BUTTERWORTH HEINEMANN

Energy Policy, Vol. 23, No. 6, pp. 509–518, 1995

0301-4215/95 $10.00 + 0.00

# Elimination of West European coal subsidies

## Implications for coal production and coal imports

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**Expanding volumes of international coal supply can be secured in West European harbours at US$50–60 (1993) per tonne. In 1993, Western Europe produced 160 million tonnes of coal, but the cost was far above the import price. High subsidies are needed to keep the production viable. Removal of these subsidies will force a large part of the West European coal industry to close down. A cut of the current output by 91 million tonnes in the medium run, rising to 108 million in the longer run, can be anticipated in consequence of subsidy elimination. Even though coal usage in Western Europe could conceivably decline, as existing obligations to purchase domestic coal are removed, most of the cut production is likely to be replaced by foreign coal. A very large increase in West European coal imports can therefore be anticipated after a discontinuation of the region's coal protection policies.**
*Keywords*: West European coal; Subsidies; Coal production and trade

The purpose of this paper is to try to answer two related questions. How much of Western Europe's hard coal production will remain economically viable in the short and long run, once the huge subsidies since long paid to these industries (Radetzki, 1994a) have been eliminated? And how will the lost energy output be replaced? Only hard coal is under consideration. Brown coal and lignite are disregarded in the following analysis, primarily because these products do not benefit from substantial public support.

The issues to be dealt with have been addressed before (ABARE, 1990; US Department of Energy, 1989). A new study seems warranted, first, because a significant time has lapsed and new data have become available since the quoted works were completed, and second, because the likelihood for West European coal subsidy elimination has greatly increased during the early 1990s.

The approach to resolving the issues is, in principle, relatively straightforward. In practice, it may prove to be quite messy, and the results and conclusions derived from the analyses should be seen as no more than rough approximations of what may in fact emerge.

The starting assumption is that existing direct and indirect subsidies are fast eliminated, and that the industries have to fend for themselves by the late 1990s. This, presumably, will lead to a speedy closure of production units whose variable costs exceed the import price, and to a more gradual decline of capacity with lower variable costs which is unable to obtain full coverage of its fixed costs, including interest and depreciation.

To quantify the impact on production from subsidy elimination, it is necessary to establish the future price of imported coal. Since imported and domestic coals are close substitutes, the import price will provide the ceiling at which domestic coal can be sold, for at any higher price, consumers would switch to imports. It is also necessary to establish the future marginal cost curve for West European coal, depicting the average variable cost levels by mine in rising order, for each country.

The intersection between this curve and the price line will indicate the volume produced after the short-run adjustment to a regime without subsidies. Finally, it is necessary to establish the curve of expected average total cost levels by mine in rising order, for the intersection between this curve and the price line will indicate the production volumes that will be viable in the longer run.

In a further refinement of the analysis, one would have to consider the cost cuts implemented by the industries in consequence of the augmented pressures for survival, when the protecting subsidy shield is removed.

The answer to the second question requires a more detailed look at the modes under which the subsidized domestic coal supplies are disposed of. If coal consumers chose the subsidized domestic coal voluntarily, and obtained it at international prices, we could expect that they would replace the reduced domestic supply, after subsidy removal, entirely by coal imports. If, on the other hand, coal subsidies were a form of coercion on consumers to use domestic coal, and/or to pay more than the import price, the one-to-one substitution of coal imports for the lost domestic output could no longer be taken for granted. Further investigations are needed in such cases to clarify the extent to which the reduction in domestic output will be replaced by imports of coal, or by a switch to other fuels.

In what follows, all values are expressed in US dollars. Conversions from national currencies or ECU have been done at the current exchange rate in the year to which the original figures apply. Constant 1993 US dollars have been obtained by the use of the World Bank's MUV index of international dollar prices (World Bank, 1994).

Coals come with different energy content. The following conversions (IEA, 1994a) have been used between tonnes and tonnes of coal equivalent (tce). One tonne of:

| | |
|---|---|
| Imports to Western Europe | = 0.89–0.96 tce |
| French coal | = 0.92 tce |
| German coal | = 0.93 tce |
| Spanish coal | = 0.72 tce |
| UK coal | = 0.82 tce |
| West European coal | = 0.86 tce |

The paper proceeds in the order outlined above. The next section briefly assesses the level of current and future coal import prices into Western Europe. The third section summarizes the West European coal production statistics, and presents available cost evidence. The likely output cuts consequent upon subsidy elimination are then quantified, and the ensuing plausible coal import increases are assessed. The concluding section draws the main threads together and summarizes the findings of the preceding analyses.

**Table 1 Representative costs for coal exports to Western Europe in 1993 (US$/tonne)**

| | Variable cost fob | Total cost fob | Ocean transport | Total cost cif |
|---|---|---|---|---|
| Steam coal from | | | | |
| Australia | 23–34 | 31–42 | 10 | 41–52 |
| Colombia | 19 | 39 | 6 | 45 |
| Indonesia | 19 | 27 | 7 | 33 |
| South Africa | 23 | 27 | 7 | 34 |
| USA | 25–40 | 27–41 | 8 | 35–49 |
| Coking coal from | | | | |
| Australia | 30–34 | 36–45 | 10 | 46–55 |
| South Africa | 26 | 35 | 7 | 42 |
| USA | 45–49 | 47–51 | 8 | 55–59 |

*Source*: IEA Coal Research, London, reported in IEA, *Coal Information 1993*, OECD, Paris

## The cost of international coal supply

Our interest in the future price of imported coal in Western Europe concerns the longer term. We abstract from shorter-term fluctuations caused by temporary disturbances in the international market. The prices we seek to establish relate to deliveries to the importing country's harbour of coal qualities typical in international trade, normally ranging between 6200 and 6700 kcal/kg, or 0.89–0.96 tce per tonne of coal (IEA, 1994a). Our investigation proceeds along three lines. First, we present a set of cost data, and conjecture that in a competitive market like the international coal market, prices will normally average out around a level at which the full cost of marginal supply is covered. Second, we present a series of historical prices. And third, we summarize recent authoritative forecasts of future coal price trends.

Table 1 presents figures of representative costs of existing mines for some of the major coal suppliers to Europe. The total fob costs have been calculated to include a 15% return on the book value of the mining companies' capital. This causes a bias against new mines (eg Colombia) where little of the investment has been written off. A gentle decline in both fob and total cif costs for most of the countries can be noted when the figures in the table are compared with those for 1988 (Radetzki, 1991). In real terms, the cost reduction over the five-year period works out at some 15% or more, representing a productivity induced cost decline of about 3% per year.

Figure 1 provides an historical overview of the price levels at which coal has been imported into the EU over the past 14 years. In the very early 1980s, international coal prices were inflated in consequence of the turmoil after the second oil shock. Between 1984 and 1993, however, the average imported steam coal prices in the EU varied within a range of US$40–50 per tonne, with coking coal prices about US$10 higher, all in nominal dollars. In constant money, there would be a significant

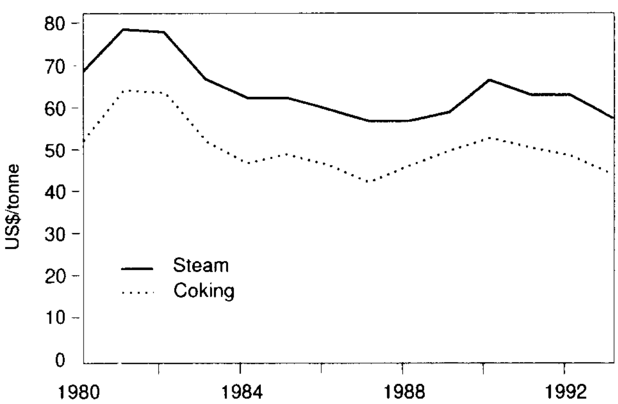


**Figure 1** West European coal import prices cif

*Source*: IEA, *Coal Information 1987*, OECD, Paris, 1987; IEA, *Coal Information 1993*, OECD, Paris, 1994.

downward slope in the price lines, given that the value of the US currency declined by about a third between the two years.

The current levels of costs and prices suggest supply costs of coal delivered in Western Europe in the early 1990s at no higher than US$50–60 per tonne. The history of costs and prices presented above suggests technological progress at work, gradually reducing these supply costs over time.

Recent studies by the International Energy Agency (1994b) and the World Bank (1994), present forecasts of coal prices in international trade. The IEA conjectures that the price of imported coal cif Western Europe, expressed in constant 1993 money will gradually rise from

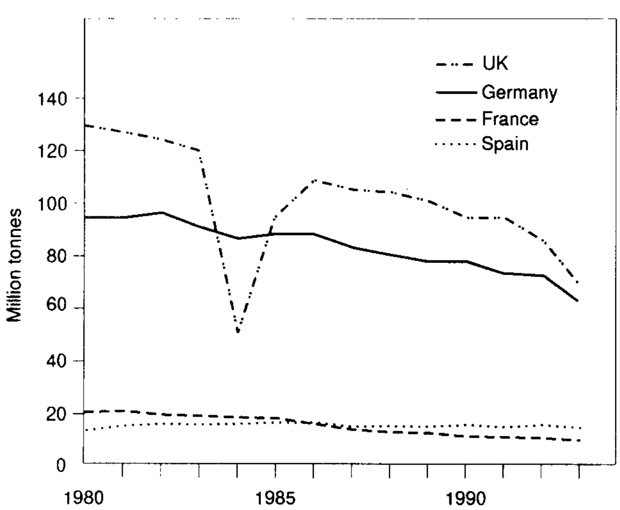


**Figure 2** West European hard coal production

*Source*: IEA, *Coal Information 1993*, OECD, Paris, 1994.

US$50 per tonne in 1995 to US$57 in 2005. The World Bank figures pertain to fob prices in Australia and the USA. When the transport costs to Europe, indicated in Table 1 are added, the cif price, again in constant 1993 money, works out at US$45 in 1995, rising to US$50 in 2005, ie significantly less than the IEA forecast. The long-run price elasticity of international coal supply is very high. Hence, the indicated forecasts would apply over a wide range of demand levels. Despite the differences, the forecasts imply that our above finding about coal supply costs in Western Europe in the early 1990s at no higher than US$50–60 per tonne, is likely to hold over the foreseeable future. This price band could in fact be on the high side, since the forecasters seem to ignore the historical decline in costs and prices caused by continuous productivity gains.

This finding ends the present section. We conclude that a coal price of (constant 1993) US$50–60 per tonne (US$54–65 per tce) in West European harbours (possibly less, given the ongoing productivity gains in worldwide coal production) constitutes a cap to what producers in Western Europe can charge for their coal. In the absence of subsidies, such producers will be able to continue in business only if they can compete with the imported supply.

## The cost of West European coal supply

The analysis of this section is simplified by the heavy national concentration of West European hard coal production. Since the early 1990s, only four countries have been producing coal on any significant scale. Figure 2 shows the production developments in these four countries between 1980 and 1993. In the latter year, total output amounted to 160 million tonnes, of which 43% in the UK, 40% in Germany, 8.8% in Spain and 5.6% in France. In the same year, the region imported 134 million tonnes, of which 56 million were destined to the four coal producing countries.

Published data on costs in West European coal mining are highly inadequate for a full fledged economic analysis of the industry's viability after subsidies have been eliminated. Nevertheless we present whatever data are available, in preparation for the inferences in the next section on the volumes of production likely to survive in an unprotected environment. The information on costs is more ample for Germany and the UK, so this permits a somewhat more detailed treatment of the dominant share of West European output, generated in these two countries.

Table 2 juxtaposes the total average costs of coal production in each of the four countries against the actual import price ranges, all expressed in current dollars per tonne of coal equivalent. Throughout the period covered,

**Table 2 Total average costs and import prices for coal in Western Europe (US$/tce)**

| | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 |
|---|---|---|---|---|---|---|---|
| France | 111 | 112 | 107 | 122 | 113 | 129 | |
| Germany | 151 | 157 | 144 | 168 | 171 | 178 | |
| Spain | 139 | 151 | 157 | 187 | 186 | 194 | |
| UK | 107 | 103 | 93 | 94 | 92 | 93 | |
| Import price range | 45–60 | 49–61 | 53–62 | 56–70 | 54–66 | 52–66 | 47–61 |

*Source*: EC, *Commission Report on the Application of the Community Rules for State Aid to the Coal Industry*, Brussels, annual; IEA, *Coal Information 1993*, OECD, Paris

the costs in all four countries have remained far above the import price. The discrepancy between costs and import prices explains the very large subsidy requirements to assure the coal industry's survival. This discrepancy has risen over time, for while the nominal prices have remained stable (a falling trend in real terms), the costs have risen substantially, at least in France, Germany and Spain. The UK stands out by having the lowest cost level among the four countries, and in recording a clear cost decline over the period.

The total average cost by country does not provide much guidance on the production capacity that could survive without subsidies, because that average says nothing about the variation of costs as one moves from the lowest cost to the highest cost installations. Rudimentary sets of data from which cost curves can be constructed exist for Germany and the UK. These are presented below.

For Germany, our data have been extracted from a comprehensive study on German hard coal, commissioned by the Ministry of Economic Affairs, and executed by a group of researchers under the chairmanship of Paul Mikat (Kohle-Kommission, 1990). This study provides the total average costs in 1988, by mine and tonnage, through the entire range of 74 million tce produced in that year. It also provides a forecast of these costs in 1995 for the 64 million tce anticipated to be produced in that year. These cost series, expressed in 1993 US US$, have been reproduced in Figures 3 and 4, along with the actual (1988) and forecast import prices for steam and coking coal into Western Europe.

Both figures reveal the hopelessly high cost of German coal production. Even the lowest cost production units recorded total average costs in 1988 about twice as high as the import price of the more expensive coking coal. This gap was seen to remain into the mid-1990s. Barring dramatic cost reductions, there appears to be little commercial viability in the long run for German coal. No such reductions seem to be in the offing. The average cost for the entire output in 1995 has been assessed by the Kohle-Kommission at 6% below the corresponding cost in 1988, when calculated in constant US dollars. Actual cost levels have risen by almost 2% between 1988 and 1992, despite a larger decline in the volume of output than anticipated by the Commission.

We would need to know the variable cost levels in order to determine the short- to medium-term cuts in production in the absence of subsidies. Perhaps because

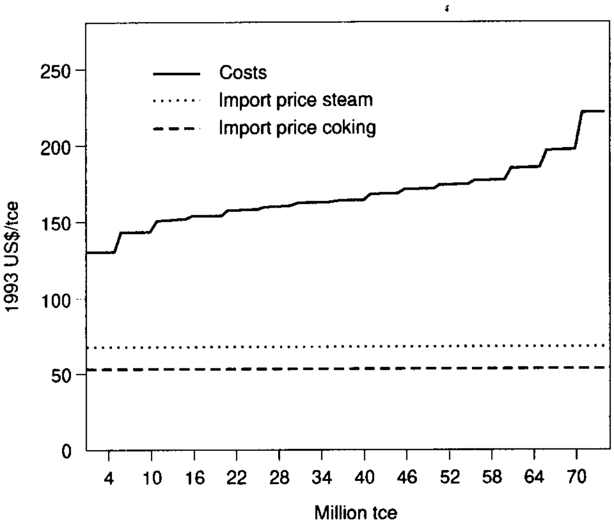


**Figure 3** German hard coal: total average cost of marginal supply, and import prices in 1988

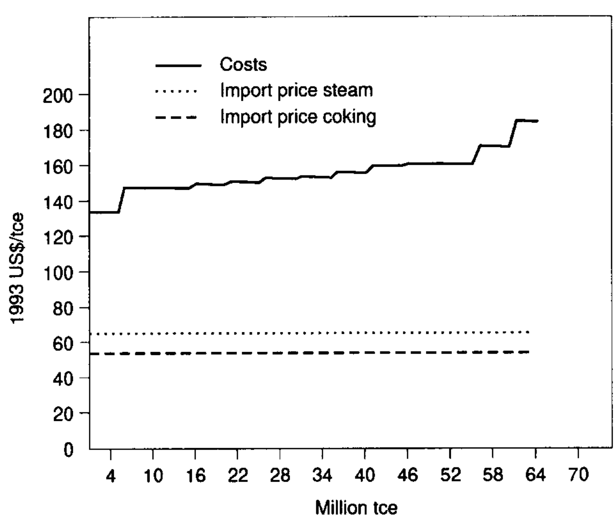


**Figure 4** German hard coal forecasts: total average cost of marginal supply, and import prices in 1985

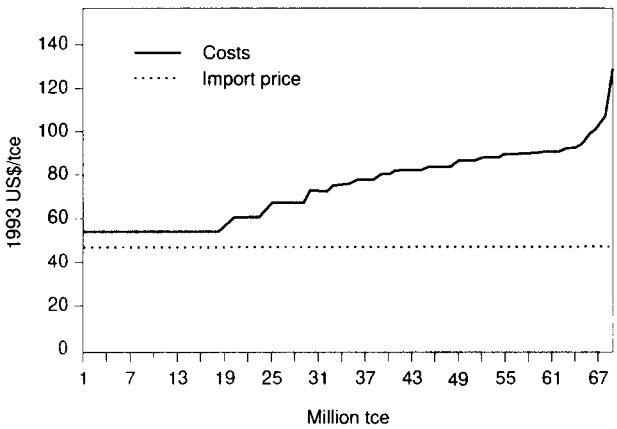


**Figure 5** UK hard coal: marginal cost of supply, and import prices in 1992

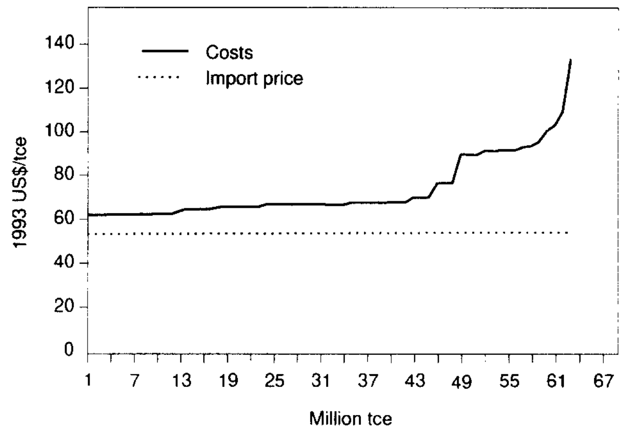


**Figure 6** UK hard coal forecasts: Marginal cost of supply and import prices in 1988

the distinction between fixed and variable costs in mining is blurred (Radetzki, 1989), the Kohle-Kommission does not subdivide its data in this way. But it does provide the cost of labour across production volumes. In 1988 the average labour cost (1993 US dollars) for the first 10 million tce of production was US$49/tce. This figure rose to US$56 for the following 10 million tce tranche. Thus, already at an output of 20 million tce, the labour cost alone was more than the import price of steam coal. The overall average variable costs should be substantially higher than the labour costs. This suggests that however they are measured, the costs which are avoidable in the medium-term, would exceed the import price at a very low level of output.

For the UK, the cost data we have found originate from the British Coal Corporation (BCC).[1] One set relates to actual 1992 costs, another is a forecast for 1998, after further restructuring to cut costs. Presumably, the numbers do not comprise fixed costs[2] and so would appear to reflect the shorter-term supply curve. The data are incomplete, in that they relate only to underground mining. In 1992 a total of 15 million tce of surface coal was produced (BCC, 1993). For 1998, a volume of around 9 million tce is forecast. Surface coal is generally significantly cheaper to produce than underground coal (Trade and Industry Commitee, 1993), but no cost numbers have been found. In constructing Figures 5 and 6, we have added 15 and 9 million tce respectively, at the lower end of the cost curve, assuming that these tonnages can be had at the same cost as the coal from the lowest cost underground mines. As in the German case, we show the actual European import price for 1992, and our forecast import price for 1998 in the figures. But since hardly any coking coal is produced in the UK, only the steam coal import prices are shown.

As in the German case, the entire cost curve, both current and forecast, lies above the import price. For relatively large segments of supply, however, the discrepancy between costs and prices is much less striking than in Germany, even if we were to assume a US$20 addition through the entire schedule, to account for fixed costs (see note 2). This is particularly true for the 1998 forecast. Furthermore, it cannot be precluded that opencast mining has lower costs than shown in the figures, and that the variable as well as total average costs of that supply might be less than the import price.

After 1992, the UK picture has been blurred by the government's energetic efforts to streamline the industry and to privatize it. Coal production fell from 85 million tonnes in 1992 to 68 million in 1993 (IEA, 1994a). The January–April output in 1994 was 35% less than in the corresponding period of 1993 (*International Coal Report*, 19 August 1994). The number of operating pits fell from 51 at the end of 1993 to 19 by March 1994 (BCC, 1994). The thrust towards privatization has transformed the cost data formerly in the public domain, into commerical assets with a considerable price tag.

No data have been found for the construction of cost curves for coal from France and Spain, which, as noted, together accounted for 14% of Western Europe's 1993 hard coal output. However, the total average cost data displayed in Table 2 permit at least some inferences about the viability of their coal industries. Spain stands out in recording both the fastest rising and the highest

[1]Obtained from David Newbery, Department of Applied Economics, University of Cambridge. The material, which originates from BCC, has been transformed for the present purposes from original units to tce and US dollars (1993).

[2]The average cost for the entire 1992 output depicted in Figure 5 works out at US$73/tce. The European Commission (EC annual) assesses the average cost in the UK in that year at US$93/tce. We take it that the difference reflects the fixed cost of output.

costs in Western Europe. France has lower, and more stable costs. Yet, the French average 1992 cost level is more than twice the forecast future import price. The issue is to determine the level of the low end of the cost curves in the two countries, for this is where survival without subsidies might occur.

In the absence of data, we take it that the the cost curves in France and Spain have the same shape as the ones in Germany and the UK. More precisely, we assume that the percentage difference between the average cost for total output and the average cost of the cheapest production decile is the same as in Germany and the UK. In the latter countries, this difference is 18% and 25% respectively. Employing the more optimistic UK figure, yields a low cost decile of US$97 in France and US$146 in Spain. These are average total costs. Average variable costs would obviously be lower. It is conceivable that a small proportion of the French output has average variable costs at levels approaching the import price. But it is hard to believe that the low end variable costs in Spain could be anywhere near the import price.

## How much will output decline and how much will imports rise in consequence of subsidy elimination?

In the world of pure neoclassical economics, where all producers always minimize their costs, and where geographical space has no role to play, the answer to this question is reasonably straightforward. If the numbers for the UK are right, the whole output will cease, once subsidies are eliminated. If our supposition is right that the variable costs of the cheapest producer in Germany exceed the import price, the entire German production will go too. Though the corresponding numbers for France and Spain do not exist, it is a reasonable conjecture that their supply costs too, start above the import price. In conclusion, then, nothing much of Western Europe's coal output will remain, simply because the variable cost of all output appears to be above the import price.

In the following discussion we qualify this dramatic conclusion, by considering (1) the incertitude of the production cost figures, especially the surface costs in the UK; (2) the geographical cost advantage of domestic coal; and (3) the downward cost pressure likely to arise among producers struggling for survival after the protective shield provided by subsidies has been removed.

The evidence on costs presented in the preceding section is highly uncertain, and the conclusion about the uncompetitiveness of West European coal could be too pessimistic. The incertitude is greatest with regard to the opencast coal in the UK. The average variable cost of this supply, and even the total average cost, could conceivably be lower than the import price (private communication from David Newbery). But given the short average life of the opencast mines, and the increasing difficulties in obtaining licences to start up new mines, the sustainability of a large and viable opencast capacity is in doubt. Small amounts of French and possibly German coal could also have average variable costs below the import price, but the data are not there to quantify these volumes.

Coal is expensive to transport. Part of consumption in the coal producing countries occurs close to the mines. Given the low cost of transporting from the mine to the nearby final consumers, the competitive advantage of domestic coal over imported coal should be strengthened in such cases. To what extent will such strengthening be sufficient to make expensive domestic coal viable? It is not feasible within the confines of this paper to undertake the detailed investigation needed to answer this question fully. Our proposed approach provides a method for thinking about the issue, and some very rough conclusions.

The cited costs of domestic coal are ex mine, the cif price of imports is on board the ship in the importing country's harbour. In both cases, the coal ordinarily needs to be loaded onto rail wagons or barges, for onward transport to the final consumer. We simplify by assuming that such loading carries the same cost in both cases. Hence, we can abstract from this cost in comparing the domestic competitiveness of the two coals.

All coal consumption in the UK, and virtually all in France, Germany and Spain, takes place within a distance of 500 km or less, by rail or barge, from coal import harbours. Hence, the maximum transport cost disadvantage of imported coal will equal the cost of inland transport across 500 km. This maximum will occur in cases where coal consumption occurs at a 500 km distance from the import harbour, but in the immediate proximity of a domestic coal mine. Such consumption must be quite small.

Rail transport costs vary widely, and are incompletely documented. IEA (1993) provides some data, mainly for the coal exporting countries. For distances of less than 1000 km, the charges per tonne and 100 km work out at between US$3.15 and 4.40 in Australia, US$1.30 and 1.60 in Canada and South Africa, and US$1.30 and 4.00 in the USA. The cost of transporting coal from Poland's mining district to the harbour (500 km) has been estimated at US$2 per 100 km (Radetzki, 1994a). Barge transport is considerably cheaper in all cases. In continuing to construct an extreme case, assume that the movement of imported coal through Western Europe is at US$3–4 per tonne and 100 km, the higher end of the quoted figures. The 500 km transport cost would then add up to US$15–20 per tonne for imported coal deliveries, and

**Table 3 Coal production in four West European countries**

| | Actual 1993 | | After subsidy elimination | | | |
|---|---|---|---|---|---|---|
| | | | Medium run | | Longer run | |
| | tonnes | tce | tonnes | tce | tonnes | tce |
| France | 9 | 8 | 3 | 3 | 2 | 2 |
| Germany | 63 | 59 | 16 | 15 | 9 | 8 |
| Spain | 14 | 10 | 0 | 0 | 0 | 0 |
| UK | 68 | 56 | 44 | 36 | 37 | 30 |
| Four countries | 155 | 133 | 64 | 54 | 47 | 40 |
| Output loss due to subsidy elimination | | | 91 | 79 | 108 | 93 |

about 10% more per tce. In a less extreme case, involving a more significant volume of coal, the cost advantage of domestic output could be derived from a transport differential of 250 km, adding about US$10/tce to the cost of coal imports. Given the larger land mass of France, Germany and Spain, the transport advantage of domestic coal should have a somewhat greater significance in these countries than in the UK.

An even greater uncertainty surrounds the prospects for reducing costs, once the subsidies have been removed. The availability of subsidies has undoubtedly diminished the pressure on management and labour to minimize costs. Behavioural studies of the firm strongly suggest that the survival threat which will arise when the regime of subsidies is replaced by an unprotected commercial environment, could have a very substantial impact on costs. An *ex ante* quantification of this impact is clearly not doable. We simply do not know what minimum costs could be achieved by a heavily slimmed European coal industry.

The discourse of the present section does not permit any hard and fast quantitative conclusions about the West European output decline after subsidies have been eliminated. The cost data yield a very sombre picture about the viability of hard coal in Western Europe, even when existing incertitudes are taken into account. The inland transport cost argument provides some, but not a great deal of encouragement to domestic coal. And the pressure to reduce costs could yield impressive results, but there is no way to tell how much of the industry would become competitive in consequence.

The figures contained in Table 3 are no more than qualified guesses, and we assert that it is not possible to formulate anything else than conjectures about what will happen after subsidy elimination.

The table shows the actual 1993 production figures as well as the anticipated output levels after subsidies have been eliminated. The latter attempt to isolate the impact of subsidy removal. Other plausible contemporaneous changes are disregarded. Starting from what we know about actual costs, the numbers are meant to show the volumes that can be produced at delivered costs below delivered import prices, taking into account the possible transport cost advantage of domestic coal, and the downward adjustment of costs in the post-subsidy climate. The medium-run numbers indicate the volumes with average variable costs below price. Part of this capacity will become uneconomical and will be closed down when the need for substantial reinvestment arises. The lower, longer-run numbers exhibit the volumes of output with average total costs below price.

The UK is, without comparison the lowest cost producer in Western Europe, and we posit that it will dominate the region's output after subsidies have been removed. Judging from its past cost-cutting performance, the pressure on costs must have been high, and we speculate that the ultimate elimination of subsidies will, by itself, lead to somewhat limited further cost reductions. We see the sharp production decline in early 1994 to only 44 million tonnes at annual rates, as a short-term aberration, eg to reduce existing coal stocks. We believe that roughly this volume of output can be delivered competitively in the medium term, even after the main subsidy component, the long term contract between BCC and the main power generators in the UK, assuring prices above those for coal imports, has been terminated. As needs for substantial reinvestments arise, the viable capacity is hypothesized to shrink to 37 million tonnes.

The average total coal costs in Germany are almost twice as high as in the UK, but since costs have been rising continuously, the potential for cutting should be considerably greater than in the UK. In addition, the transport cost advantage of domestic output ought to be somewhat more important in Germany. Nevertheless, we posit that the output cuts will be proportionately far greater than in the UK, from 63 million tonnes in 1993, to 15 million in the medium term, and to only 9 million in the longer term.

In the case of France, we hypothesize production declines which are proportionately somewhat smaller than those in Germany, given that French average total costs are significantly lower. Finally, for Spain, whose average total costs are by far the highest, we assume that none of the coal capacity will be able to survive subsidy elimination.

In conclusion, then, we conjecture that subsidy elimination will reduce the 1993 output in the four countries (155 million tonnes) by 60% in the medium term, and by almost 70% in the longer term. The volume will decline by 91 and 108 million tonnes respectively.

The above conclusions are compared in Table 4 with the results of two other studies on the subject (ABARE, 1990; US Department of Energy, 1989). Our numbers of the surviving output are by far the lowest. The main reason for our greater pessimism about West European coal is that we have had several additional years of

**Table 4 Projected coal output in Western Europe after subsidy elimination: a comparison of the results of three studies (million tonnes)**

| | Actual | Post-subsidy | | | |
|---|---|---|---|---|---|
| | | Radetzki | | US DOE | ABARE |
| | 1993 | Medium run | Longer run | 2000 | 2000 |
| France | 9 | 3 | 2 | 0 | 2 |
| Germany | 63 | 16 | 9 | 13 | 15 |
| Spain | 14 | 0 | 0 | 14 | 5 |
| UK | 68 | 44 | 37 | 89 | 58 |
| Total | 155 | 64 | 47 | 116 | 80 |

observation, during which imports became cheaper, West European output declined, while costs and subsidy needs continued to rise (the UK is an exception in terms of cost developments). This pessimism is corroborated in a more recent study (IEA Coal Research, 1993), which, though assuming only partial dismantling of coal subsidies in Western Europe until 2000, predicts a production decline to only 109 million tonnes in that year, significantly less than the US Department of Energy post-subsidy projection. A further possible reason for the difference in results is that ABARE's and the US DOE's analyses appear to follow from hypothetical cost levels, while ours are based on a highly discouraging evidence of factual cost data. It must be repeated that our results, as well as those of the other studies, are conjectures, providing considerable scope for personal value judgements.

The ensuing question that requires discussion is how the production losses will be replaced. This will provide an insight into the evolution of coal imports. We simplify by assuming that the loss of coal production due to subsidy elimination must be compensated in its entirety, in energy terms. Even with this simplification, coal production could either be replaced one by one by coal imports, or it could involve interfuel substitution. We also simplify by assuming that import harbours do not impose any binding limitation on coal imports. Only the countries which produce coal need to be considered. We first deal solely with the impact of subsidy elimination, *ceteris paribus*. We then consider some of the other changes, eg declining coal consumption due to technological change, or to environmental concerns, which might simultaneously occur. It should be added, at the outset, that our exercises with this issue fail in reaching a clear cut quantitative conclusion.

The structure of subsidies and the arrangements under which domestic coal is provided to the ultimate users, must be scutinized, if we want to understand how coal imports will fare after the support to domestic coal has been removed. More precisely, we need to know what the subsidy system does to the prices that consumers have to pay for domestic (and imported) coal. If the coal users are forced to finance the subsidies by paying a price above the import price, then, all else alike, the removal of subsidization should reduce the consumer price and result in a higher coal demand. Imports will then increase by more than the reduction of output, as the competitiveness of coal *vis-à-vis* other fuels improves. We also need to know if the supply arrangements in the regime of subsidies involve any binding coercion to use coal rather than alternative fuels. If such coercion is present, then, all else alike, there may be substitution in favour of other fuels, as subsidies and the accompanying coercion are removed.

We begin by considering the relatively simple case of coking coal. It is simple, first, because there are no short-term substitute fuels for coking coal, second, because only two countries produce coking coal on a significant scale, and third, because the subsidy burden appears to be borne by others than the coking coal consumers. France and Germany are the only countries where significant coking coal consumption needs were satisfied by domestic output (IEA, 1994a). In France in 1992, consumption of coking coal was 8.8 million tonnes, of which 1.4 million was domestic and the rest imported. In Germany in the same year 19 million tonnes of coking coal was consumed, virtually all of it satisfied by domestic production which amounted to 39 million tonnes. Since exports were small, a substantial volume of the coking coal produced was used as steam coal. In neither of these countries did the coking coal prices paid by the steel industry deviate by any substantial amount from the import price (IEA, 1994c). For this reason, but also because coking coal has no ready substitutes, any output decline in France will have to be replaced, one by one, by imports. The same will be true for Germany, once its coking coal output declines below the domestic consumption needs.

The relationship between subsidy elimination and steam coal consumption is more complex. We first consider the positive consumption impact that ought to follow from lower prices. We then assess how the relaxation of existing domestic coal purchase obligations might restrain coal usage.

Steam coal demand is dominated by the electrical power industry, and we simplify by consolidating the manufacturing, commercial and residential needs for steam coal into the electrical power demand category. We adopt the finding of a recent study of interfuel substitutabilities in the West European power and heat sector (Ball and Loncar, 1990), suggesting cross-price elasticities of coal with respect to gas at 0.2 in the short to medium run, rising to 0.3 in the longer run, and at close to zero with respect to oil. We focus attention on Germany and the UK.

In 1992, steam coal usage in Germany was 61 million tonnes, of which 14 million were imported. The delivered cost at power plants, constituting a weighted average of the expensive domestic, and cheaper imported coal was in excess of US$167 per tce (IEA, 1994a). Imported steam coal cost US$53 (cif), or US$73 delivered at the customer's gate, if the average cost of loading and transporting the imported coal are taken at US$20 per tce. The cross price elasticities suggest that the average price decline of 56% (from US$167 to US$73) would raise demand by 11% or 7 million tonnes in the short to medium run, and by 18% or 11 million tonnes in the longer run.

In the UK in the same year, steam coal consumption was 90 million tonnes, of which 12 million were imports. The price of domestic supply, according to the contract between BCC and the power generators, in force at the time, was about US$95/tce (*Coal News*, April 1993, p 1), but it is unclear to which geographical point this price applies. Assuming that this price was applied at the power producer's gate, and that the delivered import price was as in Germany, the price difference between the two sources of coal works out at 23%. Steam coal demand would rise by the order of magnitude of 5% (4–5 million tonnes), both in the medium and longer run, if prices fall accordingly.

The steam coal consumption increases posited above must be reconsidered in the light of the simultaneous removal of obligations to purchase domestic coal, following from subsidy elimination. At first sight, the arrangements in force in 1992, obliging coal consumers in Germany and the UK to purchase a very large part of their needs from domestic suppliers, do not appear to constitute a binding coercion on coal use, given that substantial coal imports supplemented the domestic supplies in both countries in that year. A closer scrutiny reveals that the purchase obligations could in fact have raised overall consumption levels, and that therefore consumption would decline as such obligations were removed. In both countries, foreign coal is employed in power stations close to the importing ports, where its competitiveness is greatest. Domestic coal, in contrast, is predominantly used in inland locations, and it is by no means clear that even the cheaper, imported, coal could compete with gas or fuel oil in such places. It follows that consumption could fall, conceivably even by more than the demand increases due to declining prices, as subsidies and the accompanying purchase obligations are discontinued, but we have no rod by which to quantify this effect, and so to assess the net impact on imports.

The assessment of West European import needs is further blurred by the fast evolution of coal policies, especially in the UK. We used the 1992 conditions in that country to determine how demand might increase as imports were freed and prices reduced. These conditions have subsequently been substantially changed. Since 1993, coal subsidies in the UK are primarily embedded in a new five-year coal delivery contract between the BCC and the electrical utilities. This contract stipulates that the price of domestic coal is to decline gradually until 1997, to reach near parity with imported coal in the latter year. With the declining level of coal support implied by the contract structure, complete removal of remaining subsidies would have a lesser impact on price and demand, the later it occurs. Taking 1994 as the benchmark year, the change in demanded coal volume resulting from subsidy elimination would be so small that it could be disregarded in an overall West European context.

Even greater problems arise when the *ceteris paribus* assumption is removed, and other developments occurring simultaneously with a gradual subsidy elimination are taken into account. For instance, the improving competitiveness of natural gas, caused by both technical and commercial developments (Radetzki, 1994b), or a widespread introduction of $CO_2$ taxes, could lead to a substantial reduction of total West European coal usage.

Even if these possibilities are real, they would clearly be overwhelmed by the huge coal production declines posited above. Hence, it is evident that West European subsidy elimination will lead to a very large increase in coal import needs, raising the 1993 actual of 134 million tonnes by 50% or more, and to a substantial expansion of the globally traded coal volume (385 million tonnes in 1993).

## A summary of findings

International coal supply can be secured in Western Europe (cif) at costs no higher than (constant 1993) US$50–60 per tonne (US$54–65 per tce). Given the very high price elasticity of international coal supply in the longer run, these prices are virtually independent of the volume of West European import demand.

In 1993 Western Europe produced 160 million tonnes of coal, and imported 134 million tonnes. The UK and Germany dominated total production, with smaller contributions by Spain and France. The cost of West European domestic supply is substantially above the import price. Hence, very high subsidy levels are needed to keep the coal industry operative. Especially high and rising costs have been recorded by Spain and Germany. For example, the average total cost of German coal is more than three times the import price. The UK records by far the lowest, and declining cost levels over time.

Cost curves showing the average total and variable cost at the margin for different levels of output would be needed to determine how much of the industry will survive competition from imports after subsidies have been eliminated. Cost curves of this type for Germany and the UK suggest that the variable cost of supply is higher than the import price at all levels of output. Data are not available to construct corresponding cost curves for the Spanish and French supply. In determining viability in an environment without subsidies, one must also take into account the freight cost advantage of domestic over import coal, and the strong downward cost pressure likely to arise when survival is threatened.

Our assessments, based on simplifying assumptions and shaky data, suggest, *ceteris paribus*, that subsidy removal will lead to a reduction of output in the four countries by 91 million tonnes in the medium run, and by 108 million tonnes in the longer run. This is a more dramatic cut than indicated in other studies of this issue, published around 1990. The more pessimistic conclusion emerging from the present analysis is primarily due to the decline in the international supply price and the rise in the West European production costs since the other studies were published.

West European coal consumption will be boosted by the lower consumer prices likely to emerge after subsidies have been discontinued, but will be suppressed as the obligations to buy domestic coal, an important element of the subsidy policy, are removed. The above analyses have not enabled us to quantify the net impact of the two opposing forces. Coal consumption may also fall for other reasons during the 1990s, eg in consequence of the rising competitiveness of gas, or if taxation of $CO_2$ emissions is introduced on a wide scale. Even then, subsidy elimination is bound to raise West European coal imports very substantially, by 50% or more from the actual 1993 import level.

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