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**Research Report**

## Regulatory reforms in selected EU network industries

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EUROPEAN CENTRAL BANK

**OCCASIONAL PAPER SERIES**

**NO. 28 / APRIL 2005**

**REGULATORY  
REFORMS IN  
SELECTED  
EU NETWORK  
INDUSTRIES**

by Reiner Martin,  
Moreno Roma  
and Isabel Vansteenkiste



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# REGULATORY REFORMS IN SELECTED EU NETWORK INDUSTRIES<sup>1</sup>

by Reiner Martin,  
Moreno Roma  
and Isabel Vansteenkiste

In 2005 all ECB publications will feature a motif taken from the €50 banknote.

This paper can be downloaded from the ECB's website (<http://www.ecb.int>).

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## EXECUTIVE SUMMARY

In the course of the 1990s, the European Union (EU) embarked on an ambitious regulatory reform programme for a number of European network industries, such as telecommunications, energy and transport. The importance attached to network industries within the overall Lisbon reform process stems from the very substantial potential economic benefits if reforms in these sectors are successful. First, network industries are a sizeable part of the overall economy. Taken together, these sectors represent around 10% (9%) of EU15 (euro area) production and almost 7% of overall EU15 and euro area employment. Furthermore, they also represent around 7% of the EU15 and euro area HICP baskets. Second, besides their actual economic weight, they provide important inputs for a wide range of economic sectors, which further increases their economic importance. The economic implications of the regulatory reform process in these industries are therefore of considerable importance for the ECB. Against this background, this Occasional Paper analyses the economic impact of the regulatory reform programmes currently under way in selected EU network industries, with a particular focus on the analysis of regulatory reforms' price effects.

The paper first provides a review of the existing empirical literature on regulatory reforms in network industries. Starting with the economic rationale for reforming regulatory arrangements in these sectors, it reviews existing empirical evidence with regard to both the sector-specific and the economy-wide economic effects of such reforms. Economy-wide effects of regulatory reforms, especially in terms of price level reductions and (temporary) downward effects on inflation are particularly relevant for the conduct of monetary policy. Even if the magnitude of the effects differs significantly across countries and industries and depends crucially on the type of regulatory changes introduced, a common pattern of empirical results emerges.

Increased competition (either in terms of liberalisation, privatisation, unbundling, etc.) is generally associated with lower price levels, expanded output and labour productivity gains. However, regulatory reforms do have some short-term costs, mainly in the form of initial employment losses. The ultimate impact on sector and aggregate employment depends on the labour market's capacity to adjust to a changing economic situation. The quality of services provided and the extent of R&D and innovation expenditures appear also to be positively linked to regulatory reforms. All in all, the empirical results in the literature tend to confirm that regulatory reforms in network industries enhance consumers' welfare.

The paper subsequently reviews the evolution of the current regulatory framework for network industries in the EU and discusses to what extent the legal preconditions for competition have been introduced in the telecommunications, electricity, gas and air transport sectors. This paper reviews also progress with the state of regulation in railway transport and postal services, where reforms are not as advanced yet. The paper also provides some indications regarding the *actual* level of competition that has so far been achieved in these sectors. We find that from a legal point of view, most of these industries are now fully or largely subject to competition. With regard to telecommunications, regulators are gradually adapting the current regulatory framework to the new business environment by lessening regulation where competition has emerged and strengthening it where incumbents still retain a dominant position. The regulatory reform process in EU energy markets, however, is still incomplete. First, the legal market opening process will not be completed until 2007. Second, many Member States' current regulatory framework still appears to be insufficient to ensure a high level of actual competition in legally open markets. The postal sector and the rail transport industry are in even earlier stages of the regulatory reform process than the EU energy markets. By contrast, the provision of air transport services

in the EU is almost fully liberalised, although the remaining competition bottlenecks in some segments of the airline industry clearly need to be addressed. Effective competition has also increased, but a closer look at the implementation of the various regulatory reforms shows that there are still a number of unresolved issues at both the national and EU levels. Generally speaking, the experience of EU network industries demonstrates that an appropriate regulatory framework is indispensable in order to create *de facto* competition in these sectors, even after markets have become legally open. In other words, the ‘quality’ of the regulatory framework has a considerable impact on the extent to which regulatory reforms in network industries will result in lower prices and other positive economic effects.

The final chapter of this paper examines recent price developments in the telecommunications, electricity, gas and air transport sectors and provides an empirical analysis of their main determinants. In this context particular emphasis is given to the impact of regulatory reform variables. We find that recent changes in the HICP sub-indices for electricity and telecommunications relative to the developments in the overall HICP clearly suggest that the introduction of competition in these sectors led to significant relative price falls. Panel data estimations provide additional evidence that regulatory reform measures had a substantial downward impact on prices in the four sectors under review. In telecommunications, and to a lesser extent in the gas sector, different explanatory variables that were used to capture the impact of regulatory reforms on prices turn out to be significant. With regard to the electricity sector, regulatory reform measures appear to have a strong significant impact on prices for industrial electricity users and large households. For air transport, the analysis conducted in the paper shows an increase in the number of international routes operated within the EU and suggests that prices of promotional and economy class tickets have fallen due to

regulatory reforms and the resulting increase in competition. Prices for business class tickets, however, have tended to increase since the start of liberalisation, most likely due to a rebalancing of ticket prices across different segments of the market. On the basis of these empirical results it is estimated that further progress with regulatory reforms in telecommunications, gas and electricity, together with some degree of input price convergence, would result in further substantial price falls in EU network industries of up to 36%.

## I INTRODUCTION

In the course of the 1990s, the European Union (EU) embarked on an ambitious regulatory reform programme for a number of European network industries, such as telecommunications, energy and transport.<sup>1</sup> All these sectors are characterised by the presence of a bottleneck infrastructure with natural monopoly characteristics, which makes it difficult to introduce and safeguard competition in these industries.<sup>2</sup> However, further progress with regulatory reforms in these sectors designed to enhance the level of competition is an important part of the Lisbon agenda for economic reform launched by the European Council in 2000.<sup>3</sup> The importance attached to network industries within the overall Lisbon reform process stems from the fact that the potential benefits of successful reforms in these sectors are very substantial. This is due to two reasons. First, network industries are a sizeable part of the overall economy. Taken together, these sectors represent around 10% (9%) of EU15 (euro area) production and almost 7% of overall EU15 and euro area employment. Furthermore, they represent around 7% of the EU15 and euro area HICP baskets (see Section 2.1). Second, besides their actual economic weight, it is a common feature of network industries that they provide important inputs for a wide range of economic sectors, which further increases their economic importance. The economic implications of the regulatory reform process in these industries are therefore also of considerable importance for the ECB.<sup>4</sup>

Against this background, this Occasional Paper analyses the economic impact of the regulatory reform programmes currently under way in selected EU network industries. The analysis focuses on the price effects of regulatory reforms in the telecommunications, electricity, gas and air transport sectors. Furthermore, this paper reviews progress with the state of regulation in a number of other network industries, namely railway transport and postal

services, where reforms are not as advanced yet.<sup>5,6</sup>

The paper is organised as follows. Chapter 2 provides a review of the existing empirical literature on regulatory reforms in network industries. Starting with the economic rationale for reforming regulatory arrangements in these sectors, the chapter reviews existing empirical evidence with regard to both the sector-specific and the economy-wide economic effects of such reforms.

Chapter 3 reviews the evolution of the current regulatory framework for network industries in the EU and discusses to what extent the legal preconditions for competition in these sectors have been introduced. Furthermore, it provides some indications regarding the *actual* level of competition that has so far been achieved in these sectors. This is of particular importance given the fact that the *de jure* and *de facto*

1 “Regulatory reform” refers to changes that improve the regulatory quality, that is, enhance the performance, cost-effectiveness or legal quality of regulations and related government formalities. Reform can mean the revision of a single regulation, the scrapping and rebuilding of an entire regulatory regime and its institutions, or the improvement of processes for making regulations and managing reform. “Deregulation”, or “liberalisation”, is a sub-set of regulatory reform and refers to the complete or partial elimination of regulation in a sector in order to improve its performance. With regard to network industries, the aim of deregulation, or liberalisation, is to enhance competition at least in those parts of the industry that are not natural monopolies (OECD 1997a, Synthesis p. 11).

2 For a brief description of the key features of network industries see the beginning of Chapter 3.

3 See ‘Conclusions of the Presidency’, Lisbon European Council March 2000.

4 The ECB published a first assessment of price effects of regulatory reforms in selected network industries in March 2001 (ECB 2001).

5 Other network industries, such as the securities clearing and settlement industry and the credit cards and other electronic means of payment industry, are currently in the forefront of regulatory reforms. However, given the specific nature of these industries and in order to keep this occasional paper manageable in terms of length and amount of information provided to the reader, we did not include these industries in our analysis.

6 Due to data availability the focus of this Occasional Paper is on developments in the 15 EU Member States prior to EU enlargement on 1 May 2004.



levels of competition can differ significantly across sectors and countries, with the *de facto* level of competition being of crucial importance for the realisation of the potential benefits of regulatory reforms.<sup>7</sup>

Chapter 4 examines recent price developments in the four selected sectors. Furthermore, this chapter provides an empirical analysis of the main determinants of recent price developments in these industries. In this context particular emphasis is given to the impact of regulatory reform variables. Chapter 5 summarises the main conclusions.

<sup>7</sup> A market can be characterised by *de facto* or *de jure* competition. *De facto* competition implies effective competition in the market, whilst *de jure* competition is a situation where the existing regulatory framework allows market entry and exit, but a limited number of large players still retains a dominant position.

## 2 ECONOMIC EFFECTS OF REGULATORY REFORMS IN NETWORK INDUSTRIES

This section first presents the economic rationale underpinning the regulatory reforms in network industries, mainly focusing on the sector and economy-wide impact on consumer prices (section 2.1). Section 2.2 presents an overview of recent literature dealing with both the *sector-specific effects* of regulatory reforms (section 2.2.1) and the *economy-wide effects* of reforms in these sectors (section 2.2.2). A summary of the surveyed literature is provided in Table 3 at the end of this chapter.

### 2.1 ECONOMIC RATIONALE

Regulatory reforms in network industries are an important element of the overall structural reform agenda in the EU. Given that the network industries examined in this study account for almost 10% (9%) of the EU15 (euro area) production, almost 7% of EU15 and euro area employment and almost 7% of EU15 and euro area HICP, the direct macroeconomic impact of regulatory changes in network industries is indeed important (see Table 1 and Table 2 below)<sup>8</sup>.

Looking at sector-specific effects, changes in the regulatory regime of a specific sector are likely to have both supply- and demand-side effects. As an example, supply-side effects can stem from opening up the bottleneck infrastructure of a regulated network industry to new entrants that are allowed to provide services or introduce new products, thereby boosting supply. By the same token, the consumption of network industry products may increase as a consequence of a market being opened to competition and the associated expected reduction in consumer prices, the *direct consumer price effect* (see Chart 1 for an illustration). This effect is expected to persist until the industry has reached a new steady state. The transitory period is likely to differ across countries and industries and depends on the type of regulatory changes introduced. It is, however, likely that reaching a new steady state will take a relatively long period of time (see ECB 2001).

8 To compute the weight in total production and employment, we have proxied network industries with the sum of the electricity, gas and water supply sector and the transport, storage and communication sector available in the STAN database.

Table 1 Weights of selected network industries in total HICP in 2004

HICP-weights (total = 100)	Gas	Electricity	Telephone and telefax services	Postal services	Passenger transport by air	Passenger transport by railway	Total
EU-15	1.3	1.9	2.4	0.2	0.5	0.5	6.7
Euro area	1.3	2.0	2.4	0.2	0.5	0.4	6.8

Source: Eurostat and own calculations.

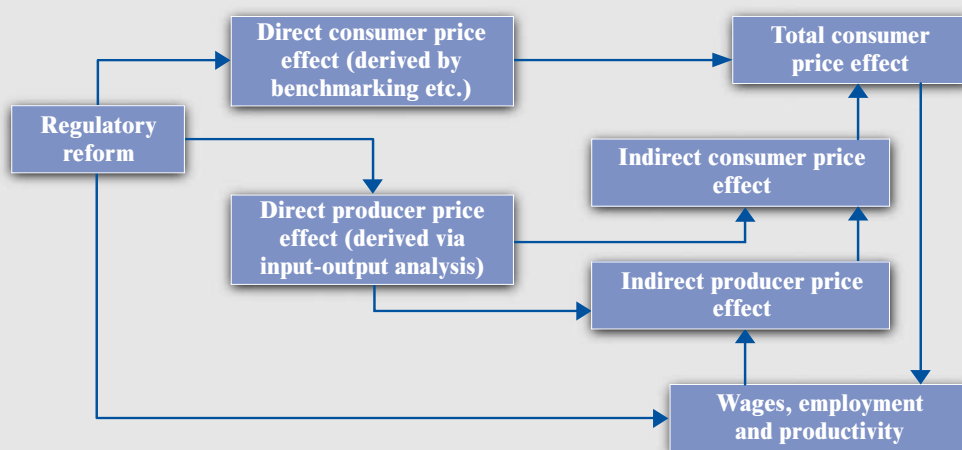
Table 2 Weights of selected network industries in production and employment in 1999<sup>1)</sup>

	Electricity, gas and water supply	Transport, storage and communication	Total	Electricity, gas and water supply	Transport, storage and communication	Total
	% of total production			% of total employment		
EU-15	2.1	7.7	9.8	0.7	5.9	6.6
Euro area	2.2	6.8	8.9	0.7	5.7	6.4

Source: STAN database and own calculations. Data for Ireland are not available.

1) 1999 data had to be used to compute the EU-15 average due to missing data for some countries after this date.

Chart 1 Price effects of regulatory reforms in network industries



Source: ECB (2001).

The above-mentioned sector specific changes are also expected to affect the economy as a whole. In particular, direct price effects for network products will also affect prices in other sectors where such products are used as input (*direct producer price effects*) triggering both *indirect consumer and producer price effects*. Direct and indirect changes in consumer prices will affect *wages, employment and productivity* throughout the economy which in turn may result in second-round price effects. In particular, regulatory reforms have direct and indirect impacts on productivity<sup>9</sup>. Direct impacts occur through the decrease in costs of doing business and through the removal of barriers to entry into new markets. Indirect effects operate through three main channels, namely a reduction of sector mark-ups and a reallocation of scarce resources (allocative efficiency); an improvement in the utilisation of the production factors by firms (productive efficiency); and an incentive for firms to innovate and to move to the modern technology frontier (dynamic efficiency).

From a monetary policy viewpoint assessing the timing and extent of price effects is particularly important. Moreover, it is fundamental to account for both direct and indirect effects of regulatory reforms on prices,

and to account for changes in employment and output growth. In the long-run, changes in supply and demand conditions are also expected to affect the readjustment of relative prices in the economy, i.e. the prices of network products relative to the prices of other goods and services. Given that changes in the overall price level are fundamentally determined by monetary policy, changes in relative prices stemming from changes in the regulatory framework are expected to be the only permanent long-run effect on prices.

However, from a monetary policy perspective, the following long-term considerations should also be taken into account.

- With regard to telecommunications in particular, regulatory reforms and the associated increase in the level of competition may accelerate technological progress. This is regarded as an important prerequisite for the emergence of an economic environment that would sustain higher rates of economic growth, higher real wage increases and lower levels of unemployment without increased risks to price stability.

<sup>9</sup> For an extensive discussion of the link between product markets reforms and productivity see European Commission (2004a).

- If markets were to become more efficient as a result of regulatory reforms and price adjustments were to be carried out more swiftly, the adjustment costs associated with monetary policy measures may be reduced. This would make it easier for the ECB to conduct stability-oriented monetary policy.
- Regulatory reforms are likely to lessen the influence of administered prices. Price changes in network industries will thus presumably become more closely related to market dynamics. However, it is not clear whether this will significantly reduce or increase the variability of the inflation rate of utility prices. On the one hand, changes in administered prices tend to be more abrupt than price changes based on market dynamics. On the other hand, in the past administered utility prices were often kept “artificially” stable for political reasons and they may become more volatile in future.

Against this background, it is advisable for monetary policy-makers to monitor closely the ongoing reforms in network industries and to assess the economic impact of the reform steps that have been undertaken so far.

## 2.2 LITERATURE OVERVIEW

### 2.2.1 SECTOR-SPECIFIC EFFECTS OF REGULATORY REFORM IN NETWORK INDUSTRIES

This section provides an overview of the most recent empirical literature regarding sector specific effects of regulatory reforms in telecommunications, electricity, gas, air transport services, railway transport and postal services (see Table 3 for a summary overview).

Before turning to more industry- and/or country-specific studies, we first start by surveying a fundamental contribution to the literature on network industries, namely the OECD (1997) Report on Regulatory reforms.<sup>10</sup> This report relies on a benchmarking technique

to estimate the long-term impacts of liberalisation in different industries. The report covers 8 OECD countries: United States, Japan, Germany, Spain, France, the Netherlands, Sweden and the UK. Cross-country differences in productivity, consumer prices<sup>11</sup> and profit margins are assumed to be partly related to differences in national regulatory regimes. Potential gains from regulatory reforms are then estimated by comparing national performance with optimum performance within the country group. The report concludes that in the long run consumer prices for *telecommunication* services are expected to decline by an average of 13% in the UK, more than 22% in Spain and Germany and 30% in France, due to lower costs of material inputs and lower mark-ups. In the long run liberalisation is estimated to boost sector telecommunication output by between 22% and 50% taking innovation-induced changes in telecommunications into account. With regard to *employment*, the findings by the OECD support the commonly held view that liberalisation is likely to have adverse employment effects in the short run. After several years of adjustment, however, sector employment will eventually rise in most countries<sup>12</sup>. The claim of improved productivity due to increased competition receives tentative support from the US experience (OECD 1997, pp. 25-6, 344-5). The relationship between liberalisation of telecommunications and *quality* has been explored less extensively, partly due to measurement problems. Nonetheless, the OECD (1997, pp. 25, 80, 82) finds that in the US, liberalisation of telecommunications has improved service quality since the inception of reforms in the early 1980s, particularly in the

<sup>10</sup> Another important contribution to the discussion is European Commission (1999), which provides a very useful overview of the regulatory and policy issues relating to regulatory reforms in network industries. However, it does not contain detailed empirical assessments of the economic implications of this reform process.

<sup>11</sup> Defined as output prices.

<sup>12</sup> Blöndal and Pilat (1997) confirm these findings. See also EC (1997).

market segment of large business consumers where competition is most intense.<sup>13</sup>

Regarding *electricity*, the OECD (1997, p. 36) estimates that consumer prices will drop by 11-15% in Germany, France and the UK<sup>14</sup> in the long run due to national deregulation and liberalisation programmes. These numbers are supported by more recent studies on the Netherlands.<sup>15</sup> In the countries examined, lower prices are estimated to boost long-term sector electricity *output* by between 4.5% and 11%. It should be noted that for the electricity sector, the OECD sees a fall in employment as very likely even in the long run due to strong productivity growth, whereas telecommunications sector employment is predicted to rebound and even increase considerably after initial job losses. More specifically, the report predicts that employment will in the long run decrease by between 9% and 46%.

### Telecommunications

#### Prices and costs

Boylaud and Nicoletti (2000) examine the effects of liberalisation and privatisation in telecommunications on prices, taking into account the differences in the regulatory regimes across 23 OECD countries from 1991 to 1997. They find strong empirical evidence that the level of competition is negatively related to consumer prices. By contrast, the effects of public ownership and prospective privatisation on prices are found to be negligible. This leads the authors to conclude that it is not ownership per se, but the presence of market power, which affects market outcomes.

#### Output and Investment

Gruber and Verboven (2000) use a large data set comprising 140 countries that adopted mobile telecommunications during the period 1981-97 and find that the promotion of competition by introduction of second entry licences has a positive impact on the diffusion of mobile services and, in turn, on sector output. Simulating a dynamic model using US

data, Clarke et al. (2004) find positive effects of competition on telecom investment.

#### Productivity

Boylaud and Nicoletti (2000, pp. 18, 21, 37, 53-6) find a significant positive correlation between liberalisation in telecommunications and labour productivity. Duso and Röller (2003) present empirical evidence regarding the effect of endogenous deregulation on productivity in the mobile telecommunication industry in the period 1993-1997 for a panel of OECD countries. Estimating simultaneous equations for both deregulation and productivity, they show that the impact of endogenous deregulation on productivity is positive and statistically significant, but considerably smaller than estimates where deregulation is considered exogenous.

#### Innovation

The effects of liberalisation and privatisation on *innovation* are the subject of some controversy in the literature. On the one hand, it can be argued that liberalisation encourages innovation, as it increases incentives to provide new services. On the other hand, liberalisation entails the loss of a secure franchise market to finance R&D investment, which has to be taken into account in the design of the regulatory framework for the industry (Newbery, 1999). By and large, however, the empirical evidence seems to favour the view that competition acts as a spur to innovation. Taking patents as an indicator of innovation performance, the OECD (1997a) finds that telecommunication patents have expanded more strongly in countries where the industry has been subject to stronger competition. Using an econometric approach, van Cuijlenburg and

13 These results are supported by Boylaud and Nicoletti (2000, pp. 18-9, 21, 39, 53-4), who find a highly significant positive correlation between liberalisation and service quality, proxied by various indicators such as the number of faults per mainline and fault clearance rates.

14 For the UK, Newbery and Pollitt (1997) provide a more detailed estimate of the economic, environmental and social effects of electricity sector reform. They estimate permanent net cost reductions of 5% p.a. and net benefits of 4.1-11.9 billion.

15 OECD (1999a), p. 28, 62, 238 and Haffner and van Bergeijk (1997).

Slaa (1995) conduct a cross-sectional multiple regression analysis for 24 OECD countries between 1989 and 1992. They also find a positive correlation between market liberalisation and innovations in telecommunications. More recently, Prieger (2002) examines the effect of regulation on product innovations in the telecommunications services using US company data. An interim period of lighter regulation in the market provides the “experimental data” to test the regulatory regime’s impact on product innovation. He finds that the number of products that firms created during periods of lighter regulation is between 60% and 100% larger than the model would have predicted had a stricter regulation been in place.

### *Electricity*

#### *Prices and costs*

Empirical evidence suggests that the liberalisation of market entry in electricity tends to put downward pressure on prices. However, estimating these reductions is difficult, especially as reforms in most countries have just started. Lijesen (2002) calibrates a forecasting model for electricity using data for the Netherlands. Notwithstanding the fact that the model is calibrated using pre-regulation data and that the quality of some of the data used is relatively poor, the author claims that the introduction of competition in the retail and wholesale electricity market reduces total costs for users. Entry of low cost competitors and lower switching costs for consumers are also likely to have a downward effect on prices. An econometric study by Steiner (2000) examines a panel of 19 OECD countries over a 10-year period. The author finds that the separation of generation and transmission, the expansion of Third Party Access<sup>16</sup> (TPA) and the introduction of spot markets tend to reduce industrial and residential end-user prices of electricity, whereas private ownership and imminence of privatisation (in a non-competitive environment) tend to increase them. The latter finding could be explained by the government’s aim of generating revenue by

privatisation, as well as persistent market power after privatisation.

London Economics (1997) uses a simulation-based approach to examine the cost savings to be generated by the introduction of a single European market for electricity. Price reductions of 5-11% for industrial consumers and 2-4% for residential consumers are expected. These cost savings originate mainly in lower construction and operating costs for generating plants and optimal fuel choice. Further gains can be realised by introducing supply (retailing) competition and national electricity pools. The authors stress that major consumer price effects can be expected from these additional measures, but do not attempt to quantify them in this study, as they were not compulsory elements of the EU legal framework for the electricity sector when this study was prepared.

#### *Efficiency*

Steiner (2000) investigates the effects of liberalisation and privatisation on efficiency. Two indicators of efficiency, the capacity utilisation rate and reserve margins (the ability of capacity to handle peak loads), are separately regressed on a number of regulatory reform variables, namely the separation of generation and transmission, TPA and private ownership.<sup>17</sup> Both measures of efficiency are positively and significantly affected by unbundling<sup>18</sup> and privatisation. The coefficient

16 In the electricity and gas markets, the right to access the existing transmission and distribution network of the incumbent operator is called *third party access*.

17 It should be kept in mind that reserve margins are difficult to interpret as indicators of efficiency. Castro-Rodriguez et al. (2001) simulate the potential welfare effects of deregulation, focusing on the choice of capacity by firms. On the basis of Spanish data, they find that deregulated electricity markets will result in under-investment in generation capacity and that the potential welfare costs are very large. Inadequate generation capacity is generally considered to be the main culprit behind California’s electricity crisis in 2000 and 2001, therefore the importance of appropriate regulation in the electricity market appears to be crucial to guarantee a sufficient level of investment.

18 In general this is referred to as the separation of vertically-integrated monopolies into independent entities. More specifically unbundling in the electricity market implies the separation of the generation from the transmission of energy.

on TPA is insignificant in both regressions, a finding that could be explained by the fact that legal rights to TPA need not necessarily translate into actual TPA, particularly if the incumbent retains its dominant position.

### *Gas*

#### *Prices and costs*

Using the methodology described above, Lijesen (2002) shows that gas prices are likely to decline in the Netherlands following the introduction of competition in the retail and wholesale markets. In the US, reform of gas regulation has been under way since the early 1980s, such that the industry structure has changed markedly by now, from regionalised monopolies to competition in generation, mandatory TPA to interstate pipelines and the creation of spot markets. The OECD (1999b, p.25) reports that these reforms have led to a 35% cost cut in real terms between 1984 and 1994. Prices to consumers likewise dropped, with margins in transmission and distribution declining by 31% between 1984 and 1993.

A study by van Oostvoorn and Boots (1999) sets up two scenarios for the implementation of the EU Gas Directive, respectively called the 'full competition' and 'semi-open competition' scenarios. Based on these scenarios, the authors estimate the impacts on industry structure and consumer prices for seven EU countries and different consumer groups by means of a model of the EU gas market. In the 'full competition' scenario, all seven EU countries are expected to see substantial gas price reductions between 1995 and 2010. Prices in the residential market segment are predicted to fall by between 15% in the Netherlands and the UK to 40% in Italy. Price reductions for industrial consumers are expected to range from 8% in Belgium to 30% in Germany. Moreover, the authors predict a considerable rise in consumption, convergence of consumer prices across EU countries and between different consumer groups due to arbitrage, and the erosion of profit margins of national transmission companies. Under the 'semi-open competition' scenario, which

captures a minimalist implementation of the Directive, only small price reductions are predicted (but not quantified), price differentials across countries and market segments persist, and profit margins are expected to remain constant or even increase slightly.

London Economics (1997) also estimates the gains from creating a European market for gas, using three scenarios: 'business-as-usual', 'increased competition' and 'open gas markets'. They conclude that the effects of a single gas market differ significantly from those in electricity, due to very large economies of scale in gas transmission, vertical separation with oligopoly in both production and transmission, and the location of major gas producers outside the EU. For these reasons, expected gains to European gas consumers as expressed by lower consumer prices are much smaller than in electricity. Even in the most favourable scenario, based on the assumption that consumers' bargaining power exceeds that of producers, the gains from the creation of a European gas market, while sizeable, are only one-ninth of the gains from an integrated electricity market.

#### *Productivity and employment*

In the US, labour productivity in the gas industry rose by 24% in the 10 years after 1984, the beginning of US gas sector reforms. This increase was partly due to a 13% decline in sector employment over the same period (OECD, 1999b, p.25). If similar figures apply to the EU, this would imply smaller long-term sector employment losses and smaller productivity gains than in the electricity sector.

### *Air transport*

#### *Prices and costs*

Several studies have documented the benefits in terms of lower prices stemming from opening up the airline industries. The experience in the US is broadly positive (Morrison and Winston, 1995). Between 1976 and 1993, prices fell by one-third relative to the average price level, with almost 60% of the

decline attributed to deregulation (Blöndal and Pilat, 1997). Blöndal and Pilat (1997) also estimate the sector impact of regulatory reforms in air transport in the US, UK, Japan, Germany and France. They find that for Japan, Germany and France, the impact of regulatory reforms on price levels would be quite substantial, ranging from –10% in Japan to –6% in Germany and France.

Gonec and Nicoletti (2000) develop a panel of 27 OECD countries focusing on the 1996-1997 travel season. Estimating cross-country and cross-route regressions, they show that fares tend to decline when regulation and market structure become more competitive. However, they conclude that in 1996-97 few international routes were truly open to competition and that a few incumbent flag-carriers or alliances among incumbent airlines tended to dominate most markets. They find some evidence that economy and (to a lesser extent) business fares are higher for routes dominated by airline alliances and are particularly sensitive to pricing regulations. Discount fares are found to be mainly affected by charter regulations and by the presence of challenger airlines.

Fischer and Kamerschen (2003) apply a cross-section regression to routes originating from Atlanta and find that the fares for routes served by a low-cost carrier were on average 16 percent lower than on routes where such competition was absent. Ng and Seabright (2001) consider a panel of twelve European and seven major US airlines and find that state ownership has a large upward impact on firms' costs. They find that deregulation measures have had a fairly limited on European carriers overall and estimate that the potential benefits of increased competition, especially if accompanied by further privatisation, could be substantial, ranging between 15% and 20% of firms' total costs.

#### *Output and employment*

According to Blöndal and Pilat (1997), price reductions stemming from regulatory reforms would substantially increase passenger traffic.

Taking into account the sector innovative effects of regulatory reforms, estimated output increases would range from 14% in Germany and France to almost 20% in Japan. Some employment losses are expected in the short run (especially in Japan and France), whilst long-run effects on employment are ambiguous, as employment growth induced by new entrants might compensate for employment losses at incumbent companies.

#### *Efficiency and quality*

The effects of deregulation on *efficiency* are not unambiguous. Gonec and Nicoletti (2000) find that overall efficiency and the rate of occupancy of aircraft seats tend to increase as the regulatory environment becomes more competitive. Liu and Lynk (1999) find that US deregulation did not induce efficiency convergence amongst carriers and that opportunities to exercise market power via predatory practices are still relatively common and tend to signal limited effective competition in the market. Gagnepain and Marín (2004) find that the 1992 European deregulation package significantly improved European airlines' efficiency.

Mazzeo (2003) uses US data for the year 2000 to investigate the link between service *quality* (in terms of flight delays) and the extent of market power. Controlling for other factors such as weather conditions and airport congestion, he finds that flights are less frequently on time on routes that are served by only one airline and in cases when the carrier's market share at the airports served is higher.

#### *Railway transport*

The US experience in railway deregulation, which started in 1980, suggests that a reduction of the regulatory burden for rail transport can result in considerable productivity gains and lower prices. However, it should be kept in mind that the US experience with regulatory reforms in the railway sector is only partly comparable to the reform model envisaged in the EU. First, railways in the US focus almost exclusively on freight rather than passenger



traffic. Second, US railways own their infrastructure and a separation of tracks and services is not envisaged.<sup>19</sup> Grimm and Winston (2000) explore the effect of competition on rates and service quality in the US railway sector. Using survey data, they find that increased rail competition lowers transport rates but in general does not improve service quality in terms of times.

Affuso and Newbery (2002) investigate whether vertical separation and auctions of short duration contracts depressed investment in the British passenger railway industry. Notwithstanding the limited size of the panel examined, they find preliminary evidence contrary to this prediction and conclude that a higher degree of competition induced by relatively frequent auction of the franchisees tends to improve investment performance.

More generally, Friebel, Ivaldi and Vibes (2004) present econometric evidence for a panel of 12 EU countries showing that the implementation of reforms (separation between infrastructure and operations, third-party access and the existence of an independent regulatory entity) had a positive impact on (quantitative) output.

#### *Postal services*

Cohen and Chu (1997) estimate that the introduction of a second firm sharing the US postal delivery market with the incumbent significantly increases the cost of delivery and route time. However, the monopoly rents of workers seem to outweigh the benefits of scale in the delivery system, which would speak in favour of more competition. The effects on efficiency have not been analysed.

More recently, Mizutani and Uranishi (2003) explore the parcel delivery market in Japan in the period 1972 to 1998 using data for six companies including the former Post Office state monopoly. They conclude that increased competition contributes to both cost reduction and TFP growth for private companies, whilst the former monopolist appears to react quite

slowly to increased competition, delivering new strategic options and products only with a considerable time lag.

#### 2.2.2 ECONOMY-WIDE EFFECTS OF REGULATORY REFORM IN NETWORK INDUSTRIES

In this section we focus on the economy-wide effects of regulatory reforms in network industries.

##### *Effects on prices and inflation*

The economy-wide impacts of network industry reforms on prices and inflation are particularly important for monetary policy making. The OECD Report on Regulatory Reform (OECD 1997) presents estimates of the effects of deregulation on a variety of macroeconomic variables, using the OECD INTERLINK model. The first-round effects described for different industries in section 2.2.1 are fed into the model as exogenous changes in order to simulate all macroeconomic responses to the shocks, including second-round effects. According to this study, producer prices in the long term are predicted to fall by 0.8-0.9% for Germany, France and the UK due to the combined effect of deregulation in the telecommunications and electricity industry. These estimates take into account not only the direct producer price effect, which derives from lower costs for electricity and telecommunications inputs in all sectors, but also indirect producer price effects. The latter comprise all repercussions of regulatory reform on producer prices as captured by the model, including second-round effects on wages due to reduced consumer prices.

With the assumption that reforms are fully implemented after a period of 10 years, the downward pressure on prices subsides and inflation rates return to their pre-reform level. Thus, in the very long-run, inflation rates are projected to be unaffected by regulatory

19 On this issue see e.g. The McKinsey Quarterly 1997, Number 4, pp. 107-119.

reform, whereas the price level is expected to remain permanently lower.

Blöndal and Pilat (1997) also estimate economy-wide first-round effects of regulatory reforms by aggregating the specific effects of each of the five sectors analysed (electricity, telecommunication, air and road transport and distribution). These five sectors account for approximately 20% of business-sector GDP and employment. Regulatory reforms are estimated to have a downward effect on the GDP deflator, ranging from -2% in Japan to close to -1.5% in France and Germany and -0.3% in the United States (compared with the baseline scenario).

*Effects on output, investment, employment and productivity.*

According to the OECD (1997), regulatory reforms in the electricity and telecommunication sectors are estimated to have long-term employment effects ranging from -0.28% and -0.21% respectively in Germany and the UK, to over -0.1% in France and Sweden, 0% in Spain, and +0.29% in the Netherlands<sup>20</sup>.

Higher output in the telecommunications and electricity sectors is expected to mechanically increase total business sector output by between 0.4% in Sweden and 1.2% in Spain (OECD, 1997). However, the overall output effect estimated in Blöndal and Pilat (1997) ranges from 1% in the United States to close to 5% in Germany and France (long-run deviation from baseline). Differences in magnitude across countries are mainly due to the different country-specific scopes of stimulating efficiencies via regulatory reforms, mainly reallocating capital and labour across economic sectors within each country.

The projected rise in output, together with the rather small (positive or negative) effects on employment, is expected to spawn a substantial increase in labour productivity growth. For Germany and France, for instance, this increase is estimated at 2.6% and 1.3% respectively

(OECD, 1997). A somewhat stronger positive effect on productivity is estimated in Blöndal and Pilat (1997). In general, they find that benefits are larger the more regulated countries are at the beginning of the reform process.

Alesina et al. (2005) explore the effects of regulation on investment in a panel of network industries (airline, railways, telecommunication, postal services, electricity and gas) and find that liberalising entry into these sectors significantly boosted investment rates (the ratio of investment to capital stock). Reducing the extent of regulation to the level in the US is estimated to increase average sector investment rates by 2.6% in Germany and France and by more than 4% in Italy. The effect of privatisation on investment is however ambiguous.

Easier regulation of entry into product markets is also found to significantly boost employment given that, as restrictions are eased and competition increases, firms earn lower product market rents, activity expands and employment rates tend to rise, as documented by Nicoletti and Scarpetta (2004).

Nicoletti and Scarpetta (2003) explore the link between multi-factor productivity (MFP) growth and various indicators of product market regulation and privatisation within a panel of 18 OECD countries. They find that countries with lower entry barriers and state control catch up more quickly to the best-practice technologies in manufacturing industries and that entry liberalisation leads to MFP gains in all countries, regardless of their initial position with respect to the technology frontier. Moreover, privatisation is found to involve direct productivity gains, although the extent of these gains depends on the promotion of de facto competition in the market where privatisation has taken place.

<sup>20</sup> All figures refer to deviation from the baseline scenario over a period of ten years.

Table 3 Overview of important sector-specific and economy-wide empirical studies

Author	Country/Period	Method variable	Explanatory variable	Performance	Main findings
<b>TELECOMS</b>					
Boylaud and Nicoletti (2000)	23 OECD countries, 1991-97	Econometric	Liberalisation Privatisation	Consumer prices Quality Labour productivity See above	Negative Positive Positive Insignificant
Duso and Röller (2003)	24 OECD countries, 1993-97	Econometric/Single and simultaneous equations estimates	Deregulation	Productivity in mobile telecommunication	Positive, but smaller if deregulation is endogenous
Gruber and Verboven (2000)	140 countries, 1981-97	Logistic econometric model of diffusion	Competition (second-entry licences in mobile telecommunication)	Diffusion of mobile services (and sector output)	Positive
OECD (1997)	8 OECD countries (US, JP, DE, ES, FR, NL, SE, UK) long-run	Benchmarking	Competition, regulatory reform	DE, ES, FR, NL, SE, UK Consumer prices Output Labour productivity Employment Innovation	-13 to -30% +22 to +50% +20 to +40% -2 to +23% Positive
OECD (1997a)	5 OECD countries, 1980-1993	Descriptive	Competition	Innovation	Higher growth of patents where competition is stronger
Prieger (2002)	US company data, 1987-97	Econometric, Generalised Poisson Models	Regulation	Product innovation in mobile telecommunication	“Lighter” regulation associated with the creation of more products
Van Cuilenburg and Slaa (1995)	24 OECD countries, 1989-92	Econometric	Liberalisation	Innovation	Positive
<b>ELECTRICITY</b>					
Castro-Rodriguez et al. (2001)	Spain, 1999-2010 (projected)	Econometric model, simulation (for year 2005)	Regulation	Investment in generation capacity	Deregulated markets resulting in under-investment
London Economics (1997)	EU	Simulation	nTPA <sup>1)</sup> rTPA under the implementation of the Single Market	Cost savings Consumer prices	€4-6 billion €10-12 billion Down 5-11% for industrial, down 2-4% for residential
Lijesen (2002)	Netherlands	Econometric model, calibration	Competition	Costs and prices	Negative
OECD (1997)	8 OECD countries (US, JP, DE, ES, FR, NL, SE, UK) long-run	Benchmarking	Competition, regulatory reform	DE, ES, FR, NL, SE, UK Consumer prices Output Labour productivity Employment	-9 to -20% +5 to +11% +30 to +100% -9 to -46%
Steiner (2000)	19 OECD countries	Econometric	TPA, unbundling Privatisation	Consumer prices Efficiency As above	Negative Positive Positive Positive

1) nTPA stands for “negotiated third party access”, i.e. the right to access the existing transmission and distribution network which is negotiated individually for each contract rather than fixed uniformly for all contracts and competitors (so called “regulated third party access” or rTPA).

**Table 3 Overview of important sector-specific and economy-wide empirical studies (cont')**

Author	Country/Period	Method variable	Explanatory variable	Performance	Main findings
<b>GAS</b>					
Lijesen (2002)	As above	As above	As above	As above	As above
London Economics (1997)	EU	Simulation	Implementation of Single Market through nTPA/rTPA	Cost savings Consumer prices	€256 million to €283 million (up to €1,382 million in most favourable scenarios) Negative
OECD (1999b)	United States, 1984-1994	Descriptive	TPA, spot markets, liberalisation	Profit margins Costs Labour productivity Employment	-31% (1984-93) -35% +24% -13%
Van Oostvoorn and Boots (1999)	EU	Simulation	Scenarios for the implementation of the Single Market for gas	AT, BE, DE, FR, IT, NL, UK Consumer prices	Residential: -15 to -40%; Industrial: 0 to -30%
<b>AIR TRANSPORT</b>					
Blöndal and Pilat (1997)	US, Japan, Germany, France and UK	Benchmarking	Regulatory reforms	Consumer price, Output Employment	-10% to -6% +14% to +20% Negative in the short run and ambiguous in the long run
Fisher and Kamerschen (2003)	Atlanta airport pair data, 1996	Cross-section regressions	Competition	Passenger fares	Negative, -16% when low-cost carrier competition is present
Gonec and Nicoletti (2000)	27 OECD countries, 1996-1997	Econometric	Competition	Passenger fares, Efficiency and Occupancy	Negative, Positive
Mazzeo (2003)	US, 2000	Econometric	Competition	Quality (in terms of flight delays)	Positive
Ng and Seabright (2001)	19 airlines (both European and US), 1982 to 1995	Econometric estimation of a carrier cost function	State ownership	Firm's costs	Negative, further privatisation could lower costs up to 20%
<b>RAILWAY TRANSPORT</b>					
Affuso and Newbery (2002)	Panel of 25 UK operators, 1997-2000	Econometric	Vertical separation and auctions of short duration contracts	Investment	Frequent actions and a higher degree of competition improve investment performance
Friebel et al. (2004)	12 EU countries, 1980-2000	Econometric	Separation between infrastructure and operations, third party access and regulatory body	(Quantitative) Output	Positive impact
Grimm and Winston (2000)	Panel of US railways, 1998	Econometric	Market competition	Price Quality	Negative Not affected
<b>POSTAL SERVICES</b>					
Cohen and Chu (1997)	US	Simulation	Introduction of a second firm (increased competition)	Cost of delivery Monopoly rent of postal workers	Increase significantly Reduce considerably

Table 3 Overview of important sector-specific and economy-wide empirical studies (cont')

Author	Country/Period	Method variable	Explanatory variable	Performance	Main findings
Mizutani and Uranishi (2003)	6 Japanese parcel delivery companies, 1972-98	Econometric	Increased competition	Costs TFP	Negative Positive
<b>ECONOMY-WIDE</b>					
Alesina et al. (2005)	21 OECD countries, 1975-96	Econometric, dynamic model	Economic Regulation in a panel of network industries	Investment in selected network industries	Reducing regulation spurs investment, from +2.6% to +4%
Blöndal and Pilat (1997)	US, Japan, Germany, France and UK As above	Aggregation of sector effects  Simulation (as OECD 1997)	Competition and regulatory reforms  As OECD 1997	GDP deflator, Total output, Productivity. Comparable to OECD (1997)	-2.1% to -0.3% +0.1% to +0.8% +0.5 to +3.5% Comparable to OECD (1997)
Nicoletti and Scarpetta (2003)	18 OECD countries, 1984-1998	Econometric	Privatisation  Entry barriers/ state control	Multi-factor productivity	Positive  Negative
OECD (1997)	8 OECD countries (US, JP, DE, ES, FR, NL, SE, UK) long-run	Simulation	Competition, regulatory reform of telecoms and electricity	DE, ES, FR, NL, SE, UK Producer prices (DE, F, UK) Output Employment Inflation	-0.77 to -0.93%  +0.44 to +1.15% -0.28 to +0.29% nil (very long term)

### 3 RECENT PROGRESS IN REGULATORY REFORMS IN EU NETWORK INDUSTRIES

Network industries are characterised by the delivery of products and services to final consumers via a “network infrastructure” consisting of different elements linking upstream supply with customers lying downstream. A typical network industry has three key components: (i) upstream core products, (ii) network infrastructure and (iii) downstream customer supply and service provision (see Bergman et al., 1998, for a discussion). Until a few years ago, network industries in EU Member States were typically characterised by the existence of one large, vertically integrated (i.e. covering the different stages of the production process mentioned above) and publicly owned incumbent firm. Arguably the most important reason for this monopolistic market structure is simultaneously the main defining feature of network industries, namely the above-mentioned presence of a bottleneck

infrastructure with natural monopoly characteristics, i.e. with average costs declining as output increases.<sup>21</sup> Examples of bottleneck infrastructures are transmission networks for electricity and gas, fixed-wire telecommunications, and rail networks. It would be extremely expensive and economically inefficient to duplicate these infrastructures, for example installing competing electricity transmission systems or parallel rail networks.<sup>22</sup> Furthermore, governments frequently pursue non-economic objectives via network industries, such as universal service obligations for utilities and public transport companies and equal prices across geographic regions. Moreover, given that network industries often provide essential services, it is important to ensure the security of supply. All these reasons are often seen as justification for regulation and more direct

21 For a detailed discussion see R. B. Braeutigam (1989).

22 The capital investment required to install a network infrastructure is also generally “sunk” or irreversible.

governmental interference than in other sectors of the economy.

More recently, however, the question emerged to what extent competition could be introduced in network industries with a view to enhancing their economic performance.<sup>23</sup> The key issue in this context is to separate the industry's natural monopoly element(s), usually the main physical infrastructure(s), from elements that do not have natural monopoly features, for example the actual supply of services. This can be done by granting different companies access to the bottleneck infrastructure. More specifically, this requires regulations in order to ensure non-discriminatory access for potential competitors under 'fair' conditions. Moreover, if incumbent firms provide different types of services in markets with different levels of competition, regulation is needed to prevent "cross-subsidisation". A well-known example for this practice occurred during the initial stages of telecoms liberalisation, when profits generated by (non-competitive) local fixed-line calls were used to subsidise long distance calls by the same company. This often made it more difficult for new long distance telecommunication service providers to enter the latter (legally contestable) market, thus lowering *de facto* competition.

As shown in more detail below, the network industries covered in this paper are currently in very different stages of the regulatory reform process and the level of competition differs significantly across sectors.

### 3.1 TELECOMMUNICATIONS

The telecommunications sector has made significant strides towards liberalisation. As of 1 January 1998, free competition among voice telephony and telecommunications infrastructure providers was introduced in the EU and by 2001 the last of old Member States' country-specific temporary derogations from implementing the relevant EU Directives had

expired. In March 2002, the European Parliament and the Council adopted a new EU framework for electronic communications networks and services. This new framework is a significant departure from past practice insofar as it assumes that competition has become the rule rather than the exception in this sector and that sector-specific regulations are from now on only needed in particular areas, such as access to the fixed-line network, rather than in the industry as a whole. Furthermore, the new framework gives a more important role to the National Regulatory Authorities (NRAs), which can grant access to networks where justified by a lack of competitive pressure on dominant operators.<sup>24</sup>

However, there remain a number of impediments to the *de facto* creation and promotion of competition. The 8th European Commission 'Report on the implementation of the telecommunications regulatory package' stated that a number of practical implementation issues still need to be resolved. These include for example cumbersome licence procedures for new service providers, the untimely delivery of leased lines by the incumbent operator to other telecommunications service providers and the cross-subsidisation by some incumbent operators of specific services for which competition is intense.<sup>25</sup>

Against this background, it is not surprising that despite the advanced stage of the reform process in telecommunications, effective

23 Technological progress and innovation have also played a role in reducing the importance of the natural monopoly characteristic of certain network industries such as in the telecommunications sector.

24 For details regarding the new framework and the state of its implementation in the EU15 see European Electronic Communications Regulation and Markets 2003: Report on the implementation of the EU Electronic Communications Regulatory Package, COM(2003)715 final, 19.11.2003.

25 European telecoms regulation and markets 2002: Eighth report on the implementation of the telecommunications regulatory package, COM (2002) 695 final, 3 December 2002.

competition in a number of countries and market segments, especially local calls and domestic fixed-line telephony, remains somewhat limited, with the dominant incumbents retaining a significant market share.

In 2002, the market share of the leading fixed-line telephony and mobile telecommunications operators remained above 40% of the overall market for all four major types of telecommunications services in all EU15 countries. The UK, with its relatively long history of regulatory reforms in the telecommunications markets, is the only EU15 Member State where the shares for at least two types of services had fallen significantly below 40% by 2002 (see Chart 2).

The dominance of the incumbent operators is strongest for local calls, for which the market shares range from 69% (Sweden) to 100%

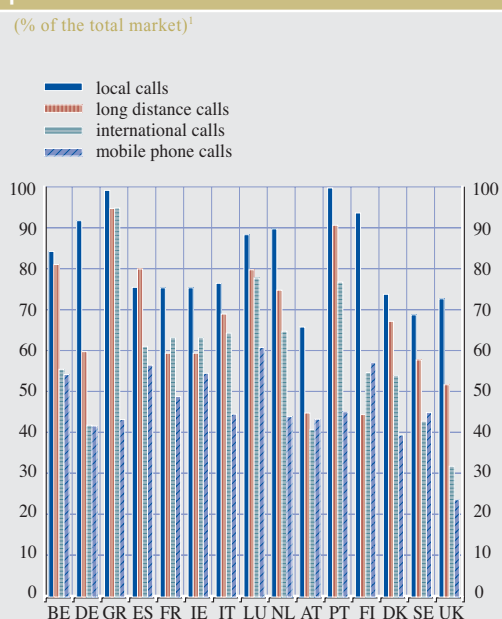
(Portugal).<sup>26</sup> This reflects the regulatory difficulties associated with securing access rights for new telecommunications companies to the ‘last mile’ of the fixed telephony network. Whereas the unweighted average of the leading providers’ market share for local calls for all EU15 Member States was around 82% in 2002, the average market share for domestic long distance calls was 68% and for international calls it was 59%. The average share for mobile calls was clearly the lowest, with 47% of the market. Looking at developments over time, the incumbent fixed-line operators’ share of local and national long distance calls declined in almost all countries, whereas the picture is much more mixed for international fixed-line and mobile calls.

The strong role of the incumbents in most EU telecommunications markets illustrates the considerable practical difficulties of ensuring non-discriminatory access to the bottleneck infrastructures in telecommunications.<sup>27</sup> It is a time-consuming process for regulators to acquire the information needed to establish, for example, the ‘fair’ price for leasing a telephone line. These implementation problems, as well as the time it takes for suppliers and consumers to adjust to a new competitive environment, explain why the creation of *de facto* competition in network industries is usually a gradual process.

### 3.2 ENERGY MARKETS

Unlike the telecommunications industry, the EU electricity and gas markets are not yet fully open to competition in all EU15 Member States. This is due to the fact that the EU Council decided to follow a gradual market opening approach in these two network industries.

**Chart 2 Incumbent market share in local, long distance, international and mobile phone calls in 2002**



<sup>1</sup> Data for local calls in Belgium, Luxembourg, Portugal, Denmark and Sweden refer to 2001.  
Source: Eurostat – structural indicators database.

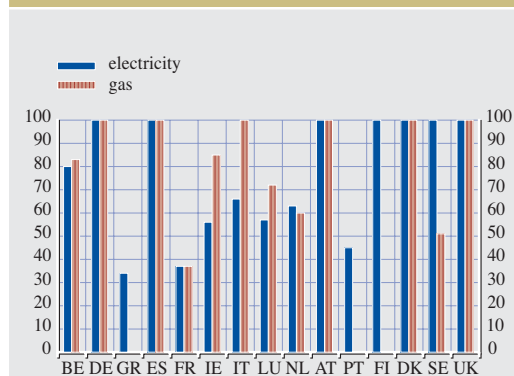
<sup>26</sup> Data for these two countries relate to 2001.

<sup>27</sup> For a general discussion on the impact of different forms of regulation in telecommunications markets on the level of competition see de Bijl and Peitz (2002).

The 1996 EU Electricity Market Directive (96/92/EC) called for an initial liberalisation of at least 25% of the national electricity markets by 1999. This share was due to increase to one-third by 2003. The 1998 EU Gas Market Directive (98/30/EC) foresaw an initial liberalisation of at least 20% of the national gas markets by 2000 and of one-third of these markets by 2008. However, an agreement to speed up the liberalisation of the electricity and gas sectors was reached in 2003, resulting in new Electricity and Gas Directives.<sup>28</sup> The agreement sets a timetable for opening the energy market, with a deadline of 1 July 2004 for non-household users and 1 July 2007 for household users. Some Member States have already gone beyond the minimum market opening requirements in these two industries and opened their energy markets fully to competition. Many other Member States, however, have so far failed to keep the schedule for the compulsory (partial) market opening. Although businesses were supposed to be allowed to freely choose their suppliers of electricity and gas from 1 July 2004, only two EU Member States, neither of them among the big EU economies, had fully implemented the necessary legislation in time.<sup>29</sup>

Chart 3 shows the percentage of the electricity and gas markets open to competition in the EU countries in 2003.

**Chart 3 Opening of the EU electricity and gas markets in 2003**



Source: European Commission (2004b). Gas market data for Greece, Portugal and Finland are not available.

Developments since 2000 show a steady increase in the share of the EU energy markets that are legally open to competition.<sup>30</sup> According to the European Commission (2004) report on the implementation of the internal electricity and gas market, six out of 25 EU countries, namely Germany, Spain, Austria, Finland, Denmark and the UK, have so far declared their electricity and gas markets fully open to competition. However, Greece, France and Portugal, as well as most of the new EU Member States, still have to open more than 50% of their electricity and gas markets to competition. The unweighted EU25 average of markets in these two sectors now open to competition is 56% for electricity and 63% for gas. The corresponding weighted average figures, using HICP weights, are 75% for electricity and 78% for gas.

The difference between fully and partially liberalised markets is important for how electricity and gas prices are likely to be affected by regulatory reforms. Direct price reductions for private households due to competition can only be expected if the electricity and gas markets for private consumers are also open for competition. Private households in Member States where only non-household energy markets have been opened to competition can therefore only expect to benefit from energy market liberalisation if lower electricity or gas prices for industrial users are passed on to consumers. However, a number of national regulatory authorities operate price cap rules that require electricity and gas suppliers to adjust prices for all consumers, including private households. Such price cap mechanisms are usually set on the basis of, for example, developments in fuel prices and assumed industry-wide efficiency gains in the electricity or gas sector. Their introduction and the resulting downward price effects for electricity and gas consumers can be

<sup>28</sup> Directives 2003/54 and 2002/55 respectively.

<sup>29</sup> Financial Times, 2 July 2004, "Brussels urges EU nations to open their energy markets".

<sup>30</sup> On this see also ECB (2001).



interpreted as a positive consequence of the regulatory reform process in energy markets.

As in the case of telecommunications, regulatory reforms in the electricity and gas sectors can only result in downward price effects if the regulatory framework ensures *de facto* competition. However, despite progress in the formal opening of the electricity market in many countries, actual competition remains so far often limited.<sup>31</sup> This is mainly due to dominant incumbents, especially in the field of electricity generation, lack of interconnection of electricity networks within and between Member States and – in some cases – insufficiently strong NRAs. Despite recent progress in the implementation of the gas directive, effective competition in the gas market is still relatively limited and even less developed than in the electricity sector. The main obstacles hampering competition in a number of EU gas markets are disparities in network access tariffs across countries and regions, the concentration of gas production and imports in the hands of a few companies and the slow development of gas trading hubs. The latter prevents potential new gas market entrants from buying wholesale gas.

### 3.3 AIR TRANSPORT SERVICES

Since 1997 the regulatory framework for the provision of air transport services within the EU gives unrestricted access to all international intra-EU routes and all domestic EU markets for any carrier holding a Community licence.<sup>32</sup> Furthermore, the freedom of market access is complemented by the freedom to set fares. However, the regulatory framework contains some safeguards, for example public service obligations to maintain services to peripheral regions.<sup>33</sup>

Notwithstanding the advanced stage of the regulatory reform process in air transport, a number of infrastructure bottlenecks continue to limit competition. The most important

bottleneck appears to be the scarcity of available slots at major airports. According to current rules, established carriers do not normally lose their take-off and landing slots however little they actually use them. Although a Council Regulation adopted in October 1999<sup>34</sup> stipulates that 50% of unused or newly created slots must be set aside for newcomers to the market, the availability of peak-time slots at congested airports did not substantially increase. In 2001, the Commission thus set a process in motion to help make the slot system more flexible. In January 2004 a study looking into mechanisms that encourage slot mobility and lead to the most efficient use of scarce airport capacity was completed. On the basis of this study, the Commission will further develop its thinking on new regulations.<sup>35</sup>

Another frequently mentioned bottleneck that reduces competition is air space congestion. In order to reduce this problem, the European Parliament and the Council approved in early 2004 a package of Commission proposals that paves the way for a single system of air traffic control in Europe, known as the ‘Single European Sky’, by 31 December 2004.<sup>36</sup>

31 See e.g. Speck and Mulder (2003) and ECB (2004).

32 Regulation (EEC) 2408/92.

33 Air traffic between the EU Member States and third countries is still heavily regulated by bilateral agreements between the individual Member States and non-EU countries. However, a 2002 European Court of Justice ruling granted the European Commission the ability to negotiate international ‘open skies’ agreements on behalf of the EU as a whole.

34 Regulation EEC 95/93.

35 ‘Flexibility arrangements’ were introduced in the wake of the crises which gripped the airline industry following the events of 11 September 2001 in the US, the outbreak of SARS and the war in Iraq in 2003. Under these arrangements, airport coordinators were required to continue to allocate slots to air carriers affected by the crisis for a certain period of time, even if air carriers had not used them in accordance with Community rules.

36 Until recently, ground-handling operations in many EU airports remained also a monopoly. Many carriers complained that these services were too expensive and acted as a competition deterrent. However, over the last few years, the market for ground handling services at EU airports has been gradually opened up to competition, and full liberalisation was achieved by December 2003. Furthermore, the Commission launched a review process of the ground-handling operations markets in 2003, taking into account the experiences so far.

A 1999 report by the European Commission on changes in the European airline industry found that in 1997, the study's reference year, more than 90% of EU air routes were still monopolistic or duopolistic. This was broadly confirmed in a 2000 report by the OECD.<sup>37</sup> For many routes this apparent lack of effective competition can be explained by the limited market volume, which allows only one or two airlines to operate profitably. More recently, developments regarding the level of competition in this sector appear to go in opposite directions. On the one hand, the recent growth of low-cost carriers appears to have substantially increased the level of competition in the industry, often by providing alternative routes at substantially lower prices than those of established carriers.<sup>38</sup> Furthermore, some industry analysts argue that ticket sales via the Internet have further increased the level of competition in the EU air transport industry. On the other hand, the increasing importance of airline alliances is perceived to be having a negative impact on effective competition.

An overall judgement of how successful regulatory reforms in this field have been at cultivating effective competition is difficult, although the recent financial pressure on many airlines in the EU (and beyond) suggests that competition has on balance intensified. However, addressing the above-mentioned competition bottlenecks in some segments of the airline industry is clearly a priority for further action.

### 3.4 POSTAL SERVICES

The following two sub-sections deal with two industries which are in even earlier stages of the regulatory reform process than the sectors discussed above, namely the postal sector and the rail transport industry.

The postal sector falls into two parts. Parcel and express services operate in a broadly competitive environment, whereas mail services in most Member States are still highly regulated. The first so-called Postal Services

Directive (97/67/EC) opened only about 3% of the regulated national mail services markets to competition. The new Postal Services Directive adopted in 2002 defined further steps in the market opening process. More specifically, Member States must open up the following market segments to competition:

- From 2003: delivery of letters weighing more than 100gr (or costing more than three times the price of a standard letter) and all outgoing cross-border mail.<sup>39</sup>
- From 2006: delivery of letters weighing more than 50gr (or costing more than two and a half times the price of a standard letter).

Taken together, these segments represent roughly 20% of the overall postal sector. Furthermore, the new Postal Services Directive requires the Commission to complete in the course of 2006 a study assessing, for each Member State, the impact of a full Internal Market for postal services in 2009 on universal service. On the basis of that study, the Commission will make a proposal confirming, if appropriate the aim of a full Internal Market for postal services in 2009 or determine any other step.

The European Commission recently assessed the impact of the 1997 Postal Directive and concluded that the Directive has been correctly implemented in the majority of Member States and that the quality of postal services has generally improved.<sup>40</sup> The experience of those

<sup>37</sup> Gonenc and Nicoletti (2000). For further details on this issue see Chapter 3.

<sup>38</sup> Most low-cost carriers provide services to and from secondary airports located close to major primary airports. These new connections are often close substitutes to existing services between primary airports, thus exerting downward price pressure on existing services (see e.g. European Commission, 2003, or "Airlines under siege" in: *The Economist*, 27 March 2004).

<sup>39</sup> Member States that need the revenue from this market segment in order to continue providing their universal service could reserve it.

<sup>40</sup> However, the European Commission initiated in 2003 procedures against Greece, France and Austria for failing to implement the 2002 Postal Services Directive.

Member States that liberalised their postal markets beyond the minimum requirements, for example Germany, the Netherlands and Sweden, appears to have been broadly positive. Increased competition led to substantial price reductions in the parcel post, bulk and direct mail markets, which resulted mainly in direct benefits for producers. Front-runners in postal liberalisation did not experience problems in the provision of universal services, even in remote areas with low population density.

### 3.5 RAIL TRANSPORT

Regulatory reforms in the rail transport industry are still in the early stages. In February 2001, the “First railway package” was adopted. The main purpose of this first package was to establish some preconditions for the provision of competing services on the European rail freight transport market. More specifically, the package called for:

- The separation of essential functions of the railway industry, such as the (bottleneck) infrastructure management and the actual rail services.
- The establishment of an independent rail regulator in each Member State.
- A reduction of the technical barriers between the different national rail networks in order to facilitate the provision of cross-border services.
- A gradual opening of the European rail freight network to all licensed rail operators. Seven years after the entry into force of the Council Directive, operators will have access to the whole rail network for international rail freight transport.

In early 2004 an agreement was reached on the “Second rail package” proposed by the European Commission in 2002. This second package foresees that the international rail freight market in the EU will be fully opened to competition by January 2006 and for all

domestic freight services across the EU (cabotage) in 2007. Furthermore, the agreement envisages opening up international passenger traffic by 2010. This issue is part of the “Third railway package”, which is already being discussed. Proposals to liberalise national passenger services are expected at a later date.

All in all, competition in railway transport is still in its early stages, but at the EU level there is clear legislative progress in the field. However, a recent study commissioned by the German operator Deutsche Bahn on barriers in the European railway market suggests great disparity in the Member States’ regulatory reform processes.<sup>41</sup> IBM has developed a “Liberalisation Index” of the EU15 Member States that places them into one of three categories (‘On Schedule’, ‘Delayed’ and ‘Pending Departure’) according to the openness of their markets. Only five countries – Denmark, Germany, the Netherlands, Sweden and the UK – are in the ‘On Schedule’ group and are considered to have made considerable progress in opening up their markets.

Different surveys amongst EU citizens suggest that consumer satisfaction is relatively lower in the railways sector than in other network industries (see European Commission 2004b).

## 4 PRICE DEVELOPMENTS IN SELECTED NETWORK INDUSTRIES

As mentioned in Section 2, a number of recent studies indicate that regulatory reforms in network industries could trigger downward price effects in these sectors<sup>42</sup>. In this section, we analyse the presence of such effects in four selected European network industries: telecommunications, electricity, gas and airlines. Section 4.1 deals with the recent price

<sup>41</sup> IBM (2003).

<sup>42</sup> For a recent discussion see also European Commission (2004c).

developments in these sectors. Section 4.2 presents the degree of price dispersion in telecommunications, electricity and gas. Using panel data econometrics, Section 4.3 explores how regulatory differences could account for the considerable variation in the level of telecommunications, electricity and gas prices across the EU. Section 4.4 looks at price developments and price level determinants in the EU airline industry.

#### 4.1 RECENT PRICE DEVELOPMENTS IN SELECTED NETWORK INDUSTRIES

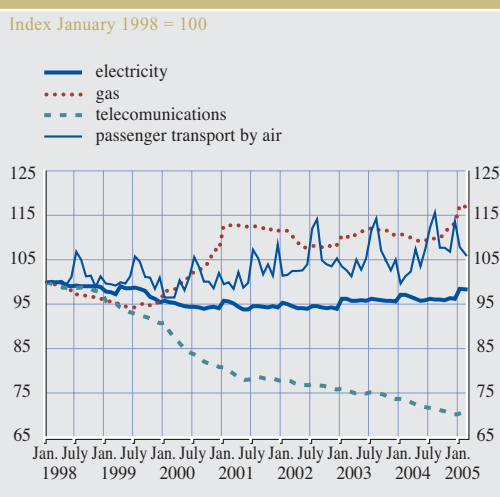
As argued above, regulatory reforms in most network industries resulted in downward price effects in these sectors. Chart 4 shows the development of the EU 15 HICP sub-indices for electricity, gas, telecommunications and air passenger transportation during the period from January 1998 to February 2005 relative to changes in the overall EU 15 HICP.

With regard to the telecommunications sub-index, a marked downward trend compared with the overall HICP is apparent since 1998. Overall, from January 1998 to February 2005 consumer telecommunications prices in the EU fell by 30.0% relative to the EU HICP. The

electricity sub-index also shows a downward trend. However, it is clearly weaker than that of telecommunications and was interrupted on several occasions, due to either increases in energy taxation or higher oil prices. Between January 1998 and February 2005 the electricity price index for the EU fell by 1.6% relative to the overall EU HICP. By contrast, the gas price sub-index rose by 17.1% relative to overall EU HICP over the same period. This increase is concentrated over the pre-deregulation period (January 1998 to November 2001), with the gas price sub-index rising by 12.1% over that period. Since then, gas prices have been moving downwards, although, as is the case with electricity, oil price hikes interrupted the trend towards the end of the period. The HICP sub-index for air passenger transportation increased by 6.4% relative to total HICP in the period January 1998 to February 2005. Whereas this suggests that the market's liberalisation has not yet provided tangible benefits for consumers at the aggregate level, a closer analysis of disaggregated data (see Section 4.4) is needed in order to disentangle the effects of market opening on different segments of the air transport market.

In sum, Chart 4 suggests some causality between market opening and relative price falls, at least in some of the sectors under review. However, it is important to keep in mind that regulatory reforms are only one of the many factors determining price developments in these industries. Other important elements may include technological progress (especially in the case of telecommunications), tax changes and oil price changes (in the case of electricity, gas and air transport).

Chart 4 Electricity, gas, telecommunications, and air passenger transportation price indices relative to the overall Harmonised Index of Consumer Prices in the EU15



#### 4.2 PRICE DISPERSION DURING THE 1995-2003 PERIOD FOR TELECOMMUNICATIONS, ELECTRICITY AND GAS

Regulatory reforms are likely to have an impact on international price level differences in network industries. As argued in Sections 1 and

2, increased domestic competition is expected to reduce profit margins and bring prices increasingly in line with costs. Furthermore, creating a single EU market for telecommunications, electricity and gas is likely to increase international competition, thereby potentially reducing price differentials across countries. However, notwithstanding the evidence of a downward trend in telecommunications and electricity prices,

Table 4 shows that there are still marked price level differences in these sectors, both between EU Member States and between various types of users.

Table 4 shows that in 2002 the ratio of the highest to the lowest price level for telecommunications services in the EU (maximum / minimum ratio) ranged between 2.0 for local calls and 4.4 for long distance

Table 4 Telecommunications price level differences in the EU15 1995-2002 <sup>1), 2)</sup>

Telecommunications		2003	2002	2001	2000	1999	1998	1997	1996	1995
Local Call	Average		0.11	0.11	0.11	0.11	0.11	0.11	0.13	0.12
	Coeff of Variation		20.81	26.14	27.55	41.61	42.71	30.21	35.85	39.48
	Max/Min. Ratio		2.00	2.38	3.17	6.50	6.25	4.67	5.50	5.25
Long Distance	Average		0.22	0.24	0.34	0.43	0.50	0.59	0.76	0.78
	Coeff of Variation		42.67	47.29	44.23	57.53	54.70	53.81	55.15	55.47
	Max/Min. Ratio		4.38	6.00	5.18	7.64	8.00	8.82	9.31	9.62
International	Average		0.70	0.75	0.99	1.17	1.26	1.41	1.77	1.77
	Coeff of Variation		40.39	36.93	24.88	17.54	15.15	11.06	14.75	15.98
	Max/Min. Ratio		3.68	3.82	2.49	2.07	1.80	1.54	1.96	1.99
Mobile	Average		0.45	0.48	0.57	0.66	0.81	n.a.	n.a.	n.a.
	Coeff of Variation		35.96	41.22	44.80	37.65	31.09	n.a.	n.a.	n.a.
	Max/Min. Ratio		4.22	4.78	5.83	5.50	3.10	n.a.	n.a.	n.a.
<b>Electricity</b>										
Small Households	Average	6.51	6.24	6.14	6.63	6.68	6.72	6.77	6.93	6.63
	Coeff of Variation	14.84	16.75	18.48	17.41	17.09	16.95	17.14	19.08	18.75
	Max/Min. Ratio	1.76	1.93	2.08	1.99	2.02	1.95	1.91	1.85	1.94
Large Households	Average	15.28	14.62	13.99	16.00	15.83	16.14	16.23	16.42	16.68
	Coeff of Variation	29.77	28.38	27.63	29.07	29.59	29.71	29.17	30.15	31.29
	Max/Min. Ratio	2.87	2.87	2.87	3.34	4.67	4.72	4.82	4.53	4.40
Small Industrial	Average	9.86	9.70	10.16	11.96	12.63	12.83	13.19	13.49	14.20
	Coeff of Variation	29.20	31.27	29.32	27.49	27.82	26.54	25.93	26.43	25.66
	Max/Min. Ratio	2.46	3.80	3.39	2.68	2.98	2.82	2.83	2.72	3.16
Large Industrial	Average	6.18	6.01	6.00	6.15	6.61	6.85	7.06	7.14	7.62
	Coeff of Variation	29.16	29.89	29.37	23.38	22.05	20.38	19.66	19.34	18.41
	Max/Min. Ratio	3.38	3.49	3.25	2.73	2.58	2.32	2.14	2.20	2.17
<b>Gas</b>										
Small Households	Average	15.29	14.64	14.70	13.30	12.29	12.60	12.77	12.40	12.73
	Coeff of Variation	15.93	14.17	14.35	17.27	19.44	20.59	22.19	22.20	21.22
	Max/Min. Ratio	1.86	1.66	1.72	1.91	2.10	2.16	2.28	2.03	1.84
Large Households	Average	8.63	8.40	8.53	7.43	6.58	6.99	7.18	6.89	6.62
	Coeff of Variation	19.08	20.21	18.71	17.45	17.00	15.00	15.44	18.03	16.62
	Max/Min. Ratio	2.01	1.92	1.73	1.70	1.66	1.59	1.55	1.75	1.69
Small Industrial	Average	6.61	6.56	7.04	5.77	4.68	5.12	5.51	5.13	4.97
	Coeff of Variation	17.10	14.73	20.40	16.18	16.72	14.41	18.02	22.93	17.39
	Max/Min. Ratio	1.79	1.71	2.02	1.85	1.89	1.72	2.22	2.87	1.98
Large Industrial	Average	5.31	5.06	5.70	4.42	3.17	3.53	3.75	3.44	3.40
	Coeff of Variation	14.31	13.04	17.21	13.85	13.79	15.70	16.20	17.34	12.72
	Max/Min. Ratio	1.70	1.54	1.83	1.65	1.61	1.67	1.69	1.95	1.50

Source: Eurostat and own calculations.

1) Average prices are weighted by the EU Member States' shares in the relevant HICP sub-indices. Taxes are not included.

2) Electricity consumers definitions: Small-scale households = 600 kWh p.a.; large-scale households = 2. GWh p.a.; small-scale industry = 3 GWh. p.a. and large-scale industry = 10 GWh p.a

2) Gas consumers definitions: Small-scale households = 8.37 GJ p.a.; large-scale households = 1,047. GJ p.a.; small-scale industry = 418.6 GJ p.a. and large-scale industry = 41,860 GJ p.a.

calls. For electricity (in 2003), the variations are broadly similar. Here the ratio of maximum to minimum prices varies between 1.8 for small households and 3.4 for large industrial users. For gas (2003), the ratio of maximum to minimum prices is somewhat lower, ranging between 1.7 and 2.0.

Price dispersion, as measured by the coefficient of variation of prices (excluding taxes) ranged between 21% and 43% in 2002 for different types of telecommunications services, between 15% and 30% for different types of electricity users (in 2003) and between 14% and 19% in the case of gas users (in 2003). It is worth noting that, except for gas users, this clearly exceeds the coefficient of variation of price levels for total private final consumption of goods and services reported by Eurostat.<sup>43</sup>

Looking at changes over time, the price level dispersion in these sectors appears to be fairly stable for the period 1995-2002/3, except for fixed-line telecommunication services and large-scale industrial electricity users. Whereas the coefficient of variation dropped by 13 and 16 percentage points for local and long distance calls respectively between 1999 and 2000, there has been a gradual increase in the coefficient of variation for international calls and large-scale industrial electricity users over the same time period. Regarding fixed-line international calls, this can mainly be attributed to the fact that, while prices fell over that period in all countries except the UK, the magnitude of price falls differed significantly among Member States. Furthermore, the largest falls occurred in those countries that already had below-average international call prices in 1995. As regards large-scale industrial electricity users, the increase in price dispersion over the past years can be explained by the different speeds at which regulatory reform measures in this sector have been implemented across EU countries.

Regarding the various types of users or services, the price level differences are even more striking. On average, international calls in the EU are more than seven times as expensive as local calls and large domestic electricity/small domestic gas consumers pay about two and a half times as much as large industrial electricity/gas users. Differences of this magnitude are unlikely to be caused entirely by cost differentials and indicate substantial differences in the level of competition in the various market segments.

### 4.3 TESTING FOR PRICE LEVEL DETERMINANTS IN THE TELECOMMUNICATIONS, ELECTRICITY AND GAS SECTORS

#### 4.3.1 METHODOLOGY

Against the background of large and persistent price differences in the European telecommunications, electricity, gas and air transport industries, it is important to analyse the price level determinants in these sectors. Such an analysis allows a quantitative assessment of the importance of policy variables for price level differences and permits an evaluation of the likely degree of persistence of these differences over the coming years. To this end, the prices of different types of electricity, gas or telecommunication services are regressed against a number of potential explanatory variables in a panel data setting.<sup>43</sup>

For telecommunications, annual average prices for a 3-minute call at peak time for four different types of services (local calls, long distance calls, international calls and mobile calls) for the period 1994 to 2001 are regressed

<sup>43</sup> Using panel data increases the number of available observations, which is likely to produce more reliable parameter estimates and enables the specification and testing of more sophisticated models, incorporating less restrictive behavioural assumptions.

against the following five explanatory variables<sup>44</sup>:

- Liberalisation variables (*de jure*). A first variable, years since liberalisation, takes the value of the number of years since liberalisation if liberalisation has taken place, and zero prior to legal liberalisation. A second variable, an impulse dummy, takes the value 1 before liberalisation and zero afterwards.
- The percentage of the incumbent firm's shares that are still publicly owned.
- A dummy for the presence of number portability.<sup>45</sup>
- The price of leased lines (i.e. the infrastructure the operator has to lease / rent in order to be able to offer the specific telecommunication service).
- The existence of 'carrier-select facilities', allowing consumers to choose operators on a call-by-call basis, using a special access code.
- The number of firms operating or disposing of a license in the specific market segment.
- The total amount of telecommunication investment in each country for each year<sup>46</sup>.

For electricity, semi-annual prices for the available four different types of consumers (two types of households and two types of industrial users) for the period 1990 to 2003 are estimated against five variables, of which the first two (the *de jure* liberalisation variable and the percentage of public ownership of the incumbent) are identical to the variables used for telecommunications. Furthermore, three electricity-specific variables are included, namely:<sup>47</sup>

- The price of gas.
- The percentage of electricity generated by gas.
- The concentration in the electricity generation market (measured by the market share of the three biggest companies).

For gas, semi-annual prices for four different types of consumers for the period 2000 to 2003 are estimated against five variables, of which the first two are identical to the variables used

for telecommunications. Furthermore, three gas-specific variables are included, namely

- The price of oil.
- An estimate of the unit costs of gas transportation over 100 km.
- A dummy indicating whether third party network access is granted on a regulated (rather than negotiated) basis.

It seemed appropriate to test for the inclusion of two different liberalisation-related variables for all industries because the implementation of regulatory reforms and the creation of *de facto* competition take a number of years, even if specific deadlines call for a complete market opening in a particular year. Besides those gradual effects, however, it can be assumed that one-off (permanent) price effects will occur once the markets are opened for competition. The first liberalisation variable, taking the value of the number of years since liberalisation and zero prior to legal liberalisation, is suitable for capturing possible gradual price effects of implementing regulatory reforms. The second variable, taking a value of 1 prior to the legal market opening, is designed to capture the one-off effects of the introduction of competition.

44 All telecommunication price data are provided by the European Commission and can be found at <http://www.ispo.cec.be/infosoc/telecompolicy/en/Study-en.htm>. Data for mobile telephone services were only available from 1998 onwards. Data on the other explanatory variables are obtained either from the European Commission, The OECD or from NRAs. Other explanatory variables such as a dummy variable for the year in which Member States opened their market for competition, the rental charge, the presence of carrier selection and the number of firms operating or disposing of a license in the specific market segment have also been included in the regressions but were never found to be significant.

45 Number portability indicates that switching telephone operators does not imply a change in the phone number.

46 As investment data is rather volatile across the years, a third order polynomial was fitted to investment data per country over the sample period 1980-2001. The resulting data for the period 1994-2001 was then used in the regressions.

47 As in the case of telecommunications, more explanatory variables have been tested, such as the percentage of oil, hydro-power and nuclear power in the production structure, investment in the electricity generation segment and the concentration and the number of generators in the market. None of them was significant. Electricity and gas price data are obtained from Eurostat's New Chronos database. Given that observations are semestrial, the prices have been adjusted by using the moving average method. Data related to the other explanatory variables are obtained from NRAs.

It should be kept in mind that the ‘gradual’ liberalisation variable has the features of a time trend for the period after deregulation is implemented and that during the last decade technological progress was substantial, particularly in the telecommunications industry. Since it is not possible to disentangle the gradual liberalisation effects from other effects (such as *inter alia* technological progress<sup>48</sup>), some caution in the interpretation of the results for this variable is warranted. As a robustness check, the inclusion of these two liberalisation variables was compared with an alternative model making use of only one variable, namely the number of years prior to/following (*de jure*) liberalisation. Prior to liberalisation, the number becomes negative, after liberalisation it turns positive. A non-nested F-test was used to obtain the most appropriate specification for each regression.

For telecommunications, the model using both the gradual and one-off liberalisation variables was superior to the model with the ‘number of years prior/since liberalisation’ variable only. For gas and electricity, the second model was always superior and was used in the estimations.

The results of the estimates for the three industries are summarised in Table 5.<sup>49</sup>

48 Although for telecommunications, technological progress should be captured by the telecommunications investment variable.

49 Fixed-effects models were used in order to make inferences conditional on the effects that are in the sample. The country fixed effects were never significant. However, they were not omitted from the regression equations because they are likely to have an impact on price levels across the EU and they do not bias the results. Non-linearity tests for all coefficients were insignificant. Unit root and Durbin-Watson tests were computed on the balanced part of the panel and behaved well in all instances.

**Table 5 Estimation results for the determinants of price levels**

Telecommunications	Local call	Long distance call	International call	Mobile call
Years since liberalisation	-2.70% <sup>2)</sup>	n.s.	-12.41% <sup>2)</sup>	n.s.
Pre-liberalisation dummy	12.65% <sup>2)</sup>	12.45% <sup>1)</sup>	6.31% <sup>1)</sup>	n.a.
Increase in the number of competitors	n.s.	-0.15% <sup>1)</sup>	n.s.	n.s.
Decreasing public ownership by 10%	-2.41% <sup>1)</sup>	-8.34% <sup>2)</sup>	-3.14% <sup>2)</sup>	-0.54% <sup>1)</sup>
Introducing number portability	n.s.	n.s.	-19.92% <sup>2)</sup>	n.s.
Introducing carrier pre-selection	n.s.	-2.92% <sup>2)</sup>	n.s.	n.s.
Increasing the connection charge by 10%	0.06% <sup>2)</sup>	0.00% <sup>1)</sup>	n.s.	n.s.
Increasing price of leased lines by 10%	0.06% <sup>2)</sup>	0.81% <sup>2)</sup>	n.s.	n.s.
Increasing investment by 10%	n.s.	-1.27% <sup>2)</sup>	-0.34% <sup>1)</sup>	-1.53% <sup>2)</sup>
R <sup>2</sup>	0.98	0.92	0.91	0.86
Durbin-Watson test	1.99	1.99	1.96	2.00
Electricity	Small households	Large households	Small industrial	Large industrial
Advancing one year in liberalisation	n.s.	-0.35% <sup>2)</sup>	-2.08% <sup>1)</sup>	-1.03% <sup>2)</sup>
Reduction of market concentration	n.s.	-3.83% <sup>1)</sup>	-14.69% <sup>2)</sup>	n.s.
Decreasing public ownership by 10%	-1.53% <sup>1)</sup>	n.s.	-2.23% <sup>1)</sup>	-2.36% <sup>1)</sup>
A fall of 1% in the gas price	-1.01% <sup>2)</sup>	-1.12% <sup>2)</sup>	-2.34% <sup>2)</sup>	-5.49% <sup>2)</sup>
R <sup>2</sup>	0.98	0.88	0.97	0.92
Durbin-Watson test	1.92	1.99	1.89	1.94
Gas	Small households	Large households	Small industrial	Large industrial
Advancing one year in liberalisation	-2.80% <sup>2)</sup>	-1.84% <sup>2)</sup>	-1.64% <sup>2)</sup>	-4.23% <sup>2)</sup>
Decreasing public ownership by 10%	-0.34% <sup>2)</sup>	-0.77% <sup>2)</sup>	-6.82% <sup>2)</sup>	-6.94% <sup>2)</sup>
Regulated access dummy	-11.75% <sup>2)</sup>	-4.39% <sup>2)</sup>	n.s.	n.s.
Decreasing the transmission cost by 10%	-1.56% <sup>2)</sup>	-3.55% <sup>2)</sup>	-0.36% <sup>2)</sup>	-0.47% <sup>2)</sup>
A fall of 10% in the oil price	-1.68% <sup>1)</sup>	-2.66% <sup>2)</sup>	-3.19% <sup>2)</sup>	-4.75% <sup>2)</sup>
R <sup>2</sup>	0.90	0.92	0.96	0.97
Durbin-Watson test	1.99	1.95	2.01	1.88

1) Significance at the 5% level

2) Significance at the 1% level

n.s. not significant

n.a. not applicable



For telecommunications, Table 5 indicates that advancing one year in the liberalisation process results in a yearly nominal price fall of around 12.4% for international calls. Such price falls are quite substantial and may partly be caused by tariff rebalancing between the international segments of the telecommunications market and the (still less competitive) local call segment, where prices in the years following liberalisation have only fallen by 2.7% on average.

The 'pre-liberalisation' dummy variable is significant for all fixed-line calls, with the results suggesting one-off price falls of between 6% and 13% due to the legal opening of the market. The importance of the introduction of competition is further reflected in the significant, albeit limited, price effect of around 0.2% of an extra competitor in the long distance market segments. When interpreting the estimation results for these three variables, it is important to keep in mind that prior to the regulatory reform process cross subsidisation had especially lifted prices for international and long distance fixed-line calls substantially above costs. These segments of the market thus offered good opportunities for new entrants to compete with the incumbents. In the local market segment, by contrast, such opportunities were scarcer, so a legal introduction of market competition led to more tepid price responses.

Looking at some more specific regulatory reform variables for the telecommunications industry, the results indicate that privatisation triggers significant price falls for international (-3.1%), long distance (-8.3%) and local call services (-2.4%)<sup>50</sup>. For mobile telephone services, the impact of privatisation is minor and only weakly significant. This can be attributed to the fact that most incumbent mobile phone operators were either already privatised by the start of the sample period (1998) or, given the stronger competitive pressure in mobile telephony, were forced to behave as a privately owned company<sup>51</sup>.

The presence of carrier pre-selection and the introduction of number portability also appear to result in significant price falls, but only for specific types of services. By contrast, increasing the price of leased lines (and to a lesser extent the connection charge) appears to have a significant upward impact on the price of both local and long distance call services. This highlights the importance of a regulatory framework that ensures that incumbent operators do not overcharge for access to the network infrastructure.

Finally, total investment in the telecommunication industry (which could be seen as a proxy for technological progress in this sector) turns out to be an important explanatory variable for long distance, international and mobile phone call services, suggesting price falls of between 0.3% and 1.5% if telecommunication investment is increased by 10%. These results confirm the importance of technological progress for price developments in the telecommunication sector over the past decade. Moreover, in the case of international call services, this variable is strongly correlated with the number of competitors in the market. This may imply that more competition in this market segment has in fact triggered higher investment. This confirms the finding of Alesina et al. (2005) that reducing barriers to entry actually spurs investment in OECD countries. One implication for our set-up is that part of the investment-induced price falls we find in the international call segment are in fact caused by

50 From a static perspective, economic theory is generally agnostic as to whether private ownership is superior in efficiency terms compared with public ownership (see e.g. Laffont and Tirole, 1993). From a dynamic perspective, however, private ownership is generally considered more efficient than public ownership. The threat of takeover for example provides a very powerful efficiency incentive and private companies are no longer in a privileged position vis-à-vis the government when asking for public support. This view is also supported by other empirical studies such as Good, Röller and Sickles (1993) and Galal, Jones, Tandon, Vogelsang (1994).

51 Results for mobile telephone services should be treated with caution given the limited number of available observations compared with the other types of telecommunication services.

the introduction of more competition and thus by deregulation.

For the electricity sector, advancing one year in the liberalisation process yields price reductions in the range of 0.4% to 2.1% for most types of users, but it is not significant for small households. There are several reasons for the differences in magnitude compared with the findings in the telecommunications sector. First, as argued above, this variable probably also captures the impact of technological advancements in the sector concerned. Such advancements were much stronger in telecommunications than in the electricity sector. Second, regulatory reform in electricity has in most Member States started more recently, especially for households. During most of the 1990-2003 sample period, the gradual effects of regulatory reform were therefore not yet particularly present. Reducing market concentration, an indicator of the *de facto* level of competition in the industry, does have significant effects in both the large household and small industrial electricity sector, with prices falling by almost 15% for small industrial users and by almost 4% for large households.

Reducing public ownership in electricity companies appears to have significant downward price effects for three types of electricity users, ranging from 1.5% for small household electricity consumers to 2.4% for large industrial users. Gas prices play a key role in determining electricity prices, with a 1% fall in the gas price leading to a price fall of between 1% and 5.5% for electricity users.

Gas prices are also significantly influenced by regulatory reforms and privatisation. More specifically, advancing one year in the deregulation process induces price falls between 1.8% and 4.2%. Further, a decrease in public ownership reduces gas prices, in particular for industrial consumers (by almost 7%), while for households the reductions are more limited (between 0.3% and 0.8%). The usage costs of the transmission network are an

important determinant of gas price developments and network access on a regulated, rather than negotiated, basis appears to result in further significant price reductions for households. Finally, the results show that gas prices are strongly linked to oil prices. This is to a large extent technologically determined, as gas is often extracted as a side product of oil extraction and many European gas contracts are to date still linked to oil price developments.<sup>52</sup>

#### 4.3.2 POTENTIAL EFFECTS OF FURTHER REGULATORY REFORM ON PRICE LEVELS AND PRICE CONVERGENCE

Based on the findings reported above, it is possible to derive mechanically how current prices would change if a number of regulatory reform variables were adjusted so as to reflect international 'best practice'.

For telecommunications such a 'best practice' scenario assumes that public ownership is abandoned completely, leased line prices and connection charges converge to the lowest current level in the EU and the number of competitors in each country equals that of the country that currently has the highest number of competitors (currently the UK). Taken together, these four measures would reduce the EU price level for local calls by 28%, for long distance calls by 0.2% and for international calls by 27%, with most of the price effects coming from the convergence of leased line prices and connection charges (see Table 6).

The 'advancing one year in liberalisation' variable has not been included in these simulations, as it is unclear to what extent these effects will persist over the years to come. Carrier pre-selection and number portability have been completely implemented in the market segments where they have a significant impact, so they cannot be expected to have any further price impact.

<sup>52</sup> However, gas is also (particularly in the industrial sector) a competing input to oil.

**Table 6 The potential future impact of the different determinants on electricity, telecommunications and gas prices**

Telecommunications	Local call	Long distance call	International call	Mobile call
Decreasing public ownership by 10%	-0.59	-0.18	-7.93	-0.05
Convergence of number of competitors	-0.65	-	0	-
Introducing number portability	-	0	-	-
Introducing carrier pre-selection	0.00	-	-	-
Convergence of connection charges	-0.04	-	-0.28	-
Convergence of prices for leased lines	-26.66	-	-18.69	-
<b>Joint potential total impact</b>	<b>-27.93</b>	<b>-0.18</b>	<b>-26.90</b>	<b>-0.05</b>
Electricity	Small households	Large households	Small industrial	Large industrial
Liberalisation has been introduced for 5 years	-	-0.99	-6.47	1.38
Decreasing public ownership by 10%	-7.08	-	-0.02	-1.27
Convergence of market concentration	-	-1.342	-11.15	-
Gas price convergence	-14.99	-14.17	-11.91	-19.59
<b>Joint potential total impact</b>	<b>-22.07</b>	<b>-16.50</b>	<b>-29.55</b>	<b>-22.25</b>
Gas	Small households	Large households	Small industrial	Large industrial
Liberalisation has been introduced for 5 years	-11.43	-4.59	-5.08	-3.36
Decreasing public ownership by 10%	-0.15	-0.36	-0.04	-3.96
Legal liberalisation	-2.38	-1.37	-1.21	-
Introducing regulated line access	-1.00	-0.39	-	-
Transport cost convergence	-8.23	-19.28	-21.77	-28.61
<b>Joint potential total impact</b>	<b>-23.19</b>	<b>-25.98</b>	<b>-28.09</b>	<b>-35.93</b>

Performing the same exercise for electricity implies that all countries move towards full privatisation and have had 5 years of market liberalisation behind them, and that competition in the electricity generation converges to the country with the highest level of competition (currently the UK). Furthermore, it is assumed that gas prices in the EU converge to the EU minimum, although this assumption is rather strong, at least in the short run.<sup>53</sup> Gas price convergence towards the lowest European level should thus be seen as an illustration of the potential downward price effect of a fully integrated European gas market rather than a likely short-run prospect.

The combined effect of the three regulatory reform measures outlined above would lower electricity prices between 17% and 30% for the different types of consumers with the strongest impact coming from the convergence of gas prices (see Table 6).

Finally, a similar exercise for gas prices reveals that the total impact of further progress with regulatory reform could be of comparable

magnitude to that in the electricity and telecommunications sectors. The convergence of transport costs is the main factor inducing price reductions. Oil prices are fairly homogenous across countries.

#### 4.4 PRICE DEVELOPMENTS AND PRICE LEVEL DETERMINANTS DURING THE 1992-2001 PERIOD FOR THE EU AIR TRANSPORT INDUSTRY

The European air transport industry is an interesting example of a network industry where regulatory reform measures designed to increase the level of competition have become 'mature'. More specifically, the current

<sup>53</sup> Gas prices are currently still diverse across the European Union, mainly due to country specific gas policies, resulting inter alia from and in the selection of different suppliers (e.g. Russia, Algeria, Norway, the Netherlands and the UK) with different price levels. Producer-distributor relationships in the gas market are usually based on long-term contracts and changing suppliers involves considerable technical obstacles. Besides, tax policies in the gas market differ significantly among the Member States, making gas in some countries much more expensive than in others. A good example in this respect is the recent introduction of an ecotax in the Netherlands, resulting in a substantial increase in gas prices and hence also electricity prices.

regulatory regime gives unrestricted access to all international intra-Community routes and all domestic markets for any carrier holding a Community licence. The effects of this deregulation are reflected, for instance, in the number of routes operated. The number of international routes linking EU Member States has steadily increased, from 1,368 in 1992 to 2,120 in 1997 and 2,313 in 2000. Moreover, the deregulation has led to increased competition. In 2000, 892 routes were served by two carriers or more, compared with 779 in 1997 and 625 in 1992.

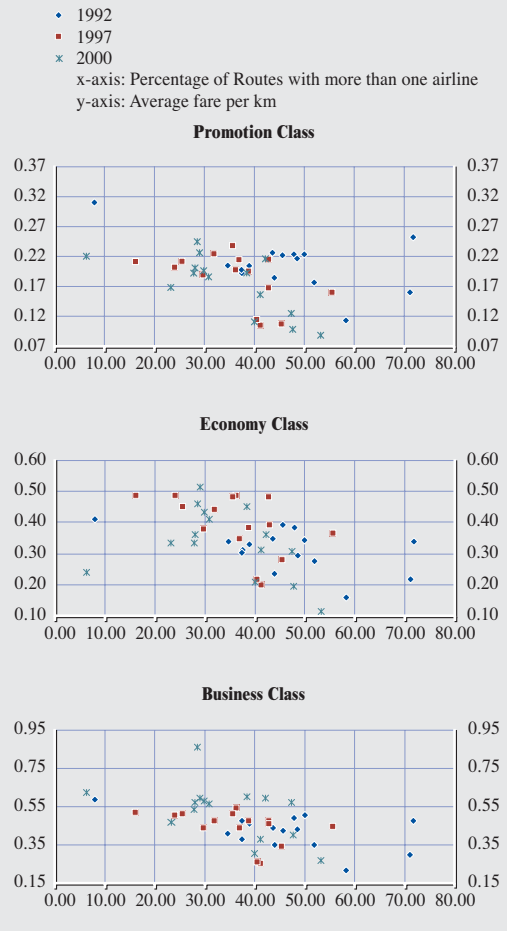
However, a number of important elements in the 'air transport production chain' such as airport slot allocation and ground handling operations are still heavily regulated (see Section 3.3). This is likely to have a dampening effect on the *de facto* level of competition. Furthermore, many loss-making EU airlines are still at least partly state-owned and subsidised, which prevents unprofitable companies from exiting the market. Given that these aspects of air transport remain mainly country-specific, a substantial degree of national heterogeneity in EU air transport markets endures.

This sub-section provides some stylised facts and estimation results on developments in international air transport services prices within the EU between 1992 and 2001.<sup>54</sup>

The figures suggest a clear negative correlation between prices and the level of competition for business and full-fare economy class tickets, with correlation coefficients of  $-0.52$  and  $-0.45$  respectively. The correlation is somewhat weaker for promotional air fares ( $-0.39$ ). The weaker link between prices for promotional tickets and the number of carriers can be explained by the fact that the carriers serving the route tend to compete not only with other scheduled carriers providing direct services but also with charter and indirect services (for which data are not available). Given the considerable increase in total international intra-EU routes between 1992 and 2000 this

**Chart 5 Average fare per km and percentage of routes with more than one carrier**

(in EU15 Member States in 1992, 1997 and 2000)



form of (indirect) competition is likely to have considerably increased, but it is not reflected in Chart 5.

Developments of average fares per kilometre over time depend strongly on the type of ticket. The average fare per kilometre for business class tickets on intra-EU international flights has steadily increased from EUR 0.42 in 1992 to EUR 0.45 in 1997 and EUR 0.53 in 2000

<sup>54</sup> The data source is a European Commission database containing information on the air transport industry, such as the number of scheduled flights, average ticket price and various cost factors such as fuel costs and airport charges.

**Table 7 Average fare per km for intra-EU international flights (in EUR)**

	1992	1997	2000
Business	0.42	0.45	0.53
Economy	0.32	0.40	0.30
Promotional	0.20	0.17	0.14

(Table 7). This contrasts with the development in the average price for full-fare economy and promotional tickets. The former increased considerably between 1992 and 1997, but subsequently declined to a level below the EU average in 1992, and the latter has consistently declined. In fact, the average promotional fare per kilometre in 2000 was at less than 30% of its level in 1992.

There are also considerable differences in the air transport price levels of different EU Member States. It is particularly interesting to see that some peripheral Member States such as Greece, Portugal and Finland had a particularly low price level in 1992. This relative position has in the meantime been partly eroded due to a number of factors, such as the equalisation of price levels as part of the general real economic convergence process within the EU. Furthermore, the European Commission has taken an increasingly tough stance in granting state aid to national airlines.

In order to test for the impact of regulatory reforms and increased competition on the price

level in the airline industry, we perform a similar exercise as presented in Section 4.3 for telecommunications, gas and electricity. More precisely, the prices of economy, business and promotional tickets are regressed against a number of potential explanatory variables in a fixed-effects panel data setting for half-yearly data over the period 1992 to 2001. The first two variables below are related to deregulation; the other variables are measures of the cost of operating the aircraft:

- Liberalisation variable (*de jure*). This variable takes the value of the number of years after liberalisation has taken place, and zero prior to legal liberalisation.
- The number of carriers operating on the same line.
- The fuel costs to operate the aircraft.
- The distance of the flight.
- The average monthly lease cost in dollars of the aircraft used.

The results of the estimations are summarised in Table 8.

In line with expectations, the regression results indicate that increases in fuel costs and in the monthly lease cost of the aircraft augment the airfare for all categories. The other variables have differing impacts according to the class of the ticket.

For business class tickets, prices have increased since the market deregulation in

**Table 8 Estimation results for the determinants of price levels**

Telecommunications	Business	Economy	Promo
Years since liberalisation	+	-	-
Increase in the number of competitors	+	n.s.	-
Fuel costs	+	+	+
Distance of the flight	-	-	+
Monthly lease cost of the aircraft	+	+	+
R <sup>2</sup>	0.93	0.93	0.94
Durbin-Watson test	1.97	1.85	2.01

Note: n.s. = not significant

1993 (as is reflected by the positive coefficient on the ‘years since liberalisation’ variable). Moreover, increasing the number of competitors on the same route has also had an upward effect on prices. By contrast, for both economy and promotional tickets, the years following the 1993 market deregulation have had a downward impact on prices. The regression results suggest the presence of some tariff rebalancing between the business and economy/promotional class market segments. For many routes, it is possible to ‘cross-subsidise’ promotional tickets with higher business class fares because competition in business class is usually restricted to companies that provide direct scheduled flights. Competition tends to be stronger for economy fares, especially promotional economy fares, including indirect routes, in particular for long-distance flights, and charter services.

When interpreting these results, a number of important caveats regarding the dataset should be kept in mind. First, the data used for this section includes only a limited number of charter flights. Second, the latest available data (i.e. summer 2001) does not capture the strong recent increase in low-cost carriers. The rapid expansion of this market segment during the last few years is likely to exert downward pressure on the industry as a whole, even though these airlines frequently use secondary airports, thus ‘indirectly’ increasing competition on many routes.<sup>55</sup> This is again likely to have the strongest impact on the economy and promotional segments of the air transport market.

On most (direct) routes, the air transport market is likely to remain at best oligopolistic and thus a particularly challenging industry for competition policy. This is further accentuated by the increasing number of airline alliances, which tend to preclude price competition between ‘allied’ carriers on jointly serviced routes.

## 5 CONCLUSIONS

Regulatory reforms in EU network industries have made great strides forward in recent years, although the network industries covered in this paper are still in very different stages of the regulatory reform process and the level of competition differs significantly between sectors.

Several empirical studies examined in this paper provide quantitative evidence of the sector-specific and economy-wide benefits of regulatory reforms in network industries. Economy-wide effects of regulatory reforms, especially in terms of price level reductions and (temporary) downward effects on inflation, are particularly relevant for the conduct of monetary policy. Even if the magnitude of the effects differs significantly across countries and industries and depends crucially on the type of regulatory changes introduced, a common pattern of empirical results emerges. Increased competition (in terms of liberalisation, privatisation, unbundling, etc.) is generally associated with lower price levels, expanded output and labour productivity gains. However, regulatory reforms do have some short-term costs, mainly in the form of initial employment losses. The ultimate impact on sector and aggregate employment depends on the labour market’s ability to adjust to a changing economic situation. Service quality and the extent of R&D and innovation expenditures appear also to be positively linked to regulatory reforms. All in all, the empirical results in the literature tend to confirm that regulatory reforms in network industries enhance consumer welfare.

From a legal point of view most of these industries are now fully or largely subject to competition. With regard to telecommunications, regulators are gradually adapting the current regulatory framework to the new business environment by lessening

<sup>55</sup> On this issue see e.g. The Economist, “Special report: Low-cost airlines”, 10 July 2004.

regulation where competition has emerged and strengthening it where incumbents still retain a dominant position. The regulatory reform process in EU energy markets, however, is still incomplete. First, the legal market opening process will not be completed until 2007. Second, many Member States' current regulatory framework still appears insufficient to ensure a high level of actual competition in legally open markets. The postal sector and the rail transport industry are in even earlier stages of the regulatory reform process than the EU energy markets. By contrast, the provision of air transport services in the EU is almost fully liberalised, although the remaining competition bottlenecks in some segments of the airline industry clearly need to be addressed.

Effective competition has also increased, but a closer look at the implementation of the various regulatory reforms shows that there are still a number of unresolved issues at both the national and EU levels. Generally speaking, the experience of EU network industries demonstrates that an appropriate regulatory framework is indispensable in order to create *de facto* competition in these sectors, even after markets have become legally open. In other words, the 'quality' of the regulatory framework has a considerable impact on the extent to which regulatory reforms in network industries will result in price falls and other positive economic effects. An important EU-specific issue is the continued national fragmentation of network industry markets, for example with regard to the physical interconnections between energy and transport networks. This prevents the creation of a truly European market and hampers effective competition, at least in some network industries.

Recent changes in the HICP sub-indices for network industries relative to the developments in the overall HICP, in particular for electricity and telecommunications, clearly suggest that the introduction of competition in

these sectors led to significant relative price falls.

Panel data estimations carried-out in this paper provide additional evidence that regulatory reform measures had a substantial downward impact on prices in the four sectors under review. Especially in telecommunications, different explanatory variables that were used to capture the impact of regulatory reforms on prices turn out to be strongly significant. The same is true for gas users, although the magnitude of the impact is smaller than in the case of telecommunications. With regard to the electricity sector, regulatory reform measures appear to have a strongly significant impact on prices for industrial electricity users and large households. Electricity prices for small private households appear to be driven mainly by fluctuations in input prices rather than regulatory reforms. However, it should be kept in mind that by the end of the sample period, the market for domestic electricity users in most EU Member States was not yet completely opened up to competition. For air transport, the analysis conducted in the paper shows an increase in the number of international routes operated within the EU and suggests that prices of promotional and economy class tickets have fallen due to regulatory reforms and the resulting increase in competition. Prices for business class tickets, however, have tended to increase since the start of liberalisation, most likely due to a rebalancing of ticket prices across different market segments of the market. On the basis of these empirical results, it is estimated that further progress with regulatory reforms in telecommunications, gas and electricity, together with some degree of input price convergence, would result in further substantial price falls in EU network industries of up to 36%.

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