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Oil and gas activity in the high north

Economic opportunities and political dependencies

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Contents

Papers 1-4:

1. Factors influencing future oil and gas prospects in the Arctic
2. Oil exploration and sea ice projections in the Arctic
3. The interdependence of European-Russian energy relations
4. The Political Consequences of Resource Dependence - How Natural Gas Export Can Affect Policy Outcomes: A Quantitative Analysis

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Summary

In recent year the Arctic region has received increased attention from scholars and commentators. A potential for large scale hydrocarbon production in combination with unprecedented changes in the Arctic climate have led to predictions about an Arctic oil and gas bonanza. Increased activity is also believed to increase the potential for international conflicts, where increased resources may give energy producers such as Russia a greater opportunity for exerting influence over energy importing states in Europe. In light of these developments this thesis seeks to analyze two different but at the same time related research questions. The first question is directed towards the driving forces behind the oil and gas development in the high north. The second studies the political effects of the oil and gas industry in the high north. Based on existing political economy theories, the thesis applies various methodological approaches in order to answer the outlined research questions.

The potential for a large increase in Arctic oil and gas output is significant. However, this study finds that while certain Arctic provinces may become more attractive, an overall Arctic oil and gas bonanza is unlikely. A harsh climate and lack of infrastructure makes production costs high, compared to other hydrocarbon rich regions. Overall, oil is likely to be more attractive than gas for the industry as the price of oil is significantly higher than the price of gas.

The study also shows that Arctic energy resources are to a large extent embedded in the Russian-European energy relationship, which are characterized by interdependence. The geopolitical implications of energy trade do not point to an increased overall asymmetry and political coercion. Natural gas may be used as a political instrument under specific conditions, but due to the influx of LNG and the liberalization of gas markets, diversification of natural gas supplies will most likely reduce the role of gas as a policy instrument.

Chapter 1: Introduction

This introductory chapter will present the thematic approach used in this thesis. Further, it will outline and discuss the research questions and present the overall structure of the thesis.

1.1. Background

The international oil and gas industry is unique both in political and economic terms (Yergin 1991). Most importantly, oil and gas is the prominent source of energy for modern societies. Today's agriculture, industry, transportation, trade and warfare are based on relative cheap oil and gas. Oil and gas also play an important role in heating and electricity generation, and a range of products are derived from these non-renewable resources. The oil and gas industry is truly global in its reach. The industry is dominated by large and powerful companies, and whether as exporters or importers, all countries are affected by the price of oil and gas. Stable and reliable supplies at reasonable costs are seen as vital for energy security.

The oil and gas industry emerged in the USA in the late 19th century. During the last 100 years, production has spread to all parts of the globe with known and recoverable resources. The largest production is now centered on the Middle East. However, new technology is making oil and gas resources recoverable in many more regions, and over the last decades even the Arctic has appeared as an attractive region for oil and gas exploration and extraction.

Arctic oil and gas development started about 50 years ago in the former Soviet Union (AMAP 2007). After the Second World War, the Soviet authorities gradually moved the country's oil and gas industry from the area around the Caspian Sea and towards West Siberia. New discoveries were also made in Canada and Alaska, which led to developments in the Mackenzie Delta (Canada) and the Prudhoe Bay on the North Slope (USA) in the 1960s and 1970s. Norway has only recently become an Arctic oil and gas producer. While production started in the North Sea in the early 1970s, the step into the Arctic was taken in 2007 when the Snøhvit LNG plant in Hammerfest came in operation.

The former Soviet Union invested heavily in infrastructure capabilities (e.g. pipelines and refineries) in Siberia as a mean for different policy goals. One was to promote industrial development (economy), another was to become self-supplied (security). Development in the former Soviet Union was not driven by market conditions such as demand and the price of

energy (AMAP 2007). This is arguably an important reason for why large-scale development took place at all in the Siberian wilderness.

A result of the Soviet energy strategy is a complex pipeline system which supplied – and continues to supply – Europe with oil and natural gas from Russia. This complex pipeline system has created a web of interdependencies, where supplier states, transit states, and finally receiver states are dependent upon each other. As such, the hydrocarbon infrastructure, connecting Russia, the former COMECON states in Eastern and Central Europe, and Western Europe, has become of geopolitical interests since the end of the cold war, in particular with respect to the natural gas trade.

The Arctic has unique characteristics which make upstream operations challenging, distinguishing it from other regions of the globe. First, the region is remote and the environment harsh (e.g. extreme temperatures, ice, permafrost, long periods of darkness, lack of infrastructure). This means that the technological challenges for the industry are immense. Second, the Arctic ecosystems are fragile and experiencing unprecedented changes (i.e. sea ice reduction, increase in ocean temperatures, etc.). Global warming is twice as fast in the Arctic as elsewhere. Environmental considerations are therefore vital, and the oil companies are subjected to strict safety requirements. Third, hydrocarbon activity in the high north has become highly politicized. It involves high level international political issues and includes a variety of different actors. There are policy-makers at various levels, managers of large multinational companies, scientists, NGOs and indigenous groups.

While some actors are drawn to the Arctic for purely economic reasons, others are interested in the political opportunities or possible threats that may come from increased Arctic hydrocarbon activity. Shortly summarized, there are both economic and political factors that drive decision-making regarding Arctic oil and gas. The desire to expand oil and gas activity is mainly related to a) the search for private returns, b) the need to raise more state revenues, and c) the possibility to achieve policy concessions from hydrocarbon importing states.

1.2. Research questions

The motivation behind a study of oil and gas in the Arctic is linked to recent developments which have been highly discussed in the media during the last years. Both policy-makers and scientists have predicted an intensified race for the Arctic oil and gas resources. In 2007, Time

Magazine devoted an issue to this topic under the heading "The Arctic resource race", and as late as 2012 The Economist labeled the Arctic oil and gas resources a "hidden treasure" . In 2008, Javier Solana, High Representative of the EU for Foreign Policy and Security, warned about possible tensions in the Arctic, as the resource race will intensify. "(B)ecause much of the world's hydrocarbon reserves are in regions vulnerable to the impacts of climate change and because many oil and gas producing states already face significant social economic and demographic challenges, instability is likely to increase" (Solana and Ferrero-Waldner 2008: 5). In academia the Arctic has received growing attention during the last years, which has resulted in numerous reports (AMAP 2007, ACIA 2005).

The belief that the Arctic may become the last oil and gas frontier is driven by a number of different factors. Substantial ice melting seems to make the region more accessible. Russia planted in August 2007 a flag on the North Pole seabed, which was interpreted as a signal to the world of the importance attributed to the Arctic by the leadership in the Kremlin. When the oil price reached US$ 147 per barrel in the summer of 2008, many feared that current oil and gas production would not be able to meet future oil demands. Simultaneously, the US Geological Survey published a report that estimated that nearly one quarter of the world's undiscovered oil and natural gas deposits was likely to be located in the Arctic (USGS 2008). As a result, commentators have come to the conclusion that we are more than likely to witness a substantial increase in oil and gas activity in the Arctic in the years to come (Howard 2009, Borgerson 2008).

Since the beginning of 2006, when the first gas dispute between Ukraine and Russia took place, politicians and commentators have also warned about EU's increased dependency on Russian gas.[1] Dependency, some have claimed, may result in a dramatic shortage of fuel which would have serious economic consequences for European states. Commentators who makes these kinds of arguments usually draw inspiration from a few sources such as the Russian security strategy paper from 2003 and Prime Minister Vladimir Putin's PhD dissertation, both of which state that Russia should use gas politically. In addition, when Russia decided to cut off supply yet again to Ukraine in January 2009, some East European states suffered a shortage of gas supply (Pirani et al. 2009). Adding to the fear of a gas shutdown from Russia to East European states is the new Nord stream pipeline which directly

[1] New York Times 2006, available online: http://www.nytimes.com/2006/01/03/international/europe/03ukraine.html?pagewanted=print&_r=0http://www.nytimes.com/2006/01/03/international/europe/03ukraine.html?pagewanted=print&_r=0

supplies Germany with gas from Russia and bypasses the traditional transit states such as Ukraine, Slovakia, Czech Republic, Belarus and Poland. This made the former Polish defense minister remark that the pipeline project may be compared to the Molotov-Ribbentrop Pact of 1939 which effectively divided Poland (Whist 2008).

Together, these controversial and highly debated developments are motivating reasons for devoting a thesis to the oil and gas industry in the high north. It is interesting to analyze and understand some of the dynamics that shape decision-making in a field of central political and economic concern to both states and private firms. The fact that political and economic issues here are closely interwoven makes the topic even more interesting.

The purpose of this thesis is therefore twofold. First, I will analyze why the Arctic still for the most part is an unexplored hydrocarbon region, even though the potential for increased production may be significant. As climate driven changes are causing unprecedented sea ice retreat, an interesting question is whether and how rapid this will make the unexplored resources more easily accessible in the future. Second, as oil and gas are pivotal commodities for every modern state, I will explore whether oil and gas originating from the high north may create economic dependencies of geopolitical importance. The thesis will thus shed light on various aspects of the industry, but will focus in particular upon the political economy of the oil and gas industry, with a view to the high north. The overriding theme comprises variables that drive the oil and gas sector combined with an analysis of the potential political effects of the hydrocarbon industry in the high north. In brief, this thesis will explore the following two questions:

1. *What determines the extent and speed of oil and gas development in the high north? (Papers 1, 2)*
2. *To what extent do energy resources extracted in the high north create economic and political dependencies? (Papers 3, 4)*

1.3. The genesis of the thesis

This thesis is based on four different papers. Two of them are published, and two are submitted for review (see table 1). The papers have been written as part of various research

projects, some of which preceded the work on this thesis. This means that the thesis did not start out as a clearly defined project with a single, overarching research question. However, all four papers have a common denominator, namely Arctic oil and gas. The purpose of this introduction is to show how the four papers are connected. Together, they analyze two different but at the same time related aspects of the hydrocarbon industry in the high north. An analysis of political dependencies of the oil and gas industry in the high north is difficult without an understanding of the factors that determine whether or not increased or continued activity will take place in the future. Likewise, in order to understand what drives decision-making in the oil and gas sector in the high north, it is pivotal to explore the premises on which decisions are taken. A key question is therefore what determines the set of possible actions that decision-makers may take. This introduction will also analyze and discuss some long-term trajectories that are not dealt with in the four respective papers. The main emphasis is on possible market changes in the natural gas industry which may have a profound bearing on the industry and government options during the coming decades. It will thus show how such changes may influence some of the key findings in the various papers.

Table 1: Papers

No	**Paper I**	**Paper II**	**Paper III**	**Paper IV**
Title	Factors influencing oil and gas activity in the Arctic	Oil exploration and sea ice projections in Arctic provinces	The interdependence of European-Russian energy relations	The political consequences of resource dependence. How natural gas export can affect policy outcomes: A quantitative analysis
Authors	Øistein Harsem, Knut Heen, Arne Eide	Øistein Harsem, Knut Heen, Joao Rodrigues, Terje Vassdal	Dag Harald Claes, Øistein Harsem	Øistein Harsem
Published/submitted	Energy Policy, published 2011, Vol 39, Issue 12. Pages 8037–8045	Polar Record, resubmitted after 1st review	Energy Policy, submitted	Journal of Contemporary European Research, published 2012, Vol 8, No 1
Project	Arctic Tipping Points (ATP)	Arctic Tipping Points (ATP), The Fram Centre	Geopolitics in the High North (GeoNor)	
Funded by	EU	EU, The Fram Centre	Norwegian Institute for Defence Studies	The Fram Centre

1.4. Structure of the thesis

The remainder of the introduction to the four papers is structured as follows. In chapter two, the current oil and gas activity in the Arctic is presented. This chapter includes a brief discussion of the importance of the hydrocarbon sector for the Arctic states. In chapter three, I will introduce the theoretical concepts that are used in the respective papers. As there is no overriding theoretical framework that deals with both the driving forces behind the oil and gas industry and the political dependencies caused by the same industry, I will outline the different theoretical approaches this study has employed. Chapter four outlines the research design and the various methodological approaches which have been used throughout this study. In chapter five I provide a summary of the findings from the four separate papers. The chapter shows how the papers are related to and conditioned on each other. Chapter six takes a step further and analyzes some key developments that may change the conditioned for the oil and industry in the high north. Here I discuss possible shifts in the use of hydrocarbons as the main energy source, and how various aspects of the natural gas market may alter the political dependencies and impact future Arctic gas production. Finally, in chapter seven, I provide some concluding remarks.

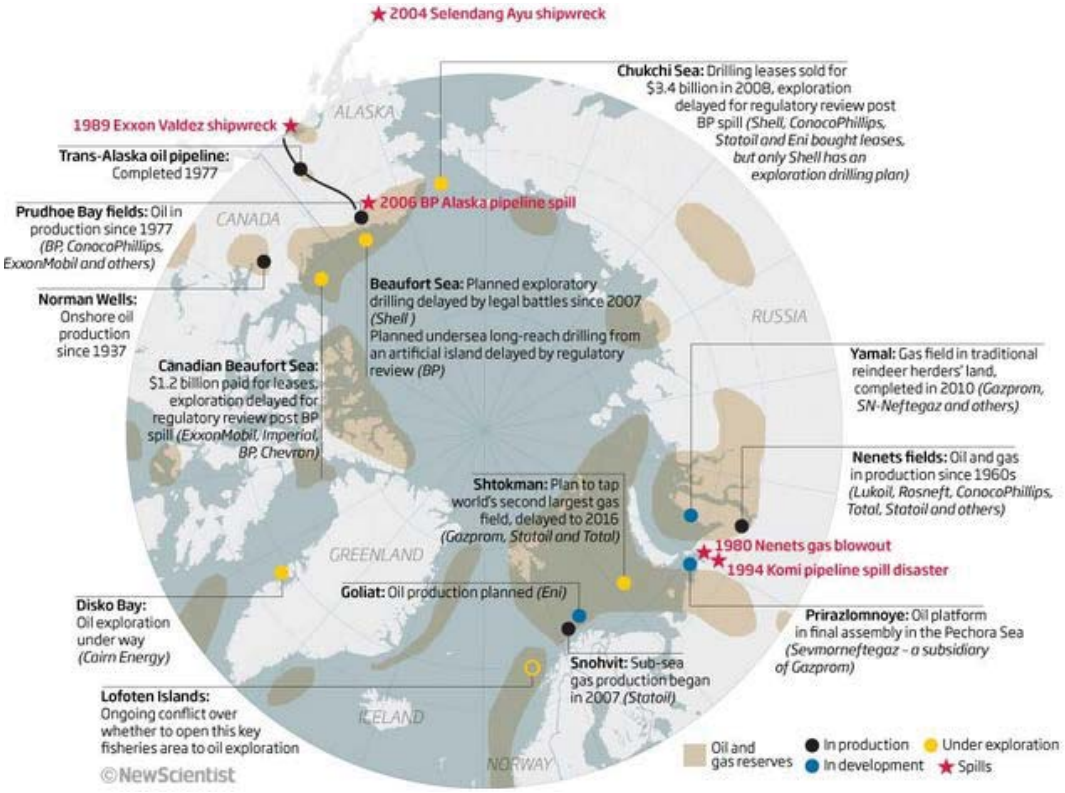
Chapter 2: Oil and gas in the high north

This chapter focuses on the value of oil and gas for key Arctic states. It starts with a brief presentation of current oil and gas activity and the associated transport infrastructure, before moving on to an analysis which centers on how oil and gas matters to the countries in the Arctic.

2.1. Activity and infrastructure

At present oil and gas activity are taking place in several parts of the Arctic (figure 1). Oil and gas are produced in Russia, Canada, Alaska (USA) and Norway (Harsem et al. 2011). The largest oil and gas reserves in the Arctic are found in Russia, but there are also substantial reserves in the other countries and probably off Greenland (Denmark). According to US Geological Survey, about 30 percent of the world's undiscovered gas and 13 percent of the world's undiscovered oil may be found in the Arctic (Gautier et al. 2009).

Figure 1: Arctic hydrocarbon activity



Source: New Scientist

However, even though many fields were discovered more than 30 years ago, production is still fairly limited. Harsh winters, sea ice and lack of infrastructure, combined with limited supply lines to end consumers, are all serious obstacles for the oil and gas industry (Budzik 2009, Dell and Pasteris 2010).

Furthermore, the large reserves indicated by the US Geological Survey (USGS) do not imply that the undiscovered resources are automatically open to international oil and gas companies. In fact, most of these resources are located on land or within the 200 mile zones of the Arctic states. This means that access to potential fields is controlled by the various governments. Domestic politics are thus crucial for oil and gas activity in the Arctic.

The fact that licenses are controlled by the governments is not the only reason for why the hydrocarbon industry is politicized. As the bulk of the oil and gas produced in the high north is transported by the use of pipelines, states have become dependent on each other both for export and import of hydrocarbons. This is notably the case for Russia and the European market (see figure 2).

Figure 2: Russian oil and gas pipelines

Source: Energy Information Administration

This web of interdependencies has strengthened the political dimension and made oil and gas an international issue of high concern for decision-makers and scholars.

2.2. The importance of oil and gas to the Arctic states

While all the Arctic oil and gas producing states benefit from the hydrocarbon sector, some are more dependent on these natural resources than others. Russia, the largest producer of oil and gas in the Arctic, is heavily dependent on free resources. Free resources, Smith (2008) defines as income which is not dependent on taxing economic activities. ”Governments obtain resources from two sources: taxation on productive economic activities and resources derived independent of the citizens’ willingness to engage in the economy. I refer to the latter form of unearned resources as free goods.**”** (Smith 2008: 780). While research does not seem to indicate that income from oil and gas has a significant effect on regime type in Russia during the last decades (Treisman 2010), it is quite clear that income from the hydrocarbon sector is salient. In 2011, oil and gas made up 24 percent of GDP and almost half of the federal revenues (World Bank 2012a). In the period from 2000-2009, Russia earned about US$ 700 billion from oil and gas production (Heuty 2012). This money enabled Russia to reduce its debts to below 10 percent of GDP and to set up a saving fund with the goal of reducing fluctuations in the Russian economy. When the financial crisis hit Russia in 2008, the government spent nearly all the savings from the oil and gas revenues to boost the economy (Heuty 2012).

More worrying, in the long-term, is how vulnerable the Russian economy is to fluctuations in oil prices. In order for the Russian federal budget to break even, the oil price needs to reach almost US$ 100 per barrel, compared to only US$ 30 per barrel up to 2007 (World Bank 2012a). Thus, a major motivating factor for Russia’s Arctic operations is the need for state revenues. From a geopolitical perspective, Russia has been able to use oil and in particular gas as an instrument to achieve policy goals. During the last five to ten years Russia has from time to time cut off gas supplies to Ukraine. Ukraine and other East European states are heavily dependent on Russian gas import, and the threat of a possible shutdown has created fears in these countries (Larrabee 2010). Gas has become an important political instrument for Russian decision-makers in a time when they have witnessed a significant decline as a great power.

While the other Arctic oil and gas producing states has not, for various reasons, been willing or perhaps able to use hydrocarbon export as a political instrument, they are still dependent on revenues from that particular sector.

In Norway, the hydrocarbon sector accounts for more than 20 percent of the country's GDP, a quarter of state revenues, and nearly 50 percent of total exports (NPD 2011). Norway is also investing heavily in the Barents Sea and is so far the sole supplier of LNG above the Arctic Circle. Increased attention on the high north has partially been a result of the fact that Norwegian output has declined during the last few years. If Norway wants to continue its current output level, Arctic oil and gas activity must increase.

The US is currently one of the world's biggest importers of oil. While the government is not as dependent on oil and gas revenues compared to Norway and Russia, development in the Arctic may be politically attractive to the US government as the reserves in Alaska are potentially oil rich. For the Alaskan state government oil and gas revenues are pivotal as they account for approximately 80-90 percent of the general fund budget (Alaska Department of Revenue 2012). The US has traditionally been a net importer of natural gas. However, due to the shale gas revolution during the last few years, the country has become self-supplied. This last point is something that I will discuss in detail in chapter 6.

Canada is also economically dependent on the oil and gas sector. In 2009 oil and gas accounted for 21 percent of total exports. Furthermore, the hydrocarbon sector accounted for approximately 5 percent of Canada's GDP in 2008. With respect to revenues, oil and gas accounted for more than 25 billion dollars in the same year (Petroleum Review 2009).

2.3. Conclusion

This chapter has outlined the current oil and gas activity in the Arctic and presented the infrastructure facilities which are connected to the oil and gas activity in the high north. It has shown the importance of oil and gas activity to the hydrocarbon producing Arctic states. In sum, all the Arctic oil and gas producing states have political and economic incentives to continue and expand their current activity in the Arctic. While some are more inclined than others to support stricter international regulations on carbon emissions, none of the Arctic states have taken serious measures to stop or slow down current and future activity.

Chapter 3: Analytic framework

This chapter provides an analytical framework for the four papers included in this thesis. The main purpose is to explain the specific theories that were chosen, to discuss how they relate to each other, and to place them in a broader analytical framework.

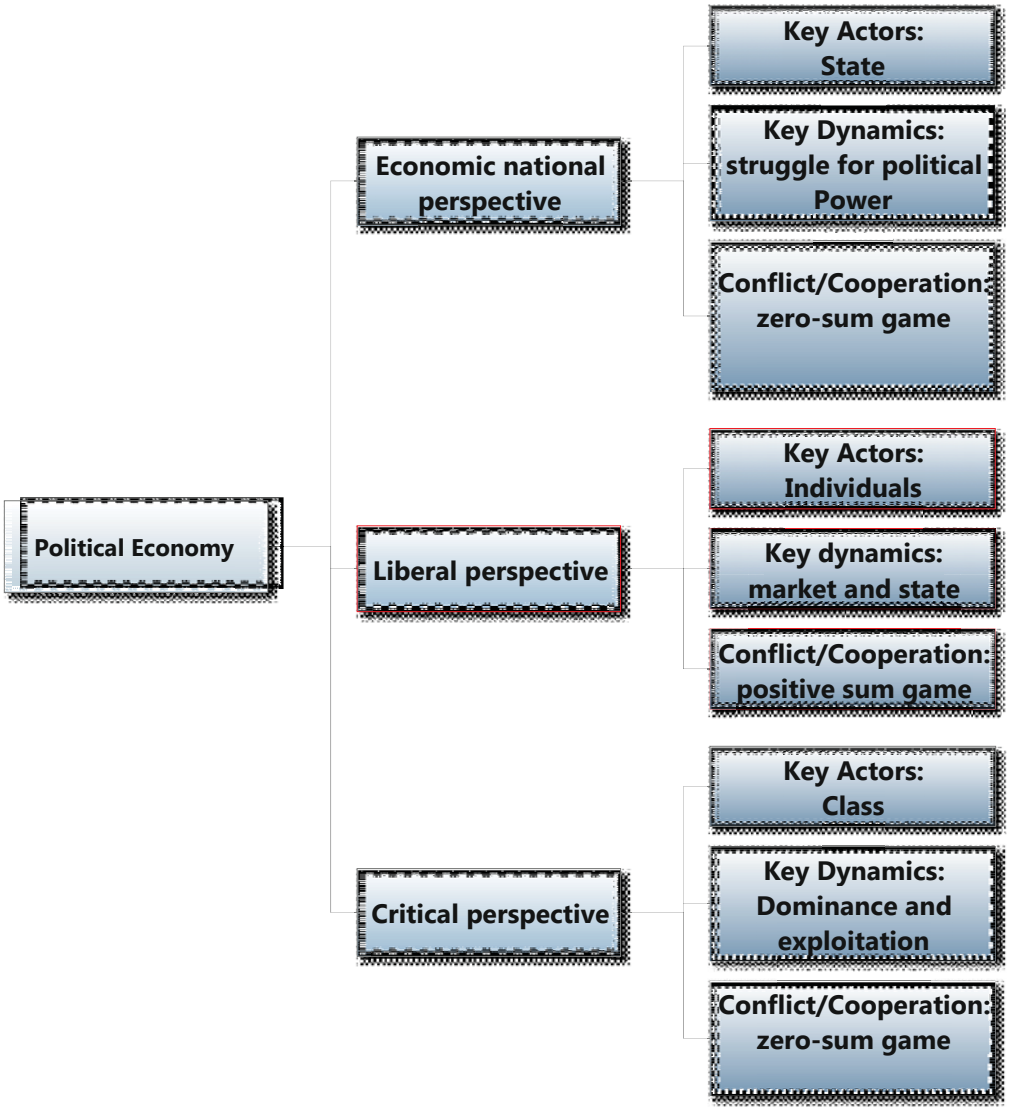
3.1. The rationale behind a political economy perspective

A challenge with the topics of this thesis, that is, to analyze and understand different sides of the oil and gas industry in the high north, is the lack of an encompassing and coherent theory that covers all aspects. To the author's knowledge, there is no existing theory that deals with both the driving forces behind the oil and gas industry and the political effects of such an industry. As a consequence, this thesis makes use of different theoretical approaches in the four respective papers. The papers focusing on the forces behind the oil and gas industry in the high north are empirically driven but nevertheless draw on existing economic theories. The other two papers, which analyses political and economic dependence, are firmly grounded in well-known theoretical concepts from the international relations literature.

What binds the four papers together is a general political economy perspective. The discipline of political economy dates back as far as the late 18th century with the works of Adams Smith and David Ricardo (Merlo 2005). However, it was not before the 1950s when the concept of political economy started to get distinct features which separated it from pure economics and political science. And while there are several schools of thought within the political economy framework, this thesis operates within the liberal/rational perspective (figure 3). The reason for why this thesis does not focus on theoretical paradigms such as *Realism* is the inability of this school to explain important aspects of the oil and gas industry (Molloy 2003). For example, one cannot fully understand decision making processes in the oil and gas sector if one only relies upon the realist assumptions (Moravcsik and Legro 1999). Decisions are not only driven by states, but also by international environment organizations, and more importantly by multinational companies. Further, in order to appropriately understand international relations, we must understand a state's domestic situation which governs a particular state. There are at least three variables which guide a state's foreign policy (Underdal 2012), that is, domestic configuration of interests, domestic power distribution and finally institutional settings (ibid). As stated by Putnam (1998: 434): "At the international

level, national governments seek to maximize their own ability to satisfy domestic pressures…".

Figure 3: The field of political economy



Source: Based on O'Brian and Williams 2010 chapter 1.

Turning to the liberal perspective which this thesis subscribes to, the first assumption which guides it is that social actors pursue strategies which they believe will serve their self-interests best. "The fundamental actors (…) are individuals and private groups, who are on the average rational and risk-averse and who organize exchange and collective action to promote differentiated interests under constraints imposed by material scarcity, conflicting values, and variations in societal influence" (Moravcsik 1997: 516). It is important to clarify the distinction between rational and bounded rational actors. Rational actors, in the strictest

sense, have full information about the sets of options, clearly defined preferences, and complete knowledge about the possible outcomes of choices made. Further, complete rational actors will choose the set of actions that will yield that highest level of benefits (Jones 1999). Bounded or limited rationality, which this thesis applies, rejects the notion that actors may have complete information about the set of possible actions which they may pursue, and full knowledge about possible outcomes. "Proponents of limited rationality suggest that the environment is fundamentally more uncertain than is understood in prevailing choice models" (Jones 1999: 308). Limited rationality implies that actors will choose a set of actions which they believe will yield the highest possible utility, without having complete information.

Liberals focus upon a wide range of different actors, from within the state to corporation and interests groups (O'Brian and Williams 2010). Further, market dynamics and political institutions are important as they impose constraints and opportunities for actors. Political economy is a field beyond the state, market or firms (Strange 1988, Palan 2000, Gilpin and Gilpin 2001). It seeks to investigate the relationship between important actors, and equally important exogenous factors that provide opportunities or limitations for decision-makers. Liberalism is in general focusing on cooperation between various actors, while at the same time paying attention to individuals (Hutchings 2000).

Another key concept of liberal political economy is the concept of interdependence. That is, states, corporation, NGOs and interest groups are mutually dependent on each other. Consequently, analyzing the degree of dependence as a potential source for coercion is a key concern (Keohane and Nye 2001). State preferences are not only conditioned on material capacities, as argued by realists. Rather, state preferences and actions are conditioned by actions and behavior on the world stage. As stated by Moravcsik (1997: 520): "This is not to assert that each state simply pursues its ideal policy, oblivious of others; instead, each state seeks to realize its distinctive preferences under varying constraints imposed by the preferences of other states".

Moreover, a political economy perspective allows for a multilevel analysis, that is, the interaction between actors on different levels. This thesis is in general operating on one level, namely the macro level. When analyzing interaction between states and corporations, attention is directed to the highest level of decision-making (Dicken 2011). This, however, does not imply that states are perceived as unitary actors with fixed preferences. Rather, it acknowledges the fact that actors' at the highest level have shifting interests and interactions

between them are crucial for decision-making outcomes. The primary focus on the relationship between states and corporations does not imply that the domestic and local level is unimportant, nor is it neglected in this thesis. On the contrary, state preferences are to a large extent formed at the domestic and local level, and thus salient for state interests. Consequently, this thesis incorporates the domestic level of analysis in order to understand and explain why and how various strategies are being pursued. When assessing Russia's interests and strategies versus European Union member states, one needs to incorporate the domestic preference formation processes within Russia.

At its core, political economy studies the importance of resources as potential for wealth and power of any state or corporation. As oil and gas make up a salient source both for state income, transportation fuel and heating in modern societies, a political economy perspective is fruitful. A political economy perspective was chosen because it recognizes that purely economic arguments that deal only with aspects such as supply, demand and profits would be insufficient in order to grasp how and why the oil and gas sector is operating in the Arctic. It also goes beyond a traditional political science perspective, as it allows for a variety of different actors. Moreover, a political economy perspective acknowledges the importance of understanding the incentives and motives which guide various stakeholders. The economic and political aspects are intertwined in the oil and gas industry, which illustrates the demand for perspectives combining economics and political science.

The hydrocarbon industry in the high north is an arena where multinational companies together with states, NGOs and others are asserting influence over decision-making outcomes. In very simple terms it can be understood as an arena where large multinational oil companies are looking to expand their activity when it is economically desirable. States are interested in increased revenues and employment, while environmental organizations are trying to keep the activity at a minimum in order to preserve the environment. However, such a description would be too simplistic. Companies in general are interested in profitable ventures, but are at the same time sensible to public perceptions. While the hydrocarbon industry is: "[s]earching for new oil sources (…), developing adequate refining systems, and controlling markets through transport infrastructure" (Maugeri 2006: 45), they are also dependent on stable international and domestic frameworks and political support for their operations.

Decision-makers within states must balance a number of different domestic interests and policy goals. As a central goal is to stay in office, they are highly sensible to public opinion

shifts. One important aspect is, for example, to make sure that hydrocarbon activity does not destroy ecosystems which in turn may trump other sustainable economic activities such as fisheries. Equally important is the need for energy security. In the modern world, energy resources such as oil and gas have a prominent role as they form the basis for almost all aspects of human activity.

The hydrocarbon industry which operates in and around the Arctic is highly complex, and the ability to study and understand all the dynamics that are in play is beyond the scope of this thesis. The specific theories selected are therefore first and foremost the ones that deal with economic resources and political dependency. This literature is extensive and ranges from questions surrounding the "resource curse" (e.g. where oil and gas have a negative effect on the general economy and the governance system) to theories about how resources may yield political advantages (Hirchman 1948, Caporaso 1978, Duvall 1978, Abdelal and Kirshner 1999, Wagner 1998). This thesis will, however, only draw upon a part of this literature, that is, location theory, transaction cost theory and dependency theory. I will in the next section outline the basic concepts behind location theory and transaction cost approach. This is followed by a discussion of theories that explains dependence and interdependence.

3.2. Approaches to the driving forces behind Arctic oil and gas

The first research question investigates driving forces behind the oil and gas industry, and is arguably more of an empirical question than theoretical. Nevertheless, such analyses are partly based on insights derived from theoretical concepts such as location theory and transaction cost theory. Location theory seeks to explain why a set of economic activities take place in a particular location, while transaction cost theory analysis what type of institutional arrangements are better equipped to reduce costs in different forms of economic activity. It is important to note that this research is only based on a small part of the theories in question. The theories draw upon different scientific fields, and touch upon the significance of location while not neglecting policy regulations. I will start by outlining the main features of location theory before moving on to the transaction cost approach.

Location theory has its historic roots in the field of economy, but has also clear multidisciplinary traits (Isard 1998). In economics, location theory may be divided into three different types of research (McCann 2009), that is, regional science and urban economics,

economic geography and finally trade theory. These different strands have historically been generally disconnected, due to the fact that they have dealt with slightly different questions. However, in recent years the different strands within location theory has been merged into one. McCann (2009: 127) argues that: "… this has led to the emergence of a rather more holistic approach to describing and explaining location behavior in which cross-discipline research is now commonplace".

Location theory deals with *what* is *where* (Thisse et al. 1996). *What* refers to the type of economic activity and *where* refers to areas, such as regions. It emphasizes, among other things, the search for least-cost sites, and is based on assumptions such as competitive pricing and different costs in different locations (Greenhut 1952). A challenge with the traditional location theory approach is that it fails to explain real world phenomena in a satisfactory way (McCann 2009). The theory treats a firm as a single point in space. The problem occurs when dealing with multinational corporations with a number of different units in various geographical locations.

This problem is highly relevant to this thesis, as the multinational corporations which operate within the Arctic all are searching for a number of different locations simultaneously. In an attempt to solve this problem, scholars within the field of location theory have drawn upon international business, management theory and geographical economic case studies. Dunning's (1977) work on the advantages of multinational corporations versus single space businesses have been used as a response to the problems with traditional location theory models. This work is relevant in explaining the advantages of large multinational corporations in the hydrocarbon sector in the high north. The three sets of advantages are classified as Ownership (O), Location (L) and Internalization (I) (ibid). These three advantages deal with benefits of controlling resources (O), understanding country-specific comparative advantages (L) and reducing transaction costs by moving to a new market (I) (McCann 2009).

Some of these outlined advantages may seem trivial and obvious for our purposes. Controlling resources, for example, is fundamental for oil and gas extraction. However, understanding country specific features, that is, everything from geographical location to political institutions is valuable. This also shows how insights from the political economy perspectives are used within location theory. It acknowledges the difficulty of making a sharp distinction between political and economic factors. A preferable location is not solely about

being located in close proximity to least costs sites and important markets. It is also about the fact that political institutions are crucial for the ability to do business efficiently.

When one investigates foreign investments in the oil and gas sector in Russia, it is evident that political institutions matter for multinational oil and gas companies. Drawing on traditional location theory models one would assume that companies interested in investing in the Arctic, would prefer Russia. This is because Russia has the largest oil and gas reserves of the Arctic states, with vast untapped resources offshore (USGS 2008). However, to base a study on the above mentioned parameters would render the analysis incomplete. It would neglect the fact that oil and gas activity has not historically been a result of supply and demand, but has in part been a result of political motives and incentives (AMAP 2007).

One challenge for Russia is its ability to attract foreign investment, and thereby attract companies with new technology which is required to increase production. For example Russian law restricts foreign investor's ability to acquire the majority of stocks in Russian oil and gas companies (Moe and Rowe 2009). The costs which are involved include the cost of operating in states with different policy institutions. When the political risks and uncertainties are too high, hydrocarbon producing multinational corporations would be less inclined to invest. Therefore, the paper which seeks to unveil factors that influence oil and gas activity in the high north (Harsem et al. 2011) are not only vested on insights from traditional location theory models. It incorporates studies about various Arctic states' oil and gas policies, and acknowledges the fact that country specific policy institutions are salient to multinational corporations (Dunning 1977).

The value of taking political factors into account is also found within a related economic theory called transaction cost, or what has later been called new institutional economics (Williamson 1981, Klein 2010). Transaction cost theory makes the same underlying assumptions about how actors behave as the liberal strand of political economy. It views actors as bounded rational, where actors are "intendedly rational", but limited by nature and an environment filled with uncertainties (Williamson 1979). Further, the theory considers opportunism as the second assumption about individual behavior. Opportunism deals with the fact that actors may cheat or mislead others. Transactions costs arise because individuals are not fully rational.

The core insight derived from this theoretical concept is that certain institutional settings are more effective in governing transactions (Shelanski and Klein 1995). Transactions are the unit

for analysis, rather than a commodity. While the basis for this thesis are two distinct commodities, that is, oil and gas, multinational hydrocarbon producing corporations must consider the total costs of operations. Transaction costs may be defined as "comparative costs of planning, adapting and monitoring task completion under alternative governance structures" (Williamson 1989: 142). Markets, firms and intermediate contractual arrangements are defined as the three categories of governance structures. Moreover, the theoretical approach in question is built on several critical dimensions, that is, uncertainty, frequency of transactions, and finally whether durable investments are needed (Williamson 1979).

3.3. Approaches to dependence

The principles of transaction cost models are not only useful to understand and explain microeconomic dynamics. The approach is also useful to shed light on the relationship between multinational corporations and/or nation states (Teece 1986). First, political institutions are needed in order to understand multinational corporations' ability to do business. Second, the concept of transaction cost is useful for analyzing bargaining relationship between states and/or firms. Third, the principles derived from transaction cost theory may be used to study the implications of national policies on foreign direct investment (ibid).

Another valuable insight derived from transaction cost theory is its ability to explain contractual arrangements. Shelanski and Klein (1995) show that governance structures, according to transaction cost theory, are outlined along a spectrum. At the one end of the spectrum is the pure spot market, where commodities are sold through simple transactions where market dynamics governs price. At the other end of the spectrum are controlled settings with integrated firms which include trading partners. The authors show that transaction cost economics (Shelanski and Klein 1995: 337): "posits that such hierarchies offer greater protections for specific investments and provide relative efficient mechanisms for responding to change where coordinated adaption is necessary". When Gazprom and other producers of gas prefer long-term contracts, it is to safeguard against opportunism. Production of natural gas does not only cover the cost of extraction, but includes production facilities and pipelines (sunk costs). Investing in high cost areas such as the Arctic will therefore involve even higher costs for the producers. The merit of transaction costs theory is that it is able to provide a

rationale for why long-term contracts exist, and why producers, especially within the Arctic, are reluctant to abandon such contractual arrangements. Significant investments in infrastructure facilities create mutual dependence between producers and buyers. While transaction cost theory is useful for studying the economic and political importance of infrastructure settings, dependence theory focuses on trade as a basis for power.

Albert O. Hirschman highlighted in his book *National Power and the Structure of Foreign Trade* (1948) how unbalanced trade relations can be a tool for coercion used by governments. Power, or more precisely 'national power', Hirschman defines as power of coercion. 'Large' countries can exploit their trade relations with others in order to enhance their power. Caporaso (1978) expands on this by stating that there are two 'primary links' between dependence and power. He points to two possible definitions of dependence, either as the 'absence of autonomy' or as 'asymmetric interdependence' (Caporaso 1978: 18). Unequal trade relations where one state relies heavily upon another state for a certain commodity can be a source of power. Second, Caporaso (1978) links dependence and power by arguing that dependence may lead to a value shift.

While the first point may be quite obvious and trivial, the second is not. By stating that dependence may lead to a value shift, Caproso implicitly claims that dependence in the long-term may lead a dependent state to shift or change its national interests in favour of the state on which it relies on for a specific commodity. On the other hand, this is hard to identify, as it is a gradual process. Hence, there is need for a model that takes into account changes over time (time-series), which is emphasized by Duvall. He points out that in order to appropriately measure dependence one should "estimate the degree to which the variance of Y is due to the variance of X and not due to other unspecified phenomena", and this "requires time-series or change data" (Duvall 1978: 66). Interests may shift because new incentives may alter perceptions of national interests (Abdelal and Kirshner 1999).

States like the US and Germany have several times in history made use of their trade advantage versus smaller states, making smaller dependent states alter and change their view and sometimes perception of the coercive state. Russia has since the cold war ended, used its trade advantages over Ukraine. "Ukraine's energy dependence on Russia has some straightforward political consequences, since Russia can, in theory, use this asymmetric interdependence to coerce Ukraine" (Abdelal and Kirshner 1999: 146). An indicator of a value shift has also been pointed out in this thesis (Harsem 2012). Small and relatively weak

European states (e.g. in Eastern Europe) which depend on Russian gas imports, are more likely to behave preferably towards Russia.

Keohane and Nye (2001) argue that pure dependence or interdependence, the latter defined as two actors mutually dependent on each other, rarely exist. In other words, we are unlikely to find two countries that are either completely dependent on each other, or where one is totally dependent on the other. On the basis of this rationale Keohane and Nye introduced the term asymmetric interdependence in an effort to use a term that is easier to locate in 'real' world politics. Keohane and Nye define asymmetric interdependence as a relationship where one actor is more dependent on another for a certain commodity. For example, Russia exports around 50 percent of its gas to Europe, with little chance of diversifying its export (Claes and Harsem 2013). Moreover, exports of energy accounts for a significant proportion of the Russian GDP. EU on the other hand imports around the same percentage of gas from Russia, thus making both actors dependent on each other (interdependence). However, even though Russia is dependent on the European market, a shutdown in gas supply would have a serious negative effect on certain European countries (Harsem 2012). Gas is a highly important commodity, which states rely on in order to fulfill some of the most basic needs in a society.

Keohane and Nye make an important distinction between sensitivity and vulnerability. The former refers to how quickly a change in one country has a costly effect on another. Vulnerability, on the other hand, rests on relative availability and costliness of the alternatives that various actors face. While sensitivity implies that more than one option is available to an actor, vulnerability does not. Vulnerability is measured by the cost of having to change due to an external event. Hence, if country A (an importer of gas) suddenly experience a shutdown in its gas supply due to the change in policy from country B (the sole provider of gas to A), then country A has no alternative but to fundamentally change its energy policy, which would be very costly considering the alternatives that exists today. In other words, the greater the importance of gas in a particular state's economy, the more sensitive and vulnerable it is to reduced supply (Underdal 2012)

Three specific conditions are important when assessing whether asymmetric trade may yield political advantages. First, a large part of a state's total trade must be controlled by another state. Second, the ability to diversify or to find other substitutes for a certain commodity must be limited. Third, the relative intensity of the demand for the specified commodity determines how important the traded commodity in question is (Armstrong 1981). The energy trade

between Russia and European countries fulfills these conditions. First of all, as pointed out by several scholars, Gazprom (a state owned company) has invested heavily in the European gas market (Light 2008). Aalto and Tynkkynen (2008) described how Gazprom has been able to buy up European companies, while Russian law prevents European companies from doing the same. Second, as outlined above, Europe cannot for the time being diversify its gas supply. And third, gas represents a highly important commodity for every actor. However, this last point is slightly more complicated due to the fact Russia is also heavily dependent on gas as a source of income. This makes it harder to determine to what extent gas can be a source of political coercion. Armstrong (1981) points out that when the issue is of high policy concern to both parties, the dominant part will try to use the commodity as a way to control the dependent part's behavior. "[A] desired political effects may occur without any threats or break in economic relations (…) economic vulnerability is a powerful influence on the minds of decision maker of the dependent nations, inhibiting a policy shift which might otherwise occur" (Armstrong 1981: 408).

3.4. Conclusion

This chapter has confronted the challenge of combining different theoretical approaches within one specific framework. By drawing on assumption and insight from the liberal branch of the political economy framework, I have tried to show the merits of combining economic and political theories. By allowing for a multitude of different actors and acknowledging the fact that drawing a sharp line between politics and economics is increasingly becoming difficult, this thesis sets out to analyze various sides of the highly complex field of oil and gas.

Chapter 4: Research design, methods and data

This chapter outlines the various methods that are used throughout the four papers. It presents data collection and the different methodological tools that were used to analyze the results. Finally, it provides a discussion of the strengths and weaknesses with respect to the specific methods chosen.

4.1. Research design

As this thesis seeks to analyze a broad range of variables, various methodological approaches were used in an effort to get a comprehensive understanding of the political and economic aspects of the oil and gas industry in the high north. While the chosen methods have to a certain extent been quantitative in nature, a lack of available data resulted in different approaches for the various papers. In addition, a factor that has influenced the choice of methodological approaches is the different research projects which this thesis has been part of.

First, as I seek to analyze the conditions that determine oil and gas activity in the high north, identifying the most important factors is crucial for several reasons. Historically, oil and gas output in the high north has been low compared to other regions (Budzik 2009). An overview of the most important factors that drive the oil and gas industry will therefore explain why oil and gas activity is at all located in a region which is both remote and harsh, and why activity has not been higher. Further, an understanding of the conditions that drives the hydrocarbon industry is important if one seeks to predict the extent and speed of further development in the coming years. To unveil some of the most important drivers may arguably contribute to such predictions. In other words, which factors have been most influential in shaping the Arctic petroleum sector during the last decades? And which variables will be most important in the coming years? This part connects the first research question with the latter and provides the rationale for why this thesis focuses upon both the political effects of oil and gas trade and the most important drivers behind the hydrocarbon industry in the high north.

Second, in identifying the political effects of the oil and industry this thesis focuses upon a particular case, namely the Russian–European energy relationship. It is important to point out that this does not imply a case study approach. Rather, this thesis studies the Russian–

European relationship by using different types of quantitative statistical tools. The Russian–European oil and gas relationship was highlighted for several reasons. First, Russia is the largest producer of oil and gas in the Arctic and is the major supplier of natural gas to the continental European market. Second, Europe is in relative close proximity to the Arctic compared to other major economic regions. Third, Russia has, from time to time, used the threat of a shutdown of gas supplies to Ukraine, which consequently affects European states due to the pipeline structure. This shows how natural gas may be used as a political instrument. Fourth, the fact that Russia historically has viewed its East European neighbor states as an important sphere of influence provides a rationale for why Russia might use hydrocarbons in an effort to achieve political gains. In addition, the papers which analyses the political effects of hydrocarbon trade focus their attention on natural gas and not oil. This choice is made on the basis of the fact that while oil is highly diversified, natural gas is not. This rationale is explained in more detail in both papers (Claes and Harsem 2013, Harsem 2012), but in short it deals with the fact that while the oil market consists of a number of different buyers and sellers, where oil can be transported to all corners of the globe, gas transportation is largely based on pipelines which prohibits diversification for suppliers and customers.

4.2. Data

In order to analyze the outlined research questions, different data was needed. The study of the driving forces behind the oil and gas industry was to a large extent multidisciplinary and relied upon data from different scientific fields. The analyses of the political effects of oil and gas trade relied upon aggregated data which are publically available. The next two sections will present and discuss the data of the two outlined research questions.

4.2.1. What determines the extent and speed of the hydrocarbon sector in the high north?

As this thesis sought a comprehensive overview of the driving forces behind the oil and gas industry, one goal was to get economic data about the cost of upstream hydrocarbon activity. However, absolute cost data about upstream activity was very difficult to obtain. Data are not publically available. Another reason for why absolute cost data was not used is the fact that it is not always reliable. Absolute costs of upstream activity have in many instances proven to

be imprecise. For example, the cost of development for Snøhvit proved to be much higher than initially estimated (Tveiterås 2010). As a result, I decided to go beyond a cost approach and focus my attention on several variables that may affect oil and gas activity in the high north. A meta-analysis (literature review) became the obvious choice for investigating possible factors that influence oil and gas activity in the high north. However, the literature review did not only cover studies about the oil and gas industry from a political economy perspective. Rather, as there are environmental factors that pose enormous challenges for the industry, the paper "Factors influencing oil and gas activity in the high north" covered a broad range of variables. Also as this paper was written as part of Arctic Tipping Points (ATP), a multidisciplinary project, the focus upon physical attributes in the Arctic, such as sea ice conditions and extreme weather, became a natural starting point. The literature review did also cover political and economic conditions that has been, and still are, important for Arctic oil and gas activity.

As a result of the literature review, I decided to focus my attention on only a few of the many factors that influence oil and gas activity in the high north and consequently to perform a cost analysis. An analysis that would involve absolute costs could be ideal. However, "the uncertainty in the calculation of the absolute costs of production and transportation is very high and the consequent results speculative and unreliable, therefore, the costs will not be evaluated in absolute terms, but as relative costs" (Harsem et al. 2013: 5). I decided therefore to focus on sea ice, as it was found to be a severe obstacle for the hydrocarbon industry in the Arctic (Harsem et al. 2011). Further, as research points to an unprecedented decline in Arctic sea ice during the last decades, combined with an expected increase in sea ice retreat during the coming decades (which may result in a total ice free Arctic during the summer), the paper "Oil exploration and sea ice projections in the Arctic" sought to investigate how a projected sea ice decline may impact further activity in the coming years. Consequently, the paper applies a multidisciplinary approach, drawing on location theory and sea ice projections from climate models, to analyze how the oil provinces might tip over to a lower cost category as sea ice decreases. This paper was written in collaboration with a sea ice scientist from the ATP project. The location analysis approach used in this study is the comparative cost technique (Isard 1998). It quantified the main cost drivers that might vary for each province where the following indicators where used: a) distance to existing human settlement, b) level and quality of infrastructure and, c) amount of sea ice.

Data collection for this paper consisted therefore of both a quantitative and a qualitative assessment. The qualitative assessment consisted of an analysis of the level of infrastructure of 21 Arctic provinces. In this part, literature that describes the level of infrastructure for the given Arctic provinces was the focal point. The quantitative part of the paper included two main features. The first was to collect data on Arctic sea ice, and to run model projections for how the sea ice may change in the coming 30 years. The second part quantified data on the level of infrastructure, distance to land, and the number of ice free months for the coming 30 years, which in total resulted in a cost index.

4.2.2. Does hydrocarbon trade create political and economic dependencies

In the two papers that sought to investigate possible political and economic dependencies, two slightly different approaches were used. Both focused on the Russian–European relationship as previously described, however, there are notable differences between the two respective papers which should be pointed out. First, in an effort to get a comprehensive overview of the level of dependence between Russia and various European states, the paper "The interdependence of European-Russian energy relations" analyses natural gas trade as part of the total trade relationships between Russia and European countries. The general trade relationship of 25 different country dyads, with Russia as the respective sender state and different EU member states as the recipients, were analyzed with data collected from Eurostat. To analyze the relative dependence of natural gas trade the paper combined imports and exports data. Double weight was given to imports compared to exports. "The effect of shortfall in imported energy for the Europeans is far more imminent than the effect of lack of export income for Russian. In the long run the lack of outlet for Russian gas could of course be more severe" (Claes and Harsem 2013: 21).

Second, in order to test how trade dependencies may have long-term effects, pooled cross sectional time series data were used in the paper "The political consequences of resource dependence. How natural gas export can affect policy outcomes: A quantitative analysis". In comparison to a detailed examination of a specific bargaining situation (e.g. a case study) involving Russia and an EU country, panel data enables us to see the effect of gas export across countries and over time. The data spans from 1991 to 2002 and contains every European Union member and the three major suppliers of gas to Europe: Russia, Norway and Algeria in order to avoid selection bias. The dependent variable, aggregated dyadic data from voting in the UN General Assembly, is an indicator of European Union member states'

compliance with gas exporting countries' policy preferences. The main explanatory variables that are used to test how natural gas may have political effects are measurements for export of gas, military power, and several economic performance indicators. The gas export variable is obtained from Eurostat and is an aggregated measure of the amount of gas that is exported from Russia, Norway and Algeria to 25 selected European Union countries. The remaining control variables are obtained from free public databases such as the World Bank and Polity IV project.

4.3. Strength and weaknesses of the various methods

Following the various methodological approaches that are applied in this study, the question is whether or not the chosen methods have been satisfactory in analyzing the outlined research questions. I will proceed with a discussion of the chosen methods for each paper, where the discussion will centre upon familiar concepts such as validity and reliability. King et al. (1994) outlines two additional principles that one should aim at in order to improve the quality of the data as much as possible. The first deals with the fact that one should record and report the process that was used for collecting data. The second is: "collecting as much data in as many diverse contexts as possible" (King et al. 1994: 24). These two principles are important. However, while the first principle, that is, report and record the data, where followed in all the four papers, the ability to collect as much diverse data as possible was a challenge. The main reason for this is that much relevant data was classified for competition purposes by the oil and gas industry. As a consequence, I had to approach the various research questions by using different methods.

Before moving on to the various challenges for the various papers, I will briefly define the above mentioned concepts. Reliability refers to how consistent the assessments are, and if the findings are repeatable, that is, "applying the same procedure in the same way will always produce the same measure" (King et al. 1994: 25). Hence, it deals with the ability of other researchers to repeat our study. It is important to note that this does not only apply to the data, "but to the entire reasoning process used in producing conclusions" (King et al. 1994: 26). It also implies that a measure should produce the same results when conducted by different researchers. Validity on the other hand deals with measuring what we seek to measure. It is important to note that there are two types of validity, external and internal (McNabb 2010). External validity deals with the ability to make inferences from a given study to the general

population. In simple terms, external validity is about generalizing the findings. External validity is therefore to a certain extent only possible to achieve in large N studies. Internal validity deals with the ability to limit possible explanations; in short, to control for exogenous or endogenous variables that may create biased outcomes. In the remainder of this chapter I will elaborate on the concepts of validity and reliability in relations to the four respective papers.

The first paper, "Factors influencing oil and gas activity in the high north" is a literature review. It reviews previous literature, with the aim of providing a comprehensive overview of factors that influence oil and gas activity. The study has its clear limitations, as it does not provide new empirical insights by for example data collections or an in-depth case study. Further, as it covers a broad range of findings from very different scientific fields, one could argue that it, to a certain degree, lacks a thorough analysis of the chosen variables. However, the value of such research is that it is possible to view previous findings in a new way. As there are different studies about possible variables that influence oil and gas activity in the high north in different fields, this particular literature review sought to combine findings from different scientific fields. "It studies oil and gas development in the Arctic by analyzing the combined effect of environmental and geological variables (below ground) and political and economic variables (above ground), which will provide a more refined picture of the oil and gas development in the Arctic" (Harsem et al. 2011: 1). By being part of the multidisciplinary project ATP, I had access to a variety of different research and researchers who focused upon the Arctic.

In the paper "Oil exploration and sea ice projections in the Arctic" the three chosen variables, sea ice change, infrastructure, and distance to land, have their merits but also their limitations. The chosen variables do not capture the entire range of variables that influence oil and gas activity in the Arctic. Political issues, such as environmental regulations and taxes, will undoubtedly affect the oil industry's willingness to invest. In addition, the level of energy prices and the growth of demand are all highly important. In other words, with respect to whether or not the paper has been able to control for possible omitted variables (internal validity), the study has its clear weaknesses. There are other factors which this paper does not control for, and hence there are possible other explanations. Despite the drawbacks with this study, the analysis still has important features that unveil some of the dynamics behind the oil and gas industry in the high north. The fact that the data are easily available to other researchers makes this study repeatable (reliability). The data chosen does provide answer for

the outlined research question in the paper, that is, how sea ice changes in the coming decade may influence oil and gas activity (validity).

The respective papers that investigate questions of political dependencies are both quantitative in nature. However, there are notable differences worth mentioning. “The interdependence of European–Russian energy relations” studies the entire trade relationship between Russia and Europe, and does therefore provide a comprehensive understanding of the nature of the relationship between the respective country dyads. It moreover provides a firm link between theory and method. However, the statistical analysis is relative simple; it does not provide a causal relationship, nor does the data span over a long time period. On the other hand, the paper “The political consequences of resource dependence” does provide a time series analysis that involves testing for significance. This last paper finds that natural gas under specific circumstances does have a statistical significant political effect. The fact that it makes general arguments about the effects of resource dependence makes it possible to generalize the findings to the entire population (external validity). Here, some of the most important sources of statistical biases have been dealt with (e.g. outliers and autocorrelation), and one could therefore argue that the results are robust. Nevertheless, there are important drawbacks with this study which should be pointed out.

First of all, the dependent variable, that is, votes in the UN General Assembly may be problematic. Votes in the UN General Assembly are far away from the natural gas trade, and one could argue that this indicator does not accurately measure political dependencies (validity). Also, the time series does only span across 10 years and it would certainly be desirable to expand on that, but as data was not available at that time, this was unfortunately not possible. On the other hand, due to lack of other available indicator the fact remains that the data spans over a certain period of time and may therefore capture some important variation. However, the dependent variable is, as often is the case in social science studies, an indicator. And if one should only use measurements that accurately depict the nature of a given phenomenon, very few studies would be possible.

The second problem with this given data set and the statistical tools which were chosen, deals with unit heterogeneity. In short, this implies that every unit (e.g. countries) has something special that cannot accurately be measures (for example a state’s culture or history). There are tools which one could use to correct for this (e.g. fixed effects models). However, due to little variation over time in the data set, this would have reduced variation down to zero. In sum,

while this study is easily repeatable, there are questions surrounding its internal validity. There are possible exogenous or endogenous variables that are not controlled for in this study. On the other hand, it is very difficult to control for all possible factors that may have a significant impact on your outcomes. The solution to add as many variables as possible to the right side of the equation does not always solve the problem. Instead, this may create problems of multicollinearity, where two or more independent variables are correlated. In short, one cannot control for all possible sources of biases.

4.4. Conclusion

The study has used different approaches in an effort to capture and analyze important aspects of the hydrocarbon industry. It has shown the value of analyzing various aspects by using different methodological tools. Perhaps most important, this chapter has shown the strengths and weaknesses of the various methods which were used. It is important to note that regardless of the methods chosen, there are obvious challenges in all the four papers. For example, one specific method may provide more depth to a specific question. Nevertheless, using different methods enables scholars to capture a broad range of important variables, and as the research questions are relatively broadly formulated, different methodological approaches may be the preferred choice.

Chapter 5: Findings

In this chapter, I will briefly highlight the most important findings from the four papers, where the starting point will be the research questions previously outlined. I will start by discussing the driving forces behind oil and gas activity in the high north, before moving on to a short presentation of the key findings related to political effects of oil and gas trade.

Table 2: Overview of the papers

No	**Paper I**	**Paper II**	**Paper III**	**Paper IV**
Title	Factors influencing oil and gas activity in the Arctic	Oil exploration and sea ice projections in Arctic provinces	The interdependence of European-Russian energy relations	The political consequences of resource dependence. How natural gas export can affect policy outcomes: A quantitative analysis
Main focus	Analysis of the main drivers behind the oil and gas industry in the Arctic	Analysis of the effects of sea ice retreat and infrastructure capabilities on oil exploration in the Arctic	Analysis of the Russian-European energy trade, focusing on dependence and interdependence	Analysis of the political effects of natural gas trade
Relation to the research question	Maps out the most important factors that affect oil and gas in the Arctic (Research question I)	Investigate the effects of three key variables on Arctic oil and gas (Research question I)	Investigates the political consequences of resource dependence as part of other traded commodities (Research question II)	The study examines the long-term political effects of resource dependence (Research question II)
Methods	Literature review focusing on findings from various scientific fields	Multidisciplinary, combining climate driven sea ice models with cost analysis	Analysis of natural gas as part of total trade between Russia and EU states	A quantitative analysis using cross-sectional time series data

5.1. What determines the extent and speed of the hydrocarbon sector in the high north?

The finding of the two papers which investigate the driving forces behind the oil and gas industry does not point to only one or two explanatory variables. Rather, they show that Arctic oil and gas production is dependent on a complex set of variables, which alone or combined will determine future development. It is to a large extent driven by the market mechanism where the global demand for hydrocarbons is crucial (Harsem et al. 2011). Further, it is driven by government decision-makers seeking to increase revenues and to create jobs. In addition, political stability is a salient factor for companies looking to expand their activity in the high north. Most of the Arctic states are democratic regimes, and considered to be relative stable. Russia, on the other hand, is suffering from corruption and is not considered to be a desirable country to invest in. According to the World Bank (World Bank Report 2012b), Russia is rated among countries such as Lebanon and Kenya, and is considered a high risk country with regards to doing business. Finally, changes in the physical environment, more specifically the sea ice decline, may also contribute to an increased activity in the high north.

However, as this study has demonstrated, the oil and gas industry in the high north face tremendous challenges compared to other regions of the globe. First of all, the Arctic is perhaps the most difficult region to operate in. A combination of seasonal ice which covers large parts of the Arctic, extreme temperatures, a winter with no sunlight and fragile ecosystems make operations not only difficult, but also extremely costly. A recent example of high costs is the fate of the Shtokman field in Russia. After several years of planning, the collaborating companies came to the conclusion that the project would not be profitable at present time (Financial Times 2012).

Second, hydrocarbon activity in the Arctic has become highly politicized during the last decade, which is down to a number of changes, most profoundly the impact of climate driven changes on a very fragile Arctic ecosystem (Harsem et al. 2011). The papers which studies the driving forces behind Arctic oil and gas development have shown how crucial sea ice is with respect to upstream operations (Harsem et al. 2011), and especially how an expected sea ice retreat may reduce the cost of exploration, production and transportation for the coming 30 years in various Arctic provinces (Harsem et al. 2013). However, those changes are nevertheless conditioned on government decision-makers' willingness to allow for further

exploration in the years ahead. While one could argue that the need for resource rents has so far trumped ecosystem concerns, major changes in the Arctic ecosystems may potentially change the priorities of top decision-makers. Arbo and Hersoug (2010) show how various actors in the oil industry, government and environmental organizations are all influencing decision-making. They point out that in some areas (Lofoten and Vesterålen) environmental concerns have been given the highest priority.

Third, sea ice model projections for the coming thirty years point to a continued summer ice decline, but only a small decline during the winter. If Arctic production of hydrocarbons will increase in the coming years due to sea ice decline, this will most likely be in the form of oil, and moreover take place in a few Arctic provinces (Beaufort Sea, Barents Sea, North Norwegian Sea, Baffin Bay and Kara Sea). The provinces have: a) been producing hydrocarbons for some years already, b) less sea ice compared to other Arctic provinces, and c) adequate infrastructure capabilities (Harsem et al. 2013). It is important to bear in mind that these predictions are conditioned on relative stable and high oil prices. The Arctic is today a significant gas producing region, and the US Geological Survey (USGS 2008) expects that 70 percent of the total undiscovered hydrocarbon resources will be in the form of gas. Though some Arctic provinces may witness an increase in production, the probability of Arctic becoming a major hydrocarbon producing region does not seem very high in the coming decades. The costs are too high, the environment is challenging, and the region is undeveloped with respect to infrastructure.

5.2. To what extent does hydrocarbon trade create political and economic dependencies?

In the two papers which analyses economic and political dependencies, it has been shown that, under very specific conditions, export of gas can be used as an effective political instrument (Harsem 2012). While Russia's position as the major supplier of gas to the continental European market is unique, this does not imply that Russia is able to assert political pressure on the EU in general. The European–Russian energy game is complex and there are many factors that go against the argument that resource dependence can easily lead to political influence, as some earlier scholars have argued (Hirschman 1948, Caporaso 1978). Only under very specific circumstances may Russia be able to use gas as a political instrument. First, Russia's coercive power rests on at least three conditions, that is: a)

relative high demand for Russian gas, b) the ability to use export of gas in bilateral negotiations with individual EU member states, and c) a fragmented EU foreign energy policy. “In short, if Russia is going to use gas as a political instrument in order to achieve political concessions from a recipient government they can in simple terms do two things: a) offer a reduced price on gas (as has been done towards Belarus), or b) threaten with a general shut-down of supply” (Claes and Harsem 2013: 23).

On the other hand, it has been shown how important it is to view a bilateral trade relationship as the total sum of all trade. For example, Russia is heavily dependent on German imports, which makes it highly unlikely that Russia is willing to exert political pressure as Germany has the ability to freeze huge quantities of export to Russia. A country like Slovakia, on the other hand, would have a much weaker bargaining position compared to Germany and could more easily be coerced since Slovakia is more dependent on Russian gas supply without a compensating trade position.

Finally, this thesis provides empirical support for the argument that trade dependence may lead to a value shift. By using cross sectional time series data it has been shown that strong powers such as Russia may influence policy preferences of a weak recipient gas state over a longer time period. The export of gas combined with a measurement for the relative strength of a given supplier state, had a significant effect on voting behavior in the UN General Assembly from 1991 to 2002. Although voting behavior in the UN assembly is far away from natural gas negotiations, it may be an indicator of how “interests may shift because new incentives may alter perceptions of interest” (Abdelal and Kirshner 1999: 121).

5.3. Summary of the findings

The findings from the various papers provide some answers to the outlined research questions. The conclusions may seem conflicting, but they signify the complexity and uncertainty of the oil and gas industry in the high north. With respect to the driving forces behind the oil and gas industry in the high north, the findings point to several key variables. In simple terms, increased activity would require a high demand for oil and gas, political willingness to open new potential fields, and finally continued sea ice retreat. Nevertheless, the results do not indicate a potential oil bonanza in the Arctic in the future. The infrastructure is lacking and sea ice retreat is limited to the summer and autumn.

With regards to the political effects of oil and gas trade, there are several conclusions to comment on. First, gas is more likely to be an effective policy instrument than oil. Second, oil and gas trade between a supplier and a buyer state must be viewed as the sum of total trade. Third, the effect of gas as a political instrument is conditioned on the relative strength of the supplier and the recipient country.

Chapter 6: Long-term trajectories and shifts

As the findings from the respective papers are based upon certain conditions, I will devote this chapter to a discussion of possible changes that may affect both oil and gas activity in the high north and the political and economic dependencies related to the hydrocarbon industry. This will elaborate on findings in the four papers.

6.1. Uncertainties

The main message which this thesis seeks to communicate is that there are a lot of uncertainties about crucial market dynamics which may influence oil and gas development in the Arctic in various ways. There are at least four possible long-term changes that will determine the significance of hydrocarbon production in the high north and the extent to which this activity can be converted to political assets. The first deals with the shale gas revolution. The second concerns the inflow of LNG to the gas markets. The third change is a potential transformation of the contracts and the pricing system in the gas market. In this regard, I will analyze and discuss the development towards hub-based gas-to-gas pricing. Such changes may alter the relative bargaining position of various suppliers and consumers. The fourth addresses a possible transition away from non-renewable energy sources. Finally, I analyze how these changes combined may influence Arctic oil and gas activity. Before moving on to the four possible long-terms changes, I will briefly outline the main features of the international gas market.

6.2. The international gas market

The term *the global gas* market does not include the same features as the global oil market. The global gas market is to a certain degree a combination of a few regional markets that are distinguishable from one another. The main regions, Asia, Europe and North America, have all unique characteristics. The key difference is found in how gas is being traded. On one side of the spectrum are spot markets, where gas-to-gas competitions govern the price mechanism. On the other side of the spectrum is trade which involves long-term contracts (LTC). LTC in the natural gas market are based on a price mechanism which uses world oil prices as a baseline.

The American gas market is largely based on gas-to-gas competition, where the Henry Hub is used as the reference point for North American gas (Rogers 2012). Due to the fact that the energy sector is to a certain extent inter fuel based, oil prices have in some instances influenced the price of gas in America. However, this has rarely taken place during the last decade. Asia, on the other hand, is dominated by LTC, but importers of gas also have the opportunity to make use of spot prices. Pricing in this region is very much linked to crude oil prices. What separates the Asian market from the European market when it comes to the use of LTC is the fact that Asian purchasers do very rarely have the opportunity to review contracts. Prices are frozen, which means that prices within the region vary more than in any other region of the globe (Rogers 2012). The fact that gas prizes are frozen for the duration of the contract implies that the buyer of gas pays a price that corresponds to the oil price at the time when the contract was made. The buyer will continue to pay the same amount, regardless of possible fluctuations in the oil market. In Europe, the Groening concept, which sets guidelines for long-term gas contracts, stipulates a price review conditioned on fluctuating oil price. Further, while long-term contracts have dominated the natural gas trade, we are witnessing an increasing use of spot prices in the natural gas market. The European gas market may thus be characterized as a hybrid market, which includes both LTC and spot. While LTC is still dominating, Europe is gradually moving towards more use of spot. This transition will be discussed in detail in section 6.5.

6.3. The shale gas revolution

A factor which has affected the European gas market is the American shale gas revolution. From 2005 the annual rate of growth in US shale production has been above 3 percent (Rogers 2012), making US gas import superfluous. EIA (2011) estimates that shale gas on the North American continent covers around 100 years of consumption at US 2010 levels (Goldthau and Hoxtell 2012). Even though the US has not yet, or perhaps never will, start exporting shale gas to Europe, the fact that US has become self-sustained with respect to gas has brought profound changes for European gas consumers. Before 2005, at the time when Qatar started their massive investment into LNG, a large proportion of LNG exports were meant for the American market. However, as the US did not need to import gas, LNG was redirected towards Europe and other continents. On the other hand, to expect that US shale gas production will continue at the same rate in the foreseeable future may be too hasty. First,

while the price of gas at the Henry Hub has ranged between US$ 3.50-4.50/mmbtu[2], overall production costs may require prices in the range of US$ 6.50/mmbtu. Second, some argue that US gas supply has no "depth" in supply (Rogers 2012), meaning that a large proportion of its production (30-40 percent) began only 12 months before. In other words, if drilling slows down, production and supply may be quickly affected (Brenna 2011, quoted in Rogers 2012).

The American shale gas revolution has affected European consumers by directing gas meant for the US market towards Europe. Assuming that American production of gas continues, one scenario could involve LNG from North America, to Europe. Estimates consider a gas price above US$ 3.50/mmbtu in order for it to become profitable for American producers to supply Europe with gas (Rogers 2012). Considering that the price in Europe is, and has been, more than twice of that in North America a potential US export of LNG to Europe is not unlikely in the near future. There are also great uncertainties with regard to the import level in Asia. For example, consumption in India, China and Japan in 2009 preceded 2008 levels by around 3 percent, while this rise has reached a staggering 18 percent in 2010 (Rogers 2012). This has naturally contributed to a rise in the demand for LNG, and in 2011 LNG import by the major gas consumers in Asia exceeded 2010 levels by 10 percent. In Japan the demand for LNG has increased to new levels as a result of the Fukushima Daiichi nuclear disaster. The level of demand for LNG will be pivotal to European consumers, as it will determine whether or not LNG from Asian producers will be available to European consumers, and equally important, at what cost. The rate and speed at which the Chinese economy will continue to grow is far from certain. China has so far been supplied by domestic production. However, if the Chinese economy continues to grow at the rate of 10 percent every year, one should expect that the need for increased import will rise.

6.4. LNG

The increased production of liquefied natural gas (LNG) is another factor which is contributing to a fundamental change in the global gas market. LNG is a product where natural gas becomes liquefied, and thereby enables storage and transportation by ships, consequently allowing for the possibility of selling it to every corner of the world. This contributes to a more globalized gas market. During the last decades, the production of LNG

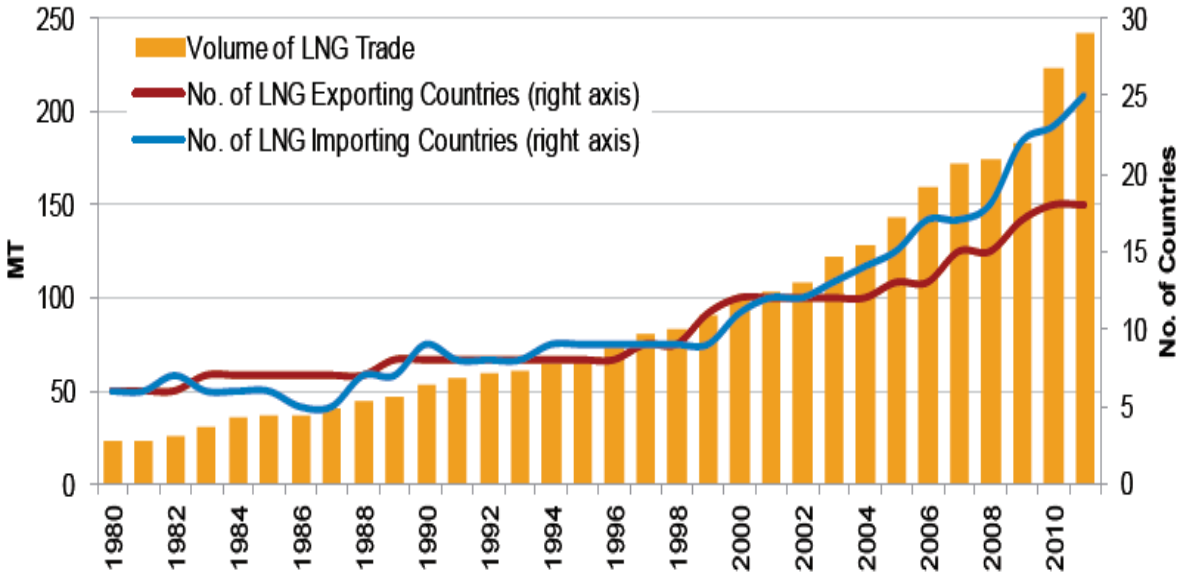
[2] Mmbtu := million British thermal unit.

has increased at a steady rate (Figure 4). In total, LNG has grown at an annual rate of 7.2 percent since 1990 (Wood 2012).

Forecasting the extent and speed of future growth is, however, difficult due to a number of reasons. Competition from unconventional gas, volatile regional market conditions, new technology and the state of the global economy are only some of the factors which influence future demand for LNG. In Europe, LNG has contributed to a decline in the use of imported pipeline gas from 86 percent in 2003 to 78 percent in 2010 (Wood 2012). While continental Europe has only a few existing import LNG terminals, there are a number of terminals under construction, and a significant number of proposed terminals. Such a development is and will be pivotal to an increase of LNG import to Europe.

The main importers of LNG are found in Europe and Asia (primarily Japan, India, China, South Korea, Taiwan). On the exporting side, countries such as Qatar, Malaysia, Indonesia, Russia, Nigeria, Trinidad, Algeria and Australia account for the largest proportions of export, with Qatar as the largest producer of LNG (IGU World LNG Report 2011). In addition Australia are in planning of large scale developments of LNG production facilities (Wood 2012)

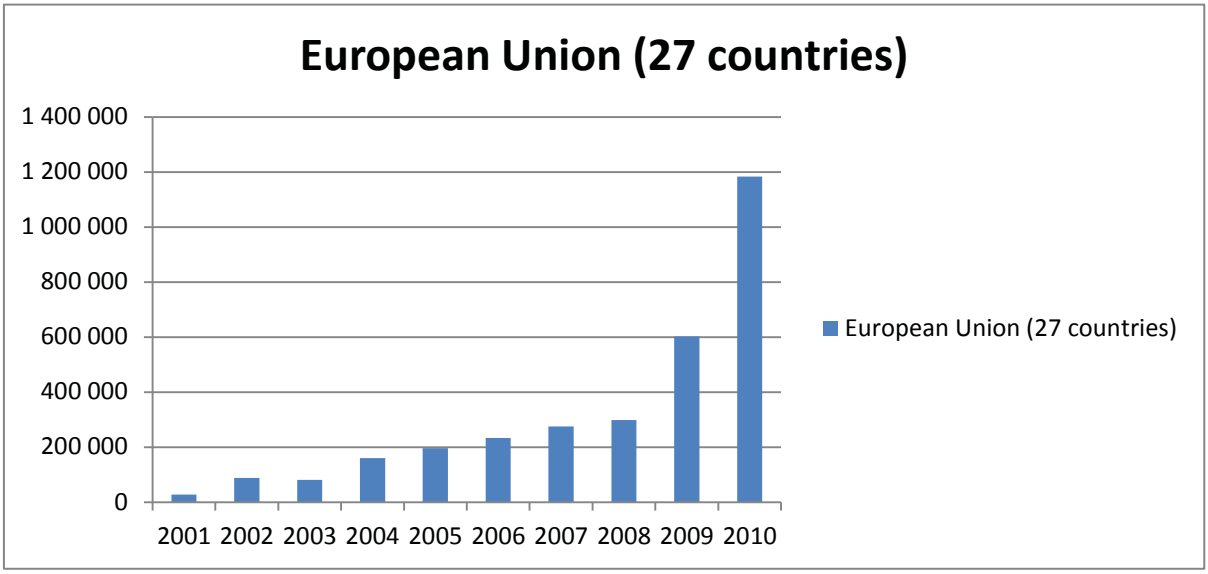
Figure 4: Total LNG trade.



Source: IGU World LNG Report 2011

The remarkable increase of LNG production in Qatar (Figure 5) during the last few years has impacted European consumers. They have become less reliant on pipeline supplies from countries such as Russia, Norway and Algeria.

Figure 5: European Union imports from Qatar



Source: Eurostat

However, there are a few obstacles which could potentially create problems for Europe's LNG supply. First, the economic crisis in Europe has decreased the demand for gas and has subsequently reduced the price. This implies that short-term supply may be drawn towards the Asian market where prices are significantly higher (Wood 2012). Second, EU countries are locked into long-term gas supply contracts. In addition, even though LNG production has increased, it has not dramatically reduced the use of LTC. LTC is used in approximately 75 percent of sales involving LNG (Rogers 2012). Despite of EU's increasing ability to diversify its import of natural gas, this has not automatically resulted in a shift from LTC to spot based prices. Heather (2012) argues that country specific features (e.g. cultural differences) are one of the reasons for why European continental hubs are not fully developed.

6.5. A changing gas market: Moving towards hub-based pricing?

The European gas market is still dominated by LTC. Historically, gas prices in Europe have been linked to global oil prices, even though European gas pricing have moved slightly in the

direction of hub-based pricing. Europe has been using long-term gas export contracts (LTGEC) since the late 1960s, which are based on a price formulation model called the Groningen concept. The Groningen concept is based on a few key elements (Konoplyanij 2010). First, LTC ensure long-term stable supply for the purchasers, and provide the suppliers with long lasting partners that enables the suppliers to make multibillions investments into gas fields and facilities. Second, prices are pegged to a gas replacement value. In Europe's case, gas has been pegged to oil. Oil in contrast is based on oil-to-oil competition where prices are set globally. The common practice has been to weigh gas prices either to 60 percent of light fuel oil (i.e. gasoil or diesel fuel), or to weigh gas prices to 40 percent of heavy fuel oil (i.e. residual fuel oil) (Konoplyanij 2010). Third, a special clause in the contract between the buyer and seller stipulates a regular review of the price in order to make sure that the price of gas reflects oil price fluctuations. European gas prices are based on the preceding six to nine month average oil prices, very often lagging three months behind oil prices (Stern and Rogers 2011). Fourth, the Groningen concept stipulates a minimum pay obligation, sometimes referred to as "take or pay" (TOP) (Konoplyanij 2010). In short, it guarantees that the producer will receive a minimum set of revenues regardless of the buyer's need. Usually this implies that the buyer has to take at least 75-80 percent of the contract volume, which leaves about 20-25 percent flexibility. The buyer can decide whether or not additional volume are needed, but are obligated by contract to buy three quarters of the volumes preciously agreed upon. Fifth, the price of gas to a given delivery point (e.g. buyer) may differ depending on transportation routes. If gas from one single producer is transported through a single delivery point to different markets, prices may vary significantly. Finally, destination clauses aims to rule out re-export of gas. Purchased gas cannot be sold at a higher price to a different market. This clause protects the consumers, as it prohibits a buyer from the possibility to manipulate the price of gas (Konoplyanij 2010).

Even though a large majority of gas sales in Europe are based on LTC, we have witnessed an increase in the use of hub-based pricing during the last few years. LTC is still dominating European gas trade with some exceptions found in UK and the Netherlands. The National Balancing Point (NBP) in Britain accounts for a substantial share of gas trade in the UK, and is according to various scholars considered to be a mature market (Heather 2012, Stern and Rogers 2011). The Title Transfer Facility (TTF) in the Netherlands has grown substantially during the last decade. In contrast to the NBP, the TTF is also a virtual trading point (Heather 2012). The rest of the continental Europe gas market is very different compared to UK and the

Netherlands. In addition, in Britain and the Netherlands relative new LNG terminals (South Hook and Grain) has expanded their capacity in order to allow for more competition between pipeline and LNG (Wood 2012). There has been a steady increase in trade by hubs from 2009. However, they still account for a smaller proportion of the total traded gas volume in Europe (Stern and Rogers 2011). While Britain and the Netherlands are historic trading nations, and consequently have developed adequate trading hubs, the remaining continental countries have for various reasons not fully mature hubs, and lack adequate infrastructure facilities. After witnessing a small, yet somewhat significant change in the way gas is sold on the European continent, an interesting question is: Why is this change happening?

In the 1970s, the rationale for linking gas prices to the price of oil was based on the fact that consumers had a real choice between oil and gas products. Buyers would be able to shift from gas to oil if price incentives were present. However, Stern and Rogers (2011) provide arguments for why the rationale for a continued linkage between the two fossil fuels in question has lost its appeal during the last decade. First, several stationary energy sectors have eliminated the use of oil products (Stern and Rogers 2011). Second, maintaining equipment that makes optional use of oil is costly and inconvenient. Third, modern oil equipment makes possible oil substitute products inefficient. And finally, tougher environmental standards favour the use of gas burning products. Another important argument against a continued link to oil prices, from the consumers' point of view, is the fact that hub-based pricing (gas-to-gas competition) seems to reduce the overall price of gas. By comparing the American market (where spot prices dominate) with the European continental market, it is apparent that the gas prices are significantly lower in North America. The average price of gas in North America was in 2010 US$ 3.50/mmbtu to 4.50/mmbtu, while European gas LTC averages around US$ 11-13/mmbtu (Rogers 2012). The European spot market average is about 0.6-0.8 of LTC (Stern and Rogers 2011), with an average of around US$ 8-10/mmbtu. In simple terms, lower gas prices are a motivating factor for European consumers to reduce their overall dependence on LTC.

On the other hand, there are significant roadblocks that are hindering EU's desire for a complete turnover to a hub-based system. There are relatively few actors that are supplying the European gas market (Harsem 2012). The main suppliers, Russia, Norway and Algeria, transport gas to the European market by pipelines. This reduces Europe's ability to diversify its supply. Few suppliers with relative strong market power do not necessary want to eliminate the current price mechanism. Also, a complete overhaul of the current price

mechanism, in the current market with a low number of suppliers, may result in price manipulation (Stern and Rogers 2011). There are also compelling arguments for maintaining LTC in the European gas market. LTC provide stability for consumers. De Hauteclocque and Glachant (2009: 5400) argue that: "the main advantage of LTC for individual firms is to hedge price and quantify risks and therefore facilitate investment or operation". Further, it is important to emphasis that LTC by nature is not monopolistic. LTC may be organized in different ways to ensure that both the seller and buyer achieve their individual preferences. On a final note, LTC which includes flexible arrangements with regards to volume and price may be the preferred choice for European consumers seeking both the lowest possible price but at the same time a long-term security of supply. One possible solution to the ongoing conflict between EU and some of its suppliers (e.g. most notably Gazprom), may be to modify some of the clauses which are part of the Groningen concept. The TOP clause for example may be in violation of EU competition policy (Boussena and Locatelli 2011).

In sum, the global gas market has witnessed substantial changes during the last decade (Harsem et al. 2012). Technological advances, increased production from unconventional gas, and a significant increase in LNG may have changed the global gas market for ever, which in turn may have serious impacts on the European market. In the next section of this thesis I discuss whether a desired move towards renewable energy sources in Europe is realistic in the near future.

6.5. EU efforts to become less reliant on non-renewables

During the last four decades, EU has been in the forefront of a transition towards a more environmental friendly society based on renewable resources. The move towards a reduction in greenhouse emissions and an increase in renewable energy started in 1975. The EU agreed upon an Environmental Action Programme, which among other things established the principle that the potential cost of pollution should be carried by the polluters themselves. However, it was not before 1987 with the Single European Act that a separate environmental policy was established. This introduced a Directorate General for environmental policies (Gerhards and Lengfeld 2008). The signing of the Amsterdam Treaty in 1997 established the overriding goal of sustainable development. Part of this was the reduction in CO_2 emissions, a goal which was laid down in the Kyoto Protocol. Following this international agreement, EU climate policy followed two pathways to reach the goals which were agreed upon in Kyoto

(Dessai and Michaelowa 2001). First, the burden share agreements (BSA) established a practice where the poorest EU members could in fact increase their greenhouse gas emissions up to 2010. The poorest countries would also get financial support from EU's Cohesion Fund. Second, the common and coordinated policies and measures (CCPM) was introduced as a measure to reach the goals agreed upon in Kyoto (Dessai and Michaelowa 2001). The Environmental Policy Integration (EPI) became formally included in the Amsterdam Treaty.

As the European Commission in 2000 stressed the need for more environmental friendly energy consumption, it would serve as a mean for two ends. First, it would reduce the Union's overall dependence on a few gas suppliers (e.g. most notably Russia). This in turn would be desirable politically and economically, as it may lead to a reduction in overall gas prices, and could reduce Russia's political influence over certain East European states. Second, it would decrease the overall carbon emissions. From the Green paper of 2000 it was concluded that: "Sustained efforts should be made to promote the penetration of new and renewable energy sources (such as hydrogen and co-generation) in our economies. The European Union has set itself an ambitious target in this respect: 12 percent of energy consumption in 2010 should come from renewables. This means, above all, mobilising aid to promote their development and use. Renewable forms of energy can only reach a sufficient level of competitiveness if they receive aid for a relatively long time" (EU Commission 2000: 72). This ambitious goal was taken even further in 2007 and 2009, when it was decided that the EU countries combined should reduce their overall greenhouse gas emission by 20 percent in 2020. This goal was complemented by two additional goals. By 2020 20 percent of the overall energy consumption should be based on renewable energy sources, and there should be a 20 percent increase of energy efficiency.

However, it was not before the Lisbon Treaty from 2007 that the pursuit of sustainable development became a specific policy objective (Benson and Jordan 2010). The subsidiarity principle, a key component of the Lisbon Treaty, seeks to ensure that decisions are taken at the lowest level possible. However, the Lisbon Treaty allocated more power to the EU versus the member states, specifically regarding climate change and energy consumption.

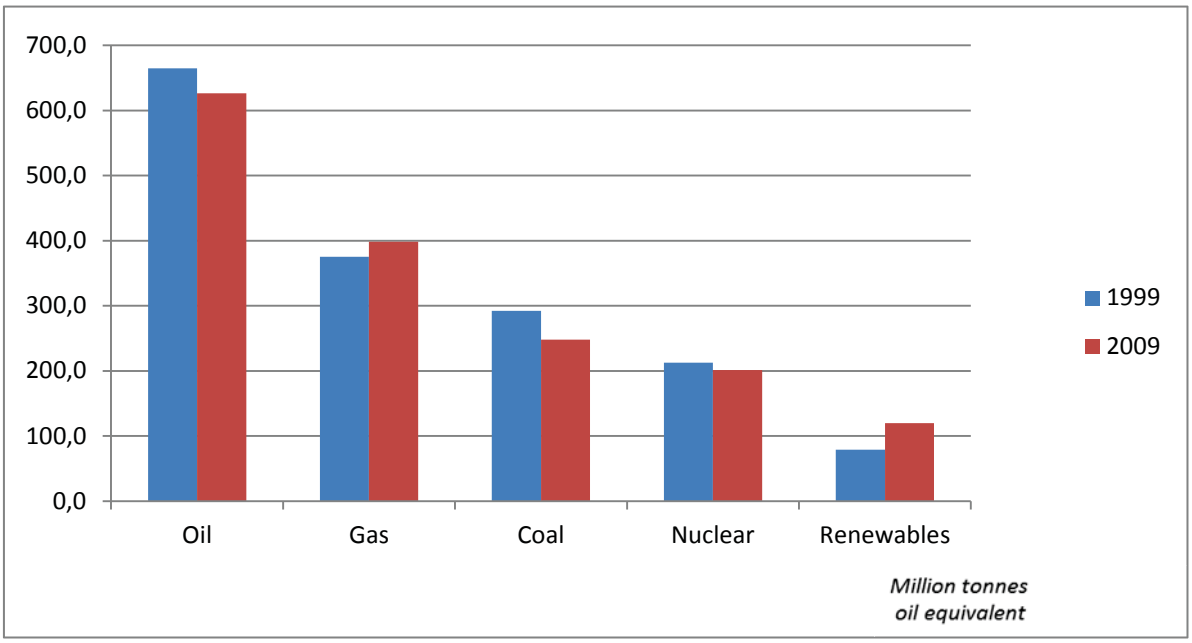
To date EU has by far the most ambitious environmental strategy of all the great powers. The heads of state of EU have committed themselves to a minimum of 80 percent reduction in greenhouse gas emissions by 2050 (EWEA 2011). This long-term goal is complemented by the 20 percent renewable energy target by 2020 (Directive 2009). In order to achieve these

targets EU has initiated a number of strategies, reforms, and institutional processes. Some of these include a strategy on biodiversity, roadmap to resource efficiency and a White Paper on transportation (Volkery et al. 2011). One of the most important policy initiatives in this regard is the different Environment Action Programmes. The 7th Environment Action Programme is in the process of being formed, and is to replace the former which ended in 2012. The Environment Action Programme aims to provide an overarching strategic framework that includes guidelines to the future development of the EU environmental policies.

As more power has been transferred to the EU from the member states, the Council together with the Commission have become two of the main driving forces behind EU's ambitious environmental strategy. For example, it was the Council of Ministers who, in 2007, decided to reduce greenhouse emissions by 20 percent in 2020, and to make 20 percent of the overall energy consumption in EU to come from renewable energy sources (Gerhards and Lengfeld 2008). The Commission has increasingly sought to centralize and harmonize decisions in the EU with regards to climate change policies (Wettestad et al. 2012). To put it in simple terms, EU's environmental policies have been driven from various institutions located in Brussels. But even though member states have agreed on the ambitious targets, there are few indicators suggesting that member states are able or willing to make arrangements that enable them to reach those targets.

The EU has been one of the driving forces behind a new international binding agreement on the reduction of carbon emissions. However, a recent report concludes that overall, the efforts taken up to 2011 (EU Climate Policy Tracker 2011) are not sufficient if EU member states are going to meet the targets set by the Council of Ministers and the Commission. Regarding how certain EU member states have taken measures to reduce their overall dependence on non-renewable from 1999 to 2009 (figure 6), it becomes evident that European Union member states are lagging behind the goals set by the European Union.

Figure 6: Energy consumption in Europe 1999 and 2008



Source: BP Statistical Review of World Energy June 2012

While renewable sources of energy accounted for around five percent in 1999, the proportion only increased to about seven percent ten years later (BP Statistical Review 2012). Thus, the overall goal of 20 percent in 2020 is likely to be a bridge too far. There are a number of reasons for why the EU is not likely to reach its targets. The Policy Tracker report pointed to lack of initiatives from the various member states. Germany, for example, is perceived as a state which has been pushing for stricter environmental protections at the international arena and in the EU. However, Germany's ability to deliver on its promises is restricted by "well-organized domestic business interests" (Sprintz and Weiss 2001: 84). Germany is constrained by groups with conflicting interests (ibid). Environmental groups moves the government further in international and regional discussions, but at the same time the interests vested in German industry are able to get away with significant rises in the costs of implementation of new environmental policies (ibid).

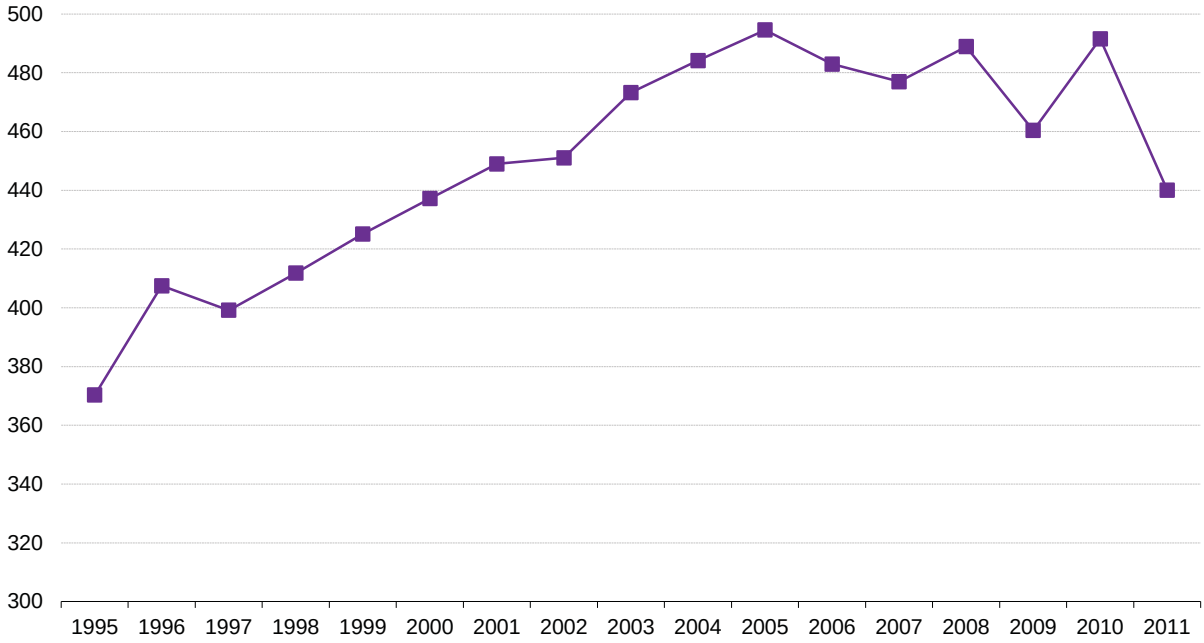
On the other hand, there has been a significant increase in the use of gas, which is a cleaner form of energy compared to oil and especially coal. The increased possibility of gas import from Asia, America, and possibly from the Arctic, may be of significant importance if one wants to reduce carbon emissions. To sum up, EU's effort to rely more upon renewable energy sources, as established by various policy goals, is lagging far behind the goals set. It is questionable whether such a fundamental change is possible in the current economic and

political climate. However, if the price of oil remains high, and countries are able to diversify their gas supply, which in turn may result in significantly lower prices on natural gas, CO_2 emissions may be reduced.

6.6. The impact on Arctic activity

In brief, there are major changes that have taken place during the last decade that are worth a thorough analysis. A significant increase in the production of LNG, an increase in demand for gas in rising economic powers such as China and India, and an unconventional gas revolution, may all have serious implications for both European consumers and for Arctic producers. In addition, as a result of the unprecedented climate changes that take place in the Arctic, states and international organizations are seeking to develop renewable resources in order to reduce CO_2 emissions. The changes in the global gas market will have significant effect on the potential for more gas production in the high north. The rate and speed of the global economy during the next decade, and equally important, the demand for gas, are crucial for further Arctic production (Harsem et al. 2011). The overall cost of exploration and production far exceeds that of other regions (ibid). Lindholt and Glomsrud (2012) also note that if the undiscovered resources are 50 percent below the estimates made by USGS (2008), Arctic production will not increase. Equally important is the fact that they expect a decrease in natural gas production in the coming four decades (Lindholt and Glomsrud 2012). For example the global financial crisis which hit Europe in 2008 had major impact on the European consumption (Figure 7).

Figure 7: Gross inland consumption of natural gas in EU-27, 1995-2011 in million tonnes of oil equivalent (Gross Calorific Value)



Source: Eurostat 2012

Despite the fact that it is very difficult to predict the future inflow of LNG, output of American shale gas, and global demand for gas, there are a few key indicators that could point to a higher Arctic gas output. First, overall demand for natural gas is expected to increase in the future (BP 2011). Second, the proven gas reserves in 2010 dropped from 63 years in the previous year to 58 years. "Although gas production grows in every region except Europe, the increasing demand continues to outpace any growth in global reserves" (Weijermars 2012: 68). The most likely scenario involving an increase in production from the Arctic rests to a certain degree on the state of the global gas market. Global demand must remain high, and a sharp increase in gas demand will most likely come as a result of increased demand from Asia. Equally important, the price of gas must be high. A transition towards a hub-based pricing system in Europe may therefore be an obstacle for further Arctic production. As the Arctic in a high cost region, upstream gas projects in the Arctic will probably demand higher investments compared to other regions. Arctic production rests therefore on stable high prices in order for production to be profitable. "It is the banking and financial community that requested LTGEC[3] to be concluded in order to guarantee pay back of the debt financing which need to be raised for upstream projects" (Konoplyanij 2012: 42). In other words, the

[3] LTGEC: Long term gas export contracts

use of LTC is very much an investment tool, which may be critical for Arctic production. This means that privatization, liberalization and competition do not automatically imply security of supply. A crucial task for governments in energy policy is to ensure security of supply, where use of LTC may be essential. Pointvogl (2009) found that EU member states' degree of willingness to join in a common European energy programme is explained by the perception of energy security.

One motivating factor for liberalizing the European gas markets is price reduction. Another is to ensure security of supply. And while liberalization of the gas markets in Europe targets new potential suppliers, potential market failures are important to bear in mind. Helm (2009) argues that competition does not necessarily deliver sufficient amounts of new investments, especially with regard to infrastructure. In theory, market dynamics can deliver security of supply targets. In practice, governments very often seek to hedge against potential market failures by backing key investments (Helm 2009). The potential fear of market failures will therefore most likely play a crucial role when governments decide upon moving towards a liberalization of the European gas markets. Market failures may be even more threatening than the fear of a gas shutdown from Russia, and is a strong argument for a continued hybrid gas market, that is, mixing spot market prices with long-term contracts.

There are nevertheless more probable scenarios that do not involve a significant increase in Arctic gas production. In a scenario where US shale gas production remains high and Asian demand remains low (Rogers 2012), prices will most likely remain low, and the Arctic output may decrease. With increased competition from the US, and LNG producers such as Qatar, high cost gas projects in the Arctic could become superfluous. An overall Arctic oil and gas bonanza therefore seems very unlikely. The large development which has begun in Australia is a good example of how cost intensive gas production may suffer in competition with American shale gas. Australia, which is planning to export large scale LNG production towards the European and Asian markets, may have to reconsider its plans as a consequence of American gas export which is believed to be sold at a significantly lower price rate.[4]

[4] The Australian: http://www.theaustralian.com.au/business/mining-energy/lng-exports-at-risk-as-us-stakes-claim/story-e6frg9df-1226553137492

6.7. Will the geopolitical instrument disappear?

A transition towards hub-based gas pricing, the influx of LNG and the shale gas revolution may not only impact the need for more hydrocarbon production in the Arctic, it may also change the importance of natural gas in international relations. A globalized gas market with gas-to-gas competition as the basis for price formulation, and where LNG makes diversification possible, may reduce the political effects of the gas trade. This is because a viable threat of supply shutdown rests on the condition that the buyer has no alternative supplier. More suppliers in the European gas market may therefore decrease Russia's ability to exert pressure on weaker recipient states.

One of the main reasons for why gas may be a more effective political instrument, compared to oil, is the fact that gas is not as easily diversifiable (Harsem 2012). The ability to exert political pressure on a gas recipient state is conditioned to a certain extent on specific trading arrangements. LTC is negotiated between a producer and buyer where a fixed volume of gas is being agreed upon within a certain time frame. Equally important, with respect to the ability to exert political pressure on the buyer state, is the lack of supply options. If the buyer state is able to buy gas from other suppliers, even with the use of LTC, the potential for political pressure is slim. However, as in the case of Russia versus certain East European states, Gazprom is the only viable alternative (Claes and Harsem 2013), which increases the probability that gas may be used as a political instrument.

However, if additional LNG production in Asia will be directed towards the European market this will not only have economic implications for European consumer (possible reduced prices), but may also be of political significance. If the demand for Russian pipeline gas in Europe decreases, Russia will not only loose valuable revenues, but may also loose political influence on certain European states.

Therefore, a reason for why the shift towards more gas-to-gas pricing is a slow process is the reluctance from the major supplier of gas to Europe, that is, Russia (Gazprom). It has been shown that the export of gas, under specific conditions, may yield political influence over time (Harsem 2012). However, if LNG import to Europe is continuing to increase, the need for Russian gas, and consequently Russia's ability to influence certain countries, may decrease. Thus, Russia (Gazprom) has both political and economic incentives to keep the current price system. They receive a higher price for their gas, as well as using the potential threat of a shutdown as instrument to achieve political concessions. Therefore one of

Gazprom strategies to retain the current LTC system and to maintain their influence has been to acquire shares and assets in transmission and distribution companies (Boussena and Locatelli 2011). Another possible solution would be to coordinate and consult with other gas exporters. Hence, a transition to a hub-based system may be inevitable, as argued by Stern and Rogers (2011), but the likelihood of it being a smooth transition is not very high.

The desire to reduce their overall dependence on Russian gas among certain European states is also a motivating reason for a transition towards renewable energy. Regardless of a possible increase in LNG import or a transition towards spot prices in the natural gas market, the EU could potentially reduce their dependence on Russian gas by developing more efficient renewable energy sources. However, as natural gas is among the more environmentally friendly non-renewable energy sources, it will most likely be a significant energy source in the coming decades within the European Union.

6.8. Conclusion

This chapter has shown how uncertainties about future market and policy developments will play a crucial role for the outlined research questions. It has shown the complexity of oil and gas activity, which makes clear predictions difficult. However, some conclusions may be drawn. First, Arctic hydrocarbon activity is not an isolated case where global market dynamics are without influence. Possible changes in the global gas market, the volume of LNG and the production of shale gas may all affect the overall supply of Arctic gas. Second, a possible move towards a more globalized gas market as a consequence of increased LNG and spot based pricing may decrease the overall political significance of natural gas trade. Equally important, this chapter has shown the value of a political economy approach. Both economic and political variables will play a crucial role in shaping the oil and gas industry in the Arctic in the coming decades.

Chapter 7: Concluding remarks

This chapter summarizes the main findings and arguments of this thesis. It highlights the contribution of this study compared to previous literature, and finally outlines suggestions for further studies.

7.1. Main arguments and findings

Returning to the outlined research questions, this thesis has analyzed two different, but at the same time, interwoven aspects of the hydrocarbon industry in the high north. The first research question required an analysis of the driving forces behind the oil and gas industry. As such, two papers with different methodological approaches tried to unveil some of the most important factors that drive oil and gas activity in the Arctic. The main findings from these studies point to two conclusions. First, Arctic oil and gas activity is driven by a number of different variables such as global demand for energy and political incentives (Harsem et al. 2011). In addition, environmental factors such as sea ice change and extreme weather are important as they partly determine whether undiscovered resources may be attainable in the future. Second, the amount of sea ice decline in the Arctic will have an important effect on the extent and speed of further activity (Harsem et al. 2013).

These findings lend support to the following argument: A potential oil bonanza in the Arctic in the near future is unlikely. This argument, though in sharp contrast to what several commentators and scholars have predicted, is based on the fact that sea ice retreat in the future is found to be seasonal. That is, sea ice will still cover the Arctic during a long period of the year during the next 30 years. The argument is also based on the fact that Arctic oil and gas face competition from unconventional sources of energy such as shale gas, which may reduce the price of oil and gas. As the Arctic in general is a high cost region, high energy prices are crucial for further increased activity (Harsem et al. 2011, Lindholt and Glomsrud 2012). The counterfactual argument stating that the Arctic will become a region where oil and gas production will increase substantially in the near future is based upon a number of uncertain assumptions. Sea ice decline must increase even during the winter, global energy prices must remain at record levels, and Arctic governments must grant licenses at an ever higher rate. If the hydrocarbon industry develops new technology that dramatically reduces the price of

operations in the Arctic, this argument may hold. However, predicting technological breakthroughs are beyond the scope of this study.

The second research question which this thesis outlined dealt with the political effects of oil and gas trade. The analytical approach to this question where both theoretical and empirical. The theoretical part considered previous arguments about resource dependence and formulated new general testable hypotheses. The empirical part studied oil and gas as part of the total trade which occurs between two states. While the two papers which were devoted to the second research question applied slightly different approaches, they provide the same conclusions. First, one must consider the relative importance of the traded commodity in questions, and whether it is diversifiable (Harsem 2012). If a recipient state has the opportunity to choose from several suppliers, the likelihood of using a given commodity as a political instrument by a supplier state is very low. In general, gas can be used as a political instrument in larger degree than oil. While oil is traded and transported all around the globe, gas is not. Natural gas is mainly transported through pipelines which make diversification more difficult.

Second, while an important commodity such as gas may be a potential instrument for policy-makers, the relative bargaining position between two countries must be viewed as the sum of total trade (Claes and Harsem 2013). Third, important commodities, such as gas, are only likely to be an effective policy tool if a) the sender state is relatively strong, and b) the recipient state is weak. [5] Gas export from the Arctic, for example Russia, to a weaker state like Slovakia, may potentially be used as a policy instrument to achieve concessions from the recipient state, as Slovakia has no other viable supplier of gas (Claes and Harsem 2013). On the other hand, due to the influx of LNG and the liberalization of gas markets, diversification may be possible and thereby reducing the political effect of gas as a policy instrument. In addition, oil is likely to be more attractive than gas for the industry as the price of oil is significantly higher than the price of gas. Gas production in the Arctic will therefore not likely be a salient policy instrument for Arctic governments in the near future.

[5] For a definition of the relative strength of a state, see Harsem (2012)

7.2. Contribution to previous literature and advice for further research

This thesis is a contribution to studies on the political and economic aspects of oil and gas in the high north. In short, the study's contribution to previous literature is twofold. On the empirical level it isolated some indicators that will be of importance on determining the extent and speed of further Arctic development. In addition, it has shown, with the use of statistical tools, how export of natural gas may be a useful political instrument over a certain time period. On the theoretical level, the study has refined previous arguments about resource dependence by considering the relative importance of the traded commodity. I would suggest further studies on at least three different aspects of the oil and gas industry in the high north.

First, as the oil and gas activity in the Arctic is complex with a number of uncertainties, further studies applying different methodological approaches are needed. I therefore would encourage more in-depth case studies focusing on local and national decision-making processes within the Arctic states. In addition, more precise estimates of the cost of operating in the high north would be valuable in order to determine how crucial exogenous factors such as prices of oil and gas would be to Arctic hydrocarbon activity.

Second, more in-depth cases studies on trade agreements involving oil and gas would make it possible to unveil how hydrocarbons are used as a political instrument to achieve policy goals. Third, longer timer series are needed in order to appropriately measure the effect of hydrocarbon import dependence over time. As this thesis only has covered a ten year period, I would suggest further studies to find indicators that allow for a longer time period.

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PAPER 1

PAPER 2

PAPER 3

PAPER 4

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