Chapter 11. Liberalisation of the European Natural Gas Market: Myth or Reality? Evidence from Greece

Irene Fafaliou
University of Piraeus

Michael L. Polemis
Hellenic Competition Commission

Abstract: During the last decade the liberalisation of the European Union (EU) natural gas market has been acknowledged as a fundamental priority adopted by officials to promote economic growth and enhance the level of competition in the region. Although significant progress has been made, competition is slow as the natural gas industry remains highly concentrated, with relatively little cross-border trade activity. The aim of this chapter is to assess the liberalization process of the EU natural gas industry and determine the extent to which it has impacted less liberalized countries such as Greece. In order to attain this object, we study the case of the Greek natural gas market by employing Porter's competitive model of five forces. Our analysis indicates that although the liberalisation of the Greek natural gas market has been set as a priority in the regulators' agenda, the level of effective competition in the market still lacks behind.

Introduction

There is a general consensus amongst the policy-makers and scholars in the field that the natural gas market, with a global net consumption of 104 trillion cubic feet in 2005, constitutes one of the most important energy markets [3], [13]. Natural gas is expected to remain a key energy source for industrial and electricity generation sector throughout the next twenty years. In particular, according to recent forecasts, the industrial sector is expected to account for 43% of projected world natural gas use in 2030 [3]. Natural gas is also important for the competitiveness and the welfare of the European countries since it is considered cost effective and less pollutant than other energy sources. Moreover, it is worth mentioning that during the period 1980-2006 world natural gas consumption increased by 2.3% annually, reaching the level of 20,283 billion cubic feet in 2006. On the contrary, the European natural gas production appeared to have a modest annual growth rate (+1% for the period 1980-2006), revealing a substantial dependence on imports (mainly from countries like Russia and Algeria).

Until the late 1990s, the European natural gas market was vertically integrated and state-owned [15]. Vertically state-owned integrated companies were mainly responsible for the *transportation, storage, distribution* and *supply* of natural gas to final consumers such as industries and households. Under this framework, prices and tariffs were regulated. However, within the last decade this situation has eventually changed due to the European-wide market opening introduced first in 1998.

In the last decade, the EU policy makers and national governments' officials were challenged to restructure the natural gas market due to dysfunctions identified in its vertically integrated segments (for example, low productivity and bottlenecks in meeting the increasing domestic energy demand especially that from the power industry). In addition, the two energy crises (1973 and 1979) as well as the intensiveness of globalization and environmental pollution, which reflects a less sustainable path for the EU countries, have also attributed to this end [7]. This policy-pursuit, however, is not a new one. It can be traced back to the pioneering experience of

Anthony N. Rezitis (Ed)

the early nineties in the United Kingdom and it is based on the goals of creating efficient competition and promoting the unification of European markets [18].

In order to eliminate the monopolistic structure of the natural gas market and generate effective competition, the European Commission issued two main directives (98/30/EC and 2003/55/EC). Although the primary goal of these Directives was to develop a single European gas market, the degree of market openness differs substantially across Member States. In particular, a few European countries like the *United Kingdom, Germany* and *Finland* acted as pioneers in the liberalization process and pursued strategies aiming at unbundling activities in the supply market segments and the full transposition of EU Directives into national legislation. Other countries like *Greece, Spain, Belgium, France, Denmark,* and *Luxembourg* opted for a gradual market opening. Finally, countries like *Czech Republic* and *Latvia* are still remaining at the initial restructuring stage.

The aim of this paper is to analyse the main aspects involved in the liberalization process of the EU natural gas industry and determine its current condition in terms of competition and regulatory reform. In order to assess the main trends and characteristics in the restructuring of the European gas market, an in-depth analysis of the Greek gas market is performed by employing Porter's competitive model of five forces [19]. The issue of investigating natural gas industry is crucial for a sound energy policy. This paper approaches the problem on a scientifically solid base with respect to the European natural gas directives. Despite the importance of the subject for the development of proper government interventions towards the full liberalization of the natural gas markets, to the best of our knowledge, there is no study dealing with the competitive dimensions of the Greek natural gas industry. Previous studies have examined various industries (mostly electricity) and energy policy issues [7], [12], [18], [8], [10] but they have neglected the natural gas markets. The present paper aims to cover this gap by expanding the research in the field and informing better policy analysts and government officials.

The remainder of the paper is structured as follows. Section 2 provides a framework of reference for the EU gas sector by describing the main characteristics, issues and trends concerning market structure and legal evolution. Section 3 reviews the main theoretical aspects of Porter's five forces competitive model in order to provide a better understanding of the mechanism that affect competition in a market place. Section 4 applies Porter's model in the case of the Greek natural gas industry by considering the main theoretical arrangements of this model such as the market players' strategic position, the threat of substitutes and the new entrants, the barriers to entry, and the existing and potential competition. Following this application, there is a critical discussion on key competitive relationships in the natural gas market. Finally, Section 5 concludes by describing the main findings of our study over the intensity of rivalry in the natural gas market and considers relevant policy implications.

Evolution in the EU natural gas sector

Natural gas is one of the most used fuels in the EU, accounting for approximately a quarter of its primary energy needs. In 2006, around 38% of this gas was produced within the EU region (UK, Netherlands, Germany, Italy, Denmark and Romania), while 54% was imported from countries like Russia, Norway and Algeria [5].

Market characteristics

The EU natural gas sector is divided into five basic market segments: a) the *extraction/production* of gas (i.e. upstream market), b) the *transportation* of gas via high pressure pipelines (i.e. transmission market), c) the *transportation on medium and low pressure pipelines* (i.e distribution market), and finally, d) the *storage* of gas and e) the *supply* of gas to customers (i.e downstream market). It is worth mentioning that the *gas supply market* can be further divided into several sub-segments[16]: i) supply of gas to dealers (including the local distribution companies), ii) supply of gas to gas-powered electricity plants, iii) supply of gas to large industrial customers, iv) supply of gas to small industrial and commercial customers, and v) supply of gas to household customers. As in the electricity industry, the *transmission* and *distribution* segments of this market act as regulated natural monopolies [7]. Further, the evidence confirms that as far as the boundaries of the gas markets are concerned, the natural gas supply markets are mainly national in scope [5].

As shown in Table 1, market opening[17] in the supply segment of the EU gas market either increased significantly between 2001 and 2005 or was already a 100% free market by 2001 (Germany, Finland and United Kingdom). It is worth mentioning that by September 2005 [6], full market liberalisation of both industry and households was completed in five member states (Denmark, Spain, Italy, Netherlands, and Austria).

Table 1: Market Opening in the Gas Supply Market (%).

Country	2001	2005
Belgium	59.0	90.0
Czech Republic	-	25.0
Denmark	30.0	100.0
Germany	100.0	100.0
Estonia	-	95.0
Greece	-	-
Spain	72.0	100.0
France	20.0	70.0
Ireland	75.0	86.0
Italy	65.0	100.0
Cyprus	-	-
Latvia	-	0.0
Lithuania	-	90.0
Luxembourg	51.0	80.0
Hungary	-	66.0
Malta	-	-
Netherlands	45.0	100.0
Austria	49.0	100.0
Poland	-	72.0
Portugal	-	-
Slovenia	-	91.0
Slovakia	-	72.0
Finland	100.0	-
Sweden	47.0	95.0
United Kingdom	100.0	100.0

Source: [6]

The extent of market concentration in the European gas industry is shown in Table 2, where the incumbent companies' share of imports and domestic production are illustrated. It has to be

[16] For a further discussion concerning the delineation of the relevant European natural gas markets see DG-COMP merger cases (e.g. *EDP/GDP*, *GDF/Suez* and *E.On/MOL*).
[17] Market opening refers to the percentage of natural gas demand open to retail competition.

stated that the incumbent suppliers ensure the majority of their gas through long-term contracts, which may relate to gas imports or domestic gas production. Long-term gas supply contracts were often linked to infrastructure development such as a pipeline or gas fired power station, since in order for an investment in such a project to be viable a long-term supply of gas needed to be secured [5]. Almost all countries represented in this table are characterised by high market concentration in the gas industry since the incumbents control the majority of the traded gas (imports and domestic production). For instance, in most of the central European countries (i.e. Czech Republic, Germany, Hungary, and Poland) the incumbents control over 90-100% of the market. On the contrary, in the United Kingdom where full ownership unbundling of the former monopoly regime has been occurred, relevant shares of the incumbent company are relatively low (20-30% of imports and 40-50% of domestic production). It is noteworthy that countries like France, Czech Republic, Slovakia and Austria have very little domestic gas production whilst Belgium has none. Hence, the incumbent companies in these countries retain control of the natural gas through imports' contracts [5].

Table 2: Total Imports and Domestic Production in Selected EU- Countries (2004)[*]

Country	Total imports	Incumbent share of imports (%)	Total domestic production	Incumbent share of domestic production (%)
Austria	9	80-90	2	-
Belgium	16	90-100	0	-
Czech Republic	9	90-100	< 1	-
Denmark	0	-	10	80-90
France	49	90-100	1	-
Great Britain	13	20-30	105	40-50
Germany	88	90-100	18	80-90
Hungary	11	90-100	3	90-100
Italy	67	60-70	13	80-90
Netherlands	18	50-60	73	90-100
Poland	10	90-100	5	90-100
Slovakia	7	90-100	< 1	-

(*) quantities are measured in billion cubic metres (bcm).
Source: [5].

Natural gas supply markets are not yet well developed within the EU countries, mainly due to limited access of new entrants to gas supplies. Even in the most developed markets, such as the United Kingdom, competitive forces are controlled by gas producers [4]. In very few cases [18], liberalization plans have attempted to limit the incumbent's significant market power (SMP) through various arrangements. This has been achieved either by completely reforming the existing market structure (i.e. United Kingdom) or forcing divestiture of imports' contracts (i.e. United Kingdom and Spain), or, even more, by setting market share ceilings (i.e. Italy and Spain). As a result, the incumbents in the European natural gas industry possess SMP in national relative markets either by largely controlling gas imports or domestic production [5]. This level of market power can potentially cause significant problems, for example, by delaying the penetration of effective competition in the market thus putting liberalisation process in jeopardy. Although incumbents trade only a small proportion of gas on continental hubs they nevertheless dominate trading on most of them [5]. Therefore, there has been little new entry into the European gas markets within the last years[18].

[18] In seven out of twenty one Member States, no independent supplier is active on national gas markets (EC, 2008).

Legal framework

As we have mentioned earlier, in the late 1990s, the European Union launched a liberalisation process in the natural gas market in order to introduce effective competition and secure availability of supply. The first European gas directive, introduced in 1998 (Council Directive 98/30/EC), lays down common rules for *storage, transmission, supply* and *distribution* of natural gas within the EU region. In 2003, the European Commission issued the Directive 2003/55/EC. This Directive set the framework for gradual market opening and considered as 'eligible' customers the following: a) all non-household customers (as from 1 July 2004 at the latest) and b) all customers (as from 1 July 2007). The second EU gas Directive also imposed regulated access to *transmission* and *distribution* infrastructures and liquefied natural gas (LNG) facilities [5]. Finally, under the provisions of the latter Directive the integrated natural gas companies had to keep separate accounts for transmission, distribution, storage and LNG activities, while a legal separation between the operators of transmission and the distribution networks was now mandatory.

Regulatory framework does not include measures that directly address the concentrated market structure inherited from the monopoly era, which remains a key problem of the internal gas market [5]. In certain European countries additional measures such as gas release programs or market share caps have been introduced in order to restrict concentration (i.e. United Kingdom, Italy, France, Germany etc). However, the supply of natural gas to final customers still depends on the capacity to use existing transport infrastructure, which constitutes a natural monopoly. For this reason, a regulatory framework is essential to ensure that access is granted in a non-discriminatory and transparent way [5]. In order to ensure a sound implementation of the regulatory framework, Community legislation requires the establishment of national energy regulators whose main responsibilities should include *inter alia* the approval of network tariffs, the effective unbundling of the energy companies and the settling of the disputes between involved parties.

Theoretical Model

This section elaborates in brief Porter's five forces theoretical model employed in our study in order to help us analyze and assess the competition in the natural gas market from each of the five forces standpoint. Porter's five forces model is a framework for industry analysis and business strategy development [19], [20]. It uses concepts developed in industrial economics to derive five forces which determine the competitive intensity and, therefore, the attractiveness and profitability of a market / industry. This model investigates five key areas to analyze and determine the competitiveness of an industry structure, namely the *threat of entry*, the *power of buyers*, the *power of suppliers*, the *threat of substitutes*, and the *competitive rivalry* (Fig. **1**). Although there are certain limitations to it, we consider that Porter's five forces model constitutes a very useful tool both for policy makers and regulators who wish to be informed properly, thus avoiding the risk of overlooking latent sources of competition in a given market / industry that may threaten its structure at any point in the future.

On the basis of the theoretical setting of the five forces model, the '*threat of new entrants*' in an industry is measured by how easy or difficult it is for new entrants to start competing effectively. It should be noted that it is not only the incumbent rivals that pose a threat to firms in a given industry but the possibility that new firms may enter the industry also affects competition. Industries that have low entry barriers, have usually certain characteristics such as low economies of scale, common technology, low capital requirements, easy access to distribution

channels and relatively low sunk costs. The '*threat of substitutes'* relates to the ability of a product or service from another market or industry to substitute the demand of an existing one in a given market / industry. While the '*threat of substitutes'* typically impacts an industry through *price competition*, there can be also other concerns in assessing the impacting value of this force (for e.g. relative performance, switching costs, etc). The '*bargaining power of buyers'* is the impact that customers have on an industry. In principle, when '*buyers' power'* in a given market is strong, then the latter is assumed to operate near to monopsony and the buyers set the prices. It is worth mentioning that this force is strong if there are few buyers in an industry possessing significant market shares. Finally, the '*bargaining power of suppliers'* determines the position of sellers' strength of the industry under investigation.

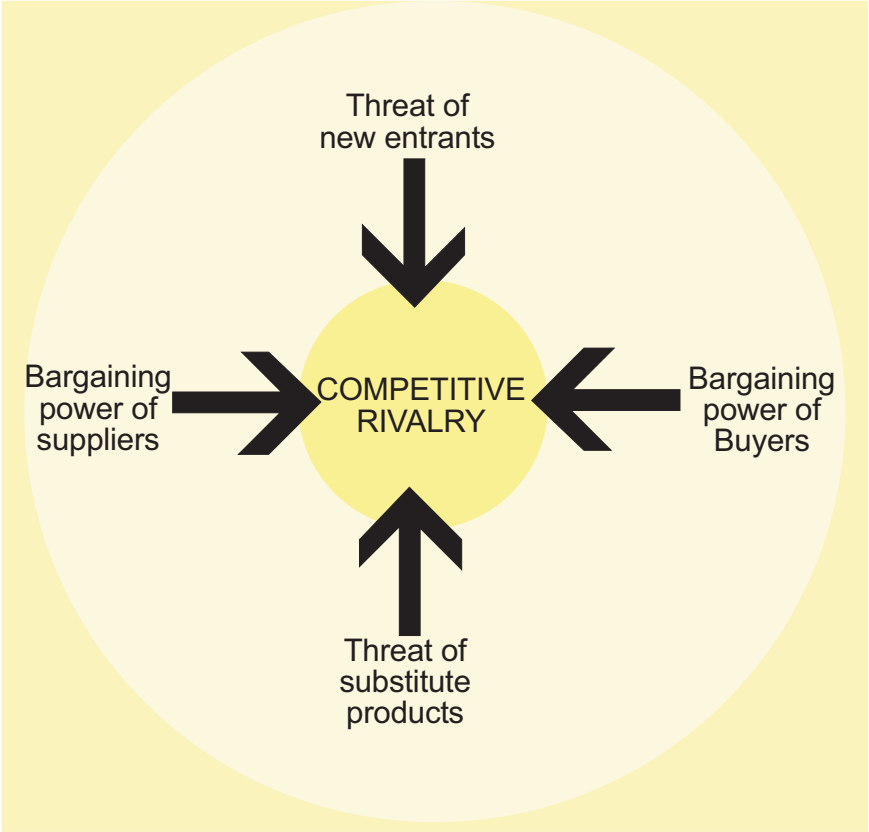

Figure 1: Porter's Competitive Model of Five Forces.
Source: Adapted from [19].

All of the aforementioned factors along with the '*competition rivalry'* (measured by industry concentration indices, i.e. concentration ratio, Hirschman-Herfindahl Index, etc.) determine the existing and potential competition within a given industry. If rivalry among established firms in an industry is low, the industry is considered to be disciplined. The intensity of rivalry is influenced by certain characteristics such as the 'large number of firms', 'market growth', 'fixed and storage costs', 'switching costs', 'level of product differentiation', 'entry and exit barriers', and 'diversity of rivals'.

The Case of the Greek natural gas sector

Overview

The legislative and regulatory framework of the Greek natural gas sector has been significantly modified over recent years, through the transposition of the EU gas market Directives into Greek law. However, it should be mentioned that Greece has benefited from derogation of the implementation of the second EU Gas market Directive (2033/55 EC) due to the infant gas market [15]. The Law 3175/2003 introduced the primary measures for the liberalization process since, as of 1st July 2005, the market was opened for the gas-fired power producers and co-generators with an annual consumption of more than 25 million cubic meters (mcm). This meant that over 60% of the market had been liberalised (Table 3). However, despite the significant market opening, the Greek incumbent, that is *Public Gas Corporation* (DEPA) remains the only active company which imports and supplies natural gas in the Greek territory [22].

The second Law 3428/2005 set the framework for the transposition of the 2003/55/EC Directive into national legislation. One of its most significant provisions was the extended market opening since it allowed competition to emerge in a further segment of the market. In particular, power producers and co-generators with annual consumption of more than 100 GWh and the new EPAs as well, are free to choose their supplier (Table 3). Furthermore, important steps towards a liberalized market such as the establishment of the *Hellenic Gas Transmission System Operator* (DESFA) and the approval of the *Standard Transportation Agreement* (STA) were taken under the provisions of this new law [21][19]. According to this Law, as of 15th of November 2009, all domestic customers not already covered by EPAs (that constitute 90% of the Greek gas market) will become eligible. Finally, under the legislative provisions, major developments occurred in the Greek gas market during the period 2005-2008. These are the interconnection with Turkey which it is expected to allow the transit flows of gas to other European countries and strengthen the domestic security of supply.

Table 3: Timetable for the Liberalisation of the Greek Gas Market.

Phase	Annual demand	Date of eligibility	Share of market (by volume)
1	Power producers and co-generators with demand > 25 mcm	1 July 2005	60%
2	Power producers and co-generators with demand > 100 GWh per year and the new EPAs	Publication of Law 3428/2005	80%
3	Non domestic customers outside EPA licence and CNG customers for vehicles	15 November 2008	85%
4	All domestic customers not covered by EPAs	15 November 2009	90%
5	All customers	End of the EPA concession period	100%

CNG = compressed natural gas
Source: Adapted from [14].

Over the last few years, the number of consumers that use natural gas (with an annual consumption of a residential, commercial, industrial, etc. Gross Calorific Value (GWh) up to 100GWh), has shown a significant increase (Fig. **2**). Within the period 2002-2010 it is estimated that the consumers in Thessaloniki, Thessaly and Attica region will increase by 74.3%, 64.0% and 34.1% per annum respectively. In the Attica region, the number of connections to the grid network represents central heating installations in apartment buildings. In the other two EPAs (located in Thessaly and Thessaloniki regions) the connections -in majority- relate to independent heating systems [21].

[19] The STA includes all necessary provisions for access to the high-pressure grid that will eventually be incorporated in the Network Code.

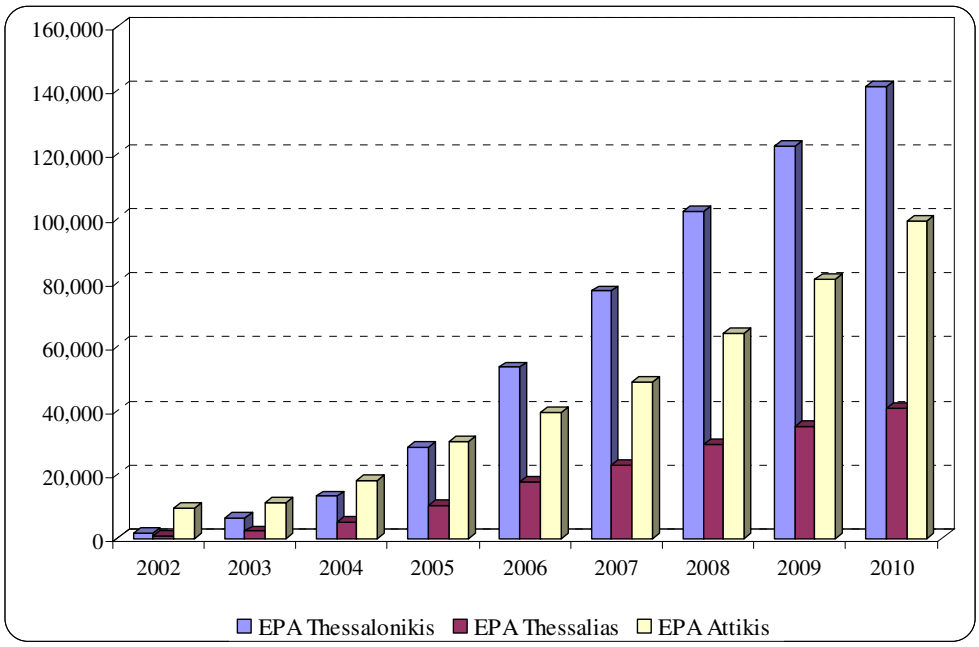

Figure 2: Number of consumers with an annual demand bellow 10 mcm (2002-2010*).
(*) Projections for the period 2007-2010.
Source: [22]

Market characteristics and industry structure

There are three entry points for the natural gas transportation system. The first is at the Greek-Bulgarian borders, where natural gas enters via a central pipeline from Russia. The second entry point is at the Greek-Turkish borders, where the *National Natural Gas Transportation System* interconnects with the corresponding *Turkish transportation system*. The third natural gas entry point is located on the island of Revythousa, where there are facilities to receive, store and gasify Liquefied Natural Gas (LNG). Further, a pipeline connection to Italy is expected to operate by the end of 2010 [14].

Market players

The upstream market of natural gas in Greece (import and supply of gas to large final consumers) is dominated by DEPA. Due to certain legal and regulatory inadequacies in combination with the high scale of investments required, only one independent natural gas company has operated in the relevant market since 1991 (i.e. Prometheus Gas S.A). In Greece like in other European countries, the supply contracts between the importer (in our case DEPA) and foreign producers are characterized by take or pay clauses which have impact on competition. These clauses might have anticompetitive effects on the (already limited) competition in the downstream market, thus prohibiting any access to gas supply within the boundaries of a specific spatial area and being able to block the market to new entrants. Moreover, take or pay clauses may also effectively prevent upstream producers from entering Greek downstream market. This is done by deterring the potential competitors from the downstream market.

In the downstream market (supply of gas to small final consumers such as residential and commercial ones), there are three gas supply companies (EPAs) whose prices are controlled by the *Regulatory Authority for Energy* (RAE) and which cover the areas of Attica, Thessalonica and Thessaly [14]. The EPAs have the exclusive right to supply customers whose gas demand does not exceed 10 million cubic meters of gas annually and are located within their authority areas for a period of 30 years (i.e. until 2029). In this market segment, prices charged to final consumers by the three EPAs are formulated freely, but RAE has the responsibility for monitoring and *ex-post* controlling of pricing tariffs. That is to say, in cases where EPAs' gross profit margins exceed the ones demonstrated in their distribution licences, the regulator (RAE) can intervene to reduce relevant margins ('rate of return' regulation). However, it is noteworthy that the Greek government is in the process of establishing three new Gas Supply Companies, thus covering the regions of Central Greece (i.e. Sterea and Evia), Central Macedonia and Eastern Macedonia & Thrace.

DEPA was established in 1988 and started its operations in 1995. DEPA is fully controlled by the Greek state as it owns 65% of its shares, while *Hellenic Petroleum S.A*. (a refinery incumbent company) holds the remaining 35%. We should bear in mind that *Public Power Corporation* (PPC) has an option to purchase 30% of DEPA's shares from the Greek government [14]. DEPA established the *Gas Distribution Companies* (EDAs) of Attica, Thessaloniki and Thessaly. Originally, in 2000 and 2001 the corresponding *Gas Supply Companies* (EPAs) were set up with foreign participation. In 2007, the *Attica Gas Distribution Company* took over the *Gas Distribution Companies of Thessaloniki* and *Thessaly* and changed its trading name to *EDA S.A.* (Fig. **3**).

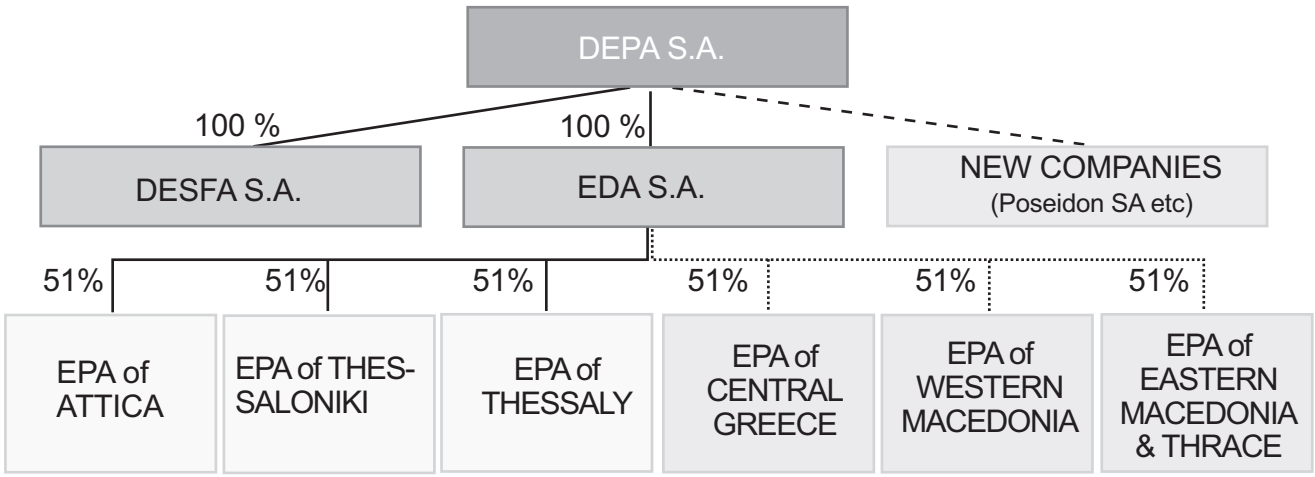

Figure 3: Group Structure of DEPA.
Source: [2]

The mission of the *Gas Supply Companies* (EPAs) is to expand, operate and maintain local networks, as well as to distribute gas to domestic, commercial and industrial consumers (with annual consumption up to 100 GWh). DEPA holds 51% of EPAs' shares, through its 100% subsidiary *Gas Distribution Company* (EDA), while private investors hold 49% and run the management. Three EPAs are in operation: a) one in Attica, with the participation of the consortium *DukeEnergy – Shell*, b) one in the region of Thessaloniki with the Italian company *Eni* as a strategic partner and c) one in the region of Thessaly, with the participation of *Eni* as well.

During 2006 and under the auspices of the natural gas Act (L. 3428/2005), specific competencies of DEPA such as transmission and system operation have been assigned to a newly established company called *DESFA*, which is a subsidiary fully owned by DEPA. Under this new legal act, DEPA has been legally separated from relevant activities. In particular, the new company undertook the transportation activity of the natural gas within the Greek territory. DESFA is the owner and operator of the national natural gas system and responsible for its future development and operation, including the granting of access to the gas network on the basis of regulated Third Party Access (TPA) tariffs [14].

Finally, *Prometheus Gas S.A*. which is a Greek – Russian joint venture (Gazpromexport Limited and Copelouzos Group) is operated in the upstream gas market since 1991. *Prometheus Gas S.A.,* has secured large quantities of natural gas for the Greek market. These quantities amount to 3 billion cubic meters (bcm) annually until 2016 and 7 bcm annually, beyond 2016 [16]. According to the national legislation, *Prometheus Gas S.A*. has the right to supply natural gas to the Greek market, as soon as DEPA sells out its annual contractual commitments in terms of gas supply. Further, according to Law 3428/2005, *Prometheus Gas S.A*. can currently conclude natural gas supply contracts with power and cogeneration facilities that consume more than 10 million cubic meters of gas annually.

Threat of substitute products

'Natural gas' and 'electricity' can be characterised as substitutes regarding specific uses such as cooking, heating, and air conditioning [14]. Furthermore, natural gas can be substituted with various types of oil such as heating oil, light fuel oil and mazout since they can be used in order to satisfy similar needs [9].

According to relevant empirical studies, natural gas is a close substitute to several energy products (for e.g., oil and electricity). A recent empirical study [11] examines the industrial natural gas consumption in the United States for the period 1958-2003. In this study it is suggested that there is some sort of substitutability between natural gas and heavy fuel oil. In particular, cross-price elasticities between natural gas and heavy fuel oil are found positive and statistically significant. In the short- and long-run they ranged from 0.067 to 0.144 and 0.267 to 0.384 respectively. The substitutability effect between natural gas and distillate oil is also evident in another study, which reports the own and cross-price elasticities of various energy products (electricity, natural gas and distillate fuel) in the residential and commercial building sector in the USA [23]. According to this study [23], cross-price elasticities range from 0.49 to 0.75 in the commercial building sector, while in the residential sector the relevant range is significantly lower (from 0.05 to 0.15). Further, natural gas substitution effects with electricity are performed by the relevant long-run cross-price elasticity experienced in the residential and commercial sector and which are estimated to 0.13 and 0.86 respectively [23]. As shown in Fig. (**4**), the price of natural gas in the Greek residential sector is significantly lower compared to other substitutes (i.e. light fuel oil and electricity). It is estimated that on average natural gas is by 20% cheaper than heating oil while electricity is 40% more expensive than natural gas [9]. It is noteworthy that the price of natural gas has shown an increase by 3.4% per annum during the period 1998-2005, while electricity and light fuel oil (i.e. heating oil) have increased by 0.8% and 14.5% respectively. Finally, during the period 1998-2004 the price of natural gas exhibited a bigger positive correlation with the price of electricity (82.9%) compared to the price of light fuel oil (31.0%).

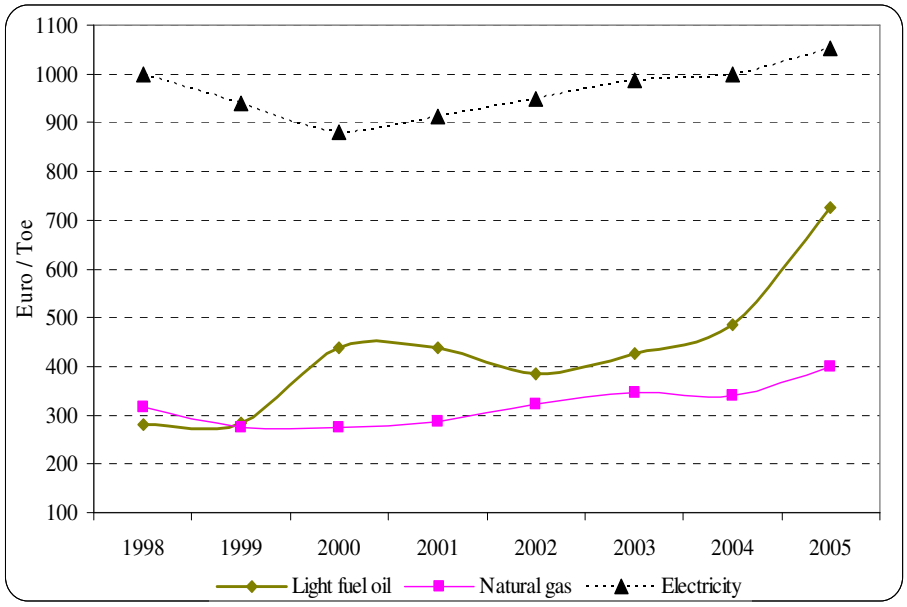

Figure 4: Residential Net Prices of Energy Forms in Greece (1998-2005*).
(*) Second quarter of 2005
Source: Authors' processed data on Energy Prices and Taxes from various issues of IEA/OECD.

Threat of new entrants

It is well acknowledged by policy makers that the Greek natural gas market is far from maturity. The existence of legal and structural barriers to entry hinders the level of competition and deteriorates the possibility of new entry [9] However, in order to achieve full market opening, the Ministry of Development plans to promote further the competition especially in the downstream market segment by the establishment of three additional EPAs. The new EPAs would be established through a tender procedure inviting private participation in certain regions of Greece (Thrace, Central Greece and Macedonia). This approach is similar to the procedure followed in the case of the existing EPAs but with shorter concession periods up to twenty years. In the upstream chain of the market, it is expected that the incumbent company (DEPA) will face competitive pressure within the next years by the established private company *Prometheus Gas S.*A. Therefore, the structure of the industry might change its form (for e.g., from a monopoly to a tight oligopoly), with various implications for the realized competition.

Barriers to entry

The dominant position of DEPA may hinder the level of effective competition in the natural gas market and create a number of serious barriers to entry. More specifically, the absence of potential market in tandem with the regulated monopoly regime of DEPA act as obstacles for new entrance. Below, we analyze some of the most significant barriers to entry.

Capital requirements

There is no doubt that the natural gas sector is capital intensive. However, although demand of natural gas grows fast in Greece (for e.g., at levels that exceed the increase in Gross Domestic Product), under the current liberalization regime there is a high cost for new entrants in the market [1]. Moreover, the relatively high start up capital required for a new company to enter the market constitutes a significant barrier to entry [9].

Legal restrictions

The existing legislation is considered as one of the main obstacles that hinders competition in all market natural gas market segments. The main weaknesses are associated with the absence of: a) an integrated licensing regulation, b) a supply code of ethics to eligible customers and c) an organized wholesale market which can reduce the financial risk of investors. Furthermore, the conflict of interests between different governmental entities and the owner of the incumbent company (i.e. the Greek government) constitutes a basic concern to policy makers for a further liberalization of the industry.

Economies of scale and cross-shareholdings

The supply markets of natural gas in Greece are characterized by significant economies of scale especially for the vertically integrated dominant firm (DEPA). That is to say, in contrast to potential rivals the incumbent companies (DEPA and EPAs) perform important cost advantages**.** Moreover, the most-favoured customer clause in the contract between the *Public Power Corporation* (PPC) and the *incumbent* (DEPA), which is still in force, may constitute an impediment to competition, especially if distance-related charges for access to the gas network were introduced [14][20].

As mentioned above, the PPC, which is the incumbent electricity company in Greece, possessing more than 90% of the market, holds an option to purchase 30% of DEPA's shares from Greek government. However, PPC is also the major customer of DEPA and competes with the other major shareholder of DEPA in the electricity market (i.e. the *Hellenic Petroleum*). In order to enter the electricity market, new companies should secure large quantities of natural gas that is used as fuel for their power stations. In such a context, a partial acquisition of DEPA by *PPC* and *Hellenic Petroleum* gives rise to concerns that the incumbents in the electricity industry would hold control over the fuel supply of their potential competitors and thus the level of effective competition in the electricity sector would be diminished [14]. This also means that new entrants in the market will find difficult to sell gas to the incumbents producing electricity (e.g. PPC and Independent Power Producers).

Competition rivalry within the industry

The high level of concentration in the market can be explained by the fact that few firms compete for the same customers and resources. Hence, the struggle for market leadership in the natural gas industry is still limited. Further, the high level of market growth hinders firms from fighting for market shares. That is to say, in a growing market, companiesare typically able to improve revenues simply because they operate within it. The low level of competition rivalry is also facilitated by the high switching costs that exist in the industry, due to the fact that customers, especially the residential ones, can not freely switch gas supplier [5]. On the other hand, structural parameters such as the existence of fixed costs (for e.g., construction of the network) and the high level of exit barriers, which place a significant sunk cost on leaving the market, increases competition rivalry within the gas industry.

Bargaining power of suppliers

[20] The clause stipulates that if another customer negotiates a lower price than PPC with DEPA, DEPA will have to offer the same price to PPC [14].

DEPA's natural gas suppliers are the Russian company *Gazprom-Export* (subsidiary of Gazprom), the Algerian company *Sonatrach,* by virtue of contracts signed in 1988 and extending to 2016 and 2020 respectively, and the Turkish *Botaş*. The contract with *Gazprom-Export* ensures the supply of 2.8 billion cubic meters of natural gas annually. Russian natural gas began flowing into Greece in September 1996. The Algerian liquefied natural gas (LNG) is transported in liquefied form by special tankers to the LNG terminal on Revythousa Island. The contract with *Sonatrach* provides for a total supply of gas from 0.51 to 0.68 billion cubic meters annually. Algerian LNG started being received in Greece in February 2000. In view of the increased demand for natural gas and in the context of the strategy that aims to make Greece part of an energy pipeline in Southeastern Europe, DEPA signed a gas supply contract in 2003 with the Turkish company *Botaş*. This contract provides for annual supplies of 0.75 billion cubic meters over 15 years. The gas is delivered to Greece from Turkey following the completion of the interconnection works of the natural gas networks between the two countries, late in 2007.

According to the structure of the Greek natural gas market, it is evident that the bargaining power of suppliers is highly significant mostly due to the substantial participation of the cost of raw materials (natural gas) to the total cost of energy companies. It is estimated that the relevant cost share is equal to 60% for the EPAs and 70% for DEPA [9]. The bargaining power of suppliers in the Greek market is also reinforced by the limited endogenous production of natural gas and the absence of alternative sources of supply (i.e. other than that of Russia and Algeria). Domestic production was 0.03 Mtoe in 2006, covering an insignificant proportion of Greek gas supplies (1.5%) and it is expected to show a further reduction [14].

Further, in order to evaluate better the importance of gas to Greek energy balance, it is useful to examine its penetration in the economy compared to other European countries. As shown in Fig. **5**, Greece has the lowest (after Sweden) per capita gas consumption in the EU-15, thus reaching the level of 254 cubic metres in 2005. By contrast, Benelux countries (Netherlands, Luxembourg and Belgium) have the highest per capita consumption in the EU-15. In particular, the latter are well above the European Union's average (1,149 cubic metres), reaching the level of 2,872, 2,790 and 1,597 respectively. The comparatively low degree of natural gas penetration in the Greek energy balance relatively to other European countries (such as the United Kingdom, Italy, Germany and Austria), raises serious concerns regarding the long-term energy planning by the Greek government.

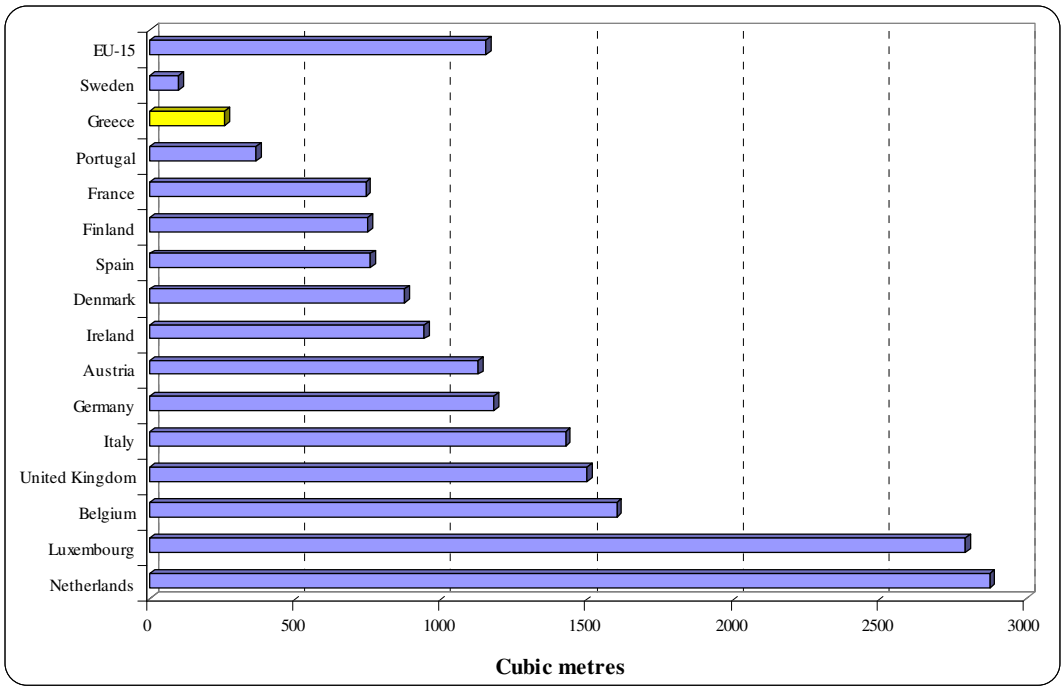

Figure 5: Natural gas consumption per capita in EU-15 (2005).

Source: Authors' processed data derived from [13]

Bargaining power of customers

The main categories of customers in the natural gas market are the residential consumers, the industrial customers and the commercial ones. It is noteworthy that the bargaining power of residential and commercial customers (small consumers) is limited since the switching cost is significant [9]. In other words, if a residential / commercial customer wants to switch to an alternative fuel (i.e heating oil) he/she will face notably high costs (for e.g., boiler conversion in the central heating system). On the contrary, industrial customers who consume large quantities of natural gas appear to have greater bargaining power and in this way achieve discounts in the price of natural gas from their supplier.

Conclusions and policy implications

One of the main concerns of this paper was to provide a comprehensive framework of how firms compete in the natural gas markets and help policy makers and interested parties to regulate them better and ensure effective competition levels. Our analysis suggests that in the past few years, the European countries have gone through a liberalization of their natural gas markets but the degree of openness of individual markets depends on the regulatory policies adopted by each country. Our theoretical approach to the issue shows that over the last few years the natural gas sector in most of the European Union member countries has undergone significant changes as a result of a gradual liberalisation. However, as in the electricity industry, Members States have opened their gas markets to a different extent and thus experience in this area has been controversial. In particular, customers' eligibility has been promoted at different pace in the EU countries. France has opened its gas market at the lowest extreme while United Kingdom has been fully liberalised since 1998. Other countries such as Italy, Austria, Spain and Netherlands have opted for full market opening since 2005.

The in-depth case study analysis of the Greek natural gas market, through the application of Porter's five forces model, indicates that this market performs as a regulated monopoly. This situation allows the dominant actors in the market such as the incumbents, the suppliers and the importers to maintain their high power since they are not threatened by any competitive forces other than substitutes. However, we should make clear that effective competition might arise only in the upstream market segment of the industry through the implementation of the licensing regulation and the completion of the supply code to eligible customers by the Ministry of Development. In the downstream chain of the market for customers bellow 10 mcm annual demand, the existence of local companies (EPAs) which have the exclusive right to supply customers within their concession areas, eliminates the possibility of introducing competition in these regions at least until 2029.

Taking into account the current structure of the natural gas market in Greece and the legal environment, our analysis in this paper has exemplified that the factors which form this market's profitability are mainly the bargaining power of the dominant sellers and customers, the pressures from substitute products (e.g. heating oil and electricity), and the regulatory framework. On the contrary, less significant factors seemed to be the threats from new entrants in the market due to the fact that most of such competitive forces are counterbalanced by the existence of high barriers to entry attributed to cost advantages already accomplished by the incumbents, the legal restrictions, and the high capital investments required for operating in the market (Table 4). Although it has been suggested that effective competition in the Greek natural gas market is far from current progress in other EU countries, this does not exclude at least the possibility of potential competition, given the undergoing attempts for regulatory reforms in the country.

Table 4: Competitive Factors' Ranking for the Greek Natural Gas Market.

Factors	1	2	3	4	5
Threat of substitute products				✓	
Threat of new entrants	✓				
Barriers to entry					
Capital requirements				✓	
Legal restrictions					✓
Economies of scale and cross-shareholdings			✓		
Competition rivalry within the industry				✓	
Bargaining power of suppliers					✓
Bargaining power of customers			✓		

1 = insignificant; 5 = extremely important

Source: Authors' elaboration.

In order to alleviate the constraints that affect the openness of the market, the established firms try to develop proper corporate and operational strategies. At the national level, where the dominant actors are DEPA and the Ministry of Development, the main scope of the employed strategies is to ensure country's gas supply with security, maintain competitive supply prices of natural gas in the upstream market and exploit the geographical position of the country. In this context, the main goals of the gas supply companies' strategies are to improve the natural gas share in the Greek energy balance-sheet through guaranteeing wide market coverage, low cost of supply and distribution of natural gas, high level of customer satisfaction and reliability of natural gas provision to final consumers. Due to the high importance of the natural gas markets to the industrial prosperity of a country and the convenient nature of Porter's competitive model of five forces, we strongly believe that extensions of this work could provide fruitful interesting insights to policy makers and regulators.

References

[1] Centre for Planning and Economic Research, KEPE. The Greek energy sector: Tendencies and ascertainment. Athens (in Greek); 2007.
[2] Public Gas Corporation, DEPA. Viewed 15 March 2009, <http://www.depa.gr/>; 2009.
[3] Energy Information Administration, EIA. International Energy Outlook 2008. Washington DC: U.S. Department of Energy; 2008.
[4] European Commission, EC. Report from the Commission to the Council and the European Parliament: Progress in creating the internal gas and electricity market. Brussels; 2008.
[5] European Commission, EC. DG Competition Report on Energy Sector Inquiry. Brussels; 2007.
[6] Eurostat. Energy production and distribution enterprises in the EU. Statistics in focus Industry, Trade and Services. Brussels; 2006.
[7] Fafaliou I, Polemis ML. Trends in the European electricity markets: the case of Greece. International Journal of Economics and Business Research 2010 (forthcoming).
[8] Floros N, Vlachou A. Energy demand and energy-related CO_2 emissions in Greek manufacturing: assessing the impact of a carbon tax. Energy Economics 2005 27: 387–413.
[9] Foundation for Economic and Industrial Research, IOBE. The natural gas market in Greece. Athens (in Greek); 2008.
[10] Hondroyiannis G. Estimating residential demand for electricity in Greece. Energy Economics 2004 26: 319-334.
[11] Huntington HG. Industrial natural gas consumption in the United States: An empirical model for evaluating future trends. Energy Economics 2007 29: 743-759.
[12] Iliadou E. Electricity sector reform in Greece. Utilities Policy 2009 17(1): 76-87.
[13] International Energy Agency, IEA. Natural Gas Information, Paris: OECD; 2009.
[14] International Energy Agency, IEA. Energy Policies of IEA Countries-Greece, Paris: OECD; 2006.
[15] Newbery D. Privitization, restructuring and regulation of network utilities. Cambridge, Massachusetts London England: MIT Press; 2000.
[16] Prometheus Gas, PG. Viewed 31 January 2009, <http://www.prometheusgas.gr/>; 2009.
[17] Polemis ML. Modelling industrial energy demand in Greece using co-integration techniques. Energy Policy 2007 35: 4039–4050.
[18] Polo M, Scarpa C. The liberalization of energy markets in Europe and Italy, Working paper 2003 No 230, IGIER (Innocenzo Gasparini Institute for Economic Research), Bocconi University.
[19] Porter ME. Competitive advantage: Creating and sustaining superior performance. New York: The Free Press; 1985.
[20] Porter ME. How competitive forces shape strategy. Harvard Business Review 1979. March/April.
[21] Regulatory Authority for Energy, RAE. National report to the European Commission. Athens; 2008.
[22] Regulatory Authority for Energy, RAE. Report for the period April 2004-December 2006. Athens (in Greek); 2007.
[23] Wade SH. Price responsiveness in the AEO2003NEMS residential and commercial buildings sector models. Washington DC: Energy Information Administration; 2003.