WELFARE DISTRIBUTION EFFECT OF A PRICE REDUCTION IN THE DUTCH GAS TRANSPORT MARKET

A scenario analysis of regulatory policy, market form and rent allocation*

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ABSTRACT

As part of the larger energy market deregulation program, the Dutch energy authority – DTe – has developed the habit to force the Dutch gas transport enterprise – Gas Transport Services, or GTS – to lower its prices. DTe's key argument is that lower gas transport prices will benefit the end-user. Indeed, that might well be the case. This policy, in general, is in line with European legislation on the liberalization of the gas market. We model and simulate the (domestic) welfare effects of a five per cent transport price reduction. From this, we conclude that at least three observations complicate matters substantially. First, GTS is government-owned, and the dominant shipper – Gasunie Trade & Supply (or GasTerra, as it was recoined recently) – is partly so (50 %). Second, shippers enter into the competitive game to make profits. Third, not only is the majority of gas transported in the Netherlands exported to foreign end-users, but also foreign owners have a large stake in Dutch shippers. As a result, part of the rents will always be distributed, or will 'leak' away, to foreign consumers and shippers (or their shareholders). These three observations together have three important implications. First, state ownership implies that much rent allocation is simply a matter of circulating money from one government sub-budget to the other. Second, given that the industry is imperfectly competitive, part of the rents will not be passed on to the end-consumers. Third, it is unavoidable that a substantial part of the rents are transferred abroad. A general conclusion for policy-makers is that market liberalization might not bring *ex post* what they expected *ex ante*.

Keywords: regulatory policy, market form, rent allocation

1. INTRODUCTION

On July 1, 2006, Regulation (EC) 1775/2005 on access conditions to the gas transmission network became active. The central aims of this Regulation are to organize tariffs, access to the network for third parties, capacity allocation and congestion management, transparency requirements, and safeguards for delivery. In general, the aim of the European Commission (EC) was to reduce potential disruptions in gas supply (see the so-called "Green paper" – EC 2000/769, 2000), but also to liberalize the market (EC 2003-55). In the slipstream of European Union policies, the Dutch government is finalizing deregulation and re-regulation of the energy market. The deregulation of the gas market is inextricably bound up with re-regulation (for a nice introduction of another example, see García, 2006). In the Netherlands, the DTe has been established as the energy market's regulator.[1] One of its tasks is, so to speak, to set prices for gas transport and distribution (from high to low-pressure services). Indeed, in recent years the DTe has introduces a series of price reductions, which have cumulated to about 34 per cent (in real terms) since DTe's involvement in the gas transport business as of 2005. In this paper, we analyze how such a price reduction affects the allocation of welfare, with an emphasis on the impact on domestic welfare.

In the gas industry, the Dutch case is special, since the Netherlands are one of Europe's main gas producers. As a consequence, the Dutch state is heavily involved in the gas business. As of March 2004, Laurens-Jan Brinkhorst, the then Dutch Minister of Economic Affairs, introduced far-fetching plans to unbundle the Dutch gas and electricity market. The central idea was to separate network management from commercial activities

[1] For the sake of brevity, we will not engage in the huge discussion about the pros and cons of deregulation and re-regulation in the energy and gas industries. For a critical overview, please consult, e.g., MacAvoy (2000).

(Baarsma et al., 2007). Central in this policy are three measures that are aimed to improve the functioning of the gas trade market: the network operator (GTS) facilitates trade by means of the so-called Title Transfer Facility (administrative aid), to increase transparency with respect to inflows and outflows of gas in the transport network, and to facilitate access for market parties to the network (EZ , 2006). This, in fact, implements EC regulations for the Dutch market (see also EC, 2000, EC 2005; for a survey, see Mulder and Zwart, 2006).

In the Dutch case, the organization took the form of the creation of Gas Transport Services B.V. (GTS), which was founded on July 2, 2004. It is the network operator of the Dutch national gas transmission system. GTS is a fully-owned subsidiary of N.V. Nederlandse Gasunie. The mission of the Gasunie is clearly to promote the Netherlands as a European gas hub (Gasunie, 2007). Currently, they are the full owner of the high and mid-pressure gas transport (henceforth referred to as transport, for short)[2] enterprise <u>and</u> the 50 per cent owner of the largest shipper and trader. Ownership of the latter – Gasunie Trade & Supply – is shared with Royal Dutch Shell (25 %) and ExxonMobil (25 %).[3] Moreover, an array of specific regulations (in, e.g., the area of taxes[4]) were and still are in place. In the context of the current analysis, we largely abstract from the latter. That is,

[2] Low-pressure gas transport services are provided by, basically, a series of local monopolies, or so-called regional network operators, that connect end-users with the country's gas "highway", which is operated for approximately 99 per cent by GTS. To complicate matters further, many regional network operators are active as a shipper and trader as well (e.g., Essent and Nuon). This paper focuses on the "highway" only, as will be explained in greater detail below.

[3] Until recently, both enterprises were unified under the Gasunie roof, with an ownership arrangement similar to Gasunie Trade & Supply's. On September 1, 2006, Gasunie Trade & Supply changed its name into GasTerra in order to prevent confusion between Gasunie (transport and infrastructure) and GUTS (trade). As our data deal with 2005, we stick to the old name.

[4] Taxes introduce much complexity without changing the qualitative outcomes of our analyses (cf. the discussion section). Indeed, gas-related taxes are very complicated, as is clear from the way gas producers are treated in the context of the so-called *MOR* (acronym for "MeerOpbrengstRegeling", or "Added Revenues Regulation").

we focus on the broader issues, ignoring many nitty-gritty details that – if included – would not affect the main conclusions of the analysis presented below. However, after introducing and discussing the heart of this paper, we will briefly reflect upon the likely bias introduced by our key abstractions in a separate discussion section with sensitivity analyses before turning to the appraisal.

Our methodology involves a scenario analysis. Building upon a simulation model, applying economics' theory of competition, we calculate the rent distribution after a one-shot price reduction of five per cent for four different scenarios. We restrict ourselves strictly to the implications of DTe on GTS, and not on the impact of other relevant aspects of deregulations and market forms on production, (Stiglitz and Dasgupta, 1982) or R&D (Nakada, 2005). In this sense, production decisions are taken as given. The central aim of allowing for more competition in the energy market is to benefit consumers. However, given the market structure in the energy markets, that might not happen, as EC policies to date have resulted in large energy multinational enterprises. The paradoxical effect might be price increases instead of decreases, or that price decreases leak away to consumers in other countries.

The latter might be an unintended side-effect for a national government. In case of the Netherlands, the recent policy of making the Netherlands a "gas hub" might make this side-effect a very real problem: investments in the Dutch transport system may especially benefit foreign consumers, rather than Dutch consumers. This change in focus of the Gasunie might be rational in a transition process towards a true multinational firm that concentrates less on production, and more on the distribution of gas (EZ, 2006). From a global welfare perspective, this might be beneficial, even if it does not benefit national consumers specifically. However, a national government is first and foremost responsible for the citizens it represents. The aim of the present paper is to highlight the consequences of liberalizing the gas transport market for national consumers and foreign consumers, without judgement as to the most preferable option.

Below, we will first provide the background information that we used to inform our model building exercise. After that, we will introduce our scenario analysis. Subsequently, as promised above, we will reflect briefly upon the implications of our main abstractions in a discussion section, partly by running sensitivity analyses. Finally, we will conclude with an appraisal, in which we will discuss the outcomes and implications of our simulation scenario analyses.

2. BACKGROUND INFORMATION

For the development of a plausible simulation model of the Dutch gas transport market, we need basically two types of information.[5] The first piece of essential information relates to the role of different parties, or players, in the gas chain (from "put to pit" in Dutch, that is from "well to burner"). All gas must be transported through GTS' system, which is organized in a market with 50 so-called shippers. This paper focuses on this shipping market. In Figure 1 the Dutch gas chain is summarized by distinguishing five key gas flows, defined by the location of the gas's entry and exit points:

1. Flow I is import, where gas produced abroad is brought into the Dutch system, and ultimately delivered to a Dutch client.

[5] The information introduced below was provided by GTS. Much of the information we use here is simply not available in the public domain, given its confidential and deconsolidated nature.

2. Flow II relates to export, where Dutch gas is transferred from the Netherlands to a foreign destination.
3. Flow III involves transit, where gas is imported into and exported out of the Netherlands without any domestic 'leakage'.
4. Flow IV deals with domestic production and supply, where gas is distributed within the Netherlands from a supplier to a buyer.
5. Flow V has to do with a 'virtual hub' (TTF), where gas is traded but not really transported.

[INSERT FIGURE 1 ABOUT HERE]

In practice, the Dutch gas transport system is much more complicated. Here, two complications are worth mentioning. Firstly, as hinted at above, all transport of gas from entry point *i* to exit point *j* is done by so-called shippers. Shipper *a* buys gas transport capacity from GTS,[6] and subsequently ships gas from entry point *i* to exit point *j* to serve a client *b (*assuming that shipping capacity is given for the time frame we are considering). From the perspective of the current analysis, we need to distinguish domestic from foreign shippers, and domestic from foreign clients. At the supply side, we initially ignore upstream producers, starting our analysis with the government's gas transport enterprise GTS. In a broad sense, this assumption reflects the notion of the Dutch government that production of gas in OECD countries becomes less important, whereas production of gas in Russia, Northern Africa, and the Middle East becomes more important. These developments increase, potentially, the role for the Netherlands as an international gas hub (EZ, 2006). At the demand side, for the time being, we abstract

[6] Approximately one per cent of the Dutch gas transport capacity is not in the hands of GTS – i.e., the Zebra-pipeline in the Noord-Brabant province. For the sake of simplicity, we ignore this small player, and model GTS as the country's gas transport (public) monopolist.

from mid-stream parties (such as traders and regional network operators, like Essent and Nuon), and focus on end-consumers only, which may be either organizations or households.[7] In the discussion, we briefly return to this issue.

Secondly, we must calibrate our model with real-world data that quantify the importance of the different flows and parties involved. For this, we use the figures underlying the input-output table detailed in Table 1, relating to our "benchmark year 2005"[8] (guestimates dated April 2005). For our purposes, five pieces of information related to Table 1 are crucial: (i) GTS's total turnover is roughly € 1,200 million; (ii) for the calculation purposes in the context of this study, Gasunie Trade & Supply's shipping market share is taken to be about 80 per cent; (iii) total export + transit volumes involve 54 from a total of 99 billion m^3/j, which reflects approximately 55 per cent; (iv) in capacity terms, the export's market share is about one third;[9] and (v) at least 40 per cent of the commercial shipping market is foreign-controlled.[10] Note that the foreign-owned shippers dominate the 20 per cent of the market that is not served by Gasunie Trade & Supply. In the discussion, we will check whether or not the outcomes of our scenario

[7] Note that many regional network operators, which serve the end-users after receiving gas from GTS through their final pipeline tracks of the network, are still government-owned (though not by the national government, but rather by provinces and municipalities).
[8] To be precise, we work with estimates that reflect the current state of the art whilst taking notice of key trends. For example, data about 2005's capacity of the gas transport network are combined with an estimate of GUTS' market share for the near future. Note that, for the sake of confidentiality, Table 1 only reports qualitative information. For our simulation exercises, we could make use of the underlying quantitative information.
[9] The export's market share in volumes (iii) is different from its share in €-terms because capacities (iv) rather than volumes are traded in the gas transport market.
[10] This percentage is calculated on the basis of a complete list of the 50 shippers that were active in the Netherlands in 2005. For the sake of confidentiality, this list is not appended to this paper. Note that a large chunk of foreign ownership is the result of ExxonMobil's 25 per cent share in GUTS, which is assumed, in this study, to control 80 per cent of the Dutch shipping market. Moreover, the government's 50 per cent ownership stake is excluded from this calculation (hence the "commercial" adjective), because we record the government's rent separately (see below). Note that, to be on the safe side, we decided to work with a conservative estimate of foreign ownership. We will deal with this issue in greater detail in the discussion section as well.

analysis are robust for changes in a number of our key abstractions and assumptions as to ownership shares and tax policies.

3. SCENARIO ANALYSIS

In our analysis of the likely domestic welfare effects of the distribution of a five per cent reduction in transport costs for natural gas, we will distinguish five main players, namely the government, domestic shippers, foreign shippers, domestic end-consumers, and foreign end-consumers. As said, here we ignore complications not really essential for the results, such as taxes and the role of producers, traders and regional network operators.[11] Note that this modelling procedure is in contrast to the one used by Egging and Gabriel (2006): they assume strategic interaction between natural gas producers and perfect competition for transportation operators, whereas we take producer prices as given and assume strategic interaction between shippers. The key question is: how is the price reduction's rent potential of € 60 million per year allocated over these five (groups of) players under different sets of assumptions (or scenarios)?[12] The government plays a dual role since it is not only the single owner of Gas Transport Services (GTS), and as such pays directly for the five per cent reduction in transport costs as a result of loss of revenues, but it also operates as the 50 per cent owner of by far the largest shipper (Gasunie Trade & Supply), and as such potentially benefits from the cost reduction due to

[11] These three groups of players are a 'fixed' component in the current analysis, as neither of them is assumed to be able to benefit from the allocation of the € 60 million after the five per cent transport price reduction. We will briefly return to this issue in the discussion.

[12] Welfare analyses can be very complicated (Baumol, 1986). Take the following pair of essential examples. First, a general equilibrium analysis would take account of the impact of changes in the gas transport market for all other markets in the economy. Our analysis is a partial equilibrium one: we restrict the argument to the gas transport market only. Second, the effect of a rent increment for player *i* is not necessarily welfare equivalent to such an increment for player *j*. We assume no such weight differences. Whoever loses or wins an extra € is not relevant in our argument: the welfare effect of this € is assumed to be equal for all parties, government, shipper and end-user alike.

increased profits. We take this dual role into consideration by netting the government's costs and benefits.[13]

At the shipper side, we distinguish foreign from domestic shippers, where we have labeled Royal Dutch Shell's share in the largest shipper (Gasunie Trade & Supply) as a domestic shipper share and ExxonMobil's as a foreign one, for the sake of simplicity.[14] As will become evident below, our analysis takes the large difference in size of the individual shippers into consideration, given Gasunie Trade & Supply's dominant position with an 80 per cent market share, although our discussion will focus on the net effects for the five individual groups of agents identified above. Finally, we assume product homogeneity (that is, "gas is gas"), implying that end-consumers compare offers of shipper *i* *vis-à-vis* shipper *j* only along the price dimension.[15] In this context, we start from the benchmark case of zero switching costs: that is, each and every end-consumer is willing to switch from shipper *i* to *j* even in response to infinitesmal price differences. With this set of assumptions in place, we maximize the potential threat of competition (see the discussion), *ceteris paribus*. This approach has as far as we know never been applied to the case of shippers, but the game-theoretic approach as such has a long history when the production of natural resources is concerned. In this sense, we extend this literature one step further in the supply chain from producer to consumer (see for a survey, Egging and Gabriel, 2006).

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[13] In effect, it is the Dutch Ministry of Finance that operates as GTS's and the Ministry of Economic Affairs as GUTS' shareholder.

[14] Strictly speaking, matters are much more complicated. For instance, in 2005, Royal Dutch Shell was formally 60 per cent Dutch and 40 per cent British. Including such subtleties would complicate our analyses substantially, without a significant impact upon our main results. For the current purposes, we decided not to complicate our analyses more than is strictly necessary. Note that this implies that our 'leakage' results are downward-biased because a substantial portion of Royal Dutch Shell's profits flows to foreign owners.

[15] In practice, gas is heterogeneous with respect to the caloric value. We abstract from this complication and assume that demand does not switch between high and low-caloric value as prices change.

Our first two scenarios, A and B, simply assume that players behave either completely egoistically (A) or completely altruistically (B). We start our discussion regarding the distribution of the five per cent transport cost reduction with the most simple case, referred to as Scenario A or the Perfect Collusion Case. That is, we assume that shippers will not pass on any rent to their clients – in our abstraction, end-consumers. Additionally, we make a number of simplifying auxiliary assumptions, which will be discussed below. Suppose, then, (a) that the transport costs are the only relevant variable costs for each individual shipper, (b) that none of the individual shippers will adjust the price charged to the end-consumer, and (c) that there is perfect collusion among the shippers such that none of them changes the quantity supplied. Under those conditions, Table 1 depicts the distribution of benefits. Recall that about 40 per cent of the commercial (i.e., excluding the 50 per cent ownership share of the government, but including the 25 per cent share of ExxonMobil in Gasunie Trade & Supply) shippers is foreign-owned, and that one third of the end-consumers' rent – if any – is passed along to foreign end-users.

Obviously, the DTe would like the transport cost reduction to lower prices for the final consumers and, ideally, increase competition in the shipping market. Scenario B, also summarized in Table 2, focuses on this Perfect Competition Case, as it presumes that the entire reduction in gas transport costs is passed on to the end-consumers, under the assumption that there is no change in quantity demanded and no change in the distribution of production across shippers. That is, the demand side's price elasticity is taken to be zero[16] and the shippers' market shares are assumed to be constant.

[INSERT TABLE 2 ABOUT HERE]

Scenarios A and B present simple benchmark cases, but hardly take the competitive structure of the market into consideration. After all, the behavior of shippers was exogenously assumed to reflect either of both corner cases – i.e., perfect egoism or *ditto* altruism (cases A and B, respectively). There is, in fact, one dominant shipper in this market (Gasunie Trade & Supply, with an assumed market share of 80 per cent), though, accompanied by a few mid-sized and small companies (about 50 shippers altogether). The literature has extensively analyzed such dominant-firm markets, where the non-dominant firms – in our case, shippers – are referred to as the competitive fringe. The other scenarios we investigate are based on this dual market structure literature (cf. Tirole, 1988; van Witteloostuijn & Boone, 2006).[17] Now, that is, we will endogenously derive the actual behavior of the competitive fringe (Scenario C), or of the competitive fringe and Gasunie Trade & Supply in interaction (Scenario D). In so doing, we apply a modern theory of competition – i.e., a dual market with a dominant center and a competitive periphery – to the Dutch gas transport market that nicely fits with the latter's key features.

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[16] This assumption is not too unrealistic, as end-users are not very flexible in their demand response to price changes. Moreover, transport costs only determine a very small portion of the gas price that emerges on the end-users' bill.

[17] Technically, this literature applies so-called game theory (see, e.g., Rasmusen, 1990; van Witteloostuijn, 2003). Game theory is the modern core of the economics of competition, or industrial organization. An example of a game-theoretic model of the European natural gas market is Egging and Gabriel (2006). In the current paper, we will simply introduce the basic equations needed to understand this paper's simulation model, ignoring the underlying game-theoretic details. Although our simulation exercises basically involve comparative statics, comparing equilibrium outcomes across a number of relevant cases, we will add a dynamic intuition (particularly in explaining Scenarios C and D) to make clear what is really going on in the competitive games modeled here.

We assume the cost structure for the fringe shippers $i = 2,...,50$ to be equal to

(1) $$F_i + \lambda_i x_i (1 + x_i)\,, \quad i = 2,...,50\,.$$

Here F_i indicates fixed costs, and $\lambda_i x_i (1 + x_i)$ marginal costs, which increase with output. This set-up rationalizes the stylized fact that the number of shippers is limited, and also that some of the shippers are large (see for an extensive discussion on production costs in relation to market forms, Brakman and Heijdra, 2004). The specific functional form facilitates subsequent calculations, incorporates the fact that there are returns to scale (fixed costs), and allows for adjustment of each shipper's cost function to calibrate the model to reflect the size of each shipper. Note that λ_i is a flexible marginal cost parameter. We call this the efficiency parameter. Also observe that this, in principle, introduces potential efficiency gains in the market if inefficient shippers disappear. The dominant firm – competitive fringe model implies the assumption that the fringe shippers take the price p set by the dominant shipper Gasunie Trade & Supply as given (which can be used for normalizations). Hence, equating marginal revenue and marginal cost for a fringe firm gives (ignoring intertemporal speculation on the gas market)

(2) $$\lambda_i (1 + 2x_i) = p\,, \quad i = 2,...,50\,.$$

The total share of the 45 smallest shippers is about five per cent of the market. So, we denote their relative sales by $\bar{x} = 5/45 = 1/9$ per cent for each small shipper. We measure the efficiency of all shippers relative to these smaller shippers, which gives: $\lambda_i = (1 + 2\bar{x})/(1 + 2x_i)$ (such that $\lambda_i = 1\,, for \quad i = 6,...,50$).[18] Thus, the efficiency of fringe shippers increases the larger their sales volume, which reflects a standard scale economies assumption. As a consequence, their market shares can only increase due to

[18] Note that this implies a normalization of the price, p, of the dominant shipper.

relative efficiency gains. Below, we will develop two plausible scenarios that illustrate how, in practice, the actual outcomes of the rent distribution game will depend upon the underlying features of rivalry: in Scenario C, we assume that the dominant shipper Gasunie Trade & Supply will not respond to the smaller shippers' behavior at all; in Scenario D, conversely, we will assume that it does react by lowering price.

First, in Scenario C, we calculate the fixed costs of the fringe shippers on the basis of the initial assumption that none of the shipping firms earns positive profits (fixed-cost investments are thus a means to reduce variable costs). Hence, the model includes a trade-off: lower marginal costs are associated with larger fixed costs. Initially, for the sake of normalization, fixed costs are thus determined by the zero-profit condition. That is, the gas transport market is assumed to be in a zero-profit equilibrium just before the five per cent transport cost reduction is launched. Subsequently, a competitive game is triggered in which both shipper parties – i.e., the dominant Gasunie Trade & Supply and the competitive fringe – engage in profit-maximizing behavior, given two different sets of behavioral assumptions (i.e., Scenarios C and D). Evidently, the smaller firms have lower overhead costs and are more flexible. Since the five per cent reduction in transport prices largely pertains to variable costs, we assume the efficiency gain (measured by the reduction in λ_i) to be proportional to the share of variable in total costs times five per cent. So, if variable costs are 80 per cent of total costs, the reduction in lambda is 5 % x 80 %. It is therefore relatively larger for the smaller shipping firms in the market's fringe.[19]

[19] So, from Scenario C to D, we move more closely into the direction of the 'competitive' outcome that the government is seeking to bring about by deregulating the market. In both scenarios, we assume that competition comes from smaller and more flexible shippers that will attack the former monopolist's (i.e., Gasunie Trade & Supply's) dominant position. In Scenario C, competition only goes 'halfway', because

Under the assumption that the dominant Gasunie Trade & Supply shipper does not change the price for the end-consumers – i.e., the dominant shipper decides not to respond to the moves of its smaller rivals –, this implies that the fringe shippers will increase their sales at the expense of the market share of the dominant shipper by lowering their price. As a result, at a given price reduction, the smaller shippers will increase their market share at the expense of the dominant shipper (recall that total demand is assumed to remain unchanged). If there is (i) no change in the price charged to the final consumer by Gasunie Trade & Supply and (ii) no entry of new fringe shippers, the model's simulation implies the loss in market share by the dominant shipper to be 1.3 percentage points (see below). The distribution of benefits in this Dominance Erosion Case is summarized in Table 3.[20]

[INSERT TABLE 3 ABOUT HERE]

The outcomes with a zero rent allocation to end-consumers and a 1.3 percentage point Gasunie Trade & Supply market share erosion only might, at first sight, be surprising. To understand this, we need to provide an intuition of the dynamics associated with the underlying competitive game. We do this in two steps. First, price compention is such that, given our assumption of behavioral asymmetry (i.e., Gasunie Trade & Supply is passive), the competitive fringe can maximize profit by launching an infinitesmall price cut. Suppose that Gasunie Trade and Supply's price is *p*. Then, under the assumption of zero

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price competition fails to materialize as Gasunie Trade & Supply does not respond to rivalry from the smaller shippers by reducing its price. In Scenario D, competition is fully brought to the fore, since then the dominant Gasunie Trade & Supply shipper plays the rivalry game by reducing its price.

[20] Note that now, in Table 3, the total rents may deviate from the original € 60 million as a result of the price effect triggered by the behavior of the fringe shippers and/or the dominant Gasunie Trade & Supply shipper.

switching cost at the demand side of the market, offering a p-ε with $\varepsilon \rightarrow 0$ to end-consumers is enough to attract the number of new clients needed to maximize profit. Second, as far as this profit-maximizing market share expansion is concerned, the competitive fringe faces the fixed cost – marginal cost tradeoff explained above, implying the danger of growing too large, given the nature of the fringe's cost function. As a result, the competitive fringe will limit the market share increase to the profit-maximizing optimum, which turns out to be 1.3 percentage points.

As explained above, it is likely that the reduction of transport costs makes it attractive for the smaller and more flexible shippers to increase their market share at the expense of the dominant shipping firm's market position by lowering their price. This effect may be exacerbated if there is entry of new shippers into the market. It is, however, unlikely that the dominant shipper will not respond to its loss in market share. Instead, if the price charged to the final consumer is lowered by Gasunie Trade & Supply, the dominant shipper can prevent its market share from eroding. Scenario D, therefore, assumes that Gasunie Trade & Supply lowers the price charged to the final consumer to such an extent that the market share of this dominant shipper remains at 80 per cent. We estimate that this implies that about 2.6 percentage points of the five per cent reduction in transport costs is passed on to the consumer (which is 52 per cent of the total reduction).[21] There is, in this Retaliation Response Case, a slight redistribution of market share among the fringe shippers, where the smallest ones will expand at the expense of their mid-sized counterparts.

[21] For the end-consumer, this reduction is small relative to the total price charged for natural gas. The change in quantity traded is therefore minimal and the reduction mainly has a competitive impact.

4. DISCUSSION

For sure, the above analyses are developed after introducing a series of abstractions and assumptions. On the one hand, this might imply that the above outcomes reflect a conservative estimation of the importance of rent 'leakages' – i.e., an underestimation of the relative size of the rents not allocated to the (Dutch) consumers. This can be illustrated by briefly discussing four of such key 'conservative' abstractions or assumptions:

1. Implicitly, our conception of competition assumes the threat implied by low switching costs for end-consumers. That is, end-consumers are assumed to switch from shipper *i* to *j* if the latter is only marginally cheaper. This is what drives competition, and what puts pressure on the dominant shipper's position. However, evidence suggests that many end-consumers are reluctant to switch, for whatever reason, hence failing to respond to price differences.
2. We abstracted from a number of other parties that are involved in the gas delivery chain. For example, upstream producers and downstream traders are not part of our model. It might be, though, that in the vertical bargaining game within the industry chain such parties are able to reap part of the rents by negotiating higher (producers) or lower (traders) prices, and hence higher margins at the expense of end-users.
3. We ignored the potential increase of the demand for transit transport in response to lower prices in the Netherlands *vis-à-vis* foreign (particularly German) pipelines. Such a substitution effect – from 'domestic' to transit transport – would imply that even more rents are passed on to foreign end-consumers.[22]

[22] Another issue relates to the impact of a binding transport capacity. If GTS's capacity is potentially binding (e.g., in years in which Jack Frost rules), the reliability of domestic delivery will be harmed if transit flows increase at the expense of domestic ones.

4. In deciding on the share of foreign ownership in the shipping market, we opted for a conservative assumption. For one, we took Royal Dutch Shell's 25 per cent share in Gasunie Trade & Supply to be fully Dutch. Additionally, we assumed that only 40 per cent of the fringe shippers were foreign. In practice, though, the foreign share is larger – and hence is the 'leak' to shareholders abroad.

On the other hand, though, at least two abstractions imply that the outcomes of our scenario analyses are upward biased (in the sense of overestimating 'leakages'): (1) the government can skim part of the shippers' rents through corporate taxes; and (2) with competition, the hope is that X-inefficiencies will be reduced. As a sensitivity check, we therefore recalculated our two 'passive' scenarios (A and B) after taking notice of, especially, the role of taxes (potentially reducing the upward bias) and traders (potentially decreasing the downward bias).

Basically, we took the model underlying Scenarios A and B, and changed the analyses in two ways. First, we added (corporate) taxes and (mid-stream) traders, as indicated above. Second, we ran a series of sensitivity analyses by subsequently manipulating three key parameters: (i) the percentage of the cost reduction passed on to the next party in the gas chain by shippers and traders; (ii) the percentage of foreign ownership in the shipping market; and three (iii) complete privatization of Gasunie Trade & Supply. We added cases where only five percent of Gasunie Trade & Supply' rents were transferred abroad (correcting for a potential upward bias, given the dampening effect of the special tax arrangement that applies to Gasunie Trade & Supply), we introduced scenarios in which the foreign ownership share in the fringe of the shipping market is assumed to be 75 per cent (correcting for a potential downward bias, given the observation that foreign ownership is probably far above the 40 per cent assumed in Scenarios A to D), and we assumed that Gasunie Trade & Supply is privatized such that ExxonMobil and Royal Dutch Shell fully share ownership in a 50 – 50 per cent arrangement (simulating a completely privatized shipper market). We redid Scenario A (the Perfect Collusion Case) with four additional parameter settings: with privatization, as well as three different sensitivity checks. Scenario B (the Perfect Competition Case) is associated with one extra run – privatization –, as other parameter settings do not affect the outcome. Moreover, we added nine intermediate cases that approximate variants of Scenarios C and D, though now exogenously assuming the shippers' (and traders') behavior rather than endogenously deriving their profit-maximizing strategies (as we did above). Here, it suffices to observe that the above outcomes are indeed robust. Adding such complications and manipulations does not affect the qualitative pattern as to the effect of a five per cent price reduction on the rent distribution reported in Table 2 above.

5. CONCLUSION

Keeping the discussion's remarks in mind, we can interpret our results as follows. As part of the larger energy market deregulation program, the DTe has developed the habit to force the Dutch near-monopoly gas transport enterprise – GTS – to lower its prices. The key argument is that lower gas transport prices will benefit the domestic end-user. Indeed, that might well be the case. However, at least three observations complicate matters substantially, as we illustrated above:

1. Observation 1: government ownership. GTS is government-owned, and the dominant shipper – Gasunie Trade & Supply – is partly so (50 %). Hence, lost revenues from

the gas transport business will all emerge at the debit side of the government's budget, and part of the shippers' rent returns in the government's pockets.

2. Observation 2: imperfect competition. Firms enter into the competitive game to make profits. Shippers are not different. So, apart from the extreme cases of perfect competition (or, more generally, perfect contestability: cf. Baumol, Panzar & Willig, 1982), part of the rents will end up in the pockets of the shippers, rather than the end-consumers.
3. Observation 3: rent export. The Netherlands are not an isolated island in the European gas ocean. Not only is the majority of gas transported in the Netherlands exported to foreign end-users, but apart from that have foreign owners a large stake in Dutch shippers. As a result, given the fact that the Dutch industry is not autarktic, part of the rents will always be distributed, or will always 'leak' away, to foreign consumers and shippers (or their shareholders).

These three observations together have three important implications. First, state ownership implies that much rent allocation is simply a matter of circulating money from one government sub-budget to the other (Observation 1). Second, given that the industry is imperfectly competitive, part of the rents will not be passed on to the end-consumers (Observation 2). Third, it is unavoidable that a substantial part of the rents are transferred abroad (Observation 3).[23] These broader implications will presumably also be important for the welfare distributions and efficiency gains of government policy in a wider

[23] Strictly speaking, the third implication may not be an issue, as the government's aim might be to allocate rents to end-consumers irrespective of where they live. Why would a, say, € 100 gas bill reduction be worth more for a Dutch end-consumer than for her or his companion in Germany, Greece, Russia or anywhere else? In effect, given economics' law of decreasing marginal utility, this € 100 gas bill reduction may be more important for end-consumers in countries poorer than the Netherlands. However, in practice, this Utopian world view is not really dominant, to put it mildly.

European energy market. To determine this, more research using the analytic tools applied here to the case of shippers is needed, thus further extending the work of Egging and Gabriel (2006). Restricting attention to the results of this paper, Table 4 summarizes the rent distribution results of our four scenario analyses, including the percentage of rents not received by Dutch end-consumers.[24] Clearly, it is very likely that large percentages of the redistributed rents end up in the hands of the government (Observation 1), shippers (Observation 2) or foreigners (Observation 3), and are not allocated to the (Dutch) end-consumers.[25]

[INSERT TABLE 4 ABOUT HERE]

[24] Because our sensitivity analyses produced outcomes very similar the Scenarios A and B, we decided not to report them in Table 6, for the sake of brevity.
[25] A fourth observation is that if foreign ownership in the Dutch gas chain increases, so will the size of the 'leakages', provided that part of the rent is passed along to end-consumers, as is clear from Table 5's sensitivity analyses.

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Table 1: Input-output table (payments in symbols) for the Dutch gas industry

Starting point upstream gas chain is always a domestic or foreign gasproducer

End nodes of the domestic gas chain

Agent	Paid to →	Ai	Bi Imports	Bt (imports for transit)	Ci	D1 (GUTS)	Di (other shippers)	Ei	Fi	G1 (GUTS)	Gi (other suppliers)	Hi (large vol. takers> 170.000 m3/y	Hi (small end users < 170.000 m3/y	Ii	Ji	…	…	Mi
Ai																		
Bi																		
Ci																		
D1		X, Y & Z	X	T	X, Y & Z		X, Y & Z (TTF)											
Di (i = 2 u/i 50)		X & Z	X	T	X & Z													
Ei																		
Fi										X	X							
G1 (GUTS)						X, T, Y & Z		X										
Gi (other)						X, T & Z	X, T & Z	X										
Hi (i = 1 u/i 275)										X	X							
Hi (i = 275 u/i 6 mln)											X							
Ii										T & Y								
Ji										T & Z	T & Z							
….																		
….																		
Mi														T & Y	T & Z			

Through various downstream the gas is finally being delivered to the foreign end-users

Ai (i = 1 u/i 15)	Domestic gas producers (NAM, BP, Petroland etc.)
Bi (i = 1 u/i 5)	Imports on behalf of inland end-consumers from e.g. Norway, GOS, UK
Bt (t = 6 u/i 10)	Transit = Imports on behalf of foreign gascompanies
Ci (i = 1 u/i 2)	GTS Network and 'Zebra-pipeline'
D1 =	GUTS as a Shipper
Di (i = 2 u/i 50)	Other Shippers
Ei (i = 1 u/i 30)	Regional net operators
Fi (i = 1 u/i 400)	Directly connected end-users
G1 =	GUTS as a supplier to foreign customers and large volume takers in the Netherlands
Gi (i = 2 u/i 25)	Other suppliers
Hi (i = 1 u/i 275)	Large volume takers in a Dutch sales area (> 170.000 m3/yr, but not being the directly connected end-users)
Hi (i = 275 u/i 6 mln)	Small end-users in a Dutch sales area (<170.000 m3/yr)
Ii (i= 1 u/i 7)	Traditional foreign customers of Gasunie (Snam, Ruhrgas, Distrigas etc.)
Ji (i = <10)	New foreign customers of Dutch gas (Stadtwerk Hannover etc.)
Mi (i= 1 u/i several mln)	Foreign end-users
GUTS	GasUnieTrade&Supply
X=Domestic	Payments in relation to gas for the sake of Dutch end-users
T=Transit	Payments in relation to the transit of gas
Y=Traditional Exports	Payments in relation to traditional exports
Z= 'New exports'	Payments in relation to 'new' exports

Table 2: Distribution of net benefits in Scenarios A and B

(Group of) agent(s)	Net benefits (in million euro per year)	
	Scenario A Perfect Collusion Case	Scenario B Perfect Competition Case
Government	– 36.00	– 60.00
Dutch shippers	19.07	0.00
Foreign shippers	16.93	0.00
Dutch end-consumers	0.00	40.00
Foreign end-consumers	0.00	20.00

Table 3: Distribution of net benefits in Scenarios C and D

(Group of) agent(s)	Net benefits (in million euro per year)	
	Scenario C Dominance Erosion Case	Scenario D Retaliation Response Case
Government	– 36.38	– 48.49
Dutch shippers	19.17	9.12
Foreign shippers	17.21	8.16
Dutch end-consumers	0.00	20.80
Foreign end-consumers	0.00	10.40

Table 4: The simulation outcomes summarized

Group of agents	Scenario A. Perfect Collusion	 B. Perfect Competition	 C. Dominance Erosion	 D. Retaliation Response
Government	– 36.00	– 60.00	– 36.38	– 48.49
Dutch shippers	19.07	0.00	19.17	9.12
Foreign shippers	16.93	0.00	17.21	8.16
Dutch end-consumers	0.00	40.00	0.00	20.80
Foreign end-consumers	0.00	20.00	0.00	10.40
Percentage not received by Dutch end-consumers	100%	33%	100%	57%

Figure 1: Five types of gas flows in and through the Netherlands