on the analysis of the Petroleum Intelligence Weekly ranking of the biggest international oil and gas companies. Eller, Hartley and Medlock (2011)

use nonparametric data envelopment analysis (DEA) as well as parametric SFA on a sample of 78 companies for the period 2002-2004, testing the theoretical predictions developed in Hartley and Medlock (2008). They use revenue as output and number of employees, oil reserves and gas reserves as inputs to calculate an average DEA technical efficiency score, which for national oil companies is equal to 0.28, compared to an average score for the five largest private enterprises of 0.73 and a sample average of 0.45 for the other firms. Victor (2007) also analyses the relative efficiency of national oil companies and private oil companies in turning reserves into products and revenues, using roughly 90 companies' data from the year 2004, but uses a univariate linear regression for the analysis. She demonstrates that the largest private oil firms are almost one-third better than NOCs at turning reserves into natural form of output (products), and tend to produce much more revenue per unit of output (Wolf 2009).

Jaffe and Soligo (2007) were exploring how IOCs and NOCs behave during the period of high oil prices and whether they invest a lot in oil exploration or not. They found out that five biggest international oil companies (ExxonMobil, Royal Dutch Shell, BP, Chevron and ConocoPhillips) had oil production levels reducing since mid-1990s. At the same time, shares of national oil companies that were actively participating and investing in oil exploration abroad were growing faster than shares of the biggest international oil companies. Also, consolidations of big IOCs in the 1990s did not directly resulted in successful development of big and serious oil projects and costs reduction of these projects.

Wolf's (2009) research, as well as Eller, Hartley and Medlock (2011), is based on the data from the Petroleum Intelligence Weekly "World's 50 Top Oil Companies". The research includes multivariate regression analyses with various dependent variables and two different estimators. He uses a panel model with company-specific intercepts and total estimator that does not count company-specific heterogeneity. He states that the company-specific intercept in the fixed effects estimator recognizes every time-invariant variable which influence dependent variable. Consequently companies keeping the same owners during the observance period are considered the same way despite the share of state or private investors' ownership. However, because total estimator lets estimate ownership's influence, it is impossible to control company-specific unobserved variables. Wolf's (2009) and Eller, Hartley and Medlock's (2011) SFA analyses are multivariate panel regression analyses that have special structure of the error terms. The easiest type of SFA supposes that error terms have time-invariant firm-specific components, taken from nonnegative distribution that shows deviations from the efficiency frontier (Hartley and Medlock 2013).

As Hartley and Medlock (2013) mention, there is also element of the error that shows measurement error and is supposed to have a symmetric distribution. On the other hand, it is supposed by the standard random effects panel estimator that error terms are symmetric and efficiency deviations are neglected. Wolf's (2009) study applies more structure on the equation in SFA, right side variables in SFA represent production function. However, all the equations that Wolf (2009) looks at do not have any structure interpretation, thus suitable estimating equation is hard to define. When extra assumptions are irrelevant, applying more structure might change the inferences. This is why non-parametric DEA should be used. DEA does not make specific assumptions about the basic production function (Hartley and Medlock 2013).

Hartley and Medlock (2013) had to use balanced panel (every company must have every used variable for every year), similar to Eller, Hartley and Medlock's (2011) research and different from Wolf's (2009) research, which affects the length of time period used.

A more detailed investigation of ownership change within the oil and gas industry is Wolf and Pollitt (2008), a time-series analysis of the performance and efficiency impact of all available privatizations since 1977. They explore 60 privatizations of 28 NOCs from 20 countries in 1977-2004. A considerable part of those privatizations were made in form of sequence offerings because states' shares were decreased through multiple actions. They were comparing mean results three years prior to shares were sold with mean results' three years after the shares were sold. They discovered that privatization lead to greater profitability, better operating efficiency, increase in production and decrease in employees' number. Wolf and Politt (2008) saw that first step of privatizations increased average performance on all indicators, but statistical significance of the result was achieved only in return on sales or assets and employee per unit of assets at the 10% level. Performance trend was positive and significant in all indicators. However, performance trend after privatization was not that positive as it was before privatization for seven out of ten of them, but significance presented only in return on sales or assets). Generally, privatization leads to improvement of oil companies' performance which starts only when expecting the following sale of shares and slows down after the shares are sold (Hartley and Medlock 2013).

1.5. Research hypothesis statement

To conclude, ownership structure of the oil and gas producing companies, or more specifically, the fact that national oil companies are controlled by the government and international oil companies are not, bring serious differences into the behavior of the international and national oil companies.

Because of state control, national oil companies could be either private or publicly traded. International oil companies usually are publicly traded because it helps them to attract additional funds for developing capital intensive projects all over the world. Besides, going public works for the company's image and transparency, thus increasing the attractiveness and bringing new partners (Draho 2004).

Also, IOC, which is not controlled by the government, has a main goal of maximizing revenue and company's value – the most important things to private shareholders. At the same time, having state government as a major shareholder influences the activity in a certain way. State, while pursuing its non-commercial goals, uses the NOC and its resources for helping achieving those goals. NOC is used as an instrument of achieving foreign policy goals, for example, for creating alliances with another national oil companies from the countries – strategic partners or for manipulating the market to make some countries perform in a certain way. Also, NOC keeps an excessive level of employment thus making real state commitments in the sphere of providing jobs and reducing unemployment for the nation. Besides, NOC invests a lot in various domestic projects, helping the government to develop the infrastructure within the country, which in turn also gives many people opportunities to get a job as well as stimulates the economic development of the state. Also, state makes NOC to supply the domestic market with low (subsidized) prices for the oil, gas and various oil products as well as paying taxes and rents to the country's budget thus contributing to the nation's wealth redistribution (Pirog 2007; Hartley and Medlock 2008).

Assessing the performance of NOCs and IOCs is better by using revenue, since it represents all the activities and efforts companies undertake and their success as well. Hartley and Medlock (2008) highlight that revenue is a key factor and indicator for state-owned and private enterprises. They also claim that since politicians want to increase their support, they would push NOCs to sell gasoline on home country market at subsidized prices so that it is impossible to stay 100% sure that consequences of such a move could be measured by physical production. In addition to this, because of the fact that most of the oil companies produce not only crude oil or gasoline but also other oil products, an obvious way to calculate those outputs would be to use their prices or generally to use revenue as the measure of the output (Eller, Hartley and Medlock 2011).

Generally, NOCs can sell more, since they have dominating position on the home market, thus, generating more revenue. At the same time, NOCs usually have bigger reserves, so they can also produce and sell more than IOCs. Demonstrating the excessive employment rate is possible though company's headcount, which is higher in NOCs due to providing excessive level of employment. And finally, investing a lot in various projects that NOCs have (both commercial and mon-commercial) would mean that they are to have bigger capital expenditure. However, these are the absolute values at a certain moment of time, which do not always demonstrate the behavior of NOCs and IOCs over time. Generally, previous researches are focused on using absolute values of indicators (like revenue) or ratios (like revenue per employee) on a sample containing both national and international companies. Previous researches use either cross-sectional or time-series data (over the long period of time – for several years and in some research for several decades.

Nevertheless, the performance could also be measured over the short period of time, so that the behavior of the companies would demonstrate their goals in the short run. Consequently, in order to explore the behavior of NOCs and IOCs in the short term, this research uses the difference of the indicators' values over one year, thus showing the results achieved over one year of operation and behavior of the companies in the short run. As it was previously mentioned, it is important to know how IOCs and NOCs behave in both stable and prosperous and shock times. This research aims at exploring IOCs and NOCs behavior during the significant drop of oil and natural gas prices happened in 2014, after almost half a decade of high oil prices, focusing on the companies' progress over the year of 2014 through several indicators values' changes. Also, since previous studies explored NOCs which were both publicly traded (like Statoil) and private (like Saudi Aramco), current research focuses on comparison of only publicly traded national and international oil companies.

More specifically, revenue change is defined as the difference of annual revenues in 2014 and 2013. As for the reserves, there are 3 types of them: proved reserves, possible proved reserves, probable reserves and possible reserves. The first type represents the reserves that could be recoverable under existing economic and political conditions using existing technology of reserves with 90% or more confidence. Probable reserves include proven reserves and also those that are not proven but have probability of 50% and more of being technically and commercially producible. Possible reserves include probable reserves and the reserves that have the probability of less than 50% of being technically and commercially producible. Because of the highest probability of being extracted and produced, proven reserves change (2013 to 2014) is chosen for this research. They include oil and gas reserves together, since, as it was earlier mentioned

industry players explore and produce both oil and gas (Van Vactor 2010). As for the production, it includes both oil and gas annual production combined. Capital expenditure and headcount change from 2013 to 2014 are defined as the difference of the indicators' values over that year.

However, before starting the comparison of one year's performance of IOCs and NOCs, it is necessary to explore the influence of the chosen performance indicators – reserves change, production change, headcount change and capital expenditure change – on the output indicator of revenue change, in order to analyze whether they are significant for revenue generating and which of those influences revenue change the most during the oil and natural gas prices decrease.

Firstly, the amount of revenue generated by company depends on the amount of sales level and, consequently, on the production level. Next, since the oil and gas are limited resources, the reserves company has are crucial for supporting (or increasing) the production level. Moreover, the company should spend significant funds on capital expenditure for increasing the level of production and adding new reserves, which in turn affect the revenue amount generated. Finally, company needs to hire new people so that the operation expansion could be possible, that, however, affect the operation expansion not as much as the extensive use of machinery does. Supposedly, revenue change is affected by the production change the most because they are directly connected, then the second place takes the reserves change, because the oil and gas are limited and production (so as revenue) depends on the reserves available, the third place takes the capital expenditure, because production and reserves increase could be done through high capex spending and, finally, the headcount change influences the revenue change the least, because the revenue increase is more likely to be achieved by an extensive use of machinery rather than employees.

So, here is the first group of hypotheses:

1a: production change has the highest degree of influence on the revenue change of the oil and gas producing company among production change, reserves change, headcount change and capital expenditure change during oil and natural gas prices decline.

1b: capital expenditure change has the second highest degree of influence on the revenue change of the oil and gas producing company among production change, reserves change, headcount change and capital expenditure change during oil and natural gas prices decline.

1c: reserves change has the third highest degree of influence on the revenue change of the oil and gas producing company among production change, reserves change, headcount change and capital expenditure change during oil and natural gas prices decline.

1d: headcount change has the lowest degree of influence on the revenue change of the oil and gas producing company among production change, reserves change, headcount change and capital expenditure change during oil and natural gas prices decline.

After estimating the relationships between four indicators' changes and revenue change, the comparison of performance of two groups of companies – NOCs and IOCs is conducted. For this analysis the same performance indicators' changes are chosen: revenue change, production change, proven reserves change, headcount change and capital expenditure change, because they demonstrate how the state control over the NOC affects its behavior and let to compare it with IOC's behavior.

Because the 2014 was the year of significant oil and natural gas prices decrease, both NOCs and IOCs tried to generate as much revenue as possible, IOCs because of keeping their investor attractiveness and share prices, NOCs because of government's extensive plans for the non-commercial goals (decline in oil and natural gas prices leads to generating less revenue and, consequently, paying less taxes). Since the prices decrease was very big, both types of companies supposedly faced revenue decrease, although both IOCs and NOCs supposedly increased the production in attempts not to let revenue fall. In turn, increased production combined with the cancellation of very costly projects resulted in decrease of reserves, so that both IOCs and NOCs supposedly reduced the reserves.

The resources prices decrease made the companies to review their participation in various projects: very costly project had to be suspended, so they gave no return. Also, because of being afraid that prices would continue to fall, both IOCs and NOCs supposedly increased the capital expenditures for some other projects in order to speed up the development of them so that the oil and gas from them became cheaper to extract and thus in future companies would have more resources available. Besides, increase in production was another reason for the increased spending on capital expenditures, which was done by both types of companies as well.

Generating less revenue leads to cutting costs, so that IOCs supposedly decreased the headcount. NOCs supposedly did the same, because it is more important for the government to let NOCs earn more and thus pay more taxes, which then might be spent on supporting various government activities (as well as subsidies for the people) rather than allow NOCs having extensive level of employment, earn less and, consequently, pay less taxes.

So here is the second group of hypotheses:

2a: there has been a decrease in revenue for both IOCs and NOCs during oil and natural gas prices decline.

2b: there has been an increase in production for both IOCs and NOCs during oil and natural gas prices decline.

2c: there has been a decrease in reserves for both IOCs and NOCs during oil and natural gas prices decline.

2d: there has been an increase in capital expenditure for both IOCs and NOCs during oil and natural gas prices decline.

2e: there has been a decrease in headcount for both IOCs and NOCs during oil and natural gas prices decline.

2. EMPIRICAL RESEARCH DESIGN

2.1. Methodology and sample

In order to estimate the influence of the production change, proven reserves change, capital expenditure change and headcount change on the revenue change, the multiple regression analysis is used.

The regression model:

*Revenue change = b0 + b1*production change + b2*reserves change + b3*headcount change + b4*capex change.*

In order to compare the performance of NOCs and IOCs for the year of operation, using revenue change, production change, proven reserves change, capital expenditure change and headcount change the t-tests are used.

This research considers national oil companies as the ones publicly traded and having state share of 50,1% and more. International oil companies are considered as publicly traded oil companies with government share of 0-50%, thus not being fully controlled by the state, which also operate in several countries (at least two countries of operation).

The companies for the sample are taken from the 2015 Platts Top 250 Global Energy Companies rankings, made by the Platts, a financial division of Mcgraw Hill. The ranking includes 250 world's biggest publicly traded energy industry companies and based on the undisclosed formula that considers such companies performance indicators as asset worth, revenues, profits and return on invested capital. The full list of companies is included in Appendix 1.

Table 6 Sample selection process

Characteristics	Number of companies
Biggest global publicly traded energy companies	250
Companies from the oil and gas industry	115
Companies operating in upstream segment *Of them:*	46
- NOCs	*16*
- IOCs (operating in at least 2 countries)	*30*

2.2. Variables

Revenue change – represents the percentage by which the revenue from the end of 2013 reporting year has changed to the end of 2014 reporting year (increased or decreased or stood the

same) during the company's operation for a year. It is measured in percentage and calculated the following way:

*Revenue change: (2014 revenue – 2013 revenue) / 2013 revenue * 100.*

2013 and 2014 revenue represents the company's annual revenues and is measured in US dollars. If company reports the revenue in other currency, it is converted to the US dollars using the exchange rate on the date on which it is stated in the report (the last day of the year).

For the regression analysis revenue change is used as a dependent variable.

Production change – represents the percentage by which the annual production from the end of 2013 reporting year has changed to the end of 2014 reporting year (increased or decreased or stood the same) during the company's operation for a year. It is measured in percentage and calculated the following way:

*Production change: (2014 annual production – 2013 annual production) / 2013 annual production * 100.*

2013 and 2014 annual production combines the production of oil, natural gas, oil and products (if company produces any) and is measured in barrels of oil equivalent (BOE) on the date on which it is stated in the report (the last day of the year).

For the regression analysis production change is used as an independent variable.

Reserves change – represents the percentage by which the proven reserves from the end of 2013 reporting year has changed to the end of 2014 reporting year (increased or decreased or stood the same) during the company's operation for a year. It is measured in percentage and calculated the following way:

*Reserves change: (2014 proven reserves – 2013 proven reserves) / 2013 proven reserves * 100.*

2013 and 2014 proven reserves combines the proven reserves of oil and natural gas and is measured in barrels of oil equivalent (BOE) on the date on which the they are stated in the report (last day of the year).

For the regression analysis reserves change is used as an independent variable.

Headcount change – represents the percentage by which the headcount from the end of 2013 reporting year has changed to the end of 2014 reporting year (increased or decreased or stood the same) during the company's operation for a year. It is measured in percentage and calculated the following way:

*Headcount change: (2014 headcount – 2013 headcount) / 2013 headcount * 100.*

2013 and 2014 headcount represents the company's number of employees and is measured in persons on the date on which it is stated in the report (last day of the year).

For the regression analysis capex change is used as an independent variable.

Capital expenditure change (capex change) – represents the percentage by which the capital expenditure from the end of 2013 reporting year has changed to the end of 2014 reporting year (increased or decreased or stood the same) during the company's operation for a year. It is measured in percentage and calculated the following way:

*Capex change: (2014 capital expenditure – 2013 capital expenditure) / 2013 capital expenditure * 100.*

2013 and 2014 capital expenditure represents the company's annual capital expenditure and is measured in US dollars. If company reports the capital expenditure in other currency, it is converted to the US dollars using the exchange rate on the date on which it is stated in the report (last day of the year).

For the regression analysis capex change is used as an independent variable.

All the indicators' values for 2013 and 2014 are taken from the companies' annual reports.

2.3. Descriptive statistics

Here are presented the descriptive statistics for the regression analysis only. The descriptive statistics for the t-tests are presented in the next paragraph.

Table 7 Descriptive statistics for the regression analysis

Descriptive Statistics

	Mean	Std. Deviation	N
revenue change, %	-7,09304367	18,76471316	44
production change, %	3,987723508	11,31515553	44
reserves change, %	-,068036606	8,575753028	44
headcount change, %	1,009371097	15,79391253	44
capex change, %	-5,33459094	25,83312599	44

Table above represents the descriptive statistics for the regression variables. It is seen that dependent variable has a negative mean of about -7. The mean for reserves change and capex change are also negative, while means for the production change and headcount change are positive.

As it is seen from the table below, no high correlations of variables are spotted.

Table 8 Pearson correlation for the regression analysis variables

		revenue change,	production change,	reserves change,	headcount change,	capex change,
Pearson	revenue change,	1	[illegible]	[illegible]	[illegible]	[illegible]
	production change,	[illegible]	1	[illegible]	[illegible]	[illegible]
	reserves change,	[illegible]	[illegible]	1	[illegible]	[illegible]
	headcount change,	[illegible]	[illegible]	[illegible]	1	[illegible]
	capex change,	[illegible]	[illegible]	[illegible]	[illegible]	1

3. EMPIRICAL RESEARCH RESULTS

3.1. Results and their interpretation

First of all, the regression analysis is done to explore the degree of influence of production change, reserves change, capital expenditure change and headcount change on the revenue change.

Regression analysis:

Table 9 Results of the regression analysis, dependent variable – revenue change, %

Variable	Coefficient	Significance
Production change, %	0,619	0,028
Reserves change, %	-0,791	0,041
Headcount change, %	0,279	0,103
Capex change,%	0,229	0,041

Table above represents the summarized results of the regression analysis, and more detailed results are included in Appendix 2.

Since the significance of all the independent variables but the headcount change are less than 0,05, it means that production change, reserves change and capex change significantly contribute to predicting revenue change. Unfortunately, the headcount change have significance is more than 0,05, which means that headcount change is insignificant for predicting the revenue change.

T-Tests analyses:

T-Tests analyses were made to compare the performance of the IOCs and NOCs on the 5 chosen variables. For conducting the comparisons, NOCs were given a code of 0, and IOCs – a code of 1. More detailed t-tests results are included in Appendix 3.

Table 10 Results of the t-test for the revenue change, %

Group Statistics

	Type	N	Mean	Std. Deviation	Std. Error Mean
revenue change, %	,0	16	-10,5713564	16,97578760	4,243946901
	1,0	29	-6,27277801	20,37204656	3,782994074

It is seen that the mean for the revenue change of the NOCs is -10,57%, while the mean for the revenue change of the IOCs is -6,27%. Because p-value of this t-test is more than 0.05, it can be concluded that there has been no significant difference between the means.

Table 11 Results of the t-test for the production change, %

Group Statistics

	Type	N	Mean	Std. Deviation	Std. Error Mean
production change, %	,0	16	3,808802594	8,102163068	2,025540767
	1,0	29	2,728426798	9,115902143	1,692780531

It is seen that the mean for the revenue change of the NOCs is 3,81%, while the mean for the revenue change of the IOCs is 2,73%. Because p-value of this t-test is more than 0.05 it can be concluded that there has been no significant difference between the means.

Table 12 Results of the t-test for the reserves change, %

Group Statistics

	Type	N	Mean	Std. Deviation	Std. Error Mean
reserves change, %	,0	16	-1,89220634	8,238283330	2,059570833
	1,0	29	-,178812641	6,654693134	1,235745492

It is seen that the mean for the revenue change of the NOCs is -1,89%, while the mean for the revenue change of the IOCs is -1,79%. Because p-value of this t-test is more than 0.05, it can be concluded that there has been no significant difference between the means.

Table 13 Results of the t-test for the headcount change, %

Group Statistics

	Type	N	Mean	Std. Deviation	Std. Error Mean
headcount change, %	,0	16	8,950889199	13,13437834	3,283594584
	1,0	30	-2,30267831	15,75904474	2,877194764

It is seen that the mean for the revenue change of the NOCs is 8,95%, while the mean for the revenue change of the IOCs is -2,3%. Because p-value of this t-test is less than 0.05, it can be concluded that there has a difference between the means.

Table 14 Results of the t-test for the capex change, %

Group Statistics

	Type	N	Mean	Std. Deviation	Std. Error Mean
capex change, %	,0	16	-18,0404984	24,31644423	6,079111057
	1,0	30	1,550740508	23,43571614	4,278756794

It is seen that the mean for the revenue change of the NOCs is -18,04%, while the mean for the revenue change of the IOCs is 1,55%. Because p-value of this t-test is less than 0.05, it can be concluded that there has a difference between the means.

3.2. Results discussion

The table below represents the results of hypotheses testing from regression and t-tests analyses:

Table 15 Hypotheses testing results

Hypothesis	Result: confirmed or rejected
1a: production change has the highest degree of influence on the revenue change of the oil and gas producing company among production change, reserves change, headcount change and capital expenditure change during oil and natural gas prices decline.	Rejected
1b: capital expenditure change has the second highest degree of influence on the revenue change of the oil and gas producing company among production change, reserves change, headcount change and capital expenditure change during oil and natural gas prices decline.	Rejected
1c: reserves change has the third highest degree of influence on the revenue change of the oil and gas producing company among production change, reserves change, headcount change and capital expenditure change during oil and natural gas prices decline.	Rejected
1d: headcount change has the lowest degree of influence on the revenue change of the oil and gas producing company among production change, reserves change, headcount change and capital expenditure change during oil and natural gas prices decline.	Rejected
2a: there has been a decrease in revenue for both IOCs and NOCs during oil and natural gas prices decline.	Confirmed
2b: there has been an increase in production for both IOCs and NOCs during oil and natural gas prices decline.	Confirmed
2c: there has been a decrease in reserves for both IOCs and NOCs during oil and natural gas prices decline.	Confirmed
2d: there has been an increase in capital expenditure for both IOCs and NOCs during oil and natural gas prices decline.	Rejected
2e: there has been a decrease in headcount for both IOCs and NOCs during oil and natural gas prices decline.	Rejected

The regression analysis was made to explore how the revenue change is influenced by production change, reserves change, headcount change and capital expenditure change during oil and natural gas prices decline. Based on the regression analysis results, table below summarizes the effects of the independent variables on the revenue change.

Table 16 Independent variables' effects on the dependent variable (revenue change, %)

Variable	Effect on the revenue change
Production change, %	As production changes by 1%, the revenue changes by 0,619%.
Reserves change, %	As reserves change by 1%, the revenue changes by 0,791%.
Headcount change, %	Headcount change does not significantly influence revenue change.
Capex change,%	As capital expenditure changes by 1%, the revenue changes by 0,229%.

The model is significant and has the R Square equal to 0,248, which means that these independent variables can explain 24,8% of the variation in the revenue change. In other words, revenue change is influenced by many factors, and there are some other factors not included in this model that influence the other 75,2% of the revenue change variation, but, obviously, the main factor influencing the revenue change over time for both IOCs and NOCs most likely is the resources price (not included in this model).

At the same time, it is seen that among those four independent variables, reserves change influences revenue change the most, despite being expected to have the third highest degree of influence on the revenue change during oil and natural gas prices decline. Production change turned out to have the second highest degree of influence on the revenue change of the oil and gas producing company, while the capital expenditures has the third highest degree of influence on the revenue change. Headcount change does not significantly influence revenue change, which means that hiring or firing employees does not bring effect to revenue change as the production change, reserves change or capex change do.

Thus, hypotheses 1a, 1b, 1c and 1d are all rejected.

However, despite the fact that headcount change does not have any significant influence on the revenue change, it is still taken for the comparison of IOCs and NOCs performance, since it demonstrates how the governments controlling NOCs behave towards the companies' personnel during the market shocks, such as resources prices decline.

T-tests analyses were made to compare NOCs and IOCs' one year of operating performance results during oil and natural gas prices decline, using revenue change, production change, reserves change, headcount change and capital expenditure change.

The results of the t-test on comparison of the revenue change of NOCs and IOCs showed that there has been a decrease in revenue for both NOCs and IOCs, so that hypothesis 2a is confirmed. It happened because of the significant resources prices decrease, so that companies could not even keep the revenue at the same level. NOCs faced the reduction of revenue by 10,6% and IOCs by 6,3%.

The results of the t-test on comparison of the production change of NOCs and IOCs showed that there has been an increase in production for both NOCs and IOCs, so that hypothesis 2b is confirmed. As it was earlier mentioned, companies tried to avoid revenue decrease by increasing the production: production increase for NOCs was 3,8% and for IOCs was 2,7%.

The results of the t-test on comparison of the reserves change of NOCs and IOCs showed that, there has been a decrease in reserves for both NOCs and IOCs, so that hypothesis 2c is confirmed. It is most likely caused by, as it was mentioned earlier, the increase in production and cancellation of very costly projects. NOCs' reserves decreased by 1,9%, while IOCs' reserves decreased by 0,2%.

The results of the t-test on comparison of the headcount change of NOCs and IOCs showed that there has been an increase in headcount for NOCs by almost 9% and a decrease in headcount for IOCs by 2,3%, so that hypothesis 2d is rejected. Such opposite moves could be explained by the government policy for providing jobs during market shock, thus supporting the nation, so that the suggestions about NOCs reducing headcount are wrong.

The results of the t-test on comparison of the capital expenditures change of NOCs and IOCs showed that there has been a decrease in capex for NOCs by impressive 18% and an increase in capex for IOCs by 1,5%, so that hypothesis 2e is rejected. NOCs dramatically reduced the capex probably because of extracting resources from the already developed oil and gas fields, thus increasing the revenue and money flows to the government. IOCs did the opposite thing: they increased the capex, trying to develop capital intensive projects as much as possible until prices do not decline even more.

Also, such serious reduction in revenue and capital expenditures for NOCs compared to IOCs might be explained by falling exchange rates of national currencies, which were caused by oil and gas prices decrease: usually, countries with NOCs have the oil industry as one of the main and important for the domestic economies, so that national currencies might follow the oil price, as, for example, Russian ruble was falling in 2014 (Bloomberg 2014).

3.3. Managerial implications

Results of this research demonstrate the behavior of both NOCs and IOCs during markets shock, more specifically, oil and natural gas prices decline, which happened in 2014.

The results show how the NOCs and IOCs behave during this market shock and crisis so that it is possible to use these results for the further forecasting and analysis of the NOCs and IOCs own behavior in future in order to get prepared in case market shock happens. It is important because NOCs control the majority of oil and gas resources on the planet, so that their behavior is really important for the global market, since it might affect the global oil and natural gas prices.

Also, the results of this research might be used for the comparison with NOCs and IOCs behavior during stable market situation, thus showing what actions companies from both types undertake in both situations and what is different. It might help to get prepared for the future shocks, which are likely to happen because both oil and natural gas are limited resources are they are depleting as the time goes by.

Also, since NOCs and IOCs sometimes work in cooperation with each other in various projects, the results might help each party to get prepared for the actions of another party (partners) during market shock and thus reduce possible risks that might arise and use it for planning their own future steps in case such situation happens.

At the same time, NOCs and IOC compete on the same market (global market), so that the results of this research might help each party to forecast the actions of another party (competitors) during market crisis and thus again reduce possible risks and use it for planning their own steps in case such situation happens.

3.4. Research limitations

Current research focuses on comparing only publicly traded national and international oil companies. Besides, only companies operating in upstream segment are chosen for the research

(so that companies operating only in downstream or midstream are not included in this research), because the variables used for the analysis are connected with exploration and production activities. Data from 46 companies used, 30 of which are IOCs and 16 are NOCs (and IOCs operate in at least 2 countries).

The companies' performance is compared using only five indicators: revenue change, production change, reserves change, capital expenditure change and headcount change. Many other existing performance indicators are not taken for this research.

The research uses methods of regression and t-tests analyses, first one for exploring the influence of four independent variables – production change, reserves change, capital expenditure change and headcount change – on the dependent variable (revenue change). The second method is used for comparison of NOCs and IOCs performance over one year of operation.

The research focuses on companies' performance of only one year – 2014, thus demonstrating behavior of the NOCs and IOCs in the short run. Also, the research focuses only on comparing NOCs and IOCs performance during market shock – decline in oil and natural gas prices occurred in 2014, thus leaving out of scope NOCs and IOCs behavior during stable market situations, like high resources prices.

As for the further research, it is possible to explore NOCs and IOCs behavior during stable market situation and then compare it with the behavior during market crisis. Also, the research might explore the longer period of time (more than one year) and have more companies in the analysis: not only publicly traded but also the private ones. In addition to this, comparison might be done using other methods, other performance indicators and a bigger number of indicators.

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APPENDIX 1

Sample companies list

[illegible]	origin	66country	[illegible]
[illegible]ko	su	[illegible]	[illegible]
apache	su	[illegible]	[illegible]
bashneft	[illegible]	[illegible]	CDN
bg	ku	[illegible]	[illegible]
bp	ku	[illegible]	[illegible]
chevron	su	[illegible]	[illegible]
cnooc	[illegible]	[illegible]	CDN
[illegible]an	[illegible]	[illegible]	[illegible]
[illegible]	su	[illegible]	[illegible]
[illegible]on	su	[illegible]	[illegible]
ecopetrol	[illegible]	[illegible]	CDN
encana	[illegible]	[illegible]	[illegible]
eni	[illegible]	[illegible]	[illegible]
[illegible]es	su	[illegible]	[illegible]
exxonmobil	su	[illegible]	[illegible]
[illegible]ia	[illegible]	[illegible]	[illegible]
gazprom	[illegible]	[illegible]	CDN
hess	su	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
inpex	[illegible]	[illegible]	[illegible]
[illegible]ation	[illegible]	[illegible]	[illegible]
[illegible]as	[illegible]	[illegible]	CDN
[illegible]	kong	hong	CDN
[illegible]oil	[illegible]	[illegible]	[illegible]
[illegible]athon	su	[illegible]	[illegible]
[illegible]an	[illegible]	[illegible]	[illegible]
[illegible]urphy	su	[illegible]	[illegible]
[illegible]	su	[illegible]	[illegible]
[illegible]	su	[illegible]	[illegible]
novatek	[illegible]	[illegible]	[illegible]
[illegible]tal	su	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	CDN
omv	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	CDN
petrobras	[illegible]	[illegible]	CDN
petrochina	[illegible]	[illegible]	CDN
pgnig	[illegible]	[illegible]	CDN
ptt	[illegible]	[illegible]	CDN
repsol	[illegible]	[illegible]	[illegible]
[illegible]eft	[illegible]	[illegible]	CDN
[illegible]	[illegible]	[illegible]	[illegible]
sinopec	[illegible]	[illegible]	CDN
statoil	[illegible]	[illegible]	CDN
total	[illegible]	[illegible]	[illegible]
[illegible]side	[illegible]	[illegible]	[illegible]
ypf	[illegible]	[illegible]	CDN

APPENDIX 2

Regression results

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,498[a]	,248	,171	17,08937360

a. Predictors: (Constant), capex change, %, production change, %, headcount change, %, reserves change, %

b. Dependent Variable: revenue change, %

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3751,101	4	937,775	3,211	,023[b]
	Residual	11389,821	39	292,047		
	Total	15140,922	43			

a. Dependent Variable: revenue change, %

b. Predictors: (Constant), capex change, %, production change, %, headcount change, %, reserves change, %

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	18,[illegible]	4,[illegible]		4,[illegible]	,000	9,[illegible]	26,[illegible]
	production change	,[illegible]	,[illegible]	,[illegible]	2,[illegible]	,[illegible]	,[illegible]	,[illegible]
	reserves change	,[illegible]	,[illegible]	,[illegible]	1,[illegible]	,[illegible]	,[illegible]	,[illegible]
	headcount change	,[illegible]	,[illegible]	,[illegible]	,[illegible]	,[illegible]	,[illegible]	,[illegible]
	capex change	,[illegible]	,[illegible]	,[illegible]	,[illegible]	,[illegible]	,[illegible]	,[illegible]

a. Dependent Variable: revenue change, %

APPENDIX 3

T-tests results

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
revenue change, %	Equal variances assumed	,283	,598	-,717	43	,477	-4,29857841	5,996546032	-16,3917660	7,794609191
	Equal variances not assumed			-,756	36,098	,454	-4,29857841	5,685255444	-15,8277226	7,230565798

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
production change, %	Equal variances assumed	,572	,453	,395	43	,695	1,080375796	2,732896738	-4,43103574	6,591787330
	Equal variances not assumed			,409	34,305	,685	1,080375796	2,639757816	-4,28250075	6,443252342

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
capex change, %	Equal variances assumed	,137	,713	-2,666	44	,011	-19,5912389	7,349069304	-34,4023149	-4,78016293
	Equal variances not assumed			-2,635	29,765	,013	-19,5912389	7,433932401	-34,7783850	-4,40409280

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
headcount change, %	Equal variances assumed	,723	,400	2,437	44	,019	11,25356751	4,617616754	1,947372432	20,55976259
	Equal variances not assumed			2,578	35,923	,014	11,25356751	4,365803832	2,398645587	20,10848943

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
reserves change, %	Equal variances assumed	1,097	,301	-,759	43	,452	-1,71339370	2,256715131	-6,26449350	2,837706103
	Equal variances not assumed			-,713	25,943	,482	-1,71339370	2,401853229	-6,65100286	3,224215460