Chapter 1
Introduction

1.1 Research background

Russia has the largest conventional gas reserves in the world with about a quarter of the total. Although Russia also has significant oil reserves and is a large producer, its natural gas reserves, in tons of oil equivalent, vastly exceed those of oil [BP 2009]. Due to the vastness of the gas reserves and the quality of natural gas as a relatively clean fuel, gas is considered to be an important fuel of the 21st century. According to the International Energy Agency [2009c], gas demand is expected to grow in the coming two decades in the main regional markets, although the outlook is still very uncertain. Russia is thus well-positioned. Moreover, in Russia’s main export market – in West and Central Europe – natural gas production is predicted to decline, opening new export possibilities. Despite the mid-term positive outlook for gas, demand declined in 2009 as a result of the financial and economic crisis. This decline in demand coincided with new gas flows, in particular liquefied natural gas (LNG)\(^2\) and unconventional gas in the United States (US), coming on the market, putting pressure on volumes and prices in some markets.\(^3\) The demand outlook in the long term looks even more uncertain vis-à-vis the mid term, largely as a result of the growing role of renewables.

Already from the Soviet era, Russia has been one of the largest producers and exporters of natural gas. Since the 1960s, also the domestic gas market expanded, and for Russia the main question is when to develop and export the resources to satisfy both domestic and foreign needs for gas; while also serving socio-economic priorities.\(^4\) After the demise of the Soviet Union, energy exports were the main exportable products for hard-currency markets. These revenues have, to a certain extent, channeled the economy into a one-product economic structure, as has been the case in many energy-exporting countries. Russia struggles with the notion that it should move its focus from energy incomes towards earnings from modern sectors, such as information technology and telecommunications [Trenin 2008; Financial Times 2009]. Yet, developing Russia’s gas reserves may offer economic stability and capital to invest in their new sectors. Moreover, energy provides Russia with an important role in international affairs. In addition, Russia may be encouraged by its off-take regions, such as Europe and perhaps China, to develop its resources for their energy

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\(^2\) LNG is a mode of transport for gas by which methane is super cooled to minus 260 degrees Celsius, enabling its transport in liquid form in tankers or LNG cargoes. The upstream physical chain, which produces LNG, is called a ‘train’. This train is able to produce a certain amount to be loaded on a cargo.

\(^3\) In markets where long-term oil-related contracts are dominated, firms in consuming countries used the room for flexible off-take on their take-or-pay contracts.

\(^4\) Increasingly, Russia is focusing on the development of a gas-based industry in order to export (semi-)products. However, this study concentrates on gas as a commodity product.
needs. Hence, the main decision-makers within the government believed that if used effectively, mineral and energy resources could provide the basis for Russia’s entry into the world economy and could offer the means to modernise Russia’s military and industrial complex [Balzer 2005; Lavrov 2007]. For this reason, management of the domestic resource base – i.e., to make use of its natural competitive advantages – plays a crucial role in the future of the Russian State.

Yet, the privatisation of the energy sector during the 1990s, induced by the introduction of market concepts based on the Western economic model in Russia, had resulted in the government’s loss of control over the sector’s resource management and windfall profits flowed largely to the private sector [Åslund 2007]. The gas sector remained rather centralised owing to a strong political lobby to keep the sector together. Both the importance for the domestic market and the rigidity of pipeline transport had reinforced its continued centralised institutionalisation. The rapid development of export markets in the period of economic decline in the 1990s and the clean properties of gas held promises for future significance. Gas holds therefore the promise for Russia to be a tool for economic growth and diversification, like oil was up till now.

Gazprom, as a government-controlled firm, has come to embody Russia’s awareness of its role as an important future gas supplier with global aspirations [Åslund 2007]. Restoring Russia’s grip over a large part of the Russian gas sector took place against the backdrop of record-breaking energy prices in the four years leading up to August 2008. Gazprom has a dominant position in Russian gas production, although the role of independent (foreign) producers is growing (25 percent in 2008) [IEA 2009b; Gazprom 2009]. In addition, Gazprom owns the Russian united gas transmission system (UGTS) and since 2006, it officially holds a monopoly over Russia’s existing and potential gas exports. However, it is possible that Gazprom must share this position with Rosneft – Russian national oil firm – who also is developing its gas resources [Financial Times 2010].

For its export and hard-currency earnings, Gazprom is highly dependant on the European markets [Gazprom 2009]. The ‘pipeline’ orientation towards Europe is the heritage of more than half a century of gas developments, both in Russia’s ‘backyard’ in the Commonwealth of Independent States (CIS) and Central Europe and the West-European hard-currency markets. Given the central role of Gazprom in gas exports, this study takes essentially the view of Gazprom as its perspective, with a particular focus on strategic infrastructure investments for Gazprom’s gas exports.

The European market, Russia’s main export market, has also been undergoing a process of major restructuring, enforced by European Union (EU) directives aimed at lowering the

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The term ‘independent’, however, has become increasingly unsuitable since Gazprom formed strategic relationship with and has taken (minority) equity stakes in these companies [Stern 2009].
barriers to entry, enhancing competition, and integrating national markets into a single European gas market [De Jong et al. 2010]. Together with changes in the other main regional gas markets – the US and Asia – market structures and trading and pricing patterns will change as a result of different factors, such as the increasing import-dependencies and the development of new supply flows. This change precipitates the need for comparatively greater interregional gas flows in the medium-term and beyond 2015-2020 [IEA 2009c].

The regional gas markets began their development in relative isolation; each with their own pricing and trade patterns and their own market structures. The regional markets have gradually become more interlinked and interconnected and have recently been exposed to many of the same LNG flows. However, they still differ in terms of how gas is priced and traded [Barnes et al. 2006]. The big prize, in absolute volume terms of rising import-dependency – and thus new market share – is likely to remain Europe for some time to come, especially for Russia [IEA 2009a]. In addition, Asia, which includes mature gas markets, such as Japan, and emerging gas markets, such as China and India, will offer most of the growth opportunities in relative terms. The expected increase in LNG imports in the US market does not look likely to materialise due to the rapid increase of unconventional gas production. The combination of new LNG and unconventional supplies and the reduction in demand caused the seller’s market of the last few years to quickly turn into a buyer’s market [IEA 2009c].

Due to the oligopolistic situation of the supply of gas for exports, only a few pipeline and LNG gas suppliers can influence the various regional gas markets. In terms of gas reserves, in addition to Russia, also Iran and Qatar can influence the market over a long period of time, while the potential to influence the market in medium term also rests with substantial suppliers, such as Norway, Algeria, Nigeria and Australia. Russia has to get used to a situation where more varied supplies can reach its traditional export market. Both LNG and alternative pipeline supplies are vying for market share on the European market.

It is in this environment of market change that we have to view Gazprom’s strategy, which is shifting its export focus from a regional to a more global scope [Stern 2009; Gazprom 2009]. For Gazprom, the issue at stake is crafting an investment strategy that maximises

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6 The non-OECD gas producing countries are also large consumers of gas (for example, the CIS, Middle Eastern and North African countries) [IEA 2009a]. This study focuses primarily on the export strategies towards gas-importing countries. Combined with the fact that these countries are more or less self-sufficient, these off-take markets will not be taken into account in an in-depth analysis.

7 The term ‘interregional’ is used to refer to the idea that, while gas is still largely traded on a regional basis, the increasing amounts of LNG made available over the last decade flow between these regional markets. In the meantime, while LNG (and pipeline) trade increasingly takes place between regions, i.e., is more interregional, the gas market is in that regard far from entirely global, especially when compared with the world oil market. Hence, the term interregional is preferable over global.
the value of its resources available for exports. Therefore, Gazprom must make a series of complex interrelated strategic investment decisions in its gas value chain to both gain access to new markets and secure old ones. Combined with the fact that Gazprom’s production has been declining recently, it must develop new gas production areas and/or increase its imports from the former Soviet republics in the Caspian region. Yet, both the development of new production areas and the Caspian imports are becoming more expensive than in the past. Nonetheless, the company has repeatedly announced investment programmes for new gas production areas (e.g., Yamal Peninsula, the Barents Sea, and Eastern Siberia).

In order to deliver additional gas volumes to expanding markets, suppliers must build also new capacities in gas transport to connect these supplies with the market. In this respect, Gazprom has announced and started to realise several gas infrastructure projects (e.g., Nord and South Stream, LNG and Asian pipeline projects). This position points to a proactive stance on Gazprom’s part when it comes to playing a more global role by reinforcing export plans [CIEP 2008; Gazprom 2009]. It is nevertheless expected that the European market will remain Gazprom’s main gas export market in the foreseeable future.

The capacities, or infrastructures, set the stage and creates the strategic context, in which the firm can preserve its continuity and thrive [Smit 2003]. In the gas market, infrastructures such as pipelines and LNG trains act as options for vertically integrated firms in gaining, maintaining or expanding access to new markets or consolidate positions in existing ones. In natural gas transport, primarily in large-diameter pipelines, economies of scale and unit costs play a critical role. Lower absolute unit costs with greater gas transport capacity can enable a gas supplier to capture additional market share relative to potential rival suppliers. Thus relative cost advantages can endow certain gas infrastructures with a certain strategic value. This value is realised when greater economies of scale in capacity lock out or limit the presence of possible competitors in the market (entry deterrence value) [Tirole 1988]. Additional value can be reaped from changing the structure of the market altogether as a result of a strategic investment that captures additional market share. Moreover, (geo)political drivers can also trigger investments to enhance the importance of the state.

Of course, market demand is not a static factor; it may rise, remain stagnant or fall and should be taken into account, alongside the potential sources of competition as a factor of uncertainty. In the case of a high downside demand risk, economies of scale in gas trans-
port can be seen as a strategic disadvantage if price competition will increase sharply and reduce income. Alternatively, a part of capacity will not be used as a result of reducing gas sales, which increases the transport unit cost. The possible downside demand risk could encourage a less pro-active strategy, despite the deterrence effect of such a strategic investment [Smit and Trigeorgis 2004]. After all, strategic investments are cumbersome and ultimately may prove to be unprofitable in the case of oversupply when other suppliers engage in strategic investments. To illustrate this fact, many large-scale LNG projects (such as those in Qatar and Nigeria) have come and will come onstream in 2009-10, much of them falling into the category of flexible LNG – gas not committed to any markets for the long term. This flexible LNG is competing with, for example, Russian supplies in Europe and unconventional gas in the US. However, US demand for gas imports has dropped as a result of the development of unconventional gas and the overall reduction in demand owing to the economic crisis. These developments have led to a situation of oversupply, at least for some years, and have affected prices negatively. Traditionally, the business model based on long-term contracts between producers and buyers in Asia and Europe mitigates volume risks in the market, and therefore ensures a first-mover advantage because of economies of scale. The new business model of flexible supplies has challenged this traditional business model.10

The current decline in economic activity, combined with falling gas prices and the relative scarcity of finance, technology and human capital, are likely to affect Gazprom’s investment decisions [CIEP 2008]. Moreover, the recent gas disputes between Russia and Ukraine (2005/06 and 2008/09), which in 2009 resulted in serious gas supply shortfalls in mainly Southeastern Europe, have politicised Russia’s position in the European market and investments. This (geo)political ‘sensitisation’ has led to a drive on the part of mostly US orientated countries, mainly Central European ones, to promote limitation and/or containment of their own (and European) dependencies on Russian gas. Therefore, these trans-Atlantic orientated countries politically support flows that might encourage diversification away from Russian gas, such as the Nabucco pipeline from the Caspian region (and the Middle East) to Europe. Conversely, continental countries (such as Germany and Italy) encourage further integration of Gazprom’s investments. This is driven by a perceived need at the national and business level of gaining greater upstream access to Russia’s gas sector in an effort to secure gas supplies in the long term. Moreover, the diversification of pipeline routes and the rerouting of existing flows could increase Russia’s security of demand (and European security of supply), and may therefore encourage new infrastructure investments to maintain access to this important export market [Grigoriev and Belova 2009].

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10 Yet, few flexible spot LNG has reached the European market, because buyers have difficulty absorbing their ‘take’ gas. Once the threshold can be breached it is possible that the ‘take’ gas will stabilise and additional supplies come from flexible spot LNG [De Jong et al. 2010].
Given the wide ranging gas market changes in both the domestic and Russia’s export markets, a strategic-economic analysis is required to fully understand Gazprom’s infrastructure investment decisions. This approach allows us to integrate the impact of potential competitors’ entry and market uncertainties. Gazprom’s assertive investment strategy (in the midstream) so far could be explained by incorporating strategic aspects, besides purely (short-term) commercial ones, like economies of scale and early mover’s advantages in capturing additional market share vis-à-vis its competition (i.e., deter competition). However, different (policy) hurdles threaten the strategic value and relevance of such investments and therefore also their institutionalisation. This in turn underlines the importance of a wait-and-see strategy, i.e., delaying investment decisions.

Because of the complexity of the interregional gas market and the fact that gas has yet to experience a further evolution in its product lifecycle, we focus here primarily on competition, where suppliers are assumed to compete with gas volumes rather than with gas prices. It is acknowledged, however, that issues of pricing and trade patterns also have a fundamental impact on the development of the interregional gas market; this will be discussed in a qualitative way. The notion that firms compete on the basis of volumes (i.e., capacities) before way is given to price competition concurs with a widely held view in industrial organisation [Tirole 1988; Jacquemain 1987].

While much has been written about the role of Russian gas in the Europe market and pipelines which supply this market, little is said about the strategic-economic value for Gazprom (and for Russia) of infrastructural investments in maintaining and expanding its export position. In this analysis, we have developed a stylised approach to assessing such value through a so-called real-option game model, which assumes value maximisation as a rational criterion. This approach offers intuitive insights about the value of Gazprom’s investments under conditions of both uncertainties of future gas demand and the strategic interaction with rival gas exporters. In addition, we apply strategic valuation techniques in real-world cases. Nevertheless, the stylised model has its limitations, despite its explanatory merits. For instance, it is limited to duopoly situations, i.e., limitation to two suppliers, whereas the gas industry is usually characterised by more than two (interregional) suppliers. Also, the model does not take the issue of pricing into account, even though pricing is an important driver in the present-day development in the interregional gas industry. Therefore, a complementary quantitative assessment, based on a conceptual toolbox, is used to include aspects, which are not covered by the model. This toolbox includes other elements into the process of decision-making as well as business models to institutionalise gas infrastructure investments.

1.2 Research objective and research questions
The politico-strategic implications of Russia’s investment strategies and decisions are bound to have a long-lasting impact on Europe’s energy balance in general, and its gas balance in particular; with all its geo-economic and ultimately also geopolitical conse-
quences. A multi-disciplinary investigation into Gazprom’s investment strategy can help shed some light on the economic and political logic of these investment strategies and is a topic that merits further research and academic inquiry. Given the above, this study presents a concerted effort to pursue the following research objective:

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<td>To identify, evaluate and extrapolate Gazprom’s investment strategy regarding Russia’s gas exports and export market behaviour, with a focus on European infrastructure projects, in a geopolitical context.</td>
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In order to pursue this objective, the following research questions are specified to disentangle the complexity of the gas export strategy and the accompanying investments in infrastructure:

1) What are the different institutional and theoretical aspects and relevant valuation tools in relation to the gas infrastructure investments in light of business strategies and markets?
2) What is the historical-institutional background with respect to Russia’s, and Gazprom’s, investment strategy regarding its export markets?
3) What is Russia’s, and Gazprom’s, position in the rapidly evolving interregional gas market that pertains to Europe?
4) How can we identify, evaluate and extrapolate Gazprom’s investment strategy regarding Russia’s gas exports and export market behaviour, based on empirical analysis of a number of case studies?

Answers to these questions may provide us with further insights into both the commercial and the economic-strategic value of (proposed) investments in gas-infrastructure projects. The study is organised into three parts, aiming in this manner to answer the different research questions (see Figure 1.1 for a chapter outline).

In order to evaluate Russia’s, and Gazprom’s, gas export strategy and the geo-economic and geopolitical developments on project-level, it is necessary to integrate macro-level aspects into project-level evaluations. These macro-level aspects require us to look at regional project-level evaluations, because of the regional and rigid character of the gas market. A major part of this research has been conducted in cooperation with a fellow PhD researcher, Mr. Timothy A. Boon von Ochssée. His work, see Boon von Ochssée [2010], deals with the market structure-level, with Russia as a focal point, aiming at discovering the boundary solutions for cooperation between gas-exporting countries. Herein Gazprom’s gas export infrastructure investments play a key role. Therefore, cooperation has been extensive on the empirical front as well as on the theoretical one. This cooperation has resulted in chapters 3, 8, 9, 10 and 12, being similar with respect to major elements of the corresponding parts of Boon von Ochssée’s study. Chapters 4 and 11 are virtually
identical to the corresponding chapters in his study. The remaining chapters have been written independently, although the reader may unavoidably find common lines of reasoning on various issues.

**Figure 1.1 Chapter outline**

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**1.3 Overview of the study**

The theoretical underpinnings of gas industry investments are outlined in Part I of this study and it aims to discuss the first research question. Chapter 2 provides a comprehensive overview of different actors’ roles and the risks involved in the various parts of the gas value chain. It is also an examination of the different risk mitigation approaches, such as vertical integration, and traditional and newly evolving business models in gas infrastructure. Chapter 3 deals with the current theoretical approaches towards the relationship between states, firms and markets, and business strategies and investments. The bedrock for the theoretical underpinning of this chapter consists of a various insights of international relations theory, industrial organisation, strategic planning (including strategic management and game theory), and corporate finance (including the discounted cash flow approach and the real-options approach). The ultimate aim is to pave the way for the real-option game model of Smit and Trigeorgis [2004] to address strategic investment behaviour. While demand uncertainty is a factor, rival investment moves also play a role. The stylised model modifies traditional valuation methods by adding strategic as well as flexibility value components to a static project value. Chapter 4 is an explanation of this real-option game model, by which the sequence of gas value chain projects with respect to
Gazprom’s export markets should be assessed, both in a quantitative and qualitative framework. This is preceded by a conceptual framework, which is used to include aspects, which are not covered by the model, such as Barnes et al. [2006] have done. The conceptual framework (toolbox) and the real-option game model concentrates on infrastructure projects, in a sense that they may create an advantageous strategic position by expanding their economies of scale in the value chain or in the infrastructure project itself, especially in the case of long-distance transport. These strategic investments feed back into the process of strategy-making vis-à-vis Gazprom, and therefore Russia’s, relative position in dynamic gas markets. In the end, these could also influence Russia’s relative power in the international political system, shaped by its resources, capabilities, and geographical disposition.

Part II is an overview of the historic-institutional development of Russia’s export strategy. Chapter 5 is a historic account of how the politico-economic rationale arose for starting Soviet gas exports, in addition to oil exports. Moreover, a discussion of the institutionalisation of the Soviet Union’s gas production and export programme is included. The consequences of the institutional transition on the Eurasian continent for Russia’s export strategy during the 1990s, a transition which began with the fall of the Berlin Wall in 1989 and the break-up of the Soviet Union more than a year later, will be discussed and explored in chapters 6 and 7. Chapter 6 is an account of the changing institutionalisation of Russia’s gas industry and Gazprom’s changing upstream and transit position and the corresponding export strategy with respect to the former Soviet states during the 1990s. Chapter 7 is an assessment of Russia’s gas export strategy to Europe during the 1990s, against the background of major political and economic transformations taking place in that period in Europe. The aim of this part is to discuss the second research question. Russia’s strategic path-dependency not only determines which investment alternatives are open to Gazprom today, but can also constrain the firm’s future choices to create a competitive advantage.

Part III assesses the current and future possible (midstream) investment strategy of Gazprom for Russia’s growing export markets in a rapidly evolving interregional gas market. In light of the current geo-economic and geopolitical dimensions of gas flows, Chapter 8 is an overview of interregional gas flows and gas pricing patterns in interregional trade. Chapter 9 addresses the gas export strategies of Russia’s main competitors, with a special focus on the former-Soviet republics in the Caspian region. Next, attention is paid to the gas-exporting countries’ market power in the European and Atlantic market and developments in the field of cooperation amongst gas-exporting countries. Chapter 10 is an exposé of Russia’s gas export strategy and its internal and external incentives as well as re-

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1 Economies of scale can be found either in the mid-stream (e.g., large diameter pipelines) or along the entire chain (e.g., large fields). Taking into account that the associated costs of midstream infrastructures are capital intensive and sunk when the investment is made.
strictons in shaping an appropriate investment strategy for Gazprom. Together, these largely descriptive chapters aiming to discuss the third research question of this study.

Chapter 11 applies the stylised real-option game model in a duopoly setting, combined with the conceptual framework for analysis, to a number of cases and aims to approach the last research question. Since the international gas market is in fact still very (sub)regional, it is useful to break down the problem into three separate case studies. This is done by looking at Gazprom’s plausible investment strategy, first through a country-level lens, then through a sub-regional level lens. The chapter is opened with a historical case, in order to provide an ex-post evaluation of a strategic investment. It focuses on growth markets, in which a proactive Gazprom investment policy is deemed desirable, given the level of competition, and market, transit and other (politico-economic) uncertainties. Account is taken of the institutionalisation strategy at the disposal of the Euro-Atlantic community to challenge Gazprom’s investment strategy. European sub-regional markets will be given specific attention in the other two cases. In Chapter 12, the various market outcomes and scenarios are analysed at a regional European level and Russia’s possible sequences of investment-scenarios over time (i.e., the so-called merit order) will be discussed in a qualitative way. In addition, the Chapter 12 addresses the rationale for overcapacity in Russia’s export pipeline system. The best export strategy-outcome for Russia and Gazprom is subject to different investment parameters, including organisational and financial constraints and consequences of various market outcomes.

Chapter 13 summarises the main findings and tries to evaluate the research objective of the study. Additionally, it provides a discussion and recommendations and suggests further research.

1.4 Research methodology
The methodology applied in this study consists of a two-fold, multi-disciplinary approach. First, a descriptive method is used to bring together all the required facts, figures and other necessary information through reviews of literature and statistical information. The descriptive method is largely applied in Part II and in chapter 8-10 of Part III. Secondly, a quantitative model is employed to analyse strategic interaction and to value investments in a real-option game setting, combined with a conceptual framework. In Part I, Chapter 3/4, the real-option game model is embedded in multi-disciplinary approaches of government-controlled business (investment) strategies in dynamic gas markets. Such two-fold, multi-disciplinary framework is necessary to integrate international relations and (political) economy in order to explain the real-world complex issues in the gas market and the interplay between governments and markets. Through three case studies, Chapter 11 in Part III applies the real-option game model, embedded in a conceptual framework. Parts of the conceptual framework will be applied in Chapter 12 as well.
The previous explanation implies that the empirical research has two main orientations. An important part is of a descriptive institutional nature. The part that concerns the evaluation of infrastructural investments is based on case-study analyses and is of an explorative nature. The multi-disciplinary nature of the research is highlighted by a combination of the use of different disciplines, notably a market-economic, a financial-economic and a politically-oriented one.

A large part of this study has been written in the context of a seller’s market for oil and natural gas. This period lasted from the mid-2000s to the autumn of 2008, while from the subsequent year onwards a buyer’s market has resulted. Account is taken of buyer’s market conditions throughout the study, even though the reader may encounter streams of thought pertaining to the prevalence of a seller’s market.

This research reports on a study of the institutional and strategic choices Russia, and Gazprom, can possibly make regarding their position in the relevant export markets. In particular, we will concentrate on Gazprom’s possible capacity expansions in the light of Russia’s desirable gas export strategy, given its socio-economic constraints. These capacity expansions could be seen for Gazprom, and Russia, as a way to ensure their position in the changing interregional gas market. Among other issues, our analysis reveals that strategic capacity expansion projects typically include the option to postpone (wait and see). Therefore, a crucial element of strategic infrastructural planning in gas markets involves the timing of strategic investments, i.e., committing now vis-à-vis postponing to a later period. This timing aspect gains even more importance when uncertainty of future demand is considered simultaneously with competitive behaviour of (potential) rival suppliers in the market.