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Reiner Martin* and Isabel Vansteenkiste**

EU Telecommunications and Electricity Markets – Heading Towards Price Convergence?

This paper investigates the sources of intra-EU price dispersion in two important network industries, namely telecommunications and electricity. Both sectors experienced substantial regulatory reforms over the past couple of years, resulting in the widespread introduction of competition in traditionally monopolistic markets. The empirical results reported in this paper confirm that the introduction of competition in these sectors resulted in significant downward price effects. Further progress with regulatory reforms in telecommunications and electricity is likely to result in further price falls in these sectors and reduced price level differences across EU Member States.

Regulatory reforms in a number of network industries are a key element of structural policy reforms in the European Union (EU). Some network industries, notably telecommunications, energy (electricity and gas), water, postal services and transport (urban, air and railways) are sizeable sectors in their own right; together they make up more than six per cent of EU GDP and employment.¹ Furthermore, they also provide essential input for almost all other economic sectors. This paper investigates the sources of intra-EU price dispersion in two of the most important network industries, namely telecommunications and electricity. Such an analysis allows a quantitative assessment of the importance of regulatory reform measures for price level differences and permits an evaluation of the likely degree of persistence of these differences over the coming years.

Like all network industries, the telecommunications and electricity sectors are characterised by the presence of a bottleneck infrastructure, in the case of electricity the transmission and distribution system and in the case of telecommunications the fixed-line network and the frequencies for mobile telephony. Both industries were therefore traditionally regarded as “natural monopolies”. However, regulatory reforms now aim to increase the economic performance of

these sectors by introducing competition. This in turn requires the unbundling of the different elements of the industries and a regulatory system that ensures non-discriminatory access to the bottleneck infrastructure for all suppliers. Furthermore, network industry reforms frequently entail at least the partial privatisation of the incumbents in order to introduce a better corporate governance system and to enhance internal efficiency.

A number of recent studies highlighted that regulatory reforms in European network industries resulted in downward price effects in these sectors.² However, there are still considerable variations in the level of network industry prices across the EU. In the following we use panel data econometrics to analyse the determinants of price level differences in the telecommunications and electricity sectors. In particular we focus on a number of variables that capture country-specific differences in the regulatory reform progress, for example the number of years that have passed since the introduction of competition and the share of public ownership in the incumbent firms. First, however, we provide an overview of the

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¹ European Commission: Liberalisation of network industries – Economic implications and main policy issues, European Economy – Reports and Studies No. 4, Brussels 1999, p. 21.

² See for example European Central Bank: Price effects of regulatory reform in selected network industries, Frankfurt/Main 2001; European Commission: Sixth Report on the Implementation of the Telecommunications Regulatory Package, COM(2000)814final, Brussels 2000; Deutsche Bundesbank: The price effects of deregulation and privatisation in the product markets, Monthly Report, December, Frankfurt/Main 2000, pp. 31–42.

current state of play of the regulatory reform process in the telecommunications and electricity sectors and sketch recent price developments in these sectors as well as the degree of price dispersion across the EU.

The State of Play of the Regulatory Reform Process

The key date for regulatory reform in the EU telecommunications industry was 1 January 1998. As of that day free competition in the provision of voice telephony and telecommunications infrastructure was introduced in the EU. However, despite the importance of 1 January 1998 as target day for the implementation of the EU's regulatory reform package for telecommunications by the Member States, the introduction of competition in the EU was in fact a gradual process. Denmark, Sweden, Finland and the UK had already opened up their telecommunications markets before 1998. In the case of the UK competition was in fact introduced as far back as 1984. Greece, Spain, Ireland and Portugal were granted temporary derogations from the implementation of the relevant EU directives. By 2001 these derogations had all expired. In fact, Greece was the last EU Member State that opened its telecommunications market for competition (on 1 January 2001).

Despite the fact that the EU telecommunications market is by now *de jure* fully opened, impediments to the *de facto* implementation of competition remain. For that reason, the European Commission produces regular "Reports on the implementation of the telecommunications regulatory package". The most recent implementation report states that a considerable number of practical implementation issues still need to be resolved.³

In some Member States license procedures for new service providers are still cumbersome. Furthermore the timely delivery of leased lines by the incumbent operator to other telecommunications service providers is not always ensured.

In order to prevent or reduce competition some incumbent operators still cross-subsidise specific services for which competition is intense, for example international calls, using profits earned in market segments where competition is more subdued, for example local calls.

The physical requirements for the installation of new entrants' equipment for the provision of local access services are not yet ensured in all Member States.

A full range of carrier pre-selection services is not yet available in all Member States.

Difficulties in obtaining rapid and equitable inter-connection remain.

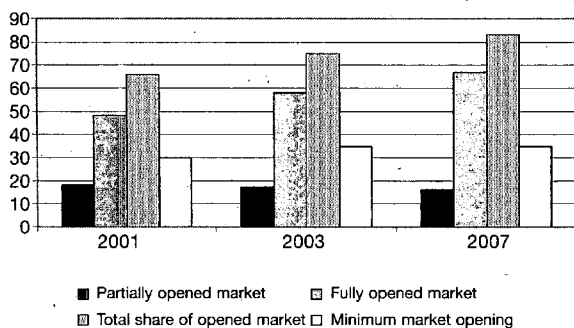
The continued existence of these implementation problems illustrates the considerable practical difficulties to ensure non-discriminatory access to bottleneck infrastructures. It is a time-consuming process for regulators to acquire the necessary information to establish for example the "fair" price for the lease of a telephone line. These implementation problems, as well as the necessary adjustment periods for suppliers and consumers to adopt to a new competitive environment, explain why the practical introduction of competition in these sectors is usually a gradual process. The length and speed of the process, however, also depend to a considerable extent on the legal framework of regulatory reform, in particular on the choice between a "big bang" approach, i.e. the complete opening of the market for competition, and a more gradual market opening.

In contrast to the telecommunications industry, the approach chosen by the EU for the electricity industry is much more cautious. The EC Electricity Market Directive (96/92/EC) adopted on 19 December 1996 required Member States to open the market for final consumers using more than 40 GWh of electricity per year by February 1999. This was equivalent to at least 27% of the Member States' electricity market. From February 2000 the consumption threshold was lowered to 20 GWh which implies that 30% of the market needed to be open for competition and by February 2003 all electricity users consuming more than 9 GWh should be able to freely choose their suppliers. This is equivalent to a market share of 35%. Member States are not legally required to open the remaining 65% of their electricity markets.⁴ In practice, however, most Member States have already exceeded the minimum market opening requirements established in the Electricity Market Directive or plan to do so. According to a summary of Member States' intentions published by the European Commission in March 2001, only France, Greece and Portugal do not envisage exceeding the minimum market opening requirements. Italy and Luxembourg envisage opening up 70% and 75% respectively of their electricity markets by 2001 and 2005 respectively. The remaining 10 Member States aim at opening up their

³ European Commission: Sixth Report on the Implementation of the Telecommunications Regulatory Package, op. cit., p. 3.

⁴ Figures from European Commission: Completing the internal energy market – Commission staff working Paper, SEC(2001)438, Brussels 12.03.2001, p. 4. In earlier publications the European Commission provided slightly different figures for the minimum market opening requirements.

Figure 1
Electricity Market Opening in the EU¹



¹ %share of the electricity market.

Sources: European Commission, Commission Staff Working Paper – Completing the internal energy market, Brussels 12.03.2001, SEC(2001)438 and own calculations.

electricity markets completely, although in the case of Ireland this is only foreseen for 2005 and in the case of Belgium only for 2007.

On the basis of these plans, Figure 1 provides an overview of the percentage share of the EU electricity market that will be partially or fully open for competition in 2001, 2003 and 2007, using the share of the individual Member States in total EU electricity consumption. For the calculation of the “fully opened market” shares only those Member States where 100% of the electricity market is or will be open for competition were included. The “partially opened market” share is calculated by using the appropriate percentage of the electricity market share of those EU Member States that are, or will continue to be, *partially* opened for competition.⁵ The “partially opened market” share for 2001 thus includes e.g. 35% of the French electricity market.

On the basis of Member States’ plans in early 2001 the share of the total EU electricity market that is *fully* opened for competition is set to increase from 48% in 2001 to 58% in 2003 and further to 67% in 2007. Taking the fully and partially opened national electricity markets together, a total share of 66% of the EU electricity market has so far been opened for competition. This share is set to increase to 75% of the EU electricity market in 2003 and further to 83%

in 2007. The difference between fully and partially liberalised markets is important for the likely electricity price effects of regulatory reforms. Direct price reductions for private households due to competition can only be expected if the electricity market for private consumers is also opened for competition. Private households in Member States with *partially* opened electricity markets can therefore only expect to benefit from electricity liberalisation if lower electricity prices for industrial electricity users are passed on to consumers. However, a number of national regulatory authorities operate price cap rules that require electricity suppliers to adjust prices for all consumers, including private households. The introduction of price cap mechanisms, which are set on the basis of, for example, developments in fuel prices and assumed industry-wide efficiency gains in the electricity sector, can be interpreted as a positive consequence of the regulatory reform process in the electricity industry. More generally, regulatory reform in electricity will only result in downward price effects if the regulatory framework ensures that *de jure* competition also results in *de facto* competition.⁶

In March 2001 the European Commission presented a set of new measures to speed up the regulatory reform process in the electricity and gas industries. In particular, the Commission suggested establishing clear deadlines for Member States with a view to *fully* opening their electricity and gas markets by 2005.⁷ However, the Stockholm European Council on 23 and 24 March 2001 did not endorse this concrete deadline. Instead the Council postponed possible decisions towards a further mandatory opening of EU electricity and gas markets to the Spring European Council in 2002.⁸

Recent Price Developments

As argued above, regulatory reforms in the telecommunications and electricity industries resulted in downward price effects in these sectors. Figure 2 shows the development of the EU HICP (Harmonised Index of Consumer Prices) sub-indices for electricity and telephone and telefax services during the period December 1997 to February 2001 relative to changes in the overall EU HICP. Furthermore, for reasons of

⁵ According to European Commission: Completing the internal energy market, op. cit. p. 5, these are Austria, Finland, Germany, Sweden and the UK in 2001. Denmark, the Netherlands and Spain envisage joining this group by 2003 and Belgium and Ireland by 2007.

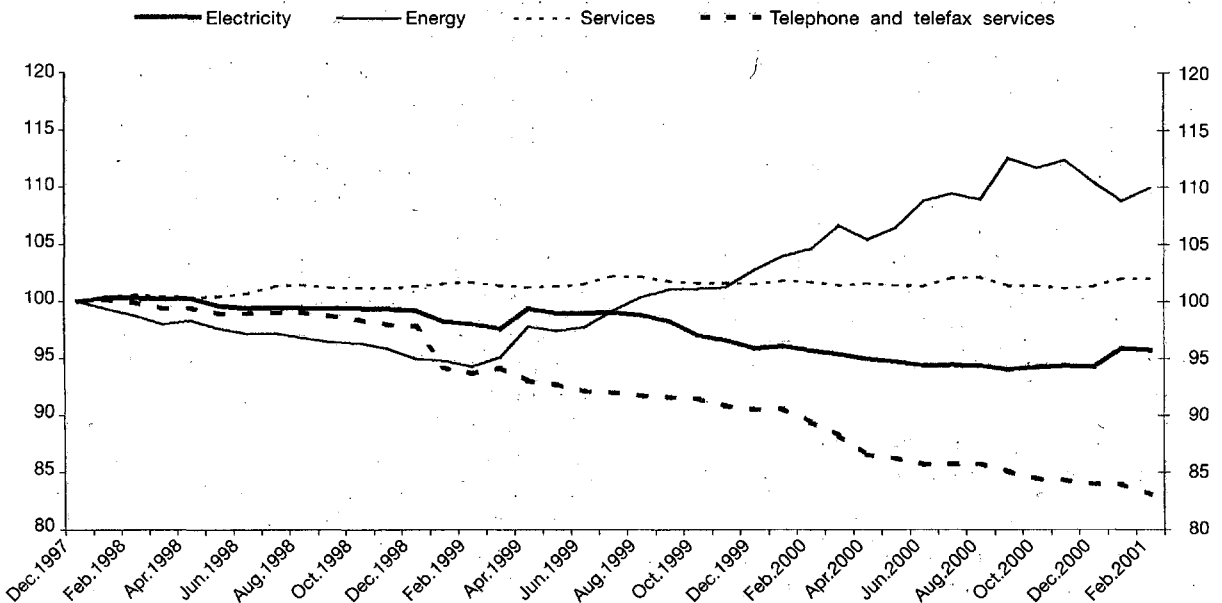
⁶ For more details on the various price effects see European Central Bank, op. cit.

⁷ The legislative proposals and accompanying documentation are available on the Internet at <http://www.europa.eu.int/comm/energy/en/internal-market/int-market.html>.

⁸ The conclusions of the Swedish presidency on the Stockholm European Council can be found at http://www.europa.eu.int/comm/stockholm_council/index.htm. See also “Single energy market plan faces setback”, Financial Times, 26 March 2001.

Figure 2
Telecommunications and Electricity Price Indices Relative to the Overall Harmonised Index of Consumer Prices in the EU

(Index December 1997 = 100)



Source : Eurostat.

comparability Figure 2 contains the broader HICP sub-indices to which electricity and telephone and telefax services belong, namely "energy" and "services".

With regard to the telephone and telefax services sub-index, a marked downward trend compared with the overall HICP index as well as the sub-index for services is discernible from 1998 onwards. From December 1997 to February 2001 consumer prices for telephone and telefax services in the EU fell by 16.9% relative to the EU HICP as a whole. The electricity sub-index also shows a downward trend, although it is weaker than that for telecommunications and it started only in 1999. Furthermore, the downward movement was interrupted in April 1999, due to the increase in energy taxation in Germany. Between December 1998 and February 2001 the electricity price index for the EU fell by 3.5% relative to the overall EU HICP.

The start of EU-wide regulatory reforms in the two sectors under review and the changes in the sector-specific price indices strongly suggest some causality between market opening and relative price falls. However, it is important to keep in mind that regulatory reform is only one of the factors deter-

mining price developments in these industries. Other important elements include technological progress (in the case of telecommunications), tax changes and energy price variations (in the case of electricity).

Price Dispersion during the 1995-2000 Period

Besides affecting recent price developments, as mentioned above, it can also be assumed that regulatory reforms have an impact on international price level differences in network industries. From a domestic perspective, increased competition is expected to reduce profit margins and bring prices increasingly in line with costs.⁹ Furthermore, creating a single EU market for telecommunications and electricity is likely to increase international competition. However, notwithstanding the fact that there has indeed been a clear downward trend of telecommunications and electricity prices, Table 1 shows that there are still marked price level differences in these

⁹ See for instance Lars Bergman et al.: Europe's Network Industries: Conflicting Priorities. Telecommunications, Centre for Economic Policy Research (CEPR), London 1998, pp. 258 ff.; M. Armstrong, S. Cowan, J. Vickers: Regulatory Reform: Economic Analysis and British Experience, London 1994, MIT Press, pp. 392 ff..

Table 1
Telecommunications and Electricity Price Level Differences in the EU 1995-2000¹

Telecommunications		2000	1999	1998	1997	1996	1995
Local Call	Average	0.11	0.12	0.12	0.11	0.14	0.14
	Coefficient of Variation	27.32	40.42	40.78	28.10	32.45	34.11
	Max/Min. Ratio	3.17	6.50	6.25	4.67	5.50	5.25
Long Distance	Average	0.40	0.44	0.54	0.63	0.85	0.87
	Coefficient of Variation	38.52	55.13	50.86	49.75	49.55	49.45
	Max/Min. Ratio	5.18	7.64	8.00	8.82	9.31	9.62
International	Average	0.97	1.14	1.21	1.35	1.66	1.68
	Coefficient of Variation	25.46	17.97	15.80	11.51	15.73	17.01
	Max/Min. Ratio	2.49	2.07	1.80	1.54	1.96	1.99
Mobile	Average	0.65	0.73	0.86	n.a.	n.a.	n.a.
	Coefficient of Variation	39.38	34.16	29.09	n.a.	n.a.	n.a.
	Max/Min. Ratio	5.83	5.50	3.10	n.a.	n.a.	n.a.
Electricity							
Small Households	Average	6.63	6.68	6.72	6.77	6.93	6.63
	Coefficient of Variation	17.41	17.09	16.95	17.14	19.08	18.75
	Max/Min. Ratio	1.99	2.02	1.95	1.91	1.85	1.94
Large Households	Average	16.00	15.83	16.14	16.23	16.42	16.68
	Coefficient of Variation	29.07	29.59	29.71	29.17	30.15	31.29
	Max/Min. Ratio	3.34	4.67	4.72	4.82	4.53	4.40
Small Industrial	Average	11.96	12.63	12.83	13.19	13.49	14.20
	Coefficient of Variation	27.49	27.82	26.54	25.93	26.43	25.66
	Max/Min. Ratio	2.68	2.98	2.82	2.83	2.72	3.16
Large Industrial	Average	6.15	6.61	6.85	7.06	7.14	7.62
	Coefficient of Variation	23.38	22.05	20.38	19.66	19.34	18.41
	Max/Min. Ratio	2.73	2.58	2.32	2.14	2.20	2.17

¹ Average prices are weighted by the EU Member States' shares in the telecommunications or electricity HICP sub-indices respectively. Taxes are not included.

Sources: Eurostat and own calculations.

sectors, both between EU Member States and between various types of users.

Regarding differences between Member States, Table 1 shows that in January 2000 the ratio of the highest to the lowest price level for telecommunications services in the EU (maximum / minimum ratio) ranges between 2.5 for international calls and 5.8 for mobile calls. For electricity, the variations are somewhat less pronounced. Here the ratio of maximum to minimum prices varies between 2.0 for

small households and 3.3 for large households.¹⁰ Price dispersion, as measured by the coefficient of variation of prices excluding taxes in January 2000 ranged between 25% and 39% for different types of telecommunications services and between 17% and 29% for different types of electricity users. It is worth noting that this clearly exceeds the 1999 coefficient of variation for total private final consumption reported by the European Commission (14%).¹¹

Looking at changes over time, the price level dispersion in these sectors appears to be fairly stable for the period 1995-2000, except for fixed line

¹⁰ The highest prices for international calls were recorded in Belgium, the lowest in the Netherlands. Prices for mobile calls are highest in Sweden and lowest in Austria. The highest electricity prices for small households were recorded in France and the lowest in Finland, while the highest prices for large households were recorded in Luxembourg and the lowest in Italy.

¹¹ European Commission: Annex to the Communication on Economic Reform: Report on the Functioning of Community Product and Capital Markets, Brussels 2000.

telecommunications services, where the coefficient of variation drops by 13 and 16 percentage points for local and long distance calls respectively between 1999 and 2000. At the same time there was an increase in the coefficient of variation of almost 7 percentage points for international calls. The latter can mainly be attributed to the fact that while in all countries, except the UK, prices fell between 1999 and 2000, the magnitude of price falls differed significantly between Member States. Furthermore the largest falls occurred in those countries that already had below average international call prices.

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 nine times as expensive as local calls and large domestic electricity consumers pay more than two and a half times as much as large industrial users. Differences of this magnitude are unlikely to be caused by cost differentials only and indicate substantial differences in the level of competition in the various market segments.

Testing for Price Level Determinants

Against the background of large and persistent price differences in the European telecommunications and electricity industries, it is important to analyse the sources of price dispersion in these two 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 or telecommunication services are regressed against a number of potential explanatory variables in a panel data setting.¹²

¹² 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. Panel data sets may also alleviate the problem of multicollinearity and make it possible to identify and measure effects that are not detectable in pure cross section or pure time series data. Finally, the use of panel data may eliminate or reduce estimation bias (P. Balestra: Introduction to Linear Models for Panel Data in: L. Matyas, P. Sevestre: The Economics of Panel Data, Boston 1996, Kluwer Academic Publishers, pp. 25-33).

¹³ All telecommunications price data are derived from 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 available only from 1998 onwards. Data on the other explanatory variables was obtained either from the European Commission or from National Regulatory Agencies. Other explanatory variables such as the rental charge, the presence of carrier pre-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.

For telecommunications, annual average prices for 3-minute peak calls of four different types of services (local calls, long distance calls, international calls and mobile calls) for the period 1995 to 2000 are regressed against the following five explanatory variables:¹³

- The number of years prior to (*de jure*) liberalisation. Once liberalisation has been introduced this variable becomes negative.
- A dummy variable for the year in which the different Member States opened the market for competition.¹⁴
- The percentage of the incumbent firm's shares that are still publicly owned.
- A dummy for the presence of number portability.¹⁵
- 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.

For electricity, semi-annual prices for four different types of consumers (two types of household consumers and two types of industrial users) for the period 1990 to 2000 are estimated against five variables, of which the first three are identical to the variables used for telecommunications. Furthermore, two electricity-specific variables are included, namely:

- The price of gas.
- The percentage of electricity generated by gas.¹⁶

It seemed appropriate to include two different liberalisation-related variables because, as argued earlier on, the actual implementation of regulatory reform and the creation of *de facto* competition takes a number of years, even if specific deadlines call for a complete market opening in a particular year. Besides those gradual effects, it can be assumed that one-off price effects will occur in the year when markets are

¹⁴ This dummy has not been introduced for mobile calls since all countries had already liberalised mobile telephony before the beginning of the sample period.

¹⁵ Number portability indicates that switching one's telephone operator does not imply a change in the phone number.

¹⁶ 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, the concentration and the number of generators in the market. None of them was significant. Electricity and gas price data were obtained from Eurostat's New Chronos database and cover small households with an annual consumption of 600KWh, large households with an annual consumption of 2 GWh, small industrial users consuming 3 GWh and large industrial users with a yearly consumption of 10 GWh. Given that observations are semi-annual, the prices have been adjusted by using the moving average method. Data related to the other explanatory variables were obtained from National Regulatory Agencies.

opened for competition. The first ("gradual") liberalisation variable, the number of years prior to liberalisation, is suitable to capture possible gradual price effects in anticipation of regulatory reforms whereas the dummy variable for the year of the market opening is designed to capture the one-off effects of the introduction of competition. However, it should be kept in mind that the "gradual" liberalisation variable has the features of a time trend and that during the last decade technological progress in the telecommunications industry was substantial. Since it is not possible to disentangle the gradual liberalisation effects from the impact of technological advances, some caution in the interpretation of the results for this variable is warranted. This caveat is less important for the electricity industry, where technological progress was more limited than in the telecommunications sector.

The results of the estimates for the aforementioned regressions are summarised in Table 2.¹⁷

For telecommunications, Table 2 indicates that advancing one year in the liberalisation process results in a yearly nominal price fall between 13 and 15% for international and long distance calls. These price falls are quite substantial and may partly be caused by tariff rebalancing between the international and long distance segments of the telecommunications market and the (still less competitive) local call segment. It is thus unlikely that price falls of this magnitude will persist over the forthcoming years. Furthermore, as argued above, the "gradual" liberalisation variable is likely to capture not only the price effects of regulatory reform but also technological progress, which explains the variable's large coefficient. The latter argument, together with the rapid evolution in competition, is most likely also behind the enormous price evolution in the mobile segment, where moving one year further in the liberalisation process makes prices fall as much as 29%. The dummy variable "introduction of competition" is only significant for international fixed-line calls, where the results suggest a price fall of almost 17% due to the legal opening of the market. Prior to liberalisation, cross subsidisation had lifted prices for international fixed-line calls substantially above costs. This segment of the market thus offered good opportu-

nities for new entrants to compete with the incumbents. In the local market segment, none of the liberalisation variables is significant. This is likely to be due to the fact that by 2000 the *de facto* level of competition in this segment of the telecommunications market is still insufficient to have a significant impact on prices.

Looking at the importance of public ownership for telecommunications price levels, the results indicate that privatisation triggers significant price falls for international (-1.1%) and long-distance fixed-line calls (-4.8%). Mobile and local services, however, seem to be unaffected by privatisation.¹⁸ For the mobile segment this can mainly be attributed to the fact that most incumbents 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. Regarding local calls, privatisation frequently resulted in tariff rebalancing which was mostly to the detriment of

Table 2
Estimation Results for the Determinants
of Price Level Differences

	Local call	Long distance call	International call	Mobile call
Advancing one year in liberalisation	n.s.	-15.16%**	-13.46%**	-29.03%**
Introducing legal liberalisation	n.s.	n.s.	-16.56%**	-
Decreasing public ownership by 10%	n.s.	-4.80%**	-1.14%*	n.s.
Introducing number portability	-19.36%**	n.s.	n.s.	n.s.
Introducing carrier selection	-0.88%*	-2.78%*	n.s.	n.s.
Increasing price of leased lines by 10%	4.40%*	3.54%**	3.11%*	-
R ²	0.83	0.93	0.85	0.65
Durbin-Watson test	1.63	1.56	1.88	2.22
	Small households	Large households	Small industrial	Large industrial
Advancing one year in liberalisation	n.s.	n.s.	-1.03%**	n.s.
Introducing legal liberalisation	n.s.	n.s.	-6.15%**	-7.80%**
Decreasing public ownership by 10%	-1.89%**	n.s.	-1.49%*	-2.84%**
A fall of 1% in the gas price	-3.02%**	-4.50%**	n.s.	n.s.
Increasing the importance of gas by 10% in the production structure	-15.53%*			
R ²	0.88	0.97	0.96	0.92
Durbin-Watson test	1.91	1.95	1.88	1.92

* Significance at the 5% level.

** Significance at the 1% level.

¹⁷ 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 European Union and they do not bias the results. Non-linearity tests for all coefficients were insignificant. Finally, the unit root and Durbin Watson tests were computed on the balanced part of the panel and both behaved well in all instances.

prices in the (less competitive) local segment. However, two other reform related variables, namely the presence of carrier selection and the introduction of number portability appear to result in significant price falls for local calls of 1% and 19% respectively. The strong impact of the latter variable confirms that switching costs are an important impediment for competition in the local market segment. Furthermore, the price of leased lines appears to have a significant impact on all types of fixed-line services. This highlights the importance of a regulatory framework that ensures that incumbent operators do not overcharge access to leased fixed telephone lines.

For the electricity sector, advancing one year in the liberalisation process hardly results in any price effects. The variable is only significant for small industrial electricity users and the coefficient is small. This contrasts strongly with the findings in the telecommunications sector and can be explained by several factors. First, as argued above, this coefficient 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 many Member States started only recently. During the sample period 1990-2000 the gradual effects of regulatory reform have not been particularly present. The second liberalisation variable, however, capturing the one-off effects of the introduction of competition, does appear to result in price falls between 6% and 8% for both types of industrial users. This corresponds well with the fact that so far it is mainly the market for industrial electricity users that was opened for competition. 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 industrial electricity consumers to 2.8% for large industrial users. Gas prices appear to play the main role in determining

electricity prices for private households. A fall in the gas price of 1% leads to a price fall of 3% and 4.5% in the small and large household segment respectively. By contrast, gas prices are not significant in the industrial segment of the electricity market. This can be partly explained by the fact that the liberalisation in the British and Swedish electricity markets has already led to the introduction of spot markets, which weaken the link between electricity and gas prices. An increase in the share of gas in the electricity production structure, suggesting a move towards more modern generation technologies, appears to have a weakly significant downward impact on electricity prices for small households.

Potential Effects of Further Regulatory Reform

Based on the findings reported above it can be mechanically derived how current prices would alter if all European countries introduced number portability and carrier selection for telecommunication services. Furthermore, it is assumed that public ownership is abandoned completely, that leased line prices converge to the lowest current level in the EU, and that competition is universally introduced.¹⁹ Based on the regression results reported above the combined mechanical effect of these four measures would be a reduction of the EU price level for local calls by 9%, for long distance calls by 22% and for international calls by 9% (see Table 3). The impact of the changes in the coefficient "advancing one year in liberalisation" has not been taken on board, as it is unclear to what extent these effects will persist over the years to come.

Performing the same exercise for electricity implies assuming that all countries move towards full privatisation and legal liberalisation. Furthermore, it is assumed that gas prices in the EU converge. This last assumption is rather strong, at least in the short run. Gas prices are currently quite diverse across the European Union, which is 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

¹⁸ From a static perspective, economic theory is generally agnostic as to whether private ownership is superior in efficiency terms compared to public ownership (see e.g. Jean-Jaques Laffont, Jean Tirole: *A Theory of Incentive Procurement and Regulation*, Cambridge 1993, MIT Press, Chapter 17). 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 David A. Good, Lars-Hendrik Röller, Robin C. Sickles: *U.S. Airlines Deregulation: Implications for European Transport*, in: *Economic Journal* 103, July 1993, pp. 1028-1041; and Ahmed Galal, Leroy Jones, Pankaj Tandon, Ingo Vogelsang: *Welfare Consequences of Selling Public Enterprises: an Empirical Analysis*, Oxford 1994, Oxford University Press.

¹⁹ The opening of the Greek fixed line telephony market on 1 January 2001 in fact marks the completion of the *de jure* market opening in the EU. However, this was not yet the case at the end of our sample period, being 2000.

Table 3
The Potential Future Impact of the Different Determinants on Electricity and Telecommunications Prices

	Local call	Long distance call	International call	Mobile call
	Decreasing public ownership by 10%	-	-1.22%	-3.34%
Introducing legal liberalisation	-	-	-0.36%	-
Introducing number portability	-2.20%	-	-	-
Introducing carrier selection	-0.63%	-9.28%	-	-
Convergence of prices for leased lines	-5.91%	-10.31%	-5.70%	-
Joint potential total impact	-8.74%	-20.81%	-9.40%	-
	Small households	Large households	Small industrial	Large industrial
	Decreasing public ownership by 10%	-0.87%	-	-1.40%
Introducing legal liberalisation	n.s.	n.s.	-5.26%	-4.19%
Gas price convergence	-4.60%	-12.04%	n.s.	n.s.
Joint potential total impact	-5.47%	-12.04%	-6.66%	-5.55%

the Member States, making gas in some countries much more expensive than in others.²⁰ Gas price convergence towards the lowest European level is therefore a useful assumption in order to illustrate the potential downward price effect of a fully integrated European gas market but it is not a likely short-run prospect.

Using again the regression results above, the combined effect of the three regulatory reforms outlined above would lower electricity prices between 5% and 12% for the different types of consumers (see Table 3). The variable "advancing one year in liberalisation" has been omitted from this analysis, mainly in view of its limited importance for electricity prices during the sample period.

In a last part of the analysis, it is assessed whether further regulatory reform and input price convergence are likely to reduce the cross-country price differentials in the two sectors considered. To this end two different scenarios are simulated. In the "regulatory convergence scenario" it is assumed that the extent of regulatory reform in EU telecommunications and electricity industries would be equal across the countries. More specifically, price levels for telecommunications services and electricity in the different EU Member States in 2000 were adjusted in the following way: For telecommunications services it was

Table 4
Price Convergence in Telecommunications and Electricity

	Coefficient of Variation		
	2000	Simulated	
		Regulatory convergence	Full convergence
Telecommunications			
Local call	27.32%	22.80%	22.05%
Long distance call	38.52%	30.36%	27.29%
International call	27.49%	21.15%	21.14%
Electricity			
Small households	17.41%	17.22%	12.91%
Large households	29.07%	29.07%	18.55%
Small industrial	27.49%	27.26%	27.26%
Large industrial	23.38%	22.99%	22.99%

assumed that all countries would fully privatise their incumbent companies, introduce number portability and open the market for competition.²¹ For electricity full privatisation and the introduction of legal liberalisation were assumed. The "full convergence scenario" assumes that on top of these regulatory changes the price for leased telecommunication lines and the price for gas converge throughout the EU. The simulated new price levels are subsequently used to calculate new coefficients of variation for the different types of telecommunications services and the different types of electricity users.

The simulated coefficients of variation shown in Table 4 suggest that further regulatory reforms and an international equalisation of input prices are likely to contribute to further price convergence in all segments of the telecommunications and electricity industries although the magnitude of the convergence potential differs significantly. In telecommunications, the results suggest that more balanced regulatory reform across the EU would be the main factor driving price convergence. Compared with the coefficients of variation in 2000, the simulated coefficients of variation for the "regulatory convergence scenario" fall between 5% and 8% for the different types of

²⁰ 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.

²¹ Given that none of these variables were significant for the mobile segment and in view of the fact that the regression results only cover the period 1998-2000, the mobile segment has been omitted from this section.

services. Equal prices for leased lines across the EU countries would reduce the coefficient of variation somewhat further, at least for local calls (-1%) and long distance calls (-3%).

With reference to electricity prices for private households, the picture is quite different. Whereas the results suggest that more balanced regulatory reforms across the EU are unlikely to result in further price convergence, an equalisation of gas prices across the EU would induce a drop of 4 to 10% in the coefficient of variation for private households' electricity prices. Incidentally, this would bring the coefficient of variation in the household electricity sector in line with the overall coefficient of variation for final private consumption as reported by the European Commission. As argued above, however, regulatory reform in electricity has in many Member States started only recently, in particular with regard to private households. This is likely to limit the explanatory value of the regulatory reform variables for household electricity prices. For industrial consumers, gas prices were not a significant explanatory variable and gas price convergence can therefore not be expected to have a substantial impact on industrial electricity price convergence. The results indicate that the potential impact of further regulatory reforms across the EU on industrial electricity price convergence is also rather limited. However, it should be kept in mind that imported competition by means of enhanced cross-border electricity trade could be another mechanism to foster electricity price convergence in the EU. Progress in this field, which is not included in the current analysis, depends mainly on improved physical interconnections between the European countries as well as regulatory measures such as clear rules on cross-border tariff setting and congestion management for electricity.

Concluding Remarks

This paper investigated the sources of intra-EU price dispersion in two important network industries, namely telecommunications and electricity. Both sectors experienced substantial regulatory reforms over the past couple of years, resulting in the widespread introduction of competition in traditionally monopolistic markets. In telecommunications, all EU consumers are now free to choose their supplier while in the electricity sector as much as 66% of the market can rely on alternative suppliers. Recent changes in the HICP sub-indices for electricity and telecommunications relative to the developments in the overall

HICP strongly suggest that the introduction of competition in these sectors resulted in significant downward price effects. However, despite the recent price falls for telecommunications and electricity, large and persistent price level differences across EU Member States remain. In fact, the coefficients of variation for prices in these sectors suggest that the current price level differences are two to three times as high as the intra-EU price level differences for overall final private consumption.

Panel data estimations confirm that regulatory reform measures had a substantial impact on prices in the two 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. With regard to the electricity sector, regulatory reform measures appear to have a strongly significant impact on prices for industrial electricity users. Electricity prices for private households appear to be mainly driven by fluctuations in input prices, in particular gas prices, rather than regulatory reform. 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 had not yet been opened up for competition.

On the basis of these empirical results it is estimated that further progress with regulatory reforms in telecommunications and electricity together with some degree of input price convergence are likely to result in further substantial price falls. Depending on the type of telecommunications service or the type of electricity user such additional price falls are estimated to range between 5 and 21% for the EU as a whole. Furthermore, these results suggest that further regulatory reform progress across EU Member States would lead to a substantial reduction of price level differentials for telecommunications services. The key prerequisite for a reduction of price level differences for domestic electricity users appears to be progress in the convergence of gas prices which in turn depends on further progress in the creation of a single European gas market. However, gas price convergence and thus domestic electricity price convergence is unlikely to be a short-term prospect. For the industrial electricity segment, neither gas price convergence nor further progress in regulatory reforms appear to be likely to induce price convergence. For this part of the electricity sector it seems that enhanced cross-border electricity trade is the mechanism most likely to foster price convergence across the European Union.