

CHAPTER 4.

AN ANALYSIS OF ENERGY PRICES IN THE EUROPEAN COMMUNITY: GAS AND ELECTRICITY

4.1. Introduction and general comments

In this document, the prices at which both gas and electricity are made available to both domestic and industrial consumers in EEC countries are analysed. The objective of the study is to clearly identify certain aspects of these prices, including a full consideration of the tax burden that each country applies to different energy consumers, that are markedly different across EEC countries. In particular, we shall point out notable differences in:

- i. final tax burdens
- ii. the final prices, both net of tax and gross of tax
- iii. the manner in which prices and the tax burden change with the amount of consumption (consumer identity)

It is hoped that by pointing out these differences, the particular areas in which EEC cohesion policy could be directed may become clearer. In any case, it must be stated that exactly how price and tax differences relate to cohesion, understood in more general economic development terms, is unclear at best. Any suggestion of how a tax burden should be altered must obviously be argued not only with respect to the final effects on price, but also on quantity purchased, and hence on the amount of taxation income generated. Similarly, policies directed at altering the pre-tax prices at which energy is made available must take into account the true underlying demand curves, in order that the proper effects on consumer surplus (and social welfare) be fully

understood. Given this, it is surely not true that simply directing cohesion policy towards equating the pre-tax prices and the final tax burden over EEC countries is sufficient to enhance cohesion in general economic growth and development. Such statements must fully consider the final effects of a change in price and tax burdens on how the quantity traded will change, which in turn depends on the availability (both current and potential) of substitutes and on the effects on the profitability of suppliers.

In any case, the current analysis has a more modest objective; to simply point out notable cases of differences in either prices or tax burden, especially in the cases of countries that present similarities in other more general aspects (above all, geographic location, and general economic climate). In particular, in order to get a relatively simple overall picture of the current situation, special attention is paid to differences over any two neighbouring countries¹ (whether they have a good general economic climate or not), and to the northern EEC countries versus the southern EEC states (which are limited to Portugal, Spain, Italy and Greece) as a very crude indication of general economic climate². In any case, in the final section some general conclusions are presented that it is hoped will be helpful for directing cohesion policy.

As an appendix, all of the information discussed is presented in tables. In the tables, all prices are quoted in ECUs so that they are totally comparable across countries. The tax burden is calculated strictly as a percentage increase over net of tax prices (even though it is possible that some countries include a constant portion within their tax system). The original source from which all the data presented is calculated is the series "Statistiques en Bref: Énergie et industrie", prepared by Eurostat on 30.11.98. It should also be pointed out here that the prices at which energy is traded are quite variable over time, and hence the differences noted here may not persist in other years, or indeed, other months. However, the above mentioned data source is the most recent that was available at the time of writing, and correspondingly, it is hoped that the information contained in this document is sufficiently close to the relevant situation at the time of reading.

¹ And even more concretely, differences between two or more markets in a single country, where any such differences exist.

² There are obviously many more possible comparisons, perhaps most notably, the length of time for which a state has been a member of the EEC.

Throughout this document, in order to make as many cross-sectional and cross-national comparisons as possible, our attention is restricted to those EEC countries in which there exist markets for both gas and electricity. Hence, some markets have been eliminated from the sample set discussed here (for example, in Belgium and France there exist many markets for industrial consumers of gas but we only consider those markets that also serve domestic consumers. A similar phenomenon is present in certain electricity markets).

Concretely, throughout the document, “gross” prices (p_g) are those prices that are paid by consumers, including any taxes, while “net” prices (p_n) are the gross prices less taxes (i.e. the pre-tax prices). The tax burden has been calculated, in all cases, as a percentage increase over the net price, i.e.

$$t = \frac{100(p_g - p_n)}{p_n}$$

For simplicity, no special allowance has been made for value added taxes. Only the final total tax burden has been calculated. While this simplification certainly presents no implicit costs as far as the domestic consumers are concerned, it may be important for industrial consumers, simply because in some EEC states industrial consumers are able to recover the value added tax (but not any others) at the end of the fiscal year. However, taking into account this possibility would be extremely laborious since, quite aside from the separation between value added taxes and other taxes, it would also require a consideration of when exactly each tax payment is made during the year and the financial cost of the corresponding loss in temporary income.

Differences in the gross prices are important to consumers, since this is the price that they must pay. If two neighbouring countries have a markedly different gross price (due to either large net price differences or large tax burden differences), then one may ask why the consumers in the high priced region do not attempt to purchase in the low priced region (naturally, given a feasible energy transmission technology between the two regions). Such cross boarder trading can be expected to contribute to equating the gross price in each market. Of course, if no current feasible energy transmission technology between the two markets exists, then one can expect that the differences in gross prices must reflect the true economic cost of the construction of such a

technology. Concretely, the cost of an adequate transmission technology must be (roughly) equal to the increase that is foreseen in total consumer surplus in the currently high priced region should such a technology be introduced³.

On the other hand, differences in net prices are important for suppliers. However, and in a very similar way, if there exist significant net price differences between two markets, then suppliers in the low priced region have an incentive to enter the high priced region market. Once again, if no feasible transmission technology currently exists, then we can expect that the differences in net prices reflects the economic cost of the construction of such a technology. Concretely, the cost of construction of a feasible technology must be (roughly) equal to the foreseeable increase in economic profits of the suppliers in the currently low priced region should such a technology become available.

Making certain simplifying assumptions concerning the demand curves in each of the two regions (the high priced region and the low priced one), as well as on the final price that would be achieved if a transmission technology were introduced, one can use the arguments of the previous two paragraphs to estimate the foreseeable alterations in social welfare that the provision of a feasible transmission technology would provide, given notable current differences in net or gross prices. In this case, it is true that, *ceteris paribus*, the greater is the difference in either gross or net price, the more valuable (in terms of social welfare) is a feasible transmission technology for the region that constructs the technology. Naturally, the final analysis must take into account the overall (or "net") change in social welfare for the entire EEC region. For example, there will be a reduction in consumer surplus in the country that suffers an increase in gross price after the construction of the technology that should be offset against the consumer surplus gains that are achieved in the other country. In short, it is hoped that the information contained here-in proves to be a sufficient guideline for such general projections along these lines that may be attempted in the near future.

In the tables in the appendix, the implicit price subsidy (*IPS*) for all consumer types, and for both gross and net prices, relative to *D2* consumers is also shown. The *IPS* expresses the reduction in the relevant price as a fraction of the *D2* consumer price:

³ If the cost of the transmission technology were less than the expected increase in consumer surplus, then one can

$$IPS_k(i) = \frac{p_k(D2) - p_k(i)}{p_k(D2)}$$

where $k = (g, n)$. For example, if $IPS_k(i) = 0.5$ then the price p_k paid by type i consumers has a 50 per cent discount, or is only one half of, over the equivalent $D2$ consumer price, while if $IPS_k(i) = 0.75$ then the price p_k paid by type i consumers has a 75 per cent discount, or is only one quarter of, over the equivalent $D2$ consumer price. In order that all figures are presented with only 2 numerals beyond the decimal point, some rounding has taken place. For example, it can be shown that if the IPS for a given consumer type is equal for both gross and net prices, then it must be that the percentage tax burden for that consumer type is equal to the percentage tax burden for $D2$ consumers. However, as can be seen in the appendix, in several places the two IPS figures are the same while there is a slight difference between the tax burdens. This is due entirely to rounding. In any case, significant differences between the two IPS figures for any given consumer type is indicative of a large difference between the tax burdens of that consumer type and the $D2$ consumers.

4.2. Gas

The final prices at which gas is made available for final consumers across the EEC countries, in almost all cases, follow a regressive trend under which larger consumers are charged a lower unit price. This regressive trend is retained from large domestic consumers to the industrial sector. The notable exceptions to this general rule are Italy, where the gross price charged to domestic consumers increases with consumption (i.e. is progressive) and Portugal where domestic consumers all pay a constant gross price independent of the amount consumed⁴. The Italian situation is due to the highly progressive nature of the tax burden charged to domestic consumers (which will be discussed below), since the net of tax price system is regressive, although not excessively so.

expect that the collective of consumers would join together to construct the relevant technology.

In almost all markets, the net of tax price system is also regressive, while the tax burden follows either a progressive trend or is constant across consumer types. Since the gross prices (including tax) are also generally regressive, whenever the tax burden is progressive it follows that the gross prices are less regressive than are the net prices, i.e. the graph of the gross prices would be higher but less steep than the graph of the net prices.

The regressive nature of the prices, both gross and net, implies that the implicit price subsidy (*IPS*) is, in general, progressive, implying that larger consumers receive a greater subsidy. In several cases, in the tables in the appendix, *IPS* figures are impossible to calculate since that particular market does not serve all consumer types. In particular, the Finnish gas market does not serve *D2* consumers, and so no *IPS* figures are shown for that market. However, the general regressive trends in both gross and net prices, as well as the general progressive trend in the tax burden is still valid for the Finnish gas market.

4.2.1. The tax burden

The consumption of gas throughout the EEC is subject to a wide array of tax systems. Most countries apply a final tax burden on most consumer types that ranges between about 16 and 30 percent, although there are certain notable exceptions to this. On one extreme, in the English markets and in Lisbon, domestic consumers face a 5 per cent tax burden⁵, and in the Luxembourg market all consumers (both domestic and industrial) are charged a constant 6 per cent tax. On the other extreme, in Italy large domestic consumers are charged tax rates that go as high as 107 per cent (*D4* consumers in the Turin market) and in Sweden even smaller domestic consumers face tax rates that go over 60 per cent, and large domestic consumers pay about 83 per cent tax.

⁴ In Portugal, a mixture of a constant and a regressive pricing system is used for industrial consumers. In particular, smaller industrial consumers are charged the same price, and then larger consumers are charged a lower price that also does not vary as their consumption increases.

⁵ This tax rate is maintained for industrial consumers in Lisbon, while in the English markets, the tax rate for industrial consumers is increased to 17,5 por ciento.

The tax systems in both the German and Italian markets are conspicuous for not following the same schedule for all consumer types in all local markets. For example, in Germany, the tax burden for *D2* consumers is about 14 per cent higher in the Weser-Ems market than in the rest of the country. It is also notable that the only German market that serves the largest industrial consumers (*I5*), Dusseldorf, charges a tax of 41 per cent to these consumers, a jump of about 7 percentage points while over all other consumer types the greatest single jump is only about 3,8 per cent (between *I3-2* and *I4-1* consumers). The differences are even more notable throughout the set of Italian markets. Larger domestic consumers in Napoles, and to a lesser extent in Rome, are charged final tax burdens that are only about 60 per cent of the tax rates in other markets.

In spite of the lower tax burden, domestic consumers in the Napoles market pay a final price (gross of tax) that is slightly higher than in other markets, and so it seems that the tax code differences over the Italian markets is an attempt to compensate differences in net prices over the different markets. The same may be true in the case of the *D2* consumers in the Weser-Ems market in Germany, since in spite of facing the greatest tax burden, these consumers pay the lowest final gross price of all German markets. In any case, if this is true it is notable that some countries follow a tax strategy under which the objective is influencing final (gross) price, while others follow strategies of constant tax rates that allow the final price to vary freely with net price.

As far as North-South comparisons are concerned, there does not appear to be any significant trend in the way in which the tax burdens are set. In both general regions, there is at least one example of an extremely high burden (Italy in the south, Sweden in the north), and at least one example of an extremely low burden (Portugal in the south, England in the north). The Spanish market (Madrid) does not apply a tax burden that is significantly different to many northern countries⁶. In any case, in the appendix we have calculated the average⁷ tax burden over the “Northern” region countries, and the same statistic for the “Southern” region countries. Comparing these averages, we find

⁶ The statistics upon which this study is based (Statistiques en Bref, by Eurostat) does not mention the existence of gas markets (either for domestic or industrial consumers) in Greece.

⁷ Naturally, the arithmetical average tax burden may not be a particularly relevant statistic, since it implicitly assumes that each country in the relevant region (North or South) has the same importance. In reality, a far more enlightening average would include weights equal to the fraction of total regional quantity transacted that occurs in each particular market.

that there does exist a very significant increase in the south for domestic consumers larger than *D2*, due entirely to the effect of the enormous tax burden in the Italian markets for these consumer types. On the other hand, the average tax burden in the Northern countries for industrial consumers is always greater than the average in the Southern countries. This difference in averages reaches a maximum of more than a 100 per cent increase in relative tax burden averages (for *I5* consumers).

The progressive nature of the tax burden is a feature of almost all markets, however there are several markets that employ a constant tax burden over all, or many, consumer types. The markets that do not discriminate any consumer types with respect to the tax burden are; Dublin (12,5 per cent), Lisbon (5 per cent) and Madrid (16 per cent). As is evident, while these markets do not discriminate over consumers with respect to the tax burden, there is discrimination over the three markets. On the other hand, the markets that employ significant constant sections⁸ within their tax burden system are; the two French markets (constant 20,5 per cent burden for all domestic consumers and the first two industrial consumer types), Brussels (constant 21 per cent tax burden for industrial consumers between *I2* and *I5*), Luxembourg (constant 6 per cent tax burden beyond the smallest domestic consumers who pay 9 per cent), and the English markets (constant 5 per cent tax burden for domestic consumers, and a second, higher, constant burden of 17,5 per cent for industrial consumers). In the Finnish market, the tax burden for industrial consumers between *I3-2* and *I5* is almost constant at around 39 per cent, although there are small variances around this benchmark.

Finally, the progressive or constant nature of the tax burden is violated for the industrial consumers in all Italian markets (where the burden initially increases with consumption, then decreases for medium sized industrial consumers, and then increases again for the largest industrial consumers), in Rotterdam (where a regressive trend in the tax burden is used for industrial consumers beyond *I2*), and in Sweden (where there is a strong regressive jump from the largest domestic consumers and the smallest industrial consumers).

In short, of the 30 markets reported in the data of the appendix, 12 (i.e. 40 per cent of the sample) employ a strictly progressive tax system, 6 (i.e. 20 per cent) employ

a progressive system with constant segments, 2 (i.e. 6,6 per cent) employ a strictly constant system, and the other 10 (i.e. 33,3 per cent) use a system with at least one regressive element⁹.

4.2.2. Prices

While it is reasonable to expect that the net prices at which gas is made available to given consumer types should vary across markets, according to the local availability and supply cost conditions, in theory these differences should not be significant between any two markets that are geographically close together. Large net price differences over markets that are close together are difficult to explain since, in principle, suppliers would earn far greater profits by supplying to the market with the highest net price. On the other hand, large gross price differences are hard to explain since consumers would earn a greater surplus by consuming in the market with the lowest gross price¹⁰. Furthermore, such price imbalances would be indicative of possible arbitrage opportunities between markets, since, in theory, price differences are limited by the relevant transport costs. In this section we note certain examples of price differences that stand out for being rather significant and yet over markets that are not so far apart geographically.

There are several instances of the net price of given consumer types being vastly different over markets that are, geographically, reasonably close together. Perhaps the most surprising example of this is the case of *D2* consumers in Wesser-Ems who pay a net price that is only 61,7 per cent of the same consumer type in the Stuttgart market (8.8 Euros versus 14,3). Similarly, while across national borders, all consumer types between *D4* and *I2* in Madrid are much lower than the same consumer types in the neighbouring Lisbon market. For example, *I2* consumers in Madrid face a net price (3,5 Euros) that is only 26,8 per cent of the net price charged in Lisbon (13 Euros) for the

⁸ We only report those markets that include a constant tax burden for more than 2 sequentially ordered consumer types.

⁹ Of these final 10 markets, however, 5 are located in one country (Italy).

¹⁰ As was mentioned in the introduction, it may be possible for some industrial consumers to get the value added taxes returned at the end of the fiscal year, and so they would want to base their consumption decisions (i.e. in which market to consume) on differences in prices net of VAT but gross of other taxes.

same consumer types. Finally, in the Scandinavian zone, the Copenhagen market faces significantly greater net prices to both Finland and Sweden. For example, *D1* consumers in Copenhagen are charged a price that is almost 3 times higher than the equivalent price in Sweden (32,18 Euros versus 10,77), and a similar price differential is present for *I2* consumers in Copenhagen (13,76 Euros) compared to both Sweden (4,31 Euros) and Finland (4,69 Euros). There are several other examples of net price imbalances, although not to such a scale as the examples cited.

Throughout the Italian markets, Milan, Turin and Genoa all have very similar prices (both net and gross), although there exist slight differences with Rome and Naples where prices for industrial consumers are somewhat higher.

As far as gross prices are concerned, there are significant differences between Madrid and Lisbon for all consumer types above *D2*, and Copenhagen continues to be much more expensive than both Sweden and Finland.

Comparing the Northern region countries with the Southern region countries once again yields very few insights. The series of average prices for the Northern countries is regressive both for gross and net prices, while the average net price for the Southern region is also regressive. However, the average gross prices over the Southern region countries is generally regressive, but includes a significant progressive element from *D2* to *D3* consumers. In the same way as for the average tax burden, this is due entirely to the effect of the Italian tax system for these consumers. When the average net prices in each of the two regions is considered for each consumer type, there is no generality as to which region is cheaper. The Northern region has a lower average net price for consumers in the classifications *D3*, *D3-b*, *D4*, *I1*, *I2*, and *I5*, while the Southern region is cheaper for consumer classifications *D1*, *D2*, *I3-1*, *I4-1* and *I4-2*, and the two regions have the same average price for the *I3-2* classification.

The final table in the appendix shows a direct comparison of the maximum and minimum prices across the entire sample set. For domestic consumers, only gross prices are shown, while for industrial consumers we show the net prices, since these are the relevant prices for each consumer type (that is, industrial consumers will discount taxes while domestic consumer will not). It is interesting to note that, for the case of gas, the set of maximum prices for each domestic consumer type is dominated by the

Copenhagen market (which has, uniformly, the most expensive prices for all consumer types that it serves), while the maximum net prices for industrial consumers are found in the Iberian peninsular for *I3-1* consumers and beyond. Hence, curiously, the most expensive area jumps from a Northern region country to Southern region countries for large consumers. However, there is no general trend as to whether the Northern regions are uniformly more or less expensive than the Southern regions, since several of the EEC minimum prices are also found in the North (Vienna, England, Luxembourg, Finland, Rotterdam and Dortmund), while Madrid is also represented in the EEC minimum price list. It is highly likely that a general trend would still not emerge if one were to take the average of, say, the three most expensive and the three cheapest markets in each of the two general regions. Perhaps the most notable feature of the table of EEC minimum and maximum gross prices for gas is the significant jump in the maximum price from *I2* to *I3-1* type consumers, which corresponds to where the Copenhagen market stops serving gas.

4.2.3. Implicit subsidies

While in the appendix we present the implicit subsidy for all consumer types with respect to *D2* consumers, the most important domestic consumer classification, here we shall only discuss the implicit subsidy for the most important industrial consumer type, that is, *I2*. We also concentrate our attention on the true price implicit subsidy that is present in gross prices. For almost all markets, the implicit subsidy that *I2* consumers enjoy with respect to *D2* consumers oscillates at values just over 0,5. However, as the above discussion comparing prices would indicate, there are several notable exceptions. In particular, the greatest single implicit subsidy in the sample is the 0,70 corresponding to the Madrid market, while the smallest value is the 0,13 implicit subsidy that *I2* consumers in Lisbon receive. It is also interesting that the maximum and minimum values appear in two markets that are, geographically, not so far apart.

It is also notable that, within the German system, in Munich the relevant implicit subsidy is 0,43, which is significantly lower than in the other markets (for example, in Dusseldorf the figure is 0,58). The German figures also stand out against the figure in

the neighbouring Venetian market, where the implicit subsidy is only 0,23, the second lowest in the entire sample. Finally, note that there is a certain difference between the implicit subsidy available in the English markets (around 0,5) and that available in Dublin (0,62).

4.3. Electricity

The prices of electricity in the EEC markets follow a similar trend as the gas prices. In almost all cases, both the gross and the net prices are regressive, that is, they decline as the consumption volume increases. The tax burdens are either progressive or constant (or some type of mixture between these two systems), although once again there are notable differences over the markets. Perhaps the most prevalent feature of the electricity tax burdens as they compare to those of gas, is the greater frequency of constant tax burdens, at least for significant groups of consumers, ordered sequentially according to consumption volume.

4.3.1. The tax burden

Although most European countries use a progressive tax burden for the gas markets, it is more common to see constant tax burdens in electricity markets. In particular, Brussels (22 per cent), all German markets where electricity is traded¹¹ (16 per cent), Madrid (22 per cent), Dublin (12,5 per cent), Athens (18 per cent), Luxembourg (6 per cent), and Lisbon (5 per cent) all use a constant tax burden over all consumers (domestic and industrial). Other countries have a constant tax burden for either domestic or industrial consumers only; Norway (industrial consumers 23 per cent), Sweden (industrial consumers 25 per cent), and the English markets (domestic consumers 5 per cent, industrial consumers 17,5 per cent). On the other hand, Denmark, Norway (for domestic consumers), Vienna, Finland, Sweden (domestic

¹¹ With the exception of the German Southern Region, where domestic consumers are charged a higher tax burden that ranges from about 22 por ciento (*Da* and *De* consumers) to about 27por ciento (*Dd* consumers).

consumers), and both Dutch markets (domestic consumers) all have progressive tax burdens. Finally, the French markets (both domestic and industrial consumers), and both Dutch markets (industrial consumers) use a regressive tax burden, albeit with several constant sections throughout in the French case.

The case of the two French electricity markets (Paris and Strasbourg) is interesting in that the tax burdens are of similar structure, but are not identical, even though they are both located within the same country. In particular, the tax burdens are exactly the same for consumer types of *Id* or greater, but for all other consumer types there is a lower tax burden in Strasbourg than in Paris. For all domestic consumers and the smallest industrial consumers, both markets function with a constant tax burden, 33,3 per cent in Paris and 24,5 per cent in Strasbourg. Then, for industrial consumers of types *Ib* and *Ic*, the tax burdens are just over 25 per cent in Paris and 22 per cent in Strasbourg.

As for the case of the gas markets, the Italian market appears to work with an entirely different tax policy to the rest of the European markets. However, whereas in the gas markets Italy stands out as having, generally, the highest tax burdens, in the case of the electricity market the Italian case stands out as it does not seem to follow any regular trend (it is not constant, progressive or regressive). In any case, with the exception of the prices charged to *D1* and *D2* consumers in Italy (who are charged very low prices for electricity), the gross price of electricity in Italy does follow a regular regressive trend, and so it is quite possible that the relevant tax burdens are fixed to achieve this feature. On average, the Italian tax burdens are high, but are not Europe's highest.

Perhaps the single most surprising feature of all the tax burden systems used in the European electricity markets is the situation in Denmark, where the *lowest* total tax burden is about 75 per cent (*Ia* consumers), and the highest total tax burden is almost 200 per cent. In comparison, for example, the tax burdens in Copenhagen in the gas markets go as high as only 39 per cent, and in the neighbouring countries of Sweden, Finland and Norway, the maximum tax burden is much lower (52 per cent, 39 per cent and 43 per cent respectively). The Danish tax burden results in generally relatively high gross prices, especially for domestic consumers.

Comparing the Northern group of countries with the Southern group, the most surprising feature regarding the tax burdens is that the averages are remarkably similar. Overall, the average tax burden in the Northern region is progressive for domestic consumers (ranging from about 20 per cent up to about 28 per cent), and almost constant for industrial consumers (between 21 and 22 per cent). On the other hand, the average tax burden percentage in the Southern countries is located in the mid to low 20 for all consumer types, except for *De* consumers (15 per cent).

4.3.2. Prices

As for gas, electricity throughout the EEC is generally priced regressively over each given general consumer classification (domestic and industrial), that is, the unit price falls as the quantity consumed increases. Furthermore, it is common that the regressive trend is maintained, approximately, over these two general classifications, in that, the series of industrial prices generally start of at a level equal to about same as *Dc* consumers and then follow a regressive trend. However, there are several instances of a sudden drop in price for *De* consumers that implies an impediment to the general trend in domestic prices. A price reduction for *De* consumers that significantly enhances the general regressive trend is a feature of the price systems in Brussels, all German markets, Luxembourg, both Dutch markets, Finland, Glasgow and Lisbon. In all other markets the price reduction for *De* consumers follows the trend of the rest of the prices much more closely. Given that in most of the countries in which the mentioned price trend interruption occurs there is a constant tax burden, the sudden price drop is due to a change in the net price at which electricity is supplied, rather than being an artificially created feature of the tax system.

Notable exceptions to the general rule noted above that the industrial consumer price series begin at a level that is comparable to the prices faced by *Dc* consumers, are the following. In the Frankfurt and Munich markets, the series of industrial prices begin at a level that is greater than the prices paid by all domestic consumers, and only drop to comparable levels beyond the *Ib* industrial type, in the Athens market the highest domestic price is lower than all industrial prices at levels greater than *Ic*, in Denmark

the highest industrial price is lower than all domestic prices, in Finland the industrial price series is almost an exact continuation of the domestic series, and in Vienna the first two industrial prices are both greater than the greatest domestic prices.

Turning now to the comparison of the EEC maximum and minimum prices for electricity for each consumer type (gross prices for domestic consumers, net prices for industrial consumers), we note that once again the maximum series are dominated by the German markets (Southern Region, Frankfurt, Dusseldorf and Erfurt), although Italy appears in the list of maximum prices for domestic consumers. As opposed to the situation in the gas market, Denmark only appears once in the maximum series of gross prices. On the other side of the table, the series of minimum gross prices for electricity is dominated by Scandinavian countries, above all Norway, which is uniformly the cheapest EEC country for all industrial consumer types except *Ic*, who are served more cheaply in Denmark. The situation of Italy is strange, since this country goes from charging the EEC minimum gross price for the first two domestic consumer types to charging the EEC maximum gross price for the second two domestic consumer types. As opposed to the case of the Italian gas markets, this sudden jump is not due to the introduction of an excessive tax burden.

In general terms, the German markets, Italy and Vienna are expensive, while Norway, Sweden, Finland and Athens are cheap. The Danish market is not as cheap as the other Scandinavian markets (which may establish certain arbitrage opportunities), but the gross price series for the Danish market is certainly one of the least regressive of all (i.e. the successive price drops as quantity consumed increases are small). One surprising feature of the table of EEC maximum and minimum gross electricity prices is the situation for *De* consumers, for which two (relatively) neighbouring countries appear as the most expensive (Denmark) and the least expensive (Finland). One wonders how this situation would be affected if Danish *De* consumers were given the opportunity to purchase in the Finnish market.

As far as a comparison of the Northern EEC countries to the Southern ones is concerned, it is notable that the average prices (both gross and net) for the two smallest domestic consumer types are significantly greater for the Northern countries. For example, the average gross price charged in the Northern countries to *Da* type

consumers is almost exactly double the equivalent average price in the Southern countries. Aside from this observation, the average prices in the two general regions are quite similar.

4.3.3. Implicit subsidies

While the implicit subsidies for all consumer types with respect to *Db* consumers are given in the tables in the appendix, once again here we shall only discuss the most relevant industrial consumers (*Ib*) and the gross price implicit subsidy. As opposed to the situation in the gas markets, where there is a certain degree of homogeneity over the sample, when one considers the implicit subsidy in electricity markets, there exists a very wide range of values. The greatest implicit subsidy is present in the Norwegian market, where the subsidy is 0,6 (that is, the *Ib* consumers pay a gross price that is only 32 per cent of the gross price charged to *Db* consumers in that same market). On the other hand, the smallest subsidy present is in the Italian market, where a figure of -1.29 appears. This (negative) number implies that the gross price that is charged to *Ib* consumers in the Italian market is more than double the price charged to *Db* consumers.

Negative implicit subsidies (a higher price charged to the industrial consumer type than to the domestic consumer type) are not so uncommon in the EEC electricity markets. They are present in Frankfurt, Munich, Erfurt, Leipzig (a very small negative subsidy here), Dublin, Italy, Athens and Vienna (i.e. 8 out of 29 sampled markets, or about 28 per cent of the sample). As far as single (or neighbouring) countries are concerned, the implicit subsidy in the German markets ranges from 0,1 in Hamburg (0,1), down to $-0,3$ in Frankfurt. Neighbouring Vienna has an implicit subsidy of $-0,3$. The Scandinavian countries all have positive implicit subsidies, ranging from 0,3 in Finland to 0,6 in Norway. The implicit subsidy in Madrid is 0,1, which compares well to the 0,2 that is given in Lisbon. In the British Isles (excepting Dublin), the Birmingham market stands out, with an implicit subsidy of only 0,1, whereas the other markets are all just over 0,2. In Dublin, as was noted above, there is a negative implicit subsidy ($-0,1$).

In general, it is fair to say that there is a great deal of variation for gross prices, net prices, tax burdens and implicit subsidies over the relevant markets for both gas and electricity. However, there does not appear to be any significant trends that set the four southern countries (Portugal, Spain, Italy and Greece) aside from the rest of the EEC countries (the Northern nations). Hence, it seems unlikely that any cohesion problems (understood in terms of general economic growth and development) for these four states in comparison with the others can be attributed to differences in gross or net prices of energy. However, in any case, it is difficult to establish a specific theoretical link between cohesion and the prices at which energy is made available.

Before going ahead and making suggestions as to how EEC tax burdens in energy markets can be best organised with an objective of enhancing cohesion, defined in economic growth and development terms, one must first fully evaluate the true reason for the existence of these taxes. For example, the taxes may be simply mechanisms under which the relevant governments accumulate funds, or they may be designed as some sort of incentive device, or indeed they may simply be a means by which governments can control and artificially manage the gross prices at which energy is traded. In principle, naturally, different reasons for tax existence will imply different effects if these tax systems are altered with a view to improving cohesion among EEC states in general.

While it is very difficult to see exactly how different price schedules for energy (both net and gross prices) over different markets affects cohesion on an aggregate basis, certainly it is true that, as a general rule, establishing a connection between markets (a feasible energy transmission mechanism) should never be harmful. This is due entirely to the fact that such a mechanism simply opens new options for all concerned, or in other words, expands opportunities. It is likely, however, that such inter-market connections should contribute to an equating of prices, and given exogenously determined net prices, to a limitation on the degree to which governments can artificially manage gross prices via tax systems. Naturally, this would also limit the existence of deadweight losses due to taxes.