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Regulatory intervention on the dynamic European gas market—neoclassical economics or transaction cost economics? ☆

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ABSTRACT

Shifts at the international gas market indicate that the transaction cost perspective provides better underpinnings for European gas regulation than the current neoclassical perspective. Three implications are that policymakers should: (1) allow alternative coordination measures to complement market exchange; (2) recognize that less than perfect competition outcomes may be optimal and (3) be more reticent in prescribing interventionist measures. Finally, the analysis provides the foundations for the empirical research required to complement this paper's theoretical approach.

1. Introduction

The European gas market is in a state of flux. Structural and regulatory reform measures are introduced to facilitate competition in gas markets traditionally managed by governments and incumbent operators (cf. Stern, 1998). Competition is introduced to better secure the public service obligations—supply security, competitiveness and sustainability. This liberalization approach is not working as hoped and anticipated, as indicated by several benchmarking reports published by the European Commission (cf. EC, 2004, 2005) and DG Competition's Energy Sector Inquiry (EC, 2007b). The benchmark reports signal a disappointing progress of competition, predominantly due to insufficient implementation of the Gas Directives as well as a lack of integration and coordination between Member States. The Sector Inquiry into the competition on gas and electricity markets corroborates the benchmark results by concluding that the second Directive has been implemented incompletely. It furthermore concludes that this Directive fails to address all structural issues. These problems are still relevant today, as indicated in the 2007 progress report on the internal market (EC, 2008). These problems induce discussion regarding the appropriateness of the regulatory regime currently in place for the European gas market.

This paper examines this issue in light of the dynamic nature of the European gas market. Specifically, it examines the suitability of current gas regulation given the changes that have recently taken place at the international gas market.

This paper is structured as follows. Sections 2 and 3 describe the shifting contexts for gas regulation. Section 2 argues that current gas regulation is built on neoclassical guiding principles and points out that the market context at the time current gas regulation was developed has facilitated the neoclassical emphasis on liberalization and (perfect) competition. Section 3 argues that a number of structural market shifts have created a new context for regulation. In this new regulatory context, investments, uncertainty and risks are important elements of a proper regulatory regime. Section 3 concludes that these elements are not explicitly recognized in current regulation. Transaction cost economics (TCE) has been built around these criteria, which is why the remainder of the paper examines whether TCE provides a more appropriate theoretical perspective to underpin European gas regulation.

After concisely setting out TCE's analytical framework in Section 4, Section 5 combines the neoclassical and TCE perspectives into a comprehensive framework that determines when to use which theoretical perspective. Section 6 applies this framework to the European gas market by examining its transactional characteristics. It shows that all TCE criteria apply to European gas. Hence, TCE provides the lens through which the European gas market should be analyzed.

Accordingly, the main message of this paper is that current European gas regulation will not result in the market behavior that is required in the new context. Consequently, European gas regulation needs to move away from its neoclassical underpinnings. Section 7 provides three important lessons for policymakers in order to better align European gas regulation with the TCE perspective. Section 8 concludes and provides the

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foundations for the empirical research required to complement this paper's theoretical analysis.

2. The context for current gas regulation

Current European gas regulation builds in large part on neoclassical theoretical underpinnings, in particular, the structure–conduct–performance paradigm (Bain, 1956). According to this paradigm, the market structure, the number and relative sizes of firms in an industry, drives firm conduct like output decisions and pricing behavior. Firm conduct subsequently yields an industry's overall economic performance in terms of for instance efficiency and profitability (CIEP, 2006). For example, the neoclassical assumption regarding market structure is that firms integrate horizontally and/or vertically in response to or anticipation of market power. In other words, integration impedes competition and must therefore be prevented or removed. To this end, ownership unbundling, and resulting market entry is supposed to improve competition by changing the market structure through a complete removal of integration (EC, 2003, 2007c). Firm conduct should subsequently change too, as a result of which market performance should become more competitive and efficient.

The market context at the instigation of European gas liberalization facilitated this competition-oriented emphasis. At least the following three factors made introducing competitive forces through liberalization the new panacea. First, the US and UK experiences in the late 1970s and early 1980s, respectively, were an important impetus for European gas liberalization. In the mid-1980s, Europe's policy emphasis shifted away from governments managing gas markets towards reducing government involvement and unleashing competitive forces. The energy sectors were thought to operate more efficiently when subjected to a market reform that focused on liberalization, privatization and competition (Stern, 1998; Helm, 2007).

Second, the excess supply situation at that time in Europe (the gas bubble) made gas widely available and cheaper, which shifted the balance of power towards the buyers. Furthermore, no government involvement to guarantee supply security was deemed necessary. The fact that large parts of the European gas market were considered mature is a third significant factor. The main differences with an immature market are that in a mature market initial investments have long been amortized and, secondly, that the transport systems required to satisfy energy demand have been built. These settings required an alternative policy (Ellis et al., 2000; IEA, 2000): the emphasis shifted from stimulating investments in new assets towards more efficiently deploying (i.e. sweating) existing assets.

In conjunction, these factors, among others, made introducing competitive forces through liberalization the new panacea. The European Commission's drive to liberalize European gas markets reflects this view. Liberalization was supposed to transform the rigid Continental gas markets managed by incumbents and governments into a single European internal gas market governed by competition.

Anticipated benefits of liberalization were that asset sweating would increase consumer surplus by driving down network costs. In the buyer's market that had developed, such a view was quite understandable and liberalizing in order to reach as closely as possible the perfect competition outcome of prices at marginal operating costs would indeed improve welfare. Furthermore, in a competitive environment, public monopolies would increasingly lose their grip on national markets. Competitive forces would also induce operators to only undertake efficient investments. In consequence, government-initiated investments would be unnecessary except for network operations. Finally, after seeing the benefits that liberalization entails to Europe, gas producers were expected to welcome European foreign direct investment and technological knowledge into their energy sectors in order to develop their reserves, guaranteeing access to reserves and securing future supplies.

In order to liberalize the European gas markets, two EU Gas Directives have been introduced; a third legislative package has been proposed in September 2007 (EC, 1998, 2003, 2007c). Each piece of legislation builds on the above neoclassical underpinnings.[1]

3. A new context for gas regulation

International gas markets are dynamic, for one because the market characteristics may change in time. This section explores some important shifts at the international gas market, and argues that these create a new context for gas regulation. Four main market shifts are highlighted (cf. Helm, 2007):

- a shift in international relations between producers and consumers—the emergence of a seller's market rather than a buyer's market;
- an increasing influence of politics on energy relations;
- a shift in energy policy objectives with security of supply having become the top priority, while climate change has climbed up the ladder too;
- an increasing need for investments along the entire value chain. Total EU-27 investment requirements amount to roughly 1800 billion Euro of which around 12%–216 billion Euro—is required for gas (EC, 2007a).

The first two shifts comprise issues like Europe's increasing import dependence, the growing assertiveness of gas producers and the need for more long-distance gas supplies by pipelines and LNG trains. LNG trade will expand, but pipelines remain the industry's mainstay (Van der Linde, 2007). Gas transit will increase as long as planned and proposed transit-avoiding pipelines like Northstream and Southstream are not in actual operation. In the pre-liberalization structure, investment risks were transferred to consumers, usually through public monopolies. Consequently, investments to guarantee supply security were no problem. However, due to the market shifts, the issue now has become to facilitate new investments rather than sweat them. Furthermore, this has to be done in a gas market dominated by sellers, where political considerations are becoming more important and where supply security and sustainability have become the top priorities for energy policy (cf. De Jong and Van der Linde, 2008). This changes the context for regulation into one of which investments, and relatedly, risks and uncertainties are the pillars. The two sections below elaborate on the consequences of the market shifts.

3.1. Investment characteristics

Investments in gas markets are required along the entire value chain, i.e. in exploration and production, transmission, distribution and ancillary services. Investments in exploration, production and transmission are predominantly irreversible (sunk). Examples

[1] The extent to which these legislative measures reflect the neoclassical view appears to be diminishing. In fact, the second gas Directive, as well as the proposed third one, has made serious amendments to the neoclassical underpinnings. We get back to these in the concluding section.

are costs for project identification, investment planning and construction (Hubert, 2007). These costs imply that the economic viability of a project is not guaranteed beforehand. In addition, transmission and distribution are considered natural monopolies due to their economies of scale and scope. Other segments exhibit scale and scope economies too. In descending order, we have gas storage and blending (i.e. quality conversion); exploration and production; and gas trading.

The irreversibility, or asset specificity, creates risks. For instance, once laid, a gas pipeline has very limited, if any, alternative use. This creates a quasi-rent which is the difference between an investment's pay-off in its current use and its highest alternative use. Furthermore, the decision to build a pipeline is usually based on negotiations between a specific consumer and a specific producer. This locks both parties into a bilateral dependency which changes through time and which affects the appropriation of the quasi-rent. Prior to the investment, the producer/investor has a relatively strong bargaining position, as the consumer or regulator depends on him for undertaking the investment.[2] Ex-post, however, the limited alternative use of his sunk investment ties the investor to the market for the foreseeable future, shifting the bargaining power to the regulator. This provides the regulator with incentives to adapt his policy to increase his own or society's rents at the expense of the investor's through arrogating the quasi-rent.[3] This can be achieved by renegotiation or expropriation. The former entails a regulator using information he has obtained during the regulatory process to increase welfare in the subsequent period(s) at the expense of the investor. Expropriation means that a regulator creams-off investor profits via for instance determining low prices or by cheaply or freely permitting entry to the infrastructure. Both may obstruct or hold-up investments. The key element in this regard is regulatory risk.

In the old context these considerations were relatively unimportant: stimulating investments was not necessary because of the market's maturity, while an oversupply of gas rendered dependency issues a minor issue. The market shifts alter the picture. Many new investments are required in new pipelines, LNG terminals and storage facilities, all of which are irreversible. Consequently, regulatory risks will increase due to the market shifts, making regulatory credibility a vital component for future energy regulation. LNG may reduce asset specificity, especially locational specificity, because LNG creates a possibility to diversify between suppliers. Also, an LNG regasification terminal does not need to be constructed for a specific producer/consumer which makes the investment less dedicated. However, as indicated, pipelines will remain the mainstay of the gas business. The increasing import dependence calls for new pipelines from the producers to Europe, which increases asset specificity. Furthermore, scale economies imply that a producer wants to utilize his pipeline as fully as possible. Consequently, new pipelines will allow for low levels of flexible off-take, necessitating additional investments in European storage facilities to satisfy the capricious gas demand.

3.2. Uncertainty

Uncertainty is another vital parameter in the new regulatory context. Investment under uncertainty is what Dixit and Pindyck (1994) are concerned with in their real options theory. Under uncertainty, delaying an investment in order to wait for more certainty to arrive may be beneficial. Uncertainty impacts investment through the option value: higher uncertainty increases the option value and therewith the hurdle rate (i.e. the price against which an investor is willing to immediately invest).[4] In a survey of the empirical literature on investment under uncertainty, Carruth et al. (2000) conclude that despite some fundamental difficulties in empirically testing the effects, uncertainty generally lowers investment, both in the short- and long-run.

One particularly important form of uncertainty is regulatory or political uncertainty (Altug et al., 2000; Buckland and Fraser, 2001). One example is the urge of some governments, prompted by record high oil and gas prices, to tax energy company profits in order to redistribute some of these profits back to consumers. This increases regulatory risk, which energy companies will incorporate into their calculations. Ultimately, these higher risk levels will feed through into higher consumer prices, at least partly contradicting the goal of changing the rent distribution.

Uncertainty hampers investments. The market shifts create additional uncertainties of which we provide three examples. First, increasing external dependence creates price risks through the uncertainty concerning producer collusion. This is possible due to the leading role of many producer governments in gas production, but also because few Member States are self-sufficient or net-exporters while most are heavily import dependent. Hence, whether justified or not, increasing import dependence creates fears of opportunistic producer behavior. Second, gas transit increases uncertainty by adding a third party to the equation. If transit countries cannot commit to agreements, the resulting potential for disputes creates an additional risk to Europe's gas supplies. Examples are (1) the postponement of the start of Algerian supply because of internal political and safety problems as well as difficult relationships with Tunisia and Morocco (Stern, 2002); (2) the reduction in Russian gas supplies via Byelorussia (to Poland and Germany) after a conflict between the Byelorussian government and Russian Gazprom in 2004 (Bruce, 2005); and (3) the gas disputes between Russia and Ukraine in early 2006 (Stern, 2006) and 2009 (Pirani et al., 2009). Increased gas transit increases the risk of a transit-induced supply interruption. This uncertainty in turn hampers investments. Third, climate change increases uncertainty because its future developments are unclear. Unresolved issues are (1) what the second commitment period of the Kyoto Protocol will look like; (2) if there will still be the political will and commitment to reduce emissions when the low-cost, easy to achieve options are exhausted and (3) the prospects of nuclear and sustainable energy.

In sum, the market shifts have created a new context for gas regulation in which irreversible investments, risks and uncertainties are the relevant criteria. The interplay of regulation with investments, irreversibility, risks and uncertainty determines whether a regulatory regime will create a governance structure that sufficiently facilitates investments. These criteria are not properly incorporated in existing regulation due to its emphasis on neoclassical economics which does not explicitly consider such issues. Because these criteria are the basis of transaction cost economics, the indicated market shifts imply that the transaction cost perspective may provide a more appropriate theoretical basis for European gas regulation. The remainder of this paper examines whether this suspicion is correct.

[2] We refer to investor and regulator throughout this paper.

[3] Society's rents increase because most regulatory models specify a social welfare function that attaches a higher weight to consumer benefits than to producer benefits. See Baron and Myerson (1982), Laffont and Tirole (1986).

[4] Spanjer (2008a) more elaborately discusses the real options view and its implications for regulation.

4. Transaction cost economics

This section provides a concise overview of the basics of transaction cost economics. The ease of contracting is an important difference between neoclassical economics and TCE. Neoclassical economics, with its perfect competition postulate, assumes that contracts are complete, i.e. that every possible contingency can be foreseen, specified and agreed upon in a contract. However, this does not imply the absence of uncertainty. In the neoclassical world, the future is not known but the probability distributions of all possible future events are (Klein, 1999). In Knight's (1921) terminology, neoclassical economics assumes the presence of risks rather than uncertainties, which allows perfect contracts to be devised.

TCE allows for the presence of uncertainties. Uncertainties limit the available contracting options because nobody knows exactly what will happen in the future. This translates into contractual incompleteness, because a contract cannot take account of ex-post changes that cannot be foreseen ex-ante. Even if we assume the possibility of contractual completeness, writing, monitoring, verifying and enforcing a complete contract will likely be prohibitively expensive. For a very simple transaction like buying an off-the-shelf component, uncertainty is relatively unimportant and spot market transactions are a good solution. However, for the more complicated, specialized transactions common to gas markets, more sophisticated modes of governance are required. According to Williamson (1975), in addition to uncertainty and the complexity of transactions, another important cause for contractual incompleteness is bounded rationality. That is, an agent intends to behave rational but will do so only to a limited degree, for instance because human beings are limited in knowledge, foresight, skill and time (Simon, 1957). In conjunction, the inherent presence of uncertainty, the complexity of transactions and bounded rational individuals render most contracts unavoidably incomplete.

Contractual incompleteness invites opportunism, also known as moral hazard, which is defined by Williamson (1996) as "self-interest seeking with guile". The gaps present in any contract can be used strategically by an agent to achieve his own personal goals which do not necessarily coincide with those of society—think of sub-goal pursuit, shirking, etcetera.

Asset specificity is a third important cornerstone of TCE. It takes one of several forms. These include (1) site or location specificity; (2) physical asset specificity; (3) human-capital specificity; (4) dedicated assets; (5) brand name capital and (6) temporal specificity (Williamson, 1996; Creti and Villeneuve, 2003). For European gas, common forms are locational and physical asset specificity and especially dedicated assets. Locational specificity relates to the spread of gas reserves, physical specificity to the network-bound character of gas and dedicated assets refer to investments in assets that are specific to a particular customer or relationship. Dedicated assets are arguably the most important in gas, as indicated in Sections 3.1. Dedicated assets sink investments into a market and create a bilateral relationship between the parties involved. As indicated, the incentive to bargain about the rents emanating from the sunk investment has negative effects on ex-ante investment and ex-post efficiency, and increases transaction costs. In fact, transaction costs are determined to a large extent by the degree of asset specificity (Williamson, 1985).

The interplay of contractual incompleteness, opportunism and asset specificity creates ex-post contractual hazards which require costly safeguards. Consequently, the costs of handling a particular transaction consist of the direct contracting costs of writing, monitoring, verifying and enforcing contracts, but also the costs of ex-post contractual hazards. These hazards render market exchange costly too, opening the door for a comparative analysis of alternative governance forms concerning their respective advantages in terms of transaction costs.

The ex-post contractual hazards warrant further attention. According to Klein (1999), the investment hold-up problem is the best-known example of an ex-post contractual hazard. Section 3 has discussed this problem and defined it as the negative impact on investments of limited regulatory credibility. Ex-post hazards regarding a sunk investment arise if circumstances change. Without any safeguards, the opportunism of the trading partners may change their ex-post behavior in order to capture the quasi-rent associated with the specific investment. This lowers the investor's ex-post profits which changes his ex-ante behavior. As long as the trading partner fails to credibly promise ex-ante not to behave opportunistically ex-post, the investor might in the extreme case choose not to invest at all. Accordingly, a governance structure capable of eliminating this investment hold-up problem given the particulars of the relationship must be created. The essence in this regard is to install safeguards that improve the ex-post credibility of the trading relationship. Examples of such safeguards are long-term contracts and vertical integration.

5. An encompassing framework

Section 3 indicated that regulation needs to focus on the interplay of investments with irreversibility, risks and uncertainty in order to be adequate in its new context. Because these criteria are explicitly captured in TCE, it is worth exploring whether this theoretical perspective provides a better theoretical basis for European gas regulation than the neoclassical perspective. Sections 2 and 3 have argued that current regulation, with its neoclassical guiding principles, does not adequately incorporate all these criteria—especially risks and uncertainty. Accordingly, the main message of this paper is that current European gas regulation will not result in the market behavior that is required in the new context. Note, however, that this paper does not refute the neoclassical perspective, but rather argues that its applicability is limited.

The applicability of each perspective is determined by the transactional characteristics of the market in question. This Section develops a theoretical framework that specifies when to use which theory. Its main criteria are contractual incompleteness, opportunism and asset specificity. Their interplay determines how a transaction should be governed in practice (Newbery, 1999), which in turn allows us to determine when the TCE perspective should be preferred over the neoclassical perspective.

If contracts are incomplete and players behave opportunistically but assets are not specific, investments can easily be redeployed in case of opportunistic regulatory behavior. Consequently, the market is contestable and market exchange the proper solution. The neoclassical perspective is appropriate in this setting. If assets are specific and opportunism is present without incomplete contracts, ex-post hazards will arise. However, these hazards are easily removed because all contingencies can be foreseen and specified in a complete contract. In this situation, there are risks but no uncertainties, rendering the neoclassical perspective appropriate. Without opportunism, finally, promises are always kept and simple, incomplete, contracts suffice to govern transactions without the need for monitoring, verification or enforcement expenses. All three solutions are straightforward and unproblematic because either market exchange solves the problem or ex-ante contracting is sufficient. The neoclassical perspective suffices in all three situations and no institution is required (Williamson, 1996). Only if all three characteristics are

present simultaneously, will ex-post contractual hazards arise which require costly safeguards. In this setting, institutions play a determining role, as indicated above. In conclusion, European gas regulation should be embedded in the TCE perspective only if the following three questions are answered affirmatively:

1. Are assets specific?
2. Are contracts incomplete?
3. Is there a risk of regulatory opportunism?

6. Application to the European gas market

This Section considers the transactional characteristics of the European gas market to determine whether it exhibits the TCE criteria in actual practice, or in other words, to what extent ex-post contractual hazards can be expected on European gas markets.

Question 1 has been answered affirmatively in Section 3.1. There it was shown that asset specificity is present by indicating the sunk and specific nature of the required gas market investments. Section 3.2 pointed towards the increasing uncertainty on the European gas market. In conjunction with the realistic assumption of bounded rationality, we have contractual incompleteness on the European gas market, which affirmatively answers question 2. Question 3 needs further elaboration. The risk of regulatory opportunism is determined by regulatory credibility or commitment (see Section 3.2). To examine under what circumstances regulatory policy can be considered credible, the next section therefore provides a non-exhaustive overview of the criteria emanating from the regulation literature that determine regulatory commitment.[5]

6.1. Criteria for regulatory commitment

Newbery (1999) provides an infinite horizon model that illustrates under which circumstances regulation may be credible without additional institutional arrangements. A two-player dynamic regulation game between a regulator and a regulatee is defined. The following sequence of actions is undertaken. First, a government or the community at large sets the rules of the game. Based on these regulatory rules and the utility's predictions of the level of revenue that the regulator will allow over the lifetime of an investment as well as his predictions of future demand, the utility chooses the level of capacity it will install. Uncertainty is introduced by not being sure in advance whether future demand will be high or low. High demand is 1 with known probability $1-P$; low demand is $1-\sigma$ with known probability P. After the utility's investment, both players observe the actual level of demand, after which the regulator determines the allowed revenue to the utility. At this point, renegotiation or expropriation may occur. The utility subsequently determines his price and output and pay-offs are generated. Playing this game provides the following solution for (rate of return) regulation to be credible (see Newbery, 1999 for the derivation):

$$(1-\sigma P)(c-b) > r[1+(1-\theta)i],$$

where $(1-\sigma P)$ is the next period's expected output; $(c-b)$ the extra variable cost of not having the utility's investment; r the fixed or capital cost of investing in capacity; $\theta<1$ the weight placed on investor profits; and i the rate of return used by the regulator to discount future benefits. This model allows the regulator and regulatee to establish a cooperative equilibrium in which the investment is undertaken and the regulator allows a price that recovers the sunk investment. In this equilibrium, a lack of regulatory commitment is no problem and no contractual hazard arises.

Levine et al. (2005) argue that such a cooperative equilibrium without ex-post hazards depends in large measure on the presence of complete information. They introduce incomplete information by assuming uncertainty concerning the type of regulator. In their model, a strong regulator likes to commit to a regulatory contract and perceives high costs of reneging. A weak regulator, on the other hand, optimizes opportunistically on a period-by-period basis. In consequence, Newbery's cooperative equilibrium is one of a range of possible equilibria, among which the no-investment/no-cooperation outcome. Another contrast with the Newbery model is that Levine et al. explicitly recognize both increasing consumer demand and the capital depreciation rate.

From these models, we derive six main criteria that determine the level of regulatory commitment. Regulatory commitment is determined by considering the costs of reneging on a regulatory contract. That is, the more expensive it is to break the regulatory contract, the more likely the contract will be upholded, and consequently, the higher will be regulatory commitment and credibility.

6.1.1. Gas demand and technological development

The expression $(1-\sigma P)$ indicates the expected output in the next period.[6] The implication is that rising expected output in the next period improves regulatory credibility. The larger the utility's output foregone by behaving opportunistically, the less likely a regulator is to renege. Levine et al. (2005) explicitly consider growing demand: rapid demand growth increases the benefits in subsequent periods, which makes reneging less likely. Technological development has a similar effect in that it also increases future pay-offs from compliance with the regulatory contract.

6.1.2. Private/public ownership

The expression $(c-b)$ indicates the costs of making a transition to alternative supply which is necessary if the utility decides not to invest.[7] Increasing costs of alternative supply eases compliance with the regulatory contract because reneging becomes more expensive. Therefore, a large comparative advantage of private over alternative (possibly public) supply makes regulation more credible. This adds ownership of a regulated firm as a variable. Schmidt (2000) shows that the incentives for regulatory opportunism in case of sunk investments can be mitigated via a privatization policy that distributes a large part of the shares to the general population (in contrast to insider privatization where shares are allocated to the workers of the company). According to Vickers (1993) and Biais and Perotti (2002), this widespread distribution can be achieved by allocating shares cheaply or freely, by restricting the number of shares an individual can own or by discouraging people to sell their shares for cash. The intuition is straightforward. Breaking the regulatory contract harms a large part of the population, which increases its political costs. Two additional issues warrant attention. First, the scope for lowering

[5] This section builds on and extends Spanjer (2006).

[6] The model assumes low demand at $1-\sigma$ with a probability of P, and high demand at 1 with a probability of $1-P$. Consequently, expected demand is $1-\sigma P$, which equals expected output.

[7] B stands for the utility's variable costs per unit. C indicates the variable costs of alternative supply when the utility chooses not to invest because of a lack of regulatory commitment. Hence, $c-b$ indicates the additional variable cost of not having the utility's investment.

the allowed number of shares an individual can possess is limited, because investors need to receive a sufficient number of shares to exert some control. The more shares that are transferred from investors to the public, the fewer incentives the investors have to invest in the first place. Second, giving away shares for free or at a discount lowers government revenues associated with the privatization. Nevertheless, the Schmidt (2000) model shows that despite these costs, "giving away a substantial part of the shares to the general population may not only reduce expropriation but also increase the restructuring efforts *and revenues* from privatization" (emphasis added).

6.1.3. Capital depreciation

The fixed or capital cost of investing in capacity, r, will at low levels increase credibility. To see how, note that r depends on the capital intensity of production and the rate of capital depreciation. The former directs us towards sunk investments which have already been discussed. Higher capital depreciation shortens the period over which capital needs to be replaced. The benefits of reneging will then be relatively short-lived, which makes it relatively expensive. Levine et al. (2005) provide an explicit treatment of capital depreciation.

6.1.4. Investor/consumer benefits

The higher the weight on investor profits – that is, the higher is θ – the less likely reneging is to occur. Along similar lines, Teulings and Bovenberg (2006) show that the potential hold-up problem in investments (in R&D) depends on the share of profits in the consumer surplus. That is, the less surplus a potential investor can extract, the lower his incentive to invest. If a regulator places relatively much emphasis on consumer rents, he will have incentives to expropriate investor rents and distribute these to consumers, as this increases welfare (see Section 3.1). This incentive becomes lower as θ increases, which lowers ex-post hazards to an investor.

6.1.5. Discount factor

A regulator's discount factor, i, indicates his view to the future. If the discount factor is low, a regulator values future pay-offs highly and will consequently be less inclined to renege. A related concept is the short-sightedness of a regulator (a regulator that values future benefits highly can by definition not be short-sighted or myopic). A myopic regulator is more likely to act opportunistically and maximize welfare over a relatively short-time horizon, which may occur if a regulator is in office for a short period of time (Lewis and Sappington, 1990).

6.2. Determining the level of regulatory commitment on the European gas market

This section examines how these criteria appear on the European gas market, in order to obtain a view on a regulator's ability and incentives to ex-post commit to his ex-ante regulatory promises.

6.2.1. Gas demand

Reducing gas demand is an important policy priority—for instance as a consequence of import-dependency anxieties and the emphasis on energy efficiency. Nevertheless, a dash for gas will likely materialize, mainly due to increasing gas demand from power generation (Honoré and Stern, 2007). Higher future gas demand increases the benefits in future periods of upholding the regulatory contract which improves commitment by lowering the incentive to renege.

6.2.2. Technological development

The rate of technological development has the potential to significantly influence a market and its regulation (as has happened in telecommunications when mobile telephony was introduced). However, a relatively low level of technological development, which results in the benefits from reneging lasting relatively long, consequently lowering commitment, generally characterizes gas markets.

6.2.3. Ownership

Regarding ownership, a recent European Court of Justice ruling that golden shares are incompatible with the free movement of capital may indicate a desire to lower government involvement.[8] Nevertheless, the current trend is one of increasing rather than decreasing government control. Most European energy companies have been and still are being controlled or influenced by their governments through majority stakes, like the Norwegian government's 62.5% stake in StatoilHydro, or golden shares, as in case of Belgium's Distrigas and GdF SUEZ, the result of the recently concluded merger between GdF (Gaz de France) and SUEZ. This merger is furthermore a bad omen, because it may indicate a movement towards creating national energy champions. Commitment would be higher in case of privatized companies not controlled or influenced by their government and with their shares spread over a large part of the general population. However, this seems unlikely for the foreseeable future.

6.2.4. Capital depreciation

Capital depreciates which means that at some point in time, investments will be worn out and must be replaced by new investments. Gas capital stock has a low level of depreciation, as it generally lasts for many years. This lengthens the period after which capital needs to be replaced, which makes the benefits of reneging last for a relatively long period of time, consequently lowering commitment.

6.2.5. Consumer/investor interest

The picture on investor interests is not very positive either, because the emphasis of existing gas regulation is on the consumer interest. As indicated in Section 2, existing gas regulation was instigated and developed during the 1980s and 1990s and consequently is firmly embedded in the competition, liberalization and privatization paradigm that prevailed during that period. This has facilitated a regulatory regime that aims to reduce costs to the benefit of consumers. The current emphasis on consumer interest is also clear from the observation that most regulation theories from which existing gas regulation emanates, assume a regulator that attaches a higher weight to consumer interest than to producer interest (see Section 3.1). A typical European gas regulator will, therefore, have incentives to redistribute investor rents to consumers, because this improves welfare. This once more lowers regulatory commitment.

6.2.6. Discount factor

The discount factor of a typical gas regulator is generally quite high. Gas is a highly politicized subject due to for instance the importance of energy, and its price, to a national economy. Regulatory bodies generally have a low degree of political autonomy. In fact, Arentsen (2004) observes: "Only Italy, The Netherlands (to some extent) and the United Kingdom have legally independent and autonomous gas market regulators with autonomous ex-ante regulatory mandates. All other countries in one way or another share regulatory mandates with governmental

[8] CoJ EC September 28, 2006 C-282/04.

bodies, in almost all cases the ministry of economic affairs or energy."

This lack of autonomy makes a regulator vulnerable to short-term electoral pressures. This renders the threat of regulation being exposed to political considerations, and consequently a low discount factor and myopic behavior, conceivable for gas. Again, commitment is low.

Table 1 summarizes the observations. Of the six variables identified, five indicate low regulatory commitment; only the projected increase in gas demand improves commitment. Note the absence of the nature of investments. These have already been discussed in the section on asset specificity. On one hand, the need for substantial new investments increases the future benefits of a cooperative solution, which improves regulatory commitment. On the other hand, however, arguably the most significant effect of investments is their sunk (i.e. specific) nature, which is an important reason for the occurrence of ex-post problems in the first place (see Section 4).

Note that this enumeration does not consider the relative impact of each criterion on commitment. For instance, if the positive impact of gas demand is sufficiently large, the overall impact may still be positive. However, import dependency concerns render it unlikely that European gas demand will be stimulated to increase policy credibility. In fact, gas-demand growth is more likely to exhibit a decreasing trend (Honoré and Stern, 2007), lowering the impact on credibility. One reason is that soaring gas prices increase the attractiveness to power generators of using coal and nuclear. Another reason follows from the fact that as long as supply security and import dependency remain political threats (whether this is justified or not), incentives in countries facing a gas deficit (by far the largest number) are to generate power with domestically available sources, such as coal, nuclear, lignite and hydro, rather than gas. All in all, there is considerable uncertainty regarding the growth in European gas demand. If gas demand grows very strongly, which currently appears unlikely, regulatory credibility may improve. Nevertheless, the predominant picture is that the specifics of the European gas market make it relatively easy (that is cheap) for a regulator to renege on the regulatory contract. This, in turn, creates a threat of regulatory opportunism, impeding investments.

In sum, the theoretical assessment indicates that the European gas market simultaneously exhibits all TCE criteria. European gas regulation is consequently prone to ex-post contractual hazards and investment hold-up problems, which the governance structure of the liberalized European gas market should mitigate. The relevant criteria are not adequately recognized in current regulation due to its neoclassical guiding principles.

The conclusion that a broader perspective towards gas regulation than the neoclassical one is required in order to take proper account of the changing market fundamentals, invites speculation about lessons that can be learned. The next section explores a number of broader implications of this paper's results by deriving three general lessons policymakers could draw from the analysis when pondering the future of European gas regulation—especially, how to create sustainable competition, i.e. competition without impeding investments, on European gas markets.

Table 1
Gas market specifics and regulatory commitment.

Variable	Presence on the European gas market	Effect on regulatory commitment
Demand	Increasing	+
Technological development	Low	−/−
Private ownership	Predominantly public	−/−
Capital depreciation	Low	−/−
Investor's profits	Emphasis on consumer interests or surplus	−/−
Discount factor	High	−/−

7. Lessons for policymakers

A first lesson is that uncompromisingly pursuing competition – through for example ownership unbundled networks and liquid, hub-based spot trading – may impede long-term market performance by not transmitting the appropriate investment signals to investors. Consequently, in order to properly facilitate investments, short-term, competitive gas markets need to be complemented with alternative coordination mechanisms such as derogations from the third party access provisions and long-term supply contracts. Note that the second Gas Directive and the proposal for a third package contain elements of both safeguards. We get back to this important observation in the concluding section.

In order to properly implement the alternative coordination measures, policymakers should take account of two additional lessons. A second lesson is that when thinking about facilitating investments while liberalizing European gas markets, policymakers should not anymore think in terms of more or less competition but rather should base their views on an assessment of the transaction costs of government failure versus those of the market failure they try to correct. The transaction costs of both failures are determined by criteria such as asymmetric information, uncertainty, investment irreversibility, interest group behavior and the institutional setting in general. These are the real criteria on which regulatory decisions should be based, rather than, as currently, the prospects for the development of full competition. Such an assessment may result in less intervention, or even non-intervention, being less expensive in terms of transaction costs than removing the market failure as much as possible. This would subsequently create a situation of less than perfect competition.

Third and final, by recognizing regulatory opportunism, the TCE perspective attaches higher costs to regulatory intervention than the neoclassical perspective, consequently implying a lower level of intervention. Therefore, the third lesson is that policymakers should display more restraint in prescribing interventionist measures in European gas markets than currently.

In sum, the less rigid way of thinking implied by the TCE perspective facilitates a regulatory framework that better deals with the fundamental problem on European gas markets, the trade-off between competition and coordination, which in turn enhances the prospect of a sustainable regulatory regime for the European gas market.

8. Conclusion and future research

8.1. Conclusions

This paper has examined whether we can expect current European gas regulation to be adequate in light of the dynamic nature of the European gas market. A number of fundamental market shifts have changed the context for regulation. This paper analyzes whether the transaction cost perspective towards gas regulation is superior to the current neoclassical perspective in this context.

This is examined by specifying a theoretical framework that combines the neoclassical and transaction cost perspectives. The

framework shows that in order to judge whether the TCE perspective is better suited to a market than the neoclassical perspective, the following three questions must be answered affirmatively:

1. Are assets specific?
2. Are contracts in complete?
3. Is there a risk of regulatory opportunism?

This paper analyzes whether European gas regulation should be embedded in the TCE perspective by testing whether these questions can indeed be answered affirmatively for the European gas market. The paper shows that on the European gas market in its new context assets are specific, contracts incomplete and policy credibility likely low, which makes transaction cost perspective the proper theoretical base for gas regulation.

The main message of this paper is that current European gas regulation will not result in the market behavior that is required in the new context. Consequently, European gas regulation needs to move away from its neoclassical underpinnings. To this end, policymakers should: (1) allow alternative coordination measures to complement market exchange; (2) recognize that a less than perfect competition outcome may be the best solution and (3) be more reticent in prescribing interventionist measures.

8.2. Future research

Regarding future research, one important caveat of this paper is that it addresses the issue from a purely theoretical viewpoint. This paper's theoretical critique must be substantiated by empirical observations, because the superiority of the transaction cost perspective over the current neoclassical perspective can only be proven by illustrating that it better explains and predicts actual regulatory behavior. This paper's analysis indicates which empirical observations are required. Section 7 has argued that current regulation has already implemented amendments that may imply a shift towards the transaction cost perspective. These are the possibility to exclude certain investments from the third-party access provisions and the allowance of a certain degree of long-term contracting. Case studies on both amendments are required. These case studies must examine the actual regulatory process and outcomes in order to trace the arguments voiced by the different stakeholders, providing insights into which specific changes to regulation have been implemented and why these changes were made. This then indicates whether the amendments imply a step back from the neoclassical perspective in actual practice.

If both amendments can be explained by the neoclassical perspective, then current regulation is appropriate also in its new context, and possible adaptations to gas regulation would be marginal (i.e. build on the neoclassical guiding principles). If not, however, gas regulation's guiding principles should be changed, which requires more fundamental adaptations. The issue then becomes whether the transaction cost perspective better explains the amendments. If so, this study's theoretical critique is corroborated. The final step would be to infer whether the current amendments sufficiently incorporate the TCE perspective into European gas regulation.

Such empirical analyses are outside the scope of this paper. Interested readers are referred to Spanjer (2008b), which provides empirical case studies on both regulatory amendments. These show that each amendment can indeed be considered as an adaptation to the neoclassical perspective, but insufficiently incorporates the TCE perspective due to its unaltered neoclassical guiding principles.

References

Altug, S., Demers, F.S., Demers, M., 2000. Political Risk And Irreversible Investment: Theory And An Application To Quebec. Centre for Economic Policy Research Discussion Paper no. 2405.

Arentsen, M.J., 2004. Politics and regulation of gas in Europe. In: Finon, D., Midttun, A. (Eds.), Reshaping European Gas and Electricity Markets. Regulation, Markets and Business Strategies. Elsevier, Amsterdam, North Holland, pp. 69–109.

Bain, J., 1956. Barriers to New Competition: Their Character and Consequences in Manufacturing Industries. Harvard University Press, Cambridge, Massachusetts.

Baron, D.P., Myerson, R.B., 1982. Regulating a monopolist with unknown costs. Econometrica 50 (4), 911–930.

Biais, B., Perotti, E., 2002. Machiavellian privatization. American Economic Review 92 (1), 240–258.

Bruce, C., 2005. Fraternal Friction or Fraternal Fiction? The Gas Factor in Russian–Belarussian Relations. Oxford Institute for Energy Studies, Oxford OIES NG 8.

Buckland, R., Fraser, P., 2001. Political and regulatory risk: beta sensitivity in UK electricity distribution. Journal of Regulatory Economics 19 (1), 5–25.

Carruth, A., Dickerson, A., Henley, A., 2000. What do we know about investment under uncertainty? Journal of Economic Surveys 14 (2), 119–153.

CIEP (Clingendael International Energy Programme), 2006. The paradigm change in international natural gas markets and the impact on regulation. International Gas Union/ The Clingendael Institute, April, The Hague.

Creti, A., Villeneuve, B., 2003. Long-term contracts and take-or-pay clauses in natural gas markets. Energy Studies Review 13 (1), 75–94.

De Jong, J., Van der Linde, C., 2008. EU energy policy in a supply-constrained World. European Policy Analysis 11, 1–9.

Dixit, A.K., Pindyck, R.S., 1994. Investment under Uncertainty. Princeton University Press, Princeton.

Ellis, A., Bowitz, E., Roland, K., 2000. Structural change in Europe's gas markets: three scenarios for the development of the European gas market to 2020. Energy Policy 28 (5), 297–309.

EC, 1998. Directive 98/30/EC of the European Parliament and of the Council of 22 June, 1998 concerning common rules for the internal market in natural gas. OJ L 204, 1–12, Brussels.

EC, 2003. Directive 2003/55/EC of the European Parliament and of the Council of 26 June, 2003 concerning common rules for the internal market in natural gas and repealing Directive 98/30/EC. OJ L 176, 57–78, Brussels.

EC, 2004. Third Benchmarking report on the implementation of the internal electricity and gas market. Commission Draft Staff Working Paper, Brussels.

EC, 2005. Fourth Benchmarking report on the implementation of the internal electricity and gas market. Annual Report on the implementation of the Gas and Electricity Internal Market. COM (2004)863 Final, Brussels.

EC, 2007a. Prospects for the internal gas and electricity market. SEC(2007) 12, Brussels.

EC, 2007b. DG Competition Report on Energy Sector Inquiry. SEC(2006) 1724, Brussels.

EC, 2007c. Proposal for a Directive of the European Parliament and of the Council amending Directive 2003/55/EC concerning common rules for the internal market in gas. COM(2007) 529 final, Brussels.

EC, 2008. Progress in creating the internal gas and electricity market. Report from the Commission to the Council and the European Parliament. COM(2008) 192 final, Brussels.

Helm, D., 2007. The new energy paradigm. In: Helm, D. (Ed.), The New Energy Paradigm. Oxford University Press, Oxford, pp. 9–36.

Honoré, A., Stern, J.P., 2007. A constrained future for gas in Europe? In: Helm, D. (Ed.), The New Energy Paradigm. Oxford University Press, Oxford, pp. 223–255.

Hubert, F., 2007. Strategic investment in international gas transport systems. EIB Papers 12(2), European Investment Bank Research Series, 62–81.

IEA, 2000. Regulatory Reform: European Gas. International Energy Agency, Paris.

Klein, P.G., 1999. New institutional economics. In: Bouckaert, B., De Geest, G. (Eds.), Encyclopedia of Law and Economics. The History and Methodology of Law and Economics, Vol. I. Edward Elgar, Cheltenham, pp. 456–489.

Knight, F.H., 1921. Risk, Uncertainty and Profit. Hart, Schaffner & Marx, New York.

Laffont, J.J., Tirole, J., 1986. Using cost observation to regulate firms. Journal of Political Economy 94 (3), 614–641.

Levine, P., Stern, J., Trillas, F., 2005. Utility price regulation and time inconsistency: comparisons with monetary policy. Oxford Economic Papers 57 (3), 447–478.

Lewis, T.R., Sappington, D.E.M., 1990. Sequential regulatory oversight. Journal of Regulatory Economics 2 (4), 327–348.

Newbery, D.M., 1999. Privatisation, Restructuring and Regulation of Network Industries. MIT Press, Cambridge, Massachusetts.

Pirani, S., Stern, J., Yafimava, K., 2009. The Russo–Ukrainian gas dispute of January 2009: a comprehensive assessment. Oxford Institute for Energy Studies, Oxford OIES NG 27.

Schmidt, K.M., 2000. The political economy of mass privatization and the risk of expropriation. European Economic Review 44 (2), 393–421.

Simon, H., 1957. Models of Man. Wiley, New York.

Spanjer, A.R., 2006. European Gas Regulation: A Change of Focus. Department of Economics Research Memorandum 2006.04. Leiden University, Leiden.

Spanjer, A.R., 2008a. Do article 22 exemptions adequately stimulate investments in European gas markets? Zeitschrift Für Energiewirtschaft 32 (1), 46–51.

Spanjer, A.R., 2008b. Structural and Regulatory Reform on the European Gas Market—Does the Current Approach Secure the Public Service Obligations? Dissertation, Leiden University, Leiden.

Spanjer, A.R., 2008c. European gas regulation—a theoretical critique. In: Magnusson, F.L., Bengtsson, O.W. (Eds.), Energy in Europe: Economics, Policy and Strategy. Nova Science Publishers, Hauppauge, New York, pp. 257–314.
Stern, J.P., 1998. Competition and Liberalization in European Gas Markets: A Diversity of Models. Royal Institute of International Affairs, London.
Stern, J.P., 2002. Security of European Natural Gas Supplies: The Impact of Import Dependence and Liberalization. Royal Institute of International Affairs, London.
Stern, J.P., 2006. The Russian–Ukrainian Gas Crisis of January 2006. OIES Comment 01/06. Oxford Institute for Energy Studies, Oxford.
Teulings, C.N., Bovenberg, A.L., 2006. Privatization, deregulation and competition: the roles of increasing returns, entrepreneurship and capital-market imperfections. Paper presented at the 62nd IIPF Congress, Paphos, Cyprus.
Van der Linde, J.G., 2007. External energy policy: old fears and new dilemmas in a larger union. In: Sapir, A. (Ed.), Fragmented Power: Europe and the Global Economy. Breughel, Brussels, pp. 266–307.
Vickers, J., 1993. Privatization and the risk of expropriation. In: Baldassarri, M., Paganetto, L., Phelps, E.S. (Eds.), Privatization Processes in Eastern Europe. MacMillan, London, pp. 115–151.
Williamson, O.E., 1975. Markets and Hierarchies: Analysis and Antitrust Implications. The Free Press, New York.
Williamson, O.E., 1985. The Economic Institutions of Capitalism. The Free Press, New York.
Williamson, O.E., 1996. The Mechanisms of Governance. Oxford University Press, Oxford, New York.