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Gas pricing in a liberalized European market; will the rent be taxed away?

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The European gas market will become 'more liberal'. Depending on in which segments competition is intensified and public interference takes place, prices in the gas chain will be affected. Rent may be redistributed among firms and prices will become more volatile. If supply overshoots demand for a long period, average consumer prices may also be pushed down. Rent may also end up as tax revenues for public authorities. This article argues that an active use of gas taxes as an instrument to derive public revenues increases the probability of a politically led liberalization process. The effect of these economic and political forces and actions may, however, be less new gas to the market. © 1997 Published by Elsevier Science Ltd. All rights reserved.

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In the highly concentrated structure of the European gas market, gas is sold and resold many times on its way from the field of production to the final user, often between monopolies/oligopolies and monopsonies/oligopsonies. Generally, *producers* (*exporters*) sell gas to transmission companies (*pipelines*) who act both as transporters and merchants in the market. The gas the pipelines buy at its entry, they resell at its exit at the city-gate to their *customers*: local distribution companies (LDCs), power plants and large industrial users. The LDCs act as both transporters and merchants, as pipelines do, and resell the gas to final *consumers* (*end-users*) in private households and businesses. Power plants and large industries are end-users themselves, and use gas as an input factor in production processes, such as for electricity, chemical products, etc. In general, producers and pipelines write long-term contracts (up to 20 years), while pipelines write medium-term contracts with customers (1–5 years).

Prices for consumers are generally set in relation to the prices of the alternatives to gas for each consuming group. The highest gas prices can be found in households and businesses (the markets for the LDCs), the lowest for gas used in electricity production. Prices for producers are in contracts net-backed from consumer prices, with the withdrawal of margins to LDCs and pipelines. These margins are mostly based on capital costs and negotiation strength, and are independent of the market price of gas. Thus, producer prices vary with consumer prices, while margins to LDCs and pipelines do not. For gas to penetrate European energy markets, consumer prices in some contracts are set below the prices of the alternatives.

As the European gas market becomes liberalized, gas need not be sold and resold quite so many times as under today's system. Under a *completely* and *perfectly* liberalized market system, producers should make direct contracts with LDCs, power plants and the industry, and buy transmission services from the pipelines (as for a toll road). The fee for this transportation should cover pipelines' normal profit, but should not give any economic profit to them. Pipelines' roles as both transporters and merchants should be *unbundled*, and they should act only as transporters. Intermediates, such as brokers and marketers, may become new actors to clear (parts of) the market.

While pipelines are often natural monopolies (or at best natural oligopolies), their behaviour and pricing practices should be regulated by a public authority. Producers and customers, however, are not necessarily natural monopolies. In order to create competition in these segments, sales monopolies in exporting countries should be abolished, and customers should compete for gas (as they, to some extent, already do in today's market). Since LDCs are natural monopolies in the areas in which they operate, it is necessary

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to regulate them as well (not their merchant function, though). If the market *theoretically* is completely and perfectly liberalized, each firm in the gas chain either operates as a price taker, due to perfect competition, or is efficiently regulated by a public authority[2].

Probably, the market will not become completely and perfectly liberalized. Nevertheless, prices and margins throughout the gas chain will be affected if only a partial liberalization takes place. In the following, we will discuss price (and rent distribution) effects of gas market liberalization under various assumptions on how the market becomes more liberal. As long as energy taxation plays a significant role in determining energy prices, to consumers and producers, the impact of a potential increase in excise taxes on gas consumption is also analysed.

In the first half of this article, the process towards a more liberal European gas market is discussed. What are the objectives, forces and obstacles leading to a more liberal market? The main structure of how gas prices are determined in Continental Europe today is described. Under various assumptions of how the market is liberalized, it is analysed how prices may be affected. The question is raised as to whether the US liberalization experiences are of any relevance for Europe. The second half of this article discusses the role of energy taxation in general, and gas taxation in particular. The sharp increases in oil product taxation over the last decade, which have led to asymmetry in the development between consumer and producer prices, is discussed, and the existing level of gas taxation is presented. What if the same happens in the gas market? It is analysed how increased taxation on gas affects gas prices in today's market and when the market gradually becomes more 'liberal'. Finally, the article argues that a more active use of gas taxation by EU governments increases the attractiveness of a politically led liberalization process. However, the increased uncertainty caused by liberalization and the potential of higher gas taxes may result in less new gas to the market, especially from new mega fields.

Competition versus regulation

For the functioning of natural gas markets, the most crucial element is the cost of, and access to, transportation. The cost of gas transportation is often characterized by strong elements of scale and scope economics, making transporting firms *natural monopolies* in the markets in which they operate. This situation exists within other types of communication as well, such as roads, harbours, airports, railways, mail services, telecommunications and public transport, water and electricity supplies, health services, education, cable-TV and garbage collection.

In Europe, many public utilities operating as natural monopolies were nationalized in the aftermath of World War II. Under nationalization, the management of a single firm should take care of both private and social goals. However, these monopolies were gradually accused of being slow to upgrade technology, service and productivity. Being monopolists by nature (but sometimes only by law), they were considered bottle-necks in the development of each nation's competitiveness. Probably, the most frequently used argument explaining these firms' inefficient use of resources has been the lack of competition.

Liberalization of such markets represents a departure from the 'one management' approach. However, the particular aspect of, by nature, non-competitive markets is that the goals of competition cannot be achieved only by removal of trade barriers. If the most efficient operation of a market is done by one, or only a few, firms, these must be *made to behave* in a way that improves efficiency. In fact, an increase in the number of actors in such markets, *per se*, may increase cost, and thus represent a waste of resources. Indeed, removal of barriers of entry into the market may not necessarily bring new firms into operation. Usually, under liberalization, national owned firms are privatized (even though the government may hold a significant share of, or control over, the ownership) and the operation of vertically integrated services is separated ('unbundled'). Competition should be established when possible, regulation when necessary (when competition does not work) and unbundling introduced when economies of scope are not present (or exhausted)[3].

The problem for policy makers is that a concentrated market structure may also be socially most efficient. More firms operating in the market may incur higher transportation costs. This argument also holds for product extension through vertical (or horizontal) integration and the exploitation of economies of scope. Thus, the challenge is to intervene in a way that preserves a market structure that has the potential to minimize cost, but at the same time avoids possible lax cost control and exploitation of market power, following the strong position of the firm.

There are several factors determining pipelines' market power in addition to the scale and scope economies. One such factor is the power of producers and customers that the pipeline meets at its end. By concentrating seller and buyer power, a counterforce to mitigate pipelines' market power is created. In the European gas market, this is, to some extent, done at the supply side, which can be better characterized as oligopolistic than competitive. There are only a few exporting nations, and within each of these nations gas sales are orchestrated through one body. At the customers side, however, it is more difficult to concentrate purchasing power. Customers are placed in several consuming countries and there are many LDCs, power plants and industrial users within each

[2]In this context, 'regulation' means that public interference takes place in firms' behaviour by encouragement or force.

[3]The word *liberalization*, used in this text, could partly cover the same as the concepts of common carriage, deregulation, reregulation, Open Access, Third Party Access (TPA), etc used in connection with various gas market liberalization efforts. The choice of word is made in order to avoid misunderstandings among those having any specific comprehension and interpretation of the other (often more specific) concepts. The IEA (1994) introduces the term 'Mandatory Open Access' (MOA) for a liberalization process for much the same reason.

of them. However, LDCs serving large urban areas may have a certain degree of market power, if they have (potential for) access to alternative routes of transmission.

In order to exploit economies of scope, producers have good reasons to integrate wholly or partially with transmission activities. In the Norwegian North Sea, this is done by giving producing firms property rights in offshore pipelines. In Russia and Algeria, it has (so far) been done by centralized firm(s) in Moscow and Algiers, planning production and transmission to the respective countries' borders. This product extension contributes in realizing the oligopolistic market structure on the supply side. In the market, the long-term contracts between producers and pipelines (in consuming countries) may also be considered as an approach to optimizing the advantages of joint management of transmission and production. Integration between LDCs and pipelines can also be argued for the same reason, even though it seems to happen to a lesser extent. Probably, this is due to greater dissimilarities between the transmission and retailing business, than between producing and transmission. Perhaps, integration between these is restrained by diseconomies of scope, reinforcing the impression of a more competitive structure across customers.

Even if cost-saving advantages cannot be obtained by bundling all kinds of services, firms may nevertheless profit by doing so due to the benefits of increased market power. For a transmitter, for example, there may be economies of scale in transportation of gas, but not necessarily economies of scope in the role as a wholesaler. The broker role may, in some cases, inhibit elements of economies of scope with the transmission service and, in other situations, it could be done more efficiently by independent firms. By having the exclusive rights (natural monopoly) in the transmission function, the pipeline company has the power to prohibit other companies wanting to act as brokers, take over their potential profit and obtain a monopoly in providing merchant service. This will contain the contact between producers and end-users and decrease market efficiency. While the pipeline gains, there is a net loss for society.

The question is how large are the benefits of vertical integration and coordination? The existence of scope advantages indicates that a liberalization of the market should open up the possibility to bundle services *in competition* with the provision of unbundled services. The smaller the market and number of players, the less cost arguments seem to be in favour of unbundling operations. If operations are unbundled and there exist economies of scope, the gain from increased competition should be weighed against the losses of less efficient operations of each firm. Thus, with the growth in the European market, gradually more arguments support the idea of unbundling. When competition gradually intensifies, as, for example, seen by Wingas's entry into the German market challenging Ruhrgas, this part of the liberalization process could speed up.

In end-user markets, competition from other fuels, in particular oil products, but also coal and nuclear electricity, provides a price cap on gas. The prices of alternative energies represent the limit on total market turnover, and on how much rent the various segments in the gas chain can 'fight over'. If the shares that are distributed to transmission and distribution companies continue to be rather insensitive to changes in end-user prices, changes in end-user prices will, in general and eventually, be to the loss or benefit of the producer.

Taken together, with some modifications, the barriers to entry are significant in pipeline transportation. Transmission companies have a great potential to exercise market power both towards producers and towards customers. The potential for and benefits of market power may lead to 'over-bundling' of services and over-investment in capacity in order to deter newcomers[4].

When competition and/or unbundling is impossible or inefficient, due to specific economies of scale and scope characteristics in firm's costs and the market structures, a regulatory mechanism must be established to make the firm behave as if competition existed (by force or by incentives). Instead of the 'invisible hand' in the market place, a 'visible' hand should be introduced, to use Adam Smith's terminology. This visible hand could be some sort of a regulatory authority to define and oversee that the optimal combination of competition and regulation exists, and that it works according to its premises.

Towards a more liberal European gas market

Even though there have been elements of public policies towards production rights, the building of pipelines and the operation of LDCs in Europe, there has been little interference in the trade of gas between producers and pipelines. This is partly due to the fact that European gas trade is international and must be dealt with on a bilateral basis. Sometimes, and especially between the former Soviet Union and the former Eastern European countries and Finland, gas trade has been part of larger barter deals. There have also been examples of governmental interference in preventing contracts from, or promoting contracts to, being signed or fulfilled. Examples include the US embargo of equipment to the Soviet pipeline, the French subsidization of Algerian gas import and the British rejection of the Norwegian Sleipner contract, all in the 1980s.

Both market growth and infrastructural developments, as well as political decision making, may now create a more competitive gas market in major parts of the European market[5]. Competition between pipelines will most likely intensify. Market growth indicates that competition between customers may intensify. Increased demand may bring new supplying countries to the market, such as Kazakhstan, Iran and others, and increase the number of oligopolists selling to the market.

[4]See Broadman (1986) for a discussion of market power in the US natural gas pipeline industry.

[5]See Stern (1992) for a discussion on whether the development primarily is regulation driven (by political decision making) or led by market growth, investment in infrastructure, etc.

Hard competition between producing companies in exporting countries is less likely to be allowed by the exporting countries themselves due to the desire to sustain market power and exploit economies of scope in production and transmission (within the exporting countries), as well as general resource management needs. This has been an argument against liberalization of the market. From the consuming countries' point of view, the maintenance of an oligopolistic supply side, while the market is liberalized downstream, may give sellers a disproportionate market power and potentially enforce an anti-competitive situation. Thus, there is a desire, from the European Union (EU) point of view, to weaken or dissolve gas exporting countries' sales monopolies. From the producing countries' point of view, the loss of long-term contracts with the pipelines will distort investment incitements. A country may be prevented from introducing more competition in its gas industry if a neighbouring country does not, for fear of causing a relocation of rent.

Although it seems likely that the European gas market will become *more liberal* than it has been, there are many reasons why it will *not* become completely and perfectly liberalized in the foreseeable future. Firstly, the varying degree of scale and scope economies in market segments makes it difficult to establish an optimal portfolio of competition, regulation and unbundling throughout the gas chain. It is also difficult technically to find regulatory schedules that do not create new inefficiencies in the market. The second-best solutions liberalization often aims at may end up as third- or fourth-best solutions in reality.

Secondly, as the market develops, authorities are often slow to change regulation in an optimal manner. The US experience tells us that the costs of policy making being slower than market dynamics may be significant. Thirdly, strong economic interests in the firms to be regulated lead these to lobby in order to prevent more competition and/or regulation. Fourthly, as European gas trade is international, also within a Maastricht version of the EU, the economic reasoning behind a possible opportunistic behaviour by one gas firm trading with firms in other countries may be supported by nation states which have a desire to maintain rent to the country and political influence following the firm's strong position in a market for an essential good like natural gas. Thus, liberalization of the European gas market may differ significantly between countries.

An important difference between the European gas market and many other markets being liberalized is that natural gas is a non-renewable resource. With a limited supply, and prices (over time) to a large extent fixed by prices of alternative energies, there is an economic rent to be earned in the market, even after it is liberalized. The total rent is determined by the difference between market prices and the sum of the cost of production, transportation, storage, distribution, gas use, etc. How this rent is distributed throughout the gas chain depends mainly on the cost structures in firms, degree of competition (market power) in market segments and taxation policies. Rent may be redistributed between producers, pipelines and customers as a result of the liberalization process. It may end up as governmental tax revenues and for shorter or longer periods as lower consumer prices. The existence of, and fight over, this rent among commercial and political actors contributes to the politicization of the European gas market more than most other markets. Partly for this reason, market liberalization should be viewed as a *time-consuming process*, where liberalization experiments will be in transition for a long time, rather than as a step from one static equilibrium to another[6].

Gas policies of the EU

The development towards liberalization and regulatory reform taking place in Europe is not an isolated phenomenon. Over the past 15 years, a number of sectors in Organization of Economic Co-operation and Development (OECD) economies have been liberalized. The US and Canada were the first to liberalize their markets in the mid-1980s. Later, gas markets in the UK, and then Australia and New Zealand, followed. In Continental Europe, steps have been taken to liberalize national gas markets in countries such as the Netherlands, Italy and Spain[7].

The strong market concentrations and huge profits taken in the natural gas industry, particularly among transmission and distribution companies, could not be dealt with in Western Europe prior to the 1990s. Within the framework of the EU's Single Market, intra-European trade may more easily be discussed, partly on multilateral and partly on a tentative supranational level.

The EU has, so far, proposed three directives aimed at a more transparent market, allowing transit of gas between high-pressure grids and introducing Third Party Access (TPA) to pipelines and unbundling their role as both merchants and transporters[8]. Of these, TPA was not introduced after being proposed in 1992 due to heavy resistance from the industry and the European Parliament. It has, however, been put on the agenda again for 1996/1997[9], following the finalization of a similar directive for electricity decided upon in December 1996[10]. With the proposal for a directive to restructure the community framework for the taxation of energy products in 1997[11], harmonization of energy taxation will probably be a reality. This proposal suggests relatively sharp increases in minimum taxation on all energies, but relatively more on natural gas (and coal).

Furthermore, in Norway, the EU has attempted to increase competition among producing/exporting firms through the EFTA Surveillance Authority (ESA), which considers whether

[6]Austvik (1996b) discusses the market situation and development in more detail.
[7]IEA (1994) (pp. 19–21) gives an overview of the liberalization steps in national gas markets taken by OECD member countries.
[8]EU (1990)(1991)(1992).
[9]See EU (1997a)
[10]EU (1996).
[11]EU (1997b).

the GFU (the Norwegian gas sales monopoly) breaks competition rules within the European Economic Area (EEA)[12]. In court, an American oil company is accusing European gas firms of anti-competitive practices.

The electricity directive proposed is viewed by many as the opener for the TPA gas directive, as the gas and electricity markets have many similarities. It states that member states may choose between two procedures to reach 'objective, transparent and non-discriminating' criteria for the access to the electricity system (articles 17 and 18). One option is *negotiated access* based on voluntary commercial agreements. A country may also opt for a regulated system based on published tariffs. The other option is a *single buyer* procedure. A single buyer is a firm responsible for the unified management of the transmission system and/or for the purchasing and selling of electricity. According to the directive, the single buyer must publish its tariffs for the use of transportation systems and let eligible customers and producers use the system in contracts with each other. Either two options give the transmission and distribution system right to refuse access to the system where it lacks the necessary capacity. The directive states that member states shall designate an authority, public or private, to be responsible for the organization, monitoring and control of the tendering procedures. The system shall be established gradually in order to enable the industry to adjust to the common rules.

The EU proposals aim at a more efficient gas market that should lower costs at all stages of the gas chain, improve the security of gas supplies, reduce the dependence on imported oil from the Middle East and take the full benefit of the environmental advantages of natural gas. In the area of taxation, it aims to move taxes from labour as production factor towards energy (including natural gas). For exporters, the changing market and fiscal environment may require a change in company strategy and be a challenge for their international energy policies.

Pricing of European gas

Contractual price formulae in the Continental European market are mostly designed to make prices react to changes in other energy prices, with a time lag reflecting the value of gas for end-users. This value, or consumers' opportunity cost, represents a weighted average of their willingness to pay. Each end-user faces different alternative energies: hydro- or nuclear-produced electricity, oil or coal (particularly coal-fired electricity generation). This principle is valid for the pricing of gas both between producers and pipelines and between pipelines and customers at the city-gate. The price of gas agreed upon in these transactions is influenced by:

(1) the alternative energies contained in the formula;
(2) the weight of each energy in the formula;
(3) the setting of the initial relationship between the gas price and the price of alternatives;
(4) the escalation mechanism of gas prices in relation to the price of the alternatives.

The alternative energy pricing principle has resulted in lowest prices of gas to electricity production, somewhat higher for industry, and highest for general supplies to households and businesses, due to the different alternatives faced by each consuming group. The discrimination between markets makes the seller able to take parts of consumer surplus without disturbing consumption patterns, compared to a situation in which each consuming group is charged the same price. The Norwegian Troll contracts signed in 1986, and virtually all contracts following, contain renegotiation clauses of price provisions, such that prices should continuously reflect the competitiveness of gas in the market, even when major changes take place. Other contracts may be renegotiated on a *force majeure* basis, although this has barely been enforced.

A change in the price of alternatives to gas leads, rather automatically, to a change in the sales price of gas to producers and to transmission networks. To a large extent, these prices are '*net-backed*' from the markets of alternative energies. Historically, the gross margins to LDCs and transmission companies (the difference between the prices at which they sell and buy gas) have largely been determined such that they do not vary with end-user prices. The margins to transmission companies are set by the negotiations with producers and customers. The pipelines attempt to 'lock in' their initial profit margins and protect themselves from any fuel price movements. LDC margins are largely determined by the negotiations with transmission companies and the relationship between these prices and prices for gas in the market.

While a typical contract for exporters has a length of some 20 years, a typical contract for pipelines selling to their customers has a length of 1–5 years. In order to increase the market share for natural gas, in many contracts (such as for Troll), the initial relationship between the end-user price of gas and the price of the alternative energies is set to less than 1 : 1, ie end-user prices of gas are set lower than the price of the alternatives. When pipelines write new contracts with customers, the price they agree upon is adjusted, in spite of the fact that they have signed more long-term contracts with exporters. That pipelines sell gas more short term than they buy may give them a profit or loss compared with the initial situation. However, the pipelines are bound to *take-or-pay* (TOP) clauses with producers, determining that pipelines must pay for (a certain share) of the gas they have contracted, even if they are not able to sell it. Equivalently, the LDCs may regulate their prices to end-users according to what it is possible to get from the market, in spite of the fact that they (too) are bound to more long-term contracts with transmission companies than they sell on.

Thus, the (net) price to the transporters depends on both the initial relationship between the gas price and the alternatives, and how the market (for each of them) develops within the contracted period. If gas can be sold at higher prices than expected in the contract period, transmission

[12]See MOE (1997) for a Norwegian view on this ongoing matter.

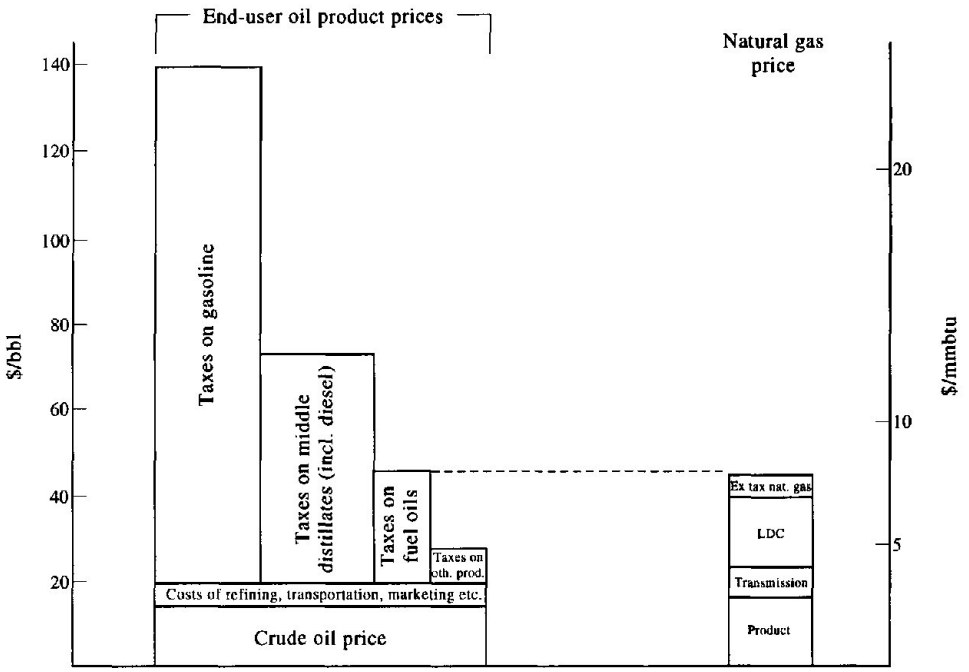


Figure 1 Gas prices in Europe and the relation to oil prices (simplified illustration)

and/or distribution companies may benefit[13]. The initial relationship between producer/pipeline and pipeline/customer prices and the price of the alternative energies determines the base for the gross margins to pipelines and will be influenced by parties' costs of operation (fixed and variable), negotiation skill and market power.

To illustrate the relationship between gas prices and the price of alternative energies we show, in Figure 1, a simplified pricing mechanism reflecting contracts where gas competes with *fuel oil*. We also disregard the more 'short-term' gains and losses transmission and distribution companies can make through changes in the sales prices of gas within a contract period.

The left set of bars shows the end-user prices of oil products. The basis for these prices is the price of crude oil and costs to refining, marketing, transportation, etc. In the figure, the crude oil price and the costs are illustrated as if they are equal across product types, even if this is not accurate. Our point, however, is that the main difference between the prices of different product types results from different *oil product taxation*. For a representative barrel of oil, our calculations show an average tax of 47 USD/bbl in OECD-Europe and an end-user price of some 70 USD/bbl in 1994 (see later). Gasoline has the highest taxation and would yield a per barrel price of some 140 USD in Europe, while taxes (and end-user prices) are falling on heavier products.

Usually, prices of crude oil are set in USD/bbl (a price per *volume* unit of crude oil), while prices of gas are usually set in USD/mmbtu (a price per unit of *energy* content of the gas). The ordinates to the left and right *illustrate* the relationship between the two prices. The gas price bar to the right in Figure 1 shows that gas prices to end-users are determined by the price of its alternatives, here fuel oil. The price of the alternatives to gas determines the size of the 'cake' to be distributed between consuming countries' governments (excise taxes on natural gas), distribution and transmission networks and producers (and thus what producing countries' treasuries take from producers). As long as the margins to LDCs and pipelines are not reacting to changes in market prices, the price of gas to the exporter can be changed in the following ways (so far keeping taxes on gas itself constant):

(1) a higher crude oil price raises fuel oil prices and, thus, end-user prices of gas;
(2) higher taxes on fuel oil also increase end-user prices of gas;
(3) higher taxes on all other oil products will, if they lower crude oil prices, lead to lower fuel oil prices, and thus lower end-user prices of gas;
(4) if taxes on all oil products are raised simultaneously, it is not clear whether the taxes are under- or over-compensated by a possible resulting lower crude oil price; it is the composition of oil product taxation that determines whether or not gas prices benefit from increased taxation;
(5) if end-user prices fall, for one reason or another, it is more or less fully reflected in a similar decline in producer prices.

From these mechanisms, it is often said that the producer takes the 'price risk' and the pipeline takes the 'volume risk'

[13]The price of gas may even, in periods, be higher than the substitute price (the price of the alternatives). This may happen when demand is inelastic in the short run, and when the cost of using gas is less than, for example, the cost of using fuel oil. Thus, the '*market value principle*' may be perceived as the net price the customer/consumer is willing to pay (costs withdrawn).

in today's market. However, as long as price and volume are interconnected in a market, it is the producer that, *over time*, takes most of the risk connected with gas sales today. Nevertheless, it is possible that transmission companies may face so many difficulties in selling gas to their customers that they have to lower prices and/or volumes sold to an extent that the TOP clause becomes effective. In that situation, the companies involved may face a loss.

A more liberal market gives more volatile prices

In general, liberalization of the European gas market will increase the number of actors operating and transactions made in the market, as well as the speed of reactions in one segment to changes in another. For example, when producers and customers make direct contracts and pipelines are no longer acting as balancing intermediaries, market conditions may more quickly affect producers' prices. The number of actors increases and the volumes of each contract (at least for producers) decrease. Brokers and marketers may establish themselves to clear (parts of) the market, in addition to the direct contact between parties.

Prices (for exporters) become more volatile as they react to market changes not only in the long term, but through gas-to-gas competition in the short and medium term (up to as much as 5–10 years). In a surplus situation, a 'gas bubble' would lower prices in short-term contracts. When demand exceeds supply, spot and other short-term prices will be pushed up. When a short-term market for natural gas is developed, it may work as a barometer for the (underlying) trend in long-term prices. Depending on how the balance between supply and demand develops, prices may actually end up both below and above the prices within the existing system, as illustrated in Figure 2.

A tight gas market will produce more long-term contracts, and a weak market more short-term contracts (including possible spot sales). With a higher number of actors and increased volatility, 'long term' in a new market structure will be shorter than in the existing system. More short-term transactions indicate greater variations in short- and medium-term prices depending on market tightness. How strong and quick responses will be depends, in addition to market conditions, on the degree and shape of liberalization and the firms' remaining market power. The increased number of short-term contracts will partly replace existing long-term contracts, but partly also satisfy customers not able to buy gas under today's system (with greater rigidity). Thus, demand may grow under liberalization.

The question has been raised as to whether gas could be *priced independently of its alternatives*. Over time, this is not possible for any commodity. For example, in the US, gas prices have been lower than its alternatives for many years. However, these low prices were probably a result of the gas 'bubble' existing after the mid-1980s, representing an oversupply in the market. As consumption has gradually reabsorbed available production capacity, prices have been rising in the 1990s. Also in the US, the market value principle for end-user prices of gas seems to be valid, even though differences may occur over the short and medium term.

However, if supply *continuously* overshoots demand, prices may remain lower than the price of the alternatives for a longer time. This may happen if demand grows and the marginal producer makes economic rent even at low prices, and therefore continues to invest in new capacity. Similarly, if energy markets in general become tight and demand for

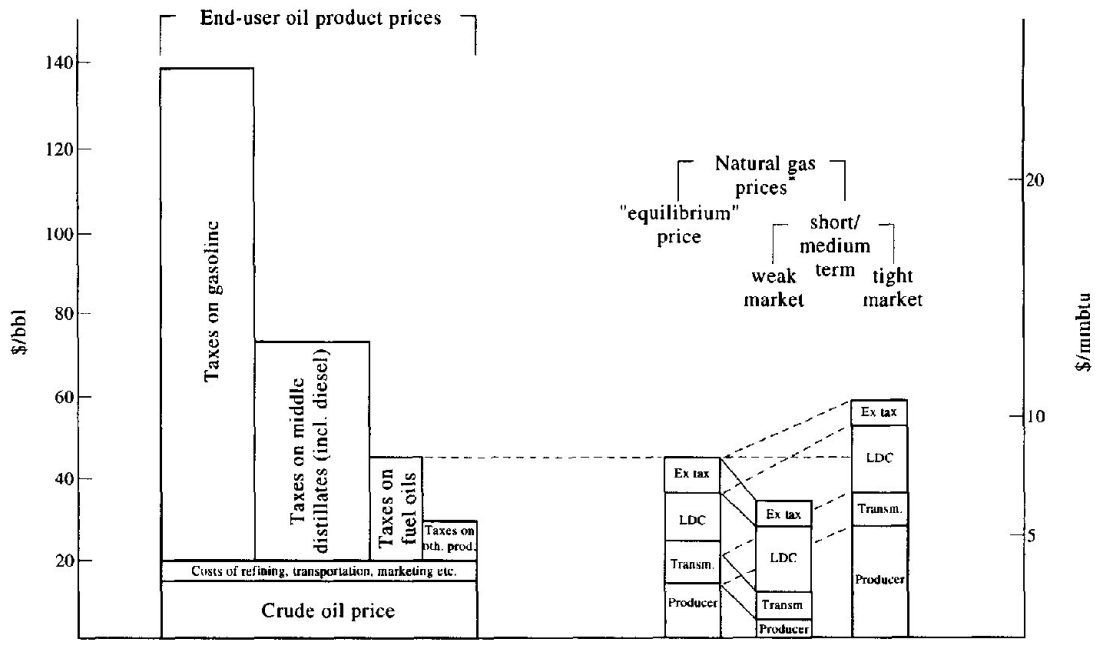


Figure 2 Increased price volatility in a liberalized market (simplified illustration)

gas overshoots supply, prices may over some time be higher than the price of the alternatives. The specific feature of natural gas markets is that such periods may last over a number of years. In the European market, if supply prognoses are correct, a 'gas bubble' may exist which, within a more liberal market structure, will more easily lead to lower prices in the intermediate term.

Who wins, who loses?

If pipelines become regulated, or competition between them intensifies, gas from different sources meets in 'gas-to-gas competition' at the customer level (at the city-gate where LDCs, power plants and large industrial users buy their gas), rather than on importing countries' borders (where merchant pipelines buy their gas). If producers maintain today's market position (as oligopolists), and transaction costs are not too high, they should meet a weaker and more diversified group of buyers at the customer level than at today's monopsonistic import level. Customers should also be better off by meeting a somewhat more diversified group of exporters than the monopolist they face in the form of a merchant pipeline.

In this case, the customers' purchasing price should drop at the same time as the producers' price increases. This implies that customers and producers share the rent made available from increased competition between pipelines. For both producers and customers, it will be important to maintain a purchasing position as concentrated as possible. The more market power each of them can obtain, the better off they may be in negotiations. If, on the other hand, exporting countries' selling monopolies are abolished or weakened, and today's purchasing pipeline consortium is maintained, each company within a single producing/exporting country should sell gas directly to the purchasing pipeline consortium. This would improve the relative position of the merchant pipelines and should lower producer prices to the benefit of the pipeline.

Corrected for transaction costs, producers would benefit from selling gas directly to customers when end-user markets are tight. Similarly, customers could benefit from buying gas directly from producers in a weak market. Thus the process moving from one set/type of contract to another as the market becomes more liberal may take the form of various parties (including exporters/producers) claiming the termination or renegotiation of existing contracts (perhaps on a *force majeure* basis).

Thus the changing market environment requires adjustments of *producers' and customers' company strategies*. As contracts become more short-term, diversified and volatile, an apparatus for closer contacts between them must be established. Spot markets, as well as hedging tools, such as futures and forward markets for natural gas, may develop. The ability to gradually develop such competence, in line with the liberalization processes, will be an important factor for rent distribution between exporters and customers.

Theoretically, if no regulation of single firms takes place, but unbundling (throughout the gas chain) and price transparency are introduced, and horizontal collaboration is made illegal between producing companies and pipelines, this should have the potential of increasing the relative market power to pipelines. This is due to the assumption that pipelines have greater elements of natural monopoly (economies of scale and/or scope) than do producing companies. Thus, the most significant threat to the pipelines' profit may be an actual regulation of the terms of operation, rather than increased competition, unless competition takes place only in the transmission segment. Eventually, if regulation of transporters' behaviour is introduced, LDCs and pipelines may become more concerned about how regulation is made and may try to 'trap' the regulator to serve their interests, rather than just oppose him.

To the extent that the European Community represents the 'collective' interests of member countries, the EU could make decisions conflicting with the interests of single firms, regions and countries in order to maximize 'community wealth'. In particular, the EU (as a group) would be interested in intensified competition and in regulating tariffs and terms for operations in situations in which the costs are carried by non-EU exporters.

For example, if nothing else happens, other than that competition increases between gas sellers/producers/exporters, the pipelines' market position will be strengthened and profit will be transferred from producers to transporters (in new contracts). For example, this may be the effect if the ESA control committee finds the Norwegian sales monopoly (GFU) illegal according to EU/EEA competition rules and no other 'liberalization' steps are taken further down the gas chain.

If the TPA directive is introduced, similar to the electricity directive, there will be some sort of a negotiated access to the grids based on commercial agreements. At the time two parties do not agree about terms, the deal must be sent to EU authorities (eg the Court of Justice). Thus, a TPA directive may be the forerunner for an access arrangement to the pipelines based on some sort of regulated tariff. Whether or not this happens, the role of the pipelines will be weakened and the customers will benefit. Producers may benefit or lose, depending on their ability to write new contracts directly with the customers, terms for pipeline transportation, market developments and taxation policies Customers at the city-gate, power plants, large industrial users and distribution companies will benefit from lower prices. The LDCs may, however, not necessarily lower their sales prices to private and commercial end-users. Rather, they may increase their profit.

The TOP provisions

Today's long-term contracts are now 'securing' exporters a market for their gas. From the producing companies view, one argument against liberalization has been that it will erode the security of volume offset. However, the stability provided by merchant pipelines in today's system is based on a *stable demand* of natural gas. Obviously, this gas can be

sold directly to customers (or via a brokerage or marketing firm), as well as through a pipeline intermediate. Furthermore, nobody knows what will happen with pipelines' TOP obligations if they are not able to sell the contracted gas under today's system, for example in a situation with a strong decline in demand. Usually, a volume can be sold if the price is sufficiently low. Thus, the risk that customers would not be able to purchase gas, or that exporters would not find buyers, as a result of a changed market structure, should not be over-estimated.

However, a more liberal market may provoke a revision of the existing contracts. Competition among pipelines or the regulation of their terms of operation may lower their profit margins, at the same time as the volumes and prices at which they can sell gas to customers are pushed down. This may indicate that there is only a question of time before the existing *merchant pipelines* will claim renegotiation of the terms under which 'old' contracts are signed with exporters. If the contract structure could be maintained, with continued sales of gas from exporters to the pipeline, with the only change that the price and contract would reflect the new and more competitive market for a pipeline selling gas at the customer level, exporters run the risk that the entire downward pressure in prices to customers will be paid by them, without reaping the benefit from the lower margins under which the pipelines operate.

However, from another point of view, unless the old merchant pipelines lower their margins to the levels of the new ones, *exporters* may claim *force majeure* negotiations, because contracts no longer reflect market conditions. Exporters could be better paid by selling gas directly to customers. At this stage, the pipelines may benefit from changing their strategy from resistance against a more competitive environment to influencing how the liberalization process occurs (to trap the regulator's decisions). This would cost the old pipeline market shares and profits, but less than if no collaboration takes place.

Thus, either way, the existing TOP clauses will come under pressure as the market becomes more liberal. As producer prices in 'old' contracts are linked to end-user prices of gas (not to pipelines' sales prices to their customers), these contracts may be maintained if pipelines accept lower margins. The question is whether or not they can argue that the market environment has changed so much that *force majeure* provisions may be enforced.

If pipelines transporting and merchant customers are unbundled and their margins are competed or regulated down, they may be unable to fulfil their obligations towards producers in existing TOP clauses. This occurred in the US in the mid-1980s after the introduction of Open Access under Order 436 simultaneously with the oversupply of gas and of pipeline capacity in the market. Pipelines' stabilizing brokerage function must be taken over by producers and customers through a greater and more diverse contract portfolio. Many of the existing contracts must be replaced with new contracts between producers and customers.

Is the US experience relevant for Europe?

The most striking *difference* between the European and US gas markets is that, in Europe, there is strong power concentration (few firms operating) at most levels and segments of the market, whereas, in the US, the market is controlled by thousands of producers and numerous distributors. While the typical pipeline in Europe faces oligopoly and oligopsony at its entrance and exit, the typical US pipeline faces something closer to competition at both ends.

In Europe today, the international trade of gas must be negotiated bilaterally, as interstate trade in the US before the Natural Gas Act (NGA) in 1938. The potential role of the EU Commission in intervening in (parts of) the market may parallel the US federal government's role in regulating the interstate trade at that time. However, even more than *50 years* after the first regulations passed Congress in 1938, the US gas market still suffered from undesired inequities. The wishes of the Congress were not always enough to make the market conform to its desires. Repeated regulations and deregulations have often led to undesired results with dramatic stop-and-go policies following.

This experience reflects the difficulty in finding optimal schedules for the liberalization of any gas market. Regulations should be made with a consciousness of the market framework and mechanisms and how these may *evolve*. Placing a lot of this judgment on policy makers and lawyers may create inefficiencies in Europe, as it has in the US. If it is possible to find self-regulatory mechanisms, the damage on the economies made by misjudgments and inefficiencies may be reduced. It is also worth observing that the choice of *doing nothing* probably has been considered the worst possible solution in the US. Few have suggested that the situation that existed before the NGA was implemented in 1938 was better than the more or less regulated situations after.

Due to the need for and complexity of regulations of natural monopolies, there may be a parallel need in Europe as in the US to oversee a 'completely liberalized market' with quite a substantial regulatory authority. The *regulatory techniques* in the US, as exercised by the Federal Energy Regulatory Commission (FERC), may be of some help in designing regulation in Europe, even though they are not necessarily directly applicable. So far, a *supranational agency* to deal with gas market regulations, like the FERC, is absent in Europe. Most agencies will remain national, while the EU will provide a looser framework for national legislation and regulation than FERC.

The EU is not a federation, and is only moving (in the long term?) towards a confederation. Trade is international, and will continue to be so. Not least, however, this is due to the fact that much gas will be imported from outside EU jurisdiction in the foreseeable future. In the US, only a minor part of consumption is imported. The lack of a judicial body to deal with the entire market limits the possibilities of a full liberalization of the European market. The fact that trade crosses nation states outside and inside the Union, with all

their differences, reinforces the problems of dealing with diverging economic interests. It indicates that, within a possible EU framework (with the TPA directive as a starter), many national solutions will be found, reinforcing the need for a gradual liberalization, rather than one that aims at reaching the goals in only a few large steps.

Another lesson to be learned from the US is that a more liberal market leads to greater and more frequent price variations, even though competing energy markets put limits on these variations in end-user markets on the upper side and costs of production on the down side. However, the drop in US prices in the late 1980s was not necessarily caused primarily by liberalization, but perhaps the 'Open Access' system introduced made reactions stronger and faster. Lower oil prices and oversupply of gas (the 'gas bubble') forced prices down. In the 1990s, US gas prices have been rising due to a better balance between supply and demand. This confirms our results, indicating that when a possibly liberalized European gas market becomes tight, producers will benefit from higher prices, as consumers will when the market becomes lax.

Energy taxes

As already discussed, taxation of alternative energies to gas, in general, and oil products, in particular, influences gas prices directly. The question now is, what happens if gas taxes themselves are raised? Due to the environmental advantages of gas, compared with oil and, in particular, coal, this issue has partly been disregarded by many analysts. For environmental reasons, gas should be taxed less than other fossil energies.

However, the EU directive for the taxation of energy products was proposed in spring 1997, right after the renewed emphasis on the TPA directive, and suggests a substantial increase in gas taxation. The proposal gives a framework for 'enabling a revenue neutral restructuring of tax systems to sustain employment and the environment'. It aims at 'modernizing the Community system for the taxation of mineral oils and extends its scope to all energy products'. The measure is a harmonization of energy taxation, and the proposal suggests the introduction of minimum charges on the use of all energies. Following 'the deadlock of negotiations on the CO_2/energy tax', it suggests reducing statutory charges on labour, replacing them with higher energy taxes. The directive moves the emphasis from the environmental benefits of natural gas towards the nations need for revenues and competitiveness. It offers member states a greater use of energy taxation for environmental purposes, but in favour of labour as a factor of production in a 'revenue neutral' manner. It 'states' that consumers will be very little hurt by the sharp tax increases suggested. The minimum charges should be introduced in 1998, and raised step-by-step until 2002, when a new escalation plan may be put on the agenda. The minimum rate for natural gas will be increased by 350% in the period 1998–2002.

To illustrate the important role energy taxation has begun

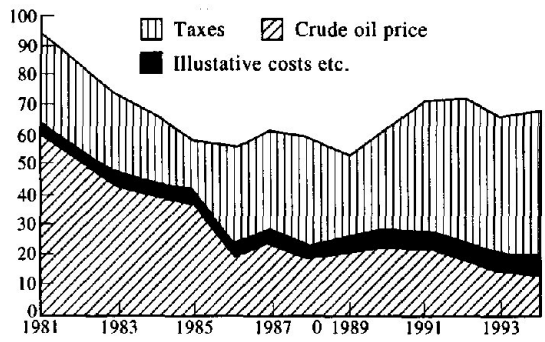


Figure 3 Crude oil prices, taxes and end-user prices on oil products (1994 value) in OECD-Europe ($US/bbl)

to play in energy markets, we will take a short look at what has happened in this area in the oil market over the last decade. The directive for increased CO_2 taxes, mentioned in the EU tax proposal of 1997, was proposed by the EU in 1990. It suggested a 10 USD/bbl increase in the taxation of oil by the year 2000. The directive was not implemented, and was not necessary. Already in 1993, this tax increase suggested was implemented in the major European industrialized countries. In some cases, it was vastly exceeded[14].

EU countries have been the forerunner in increasing oil product taxes. To demonstrate their willingness to tax, even without directives saying that they should do so, the different development in oil prices to consumers and producers is shown in Figure 3. After the drop in crude oil prices in 1985/1986, today's real value of a barrel of oil is about a quarter of the value at the beginning of the 1980s. Since the Gulf War in 1991, real crude prices have continued to drop, to some two-thirds of the 1990 value (with the exception of a fall in 1996). Prices to consumers have, on the other hand, been much more stable. In real terms, EU consumers now pay about the same as they did in 1986[15].

In real 1994 terms, the price of crude oil decreased from 61 to 16 USD/bbl in the period 1985–1995. In OECD-Europe, the decline in price of 46 USD/bbl has partly been compensated for by an increase in taxes of some 20 USD/bbl. On average, in Europe, the amount of tax in a barrel of oil was some 47 USD/bbl in 1994, against 20–30 USD/bbl in the early 1980s. Thus, in spite of the dramatic drop in crude prices, the average price to consumers decreased (only) from 95 to 70 USD/bbl, as shown in Figure 3[16]. As a percentage of end-user prices, the typical tax in 1996 was 70%–80% on gasoline, 50%–60% on diesel and 30%–70% on light fuel oils. Probably, these taxes have contributed in depressing crude

[14]Reinsch *et al* (1994).

[15]Consumers in the US and Japan have experienced a real decline in prices since 1990. On average, for the entire OECD area, consumer prices are about 60% of the level in the early 1980s and 90% of the 1990 level. Crude oil prices were, in 1995, 5 USD/bbl at 1973 values, just above the pre-shock level in 1973 of 3–4 USD/bbl.

[16]See Austvik (1996a) for details of calculations on the development of oil prices to consumers and producers in the period 1981–1994. This text is, however, in Norwegian only.

Table 1 Taxes as share of end-user prices on gas and coal in selected countries

Country	Households		Electricity		Industry		Coal to industry	
	1984	1995/1996	1984	1995/1996	1984	1995/1996	1984	1995/1996
Austria	16.7	16.7	0.0	n.a.	0.0	0.0	0.0	0.0
Belgium	14.5	21.3	0.0	0.0	0.0	0.0	0.0	n.a.
Denmark	18.0	25.4	n.a.	n.a.	n.a.	n.a.	0.0	25.4
Finland	1.7	25.1	n.a.	n.a.	1.7	8.6	9.6	30.0
France	15.7	16.4	0.0	0.0	0.0	0.0	0.0	0.0
Germany	12.3	19.2	n.a.	17.7	0.0	14.0	0.0	0.0
Hungary	0.0	10.7	0.0	0.0	0.0	0.0	0.0	n.a.
Italy	13.4	44.5	0.0	0.0	0.0	9.6	0.0	0.0
Netherlands	16.0	25.0	0.1	7.3	0.0	7.0	0.0	n.a.
Spain	1.5	15.1	0.0	0.0	1.5	0.0	n.a.	n.a.
United Kingdom	0.0	7.4	0.0	0.0	0.0	0.0	0.0	0.0
USA[a]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Canada	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Japan	0.6	2.9	0.0	n.a.	0.9	2.9	n.a.	2.9
New Zealand	8.1	14.3	n.a.	n.a.	11.3	6.0	1.6	n.a.

Source: IEA (n.a., not available/relevant).
[a]Taxes on gas use vary between 3% and 6% of end-user prices (IEA).

oil prices in the period[17]. There is now an asymmetry in the response of product demand to changes in the crude oil price. While crude prices are dropping, product prices are stable or rising. Therefore, analyses of demand for oil must be modified with respect to product taxation.

Effects of gas taxation

So far, gas prices have benefited from the sharp increase in oil product taxation, while the taxation of gas has been more moderate. As a percentage share of end-user prices to households, they have increased from some 15% in 1984 to more than 20% in 1994 in many countries (Table 1). Taxation of gas to power plants and the industry is lower, in many countries zero. Even though gas taxes are low compared with oil product taxation, taxes on polluting coal are even less; indeed, coal is subsidized in many countries. This tax structure reinforces the impression that energy taxation in consuming countries has primarily not been set with reference to the environment, but first of all from fiscal needs, often as a replacement for lower income taxes.

A tax creates (or increases) the difference between the price producers receive and the price consumers pay. In general, such a tax is partly borne by producers (through lower prices) and partly paid by consumers (through higher prices). It will always be the side that is least elastic that pays most of the tax. For example, if demand is more elastic than supply, more than half of the tax will be paid by producers. If supply is totally inelastic with respect to prices, producers pay the entire tax (and vice versa).

If gas taxes are raised, the first effect could be that the increase is partly producer and partly consumer paid, as shown in the middle gas bar in Figure 4. However, a tax rise must, eventually, push prices in the gas chain down, as consumer prices *over time* cannot be higher than the price of the alternatives. In the short term, it is possible that the tax may be partly paid by end-users, depending on how (in)elastic demand for gas is, and whether end-user prices match the alternatives initially. If gas prices initially are lower than the prices of the alternatives (in order to increase the share of gas in the overall energy demand), consumers may pay the tax more permanently at the cost of a lower growth in gas demand. If the transporters (pipelines and LDCs) take a higher price for gas than what the initial relationship between gas prices and the alternatives presupposes, the transporters may also pay the tax in the short term. If, however, demand growth is maintained or the market matures in a way that end-user prices of gas equal prices of the alternatives, the tax must, eventually, be paid by the producers or transporters through negotiations.

How these negotiations end up depends on the parties' costs, negotiation strength/market power, etc. As already mentioned, historically, transporters' margins seem rather independent of end-user prices in the negotiations. As long as transporters can argue that the level of their (rather high) existing margins are necessary to cover costs, an increase in taxes will not be borne by them. Thus, in the case of fixed margins to LDCs and pipelines, a gas tax must, eventually, be borne by producers. This is shown in the third gas bar to the right in Figure 4.

The less dependent margins to pipelines and LDCs are on end-user prices, the more of the tax, if not all, must eventually be borne by producers/exporters. The heavy taxation of oil products over the last decade is an illustration on how popular taxation of energy has become in consuming countries in general, and in the EU in particular. Thus, as the consumption of gas largely takes place within the Union and increasingly more production takes place outside, gas taxes may become particularly attractive for consuming countries as a

[17]However, this is very difficult to determine empirically. The crude oil price depends on a number of factors in addition to the size of taxes, eg the taxing countries' representativeness for total consumption, demand and supply elasticities, etc.

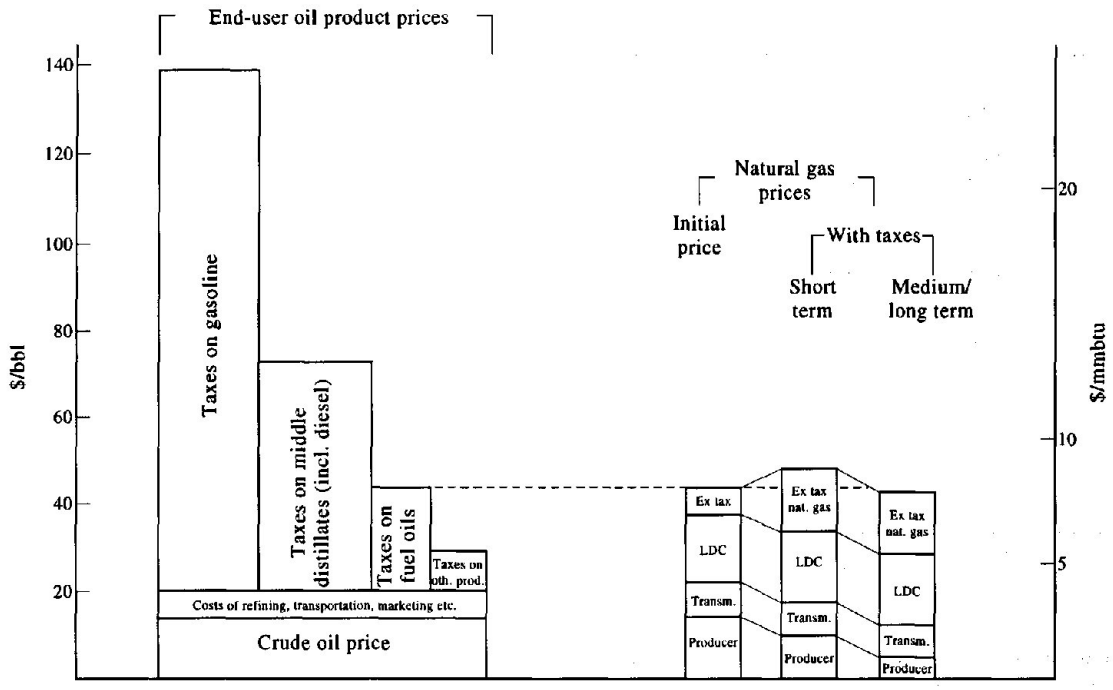


Figure 4 Natural gas excise taxes and natural gas prices (simplified illustration)

source of revenue and transfer of rent from producers' to consuming countries' treasuries.

Probably, the result will be that, over time, a new gas burden will be shared throughout the industry and contribute to bringing end-user prices equal to the alternatives (1 : 1) if they are not so today. In the case of liberalization, there may be a redistribution of rent within the gas chain. Some may lose, and some win. In the case of taxation, money is transferred from the industry and to consuming countries' government treasuries. Thus, the natural gas industry may more easily oppose the taxation directive together than the TPA (and following gas) directive(s), as it places a pressure on everyone's margins.

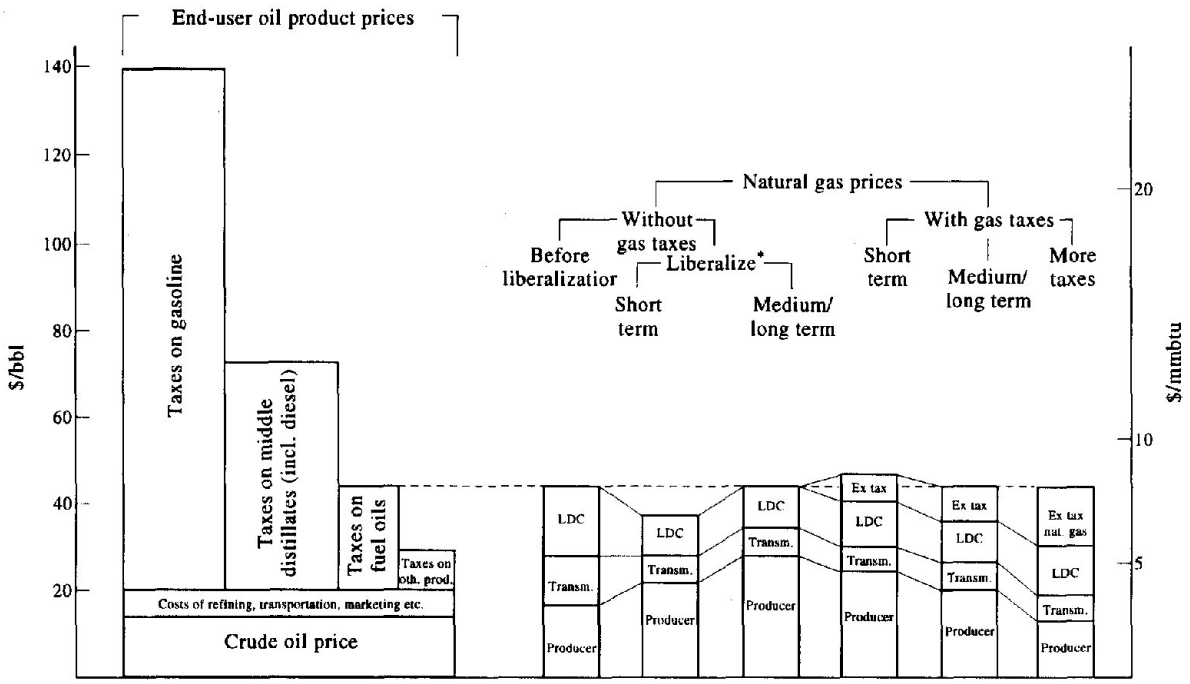
Limits to gas taxation

One limit to gas taxation, at a given status of the market, will be determined by the cost of getting new gas to the market (long-term marginal cost of gas production). The higher the ambition of increasing gas consumption, the lower the taxes must be. However, producer prices need not be higher than what is 'necessary' in order for producers to invest in new capacity. As long as some rent, with 'reasonable certainty', is left to a producer making calculations for new field developments, he will invest. However, if gas taxes are used as a strategic economic instrument among consuming countries to derive rent, the only fields making economic rent may eventually be those of low cost. Furthermore, the more cost effectively producers can operate, the higher taxes can be. Thus, an owner of an exhaustible resource will, over time, not necessarily earn economic rent, even if consumer prices are rising.

At a given margin to transporters, the long-run marginal cost (LRMC) of bringing new gas to the market will set a limit to how low producer prices can be, and thus put a ceiling on gas taxes. If the share of natural gas continues to grow, exporters' prices will be higher than if consumption remains stable. This may particularly be the case if new gas comes from Iran, Kazakhstan, northern Norway and Siberia (at least if the Russian economy develops as a market economy).

Between sectors, there may be different limits to taxation. Industries that use gas are in regional or European competition in using gas as an input factor. In the product markets, however, they are to a larger extent in global competition, in the same way as industry using oil as an input factor. Private households do not compete in global markets, but choose their energy (mix) according to relative prices (including taxes), technology, cost of switching between energies, etc. This uneven competitive position across gas consuming sectors may imply that taxation on gas use in households/ business will remain higher than on use in industry and power plants.

With oversupply in a more liberal market, gas-to-gas competition may force prices to customers and consumers down. If gross margins to transporters are fixed, producer prices will be pushed down. In this situation, taxes must be lower than in a situation in which gas prices equal the substitute price, in order to give producers a price that covers cost. However, in the 'long run', the end-user price of gas must equal the price of its alternatives. As long as gas prices are lower than the prices of alternatives, more users will switch to gas. Since we are facing an exhaustible, non-renewable resource, at some stage supply increases must end, and prices to users will again equal the prices of alternatives. On the other hand, if the 'long run' in the gas industry is 5–10 years or more (as in the US), a situation in



*Shares to distribution and transmission lowered due to more efficient operation and abolishment of their economic profit.

Figure 5 Market liberalization and active use of gas taxes

which supply continuously overshoots demand may place a limit on taxation for a rather long period.

If, however, energy taxes to a larger extent than today are set to reflect each carrier's environmental benefits and costs, taxes on gas should be low, and taxes on coal increased (and subsidies removed). Among fossil fuels, natural gas is the environment's best friend. The removal of coal subsidies should increase demand for gas. The price of gas should, however, remain the same as its alternatives. A (theoretical) removal of all gas taxes should therefore not increase gas consumption through lower prices to consumers. Low gas taxes would benefit producers (and possibly transporters) through higher prices and consuming countries through continued increases in supply.

Within such limitations (and temptations), gas taxes *may* become revenue generators for consuming countries' governments in the same way as oil product taxes are. At least, if (most of the) gas taxes are eventually paid by a transfer of economic rent from producing/exporting countries, there seem to be few reasons why consuming countries should not optimize the gas tax portfolio, with respect to the limitations set up.

An increase in gas excise taxes may become particularly attractive for consuming countries' governments when rent is made available in the gas chain, whatever the cause. This is what has happened in the oil market over the last decade. When crude oil prices dropped in 1986 and 1991, consumers could have derived the benefit from the loss of rent among producers. However, consuming countries raised oil product taxation, which stabilized end-user prices of oil and suppressed a potential later price rise on crude oil. As downward trends in crude oil prices can be used to increase oil product taxation, while an upward trend can be used to increase gas taxes, energy taxation as such may become a major political challenge for both oil and gas producers in their relations to importing countries.

Taxation and market liberalization

With no tax changes, regulations of LDCs could benefit transmission lines and/or exporters (depending on the remaining market structure). Regulation of pipelines could benefit exporters and/or customers. In these cases, local and national authorities may be better off by leaving the rent in the local or national company, rather than sending it (in most cases) out of the region or abroad. Then, it may seem better to leave the market 'unregulated'. If, however, these authorities can collect the rent made available through taxation, the desire to regulate down margins in transmission and/or distribution could be reinforced.

In the simplified illustration in Figure 5, the second gas bar shows the successful regulation of transporting companies to the benefit partly of consumers and partly of producers. The third gas bar shows that end-user prices eventually must match their alternatives, and be raised to this level after some adjustment time. With fixed margins to LDCs and pipeline companies, this must benefit producers.

An increase in taxes in this situation may be partly paid by consumers through higher prices and partly by producers by lower prices, as shown in the fourth gas bar. Eventually, as long as end-user prices match the prices of alternatives, this tax must all be paid by producers. In fact,

taxes may be increased to a level such that producers make only normal profit, as illustrated by the gas bar furthest to the left.

One important question is whether transporters will be able to argue that their often huge profit margins[18] are necessary in order to maintain operation. As margins are being pressurized, it seems likely that pipelines and LDCs must also pay some of the tax. Another question is whether consumers can pay some of the tax, especially as long as some gas is priced under its alternatives in order to penetrate the market. In these cases, the tax may lead to slower growth in gas usage (at the extreme, zero growth or declining consumption).

Less new gas to the market?

From a consuming country's point of view, a downstream liberalization of the market only (from when the gas enters the EU area), there is a question whether there are enough sellers to create a real market with competition or whether the oligopolistic exporting countries will be able to enforce an anti-competitive situation. Our analysis concludes that this concern may have some validity, but only under certain assumptions. For producers, it is a genuine risk connected with the increased uncertainty and price volatility a more liberal market creates, in general, and of the possibility of increased gas taxation, in particular.

A (theoretically) completely liberalized market requires competition between exporting firms, which is not the case today. However, joint operation of gas fields and transportation within exporting countries is important in order to exploit the benefits of economies of scope. One scope benefit is in horizontal integration across producing fields when determining optimal extraction paths, taking into consideration the fact that natural gas is an exhaustible resource. Another scope benefit is that of vertical integration among exporters' and (importing countries') transmission lines in orchestrating production and transportation to the market, as represented by the long-term TOP contracts. A third scope benefit is of resource management kind, and the orchestration of many smaller contracts in one merchant and production management. Coordinated gas sales and production can be maintained and developed in several ways, including competition between exporters of single fields and regulation of exporting countries' pipelines. The point is that, from a producing country's point of view, some institution should have the overall view on the benefits of economies of scope, distribution of rent throughout the gas chain and other commercial aspects of exporters' competitiveness.

As prices in each contract may vary more, and contract lengths may become shorter, the increased *volatility and diversity* require a greater dynamism and apparatus among both exporters and customers in order to operate competitively in a more liberal market. 'Price risk' in a new system will be taken by producers/exporters, as in today's system, and pipelines and LDCs will continue to operate under low risk, but under lower profit margins and costs. Prices to exporters may become higher or lower than under today's system depending on the use of gas taxes, but uncertainty will be greater.

The worst case scenario for exporters occurs when fields and pipelines in producing countries are 'fully' developed. At this stage, most producers' costs are sunk, and producers have no alternative but to continue supplying gas through existing facilities and grids even though prices are well below what was expected. In the extreme, if no new capacity is available, taxes could be raised to the point at which producers' prices just cover slightly more than variable costs. With all costs sunk, producers would benefit from continuing production even if prices did not cover fixed costs. In a more mercenary world than today's, tariffs on gas imports could be used selectively towards each producer (using an 'optimal tariff' towards each country). As each producing region/country becomes 'fully' developed, import tariffs are raised to transfer the rent from producers to consuming countries' treasuries without affecting future supply to a great extent.

This situation may lead to a new situation in the development of exporter's new mega fields and pipeline projects[19]. Financing gas projects could, in general, become more dependent on the financial community's assessment of the long-term risk in the market, rather than based on fixed pre-sales of gas. It could also lead to different ways of sharing risk, such as customers being engaged in upstream activities, exporters and customers in new pipeline projects and exporters in LDC and gas power plant developments. Under liberalization, investment decisions may (in principle) become more similar to those of mega oil projects, where the price risk also exists, and the volumes are sold spot or in a few months. For the development of giant oil fields, exporters will be able to borrow money in the belief by financial institutions that the market for oil will yield revenues that will enable the oil company to cover repayments.

For producers, it is important to have time to develop the expertise and network to make a large enough portfolio of contracts to defend (the huge) investments. Liberalization will require more direct contacts with customers and greater activity in the markets to (partly) replace the broker role of transmission companies. Furthermore, access to storage facilities is crucial to be able to supply customers on a regular basis.

Secondly, increased price volatility due to liberalization requires higher expected profit in the investments compared with today's more stable prices. In a liberalized market, the financing of new huge gas field developments will probably be similar to the situation when oil fields are developed. Today, the huge contracts to a large extent guarantee for investment costs.

[18]See Noreng (1994).

[19]Smaller gas fields may more easily be developed under liberalization if pipelines are not too far away from the field and capacity is available at reasonable, and foreseeable, cost.

Thirdly, and probably most problematic, is that purchasing countries through energy taxes have a political tool that can derive (much of) their expected rent. Therefore, one element that should be included in future contracts is decisions over how a tax burden will be shared within the industry. It is, however, difficult to limit future parliaments' ability to put new taxes on the use of gas. If the gas tax instrument is used to a larger extent than today, producers will no longer face market prices only, even in a liberalized market. With an active use of gas taxes, prices will be heavily influenced by political decision making. If this situation cannot be solved, producers may no longer be able to take the price risk and, consequently, huge new investment projects will be delayed.

Conclusions

The process towards a more liberal European gas market is partly driven by increased competition, due to market growth, investment in new transportation routes, etc. and partly led by political decision making on national and/or EU levels. Stern (1992) argues that the common rules from the EU only will provide a 'loose frame of reference' for national governments. He also argues that the process will gradually evolve, led more by market players than driven by regulators. In his view, liberalization (or TPA as Stern discusses) will develop on a country-by-country and case-by-case basis, which over time may lead to a more equitable and uniform regime, rather than initiated by a supranational EU body. Stern's arguments seem valid within the context of the discussion above.

However, local and national authorities may desire (if politically possible) to use their visible hands to regulate margins in transmission and/or distribution down sooner if they can collect the rent made available themselves, for example through taxation. The recent proposal on the revision of energy taxation may be a step in this direction. Taxes could be placed on consumers as well as on transmission and distribution services. With no tax changes, regulations of LDCs would benefit transmission lines and/or exporters (depending on *how* the market is liberalized). Regulations of pipelines would benefit exporters and/or customers. In these situations, local and national authorities may be better off by leaving the rent in the local or national company, rather than sending it (in most cases) out of the region and/or abroad and leave the market unregulated if taxes cannot be increased.

An increase in gas taxes is particularly tempting when the prices of the alternatives to gas are increasing. In our illustration, this could take place when either crude oil prices or taxes on oil products are increasing. For example, Italy increased gas taxes substantially at the end of the 1980s as a joint policy with the increase in oil product taxes.

If gas taxes are increased simultaneously with the use of invisible and visible hands that reduce profit margins and improve cost effectiveness in transmission and distribution companies, the EU may more easily obtain support from national governments in proceeding with the liberalization process. An active use of gas taxes as a strategic instrument to derive rent increases the probability of a politically led liberalization process on both local, national and EU levels.

The question is, however, whether such a policy will give enough gas to the market in the next century. Liberalization requires a change in company strategy among exporters. Exporters need more downstream activities in order to remain competitive, downstream investments and marketing included, as the market becomes more liberal. By doing this, exporters may not necessarily lose on liberalization and supply growth may continue. However, if the tax instrument is used actively in the market, the political price risk run by exporters may become significant. This may delay huge new sunk and long-term investments, the market being liberalized or not.

Any movement in crude oil prices can be used to increase taxes either on oil products (when crude prices are dropping) or on gas (when crude prices or oil product taxes are increasing). As it is producing countries' governments that take most of the rent on the supply side, and consuming countries' governments that take most of the rent on the demand side (both through taxation), energy taxation should become a conflict of interests first of all between producing and consuming countries' governments.

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