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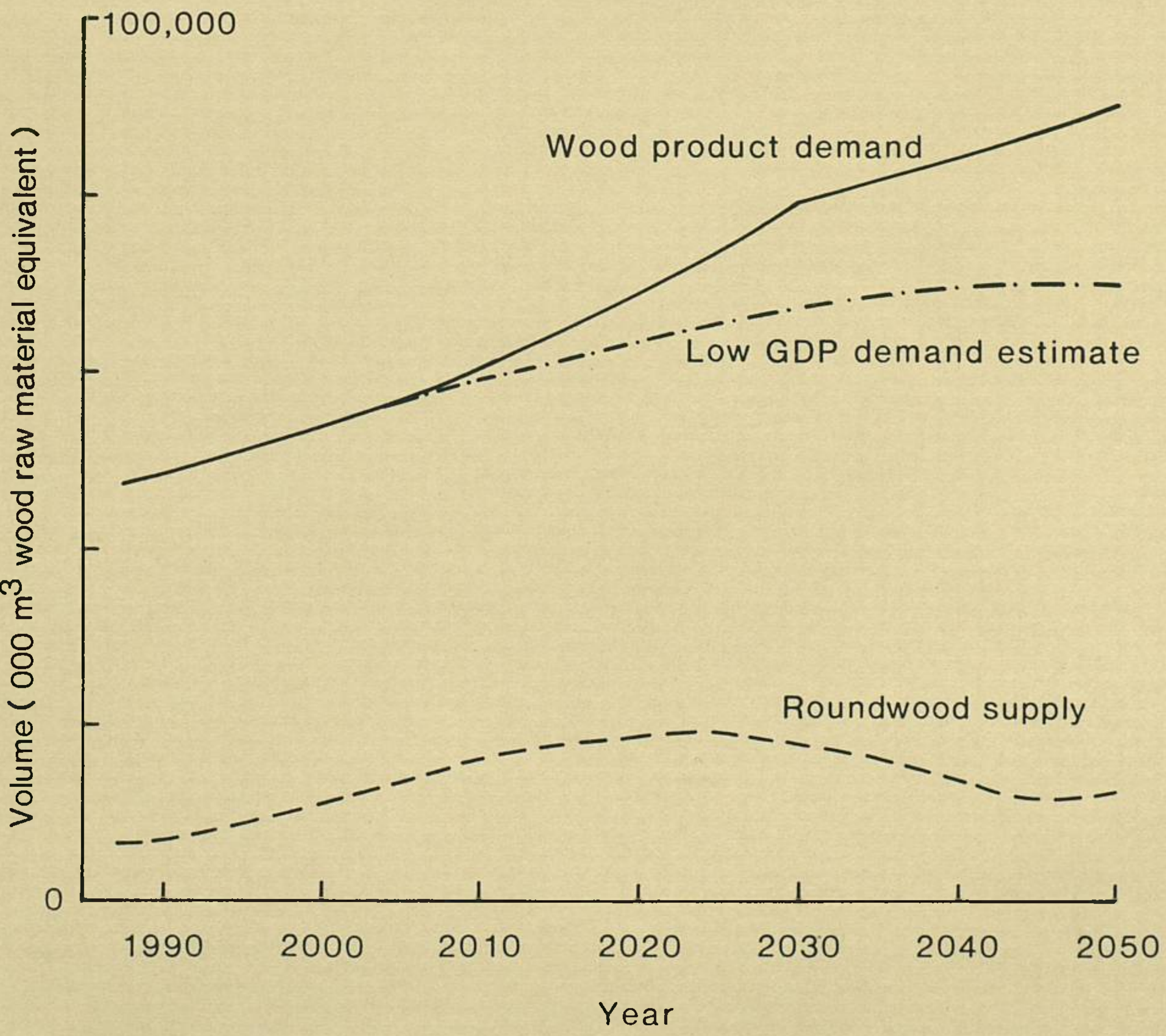
# The Supply and Demand for Wood in the United Kingdom

A. Whiteman



*FORESTRY COMMISSION OCCASIONAL PAPER 29*

# The Supply and Demand for Wood in the United Kingdom

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# Summary

This paper consists of two main parts. The larger part is concerned with new models of wood product demand that have been developed at the Forestry Commission. These models have highlighted the most important influences on demand, which turn out to be: price; prices of substitutes; national income and investment; and levels of output in certain industries. The models were constructed from figures on consumption in the UK of the products identified between 1956 and 1986. The rest of the paper then takes these models and, comparing them with future forecasts of UK roundwood production, examines the likely future raw material balance for wood and wood products in the UK. The forecasts show that it is likely that timber production will rise in line with consumption up to 2025. After that, if no new planting is undertaken, production is set to fall, while demand will continue to rise, although the extent of the rise in demand after 2025 is uncertain. In practice, new planting and efforts to reschedule production may both have the effect of removing this peak. Future technological change and increases in recycling are not addressed in this paper, but it is likely that they will have the effect of improving UK self-sufficiency to levels higher than those presented here.

### Acknowledgements

Completing this study has been a lengthy task, and the author would like to thank the many people who have offered help and encouragement. In particular, A.J. Grayson provided many useful comments on the text, as did D.B. Henderson-Howat, D. Thompson, M. Gale, D. Grundy and H. Insley. Mrs G. Cummings had the unenviable task of collecting and coding all the data, for which the author is very grateful, and W.T. Wilson provided the figures for Northern Ireland.

### A note on data sources

Figures on prices, consumption and production covering the period 1956-86 were obtained from United Nations (1988, and earlier). During the course of this work, a further volume of the *Yearbook of forest products* was published, so the figures on per capita consumption go up to 1987. The forecast of future production comes from Forestry Commission sources supplemented by information from the Northern Ireland Forest Service. Estimates of production and consumption for 1989 have been taken from Forestry Commission sources: it must be noted that these are provisional. Due to different classification systems, and the difference between the United Kingdom and Great Britain, some of the United Nations figures do not match those presented in Forestry Commission publications (e.g. Forestry Commission, 1989).

# Chapter 1

# Introduction

The last thorough study of the UK wood market was the *The wood production outlook in Britain* (Forestry Commission, 1977). Since then, the Economic Commission for Europe has produced one of its periodic studies of European supply and demand (United Nations, 1986), which includes the UK in an abbreviated form, but there has been no systematic analysis since 1977. A new study is therefore timely. This paper investigates, in statistical terms, the UK market for wood and wood products in order to make projections of future demand which can be compared with forecasts of domestic roundwood supply.

Chapter 2 explains how the different markets for wood and wood products are classified and discusses the main factors affecting the wood market. Chapter 3 outlines the approach that has been taken to modelling demand and compares it with previous attempts in Chapter 4. Forecasts of UK timber supply are presented in Chapter 5 and Chapter 6 concludes the paper by drawing together the results of the analysis. Long range forecasting of supply and demand is very uncertain so forecasts beyond 2000 should be treated as merely indicative of possible trends. Furthermore, the techniques used in this paper are statistical or econometric and account is not taken of future technological, social or political changes that may affect the pattern of supply and demand.

Appendix 1 gives details of the demand models that have been developed for each of the 11 products identified in Chapter 2. Details of explanatory variables used in Appendix 1 are given in Appendix 2. Appendix 3 provides a check on the forecasts made in Appendix 1 by undertaking a cross-sectional analysis of the consumption of particular products in a range of other countries. Finally, Appendix 4 deals with the conversion of quantities of product actually produced into cubic metres of wood raw material equivalent, so that comparisons may be made with supplies.

# Chapter 2

# The market for wood

Wood and wood products have played an important and very varied role in human activity. The use of wood as fuel is still crucial in many parts of the world. An early example of industrial use was the production of charcoal for iron smelting. Nowadays, wood is needed for many industrial and domestic purposes in the UK, where every person consumes the equivalent of about one cubic metre of wood each year.

For some products such as fuelwood or fence posts, the conversion from standing tree to end product is simple. There are, however, many products — ranging from floor joists to high quality writing paper — that require a series of industrial processes, with important markets for intermediate products. Consumer demand for the finished product depends, among other things, on income, price and the price of substitutes. Even where the finished product is used by industry, ultimate demand for roundwood depends upon the consumer because consumer demand determines the level of activity within that industry.

In this paper, 11 categories of wood products are analysed. These categories are based upon the FAO classification of forest products (United Nations, 1988). Figure 1 shows the relationship between roundwood supply and each of these products; no distinction is made between home grown and imported timber in this diagram.

In deciding how to analyse demand it was useful to distinguish between raw materials and intermediate products (which are sold to other wood processors); finished products for industry and finished products for domestic consumption.

It is only necessary to construct demand models for finished products since the demand for raw materials and intermediate products can be estimated from the demand for finished products by means of conversion factors. The demand for finished products for domestic consumption can be modelled by looking at levels of income and prices in the economy. It may be more appropriate however, to examine the demand for wood used in industry by relating it to levels of output in relevant industries (end-use analysis).

Comprehensive information about industrial use of wood products is not available, but Table 1 suggests that a few industries account for much of the demand for a range of wood products. Accordingly, demand has been analysed by looking at key industries as well as relevant macro-economic variables.

**Table 1** Main end-use sectors of mechanical wood products

| *Percentage by volume* | *Sawn and planed softwood* | *Sawn hardwood* | *Plywood and blockboard* | *Wood particleboard* |
|---|---|---|---|---|
| Construction | 67 | 38 | 48 | 49 |
| Furniture | 4 | 24 | 16 | 40 |
| Transport | 0 | 4 | 11 | 3 |
| Packaging/pallets | 14 | 9 | 10 | 1 |
| DIY | 3 | 0 | 6 | 5 |
| Others | 1 | 15 | 9 | 2 |
| Fencing | 11 | 10 | — | — |
| | 100 | 100 | 100 | 100 |
| Approximate consumption million $m^3$ product volume (1980) | 8.5 | 1.4 | 1.0 | 1.0 |

*Sources:* Cibula (1980) and Elliott (1985) with percentages updated from Forestry Commission sources where possible.

Table 2 shows the country of origin of a range of wood products imported into the UK. Fifty-eight per cent of coniferous sawnwood comes from Scandinavia, Canada and the USSR. Thirty-nine per cent of non-coniferous sawnwood and 45% of plywood comes from the tropical forests of Brazil, Malaysia, Indonesia and the Philippines. Very little roundwood is imported and home grown roundwood comes from both publicly and privately owned forests; in 1988, the Forestry Commission produced about 53% of the domestic roundwood supply.

**Table 2** Countries supplying the UK market for wood

| *Countries* | *Coniferous sawnwood* | *Non-coniferous sawnwood* | *Plywood* | *Particleboard* | *Fibreboard* | *Wood pulp* | *Paper and paperboard* |
|---|---|---|---|---|---|---|---|
| United Kingdom | 16 | 32 | 1 | 37 | 25 | 19 | 49 |
| Temperate forests | | | | | | | |
| Canada | 15 | 2 | 5 | — | — | 18 | 1 |
| USSR | 12 | — | 9 | — | 2 | 2 | — |
| Sweden | 20 | — | — | 2 | 21 | 13 | 11 |
| Finland | 11 | — | 7 | 7 | 7 | 12 | 12 |
| USA | 1 | 6 | 6 | — | 18 | 11 | 3 |
| Tropical forests | | | | | | | |
| Brazil | — | 9 | 5 | — | 2 | — | 1 |
| Philippines | — | 15 | 7 | — | — | — | — |
| Malaysia | — | 9 | 11 | — | — | — | — |
| Indonesia | — | 6 | 22 | — | — | — | — |
| Others | 24 | 22 | 27 | 54* | 26 | 26 | 24 |
| | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

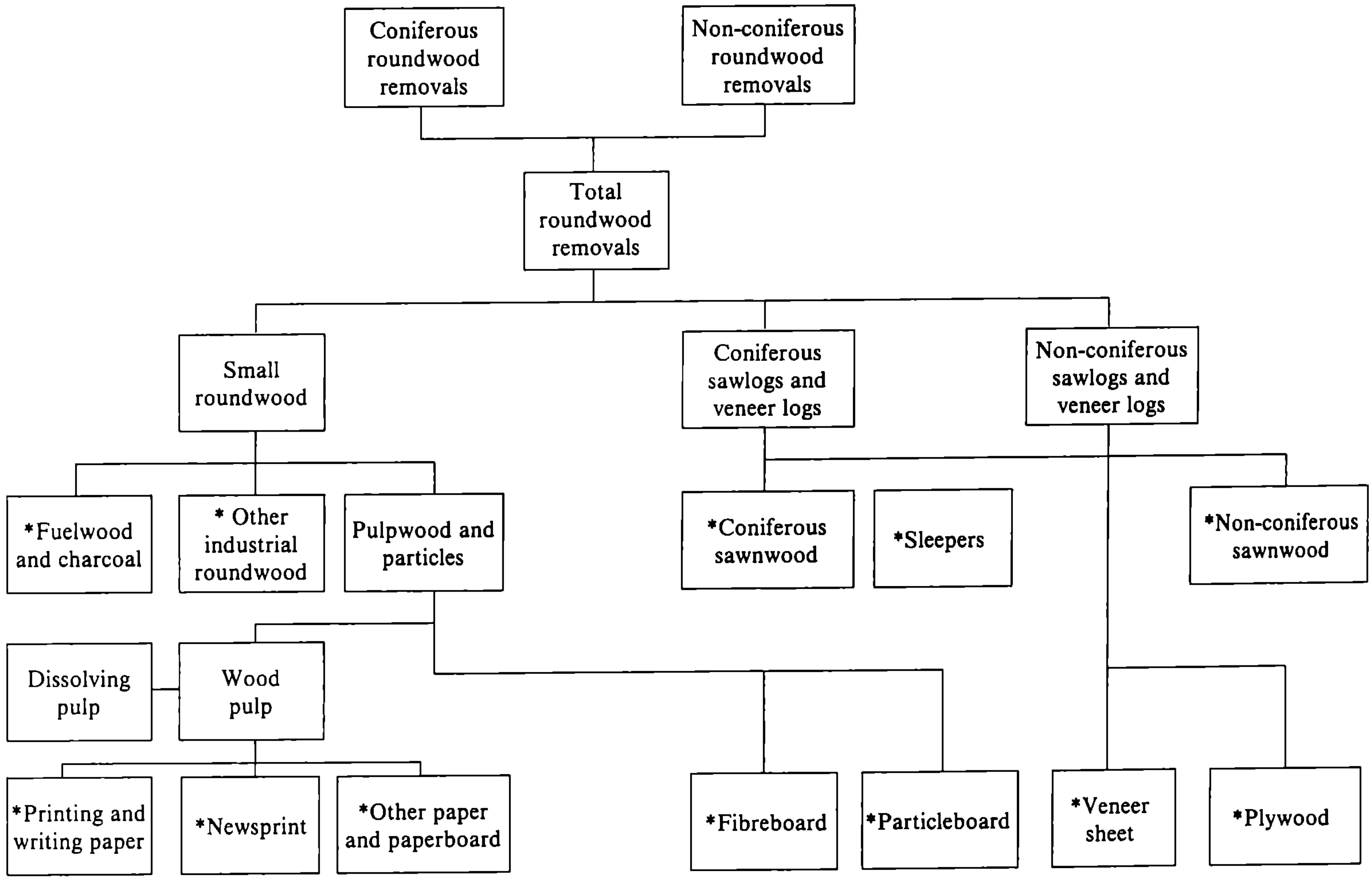
Figures are percentages of domestic consumption by true volume in 1986.

*Mainly from within the EEC.

*Source:* United Nations (1988)

The supply and demand balance in wood and wood products for the UK is shown in Figure 2. This shows that the UK is heavily dependent on imports to satisfy demand. In 1988, the UK self-sufficiency stood at 12% (Forestry Commission, 1989). This high import dependence means that the UK price of wood is effectively determined by the world price. This, in turn, sets the level of domestic demand, which determines the amount of wood imported in any year. Price may also affect domestic supply, but the relationship is much harder to identify. Because domestic supply is so small compared with world supply, domestic supply has little or no influence in setting the world price for timber (although the same cannot be said about domestic demand). This means that UK supply and demand can be analysed separately, because one does not affect the other through the price mechanism. This differs from the situation of larger producers and consumers such as Canada and the USA, where supply and demand have to be modelled simultaneously.

**Figure 1** The linkages between roundwood and wood products




*Notes:* * = final products
Recycling/residue interactions are not shown.

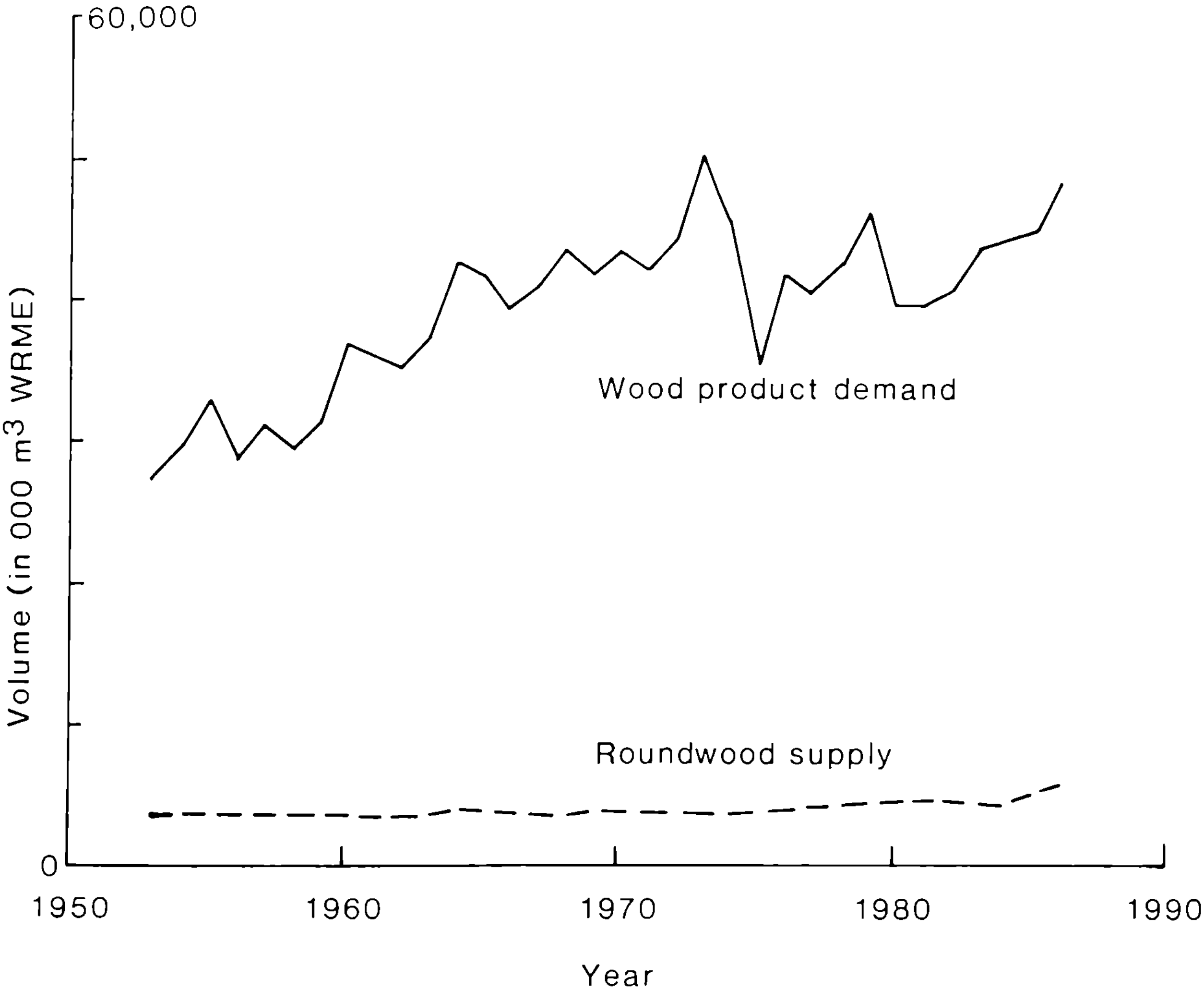



**Figure 2** United Kingdom roundwood supply and wood product consumption 1953-1986 (expressed as wood raw material equivalent)

# Chapter 3

# Modelling the demand for wood

Future demand for wood can be looked at in a number of ways. Expert opinions may be sought; trends may be examined; or statistical models may be built (MacGregor and Watt, 1973). This study is based largely upon the use of statistical models. Regression analysis was used to develop models that appeared to explain past trends in the consumption of wood. The framework for this analysis was a conventional supply and demand model. This is illustrated in Figure 3.

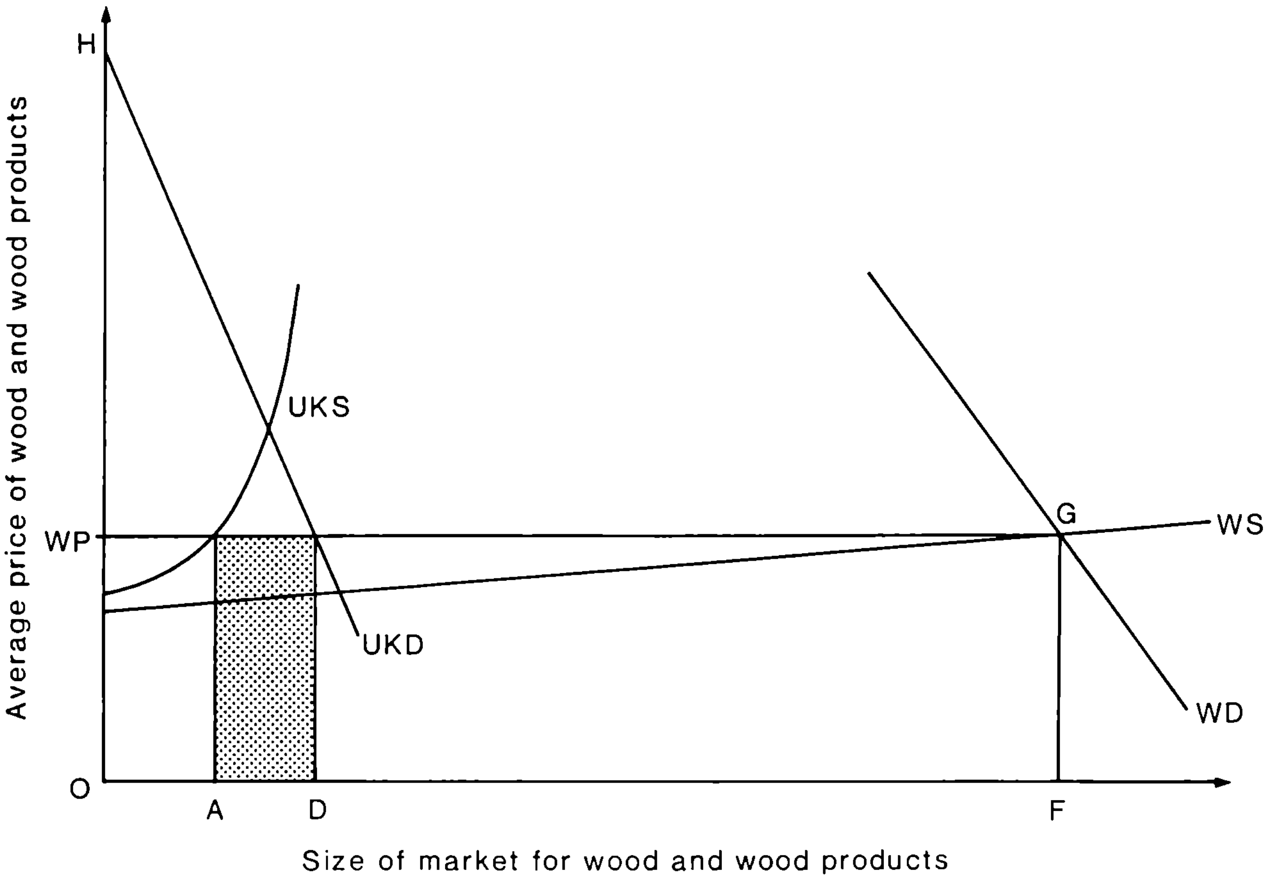



**Figure 3** The world domestic supply and demand of wood and wood products (see text for key to letters)

World supply and demand, depicted by curves WS and WD, interact to set the world price WP. Because such a high proportion of timber is imported, and the UK operates a relatively free trading regime, domestic wood prices are set close to this world price. This price and the UK demand curve UKD result in OD wood being demanded in the UK. Similarly, UKS (the UK supply curve) sets UK output at OA. This curve changes slope, because successively higher prices are required to bring more timber to the market, usually in the form of wood and roundwood felled prematurely. The position of UKS is determined principally by the age structure of the forest in the UK; changes in that age structure may shift the curve to the left or right. The difference between supply and demand AD is met by imports at the prevailing world price.

Supply and demand diagrams are only two-dimensional and cannot therefore show the full range of causes and effects in the timber market. Changes in income, population and other non-price effects shift the demand curve, which results in a change in the quantity demanded. Changes in price also result in a change in quantity demanded, but these are depicted as moves up or down the curve. The full range of effects on demand must be taken into account in a rigorous analysis of the market.

More formally, demand for one of the finished wood products can be defined as:

$$D_i = f(P_i, Y, \rho_j, O_i, T),$$

where $D_i$ = quantity demanded of product $i$,

$P_i$ = price of product $i$ (which may include lagged prices),

$Y$ = set of macro-economic variables to define income, population and investment,

$\rho_j$ = set of prices of substitute wood and non-wood products $j$,

$O_i$ = set of output indicators for any industries using the product $i$,

$T$ = factors such as changes in tastes or technology that are difficult to quantify and which may be best portrayed as a time trend.

One or more of the variables may be insignificant and can be dropped from the model. The aim is to reduce the model to the most important influences, which may be only one or two variables. Macro-economic variables ($Y$) and industrial outputs ($O_i$) may be correlated; this leads to statistical problems so individual models should not contain both these types of variable. The variables to be used can be chosen on statistical grounds, or by using economic arguments, for example by considering whether the products are for industrial use or domestic consumption. Wherever possible, time trends ($T$) should not be used because in effect this would mean that it had become necessary to have recourse to an unidentified factor in explaining some of the changes in demand.

Figure 3 shows the demand curve as being linear, but in reality it may be curved. In such cases other specifications of the model could turn out to be more appropriate. It may also be better to model consumption on a per capita rather than an aggregate basis, particularly where the underlying per capita relationship has been steady through periods of fluctuating population. Forecasts of future population are fairly reliable and consumption forecasts derived from per capita models for domestic consumption should benefit from this ability to incorporate population projections in the consumption forecast. Nevertheless it is only sensible to use per capita models of demand for the consumption of finished products for domestic consumption as the relationship between final consumer and consumption is more tenuous for products for industry and raw materials.

The effect of changes in technology, substitute prices and end-use industry output on quantities of raw materials and industrial products demanded can be shown through the use of the production isoquants (Varian, 1984). As an illustration, an industry using only two inputs to make its product is considered. One input may be a wood product and the other a substitute. At a given level of output, the industry requires a mix of these two inputs to produce that output. This can be represented by the production isoquant $0_1$ in Figure 4. The optimal mix of the two inputs is found where the isoquant just touches the relative price line $Pw_1/Ps_1$. At this level of output quantity $W_1$ of the wood product is demanded and $S_1$ of the other input is demanded. This condition is optimal because it fulfils the criterion that the ratio of the marginal products of the two inputs is equal to the ratio of the prices. With the aid of this diagram, changes in price, technology and output can be examined for their effect on wood demands.

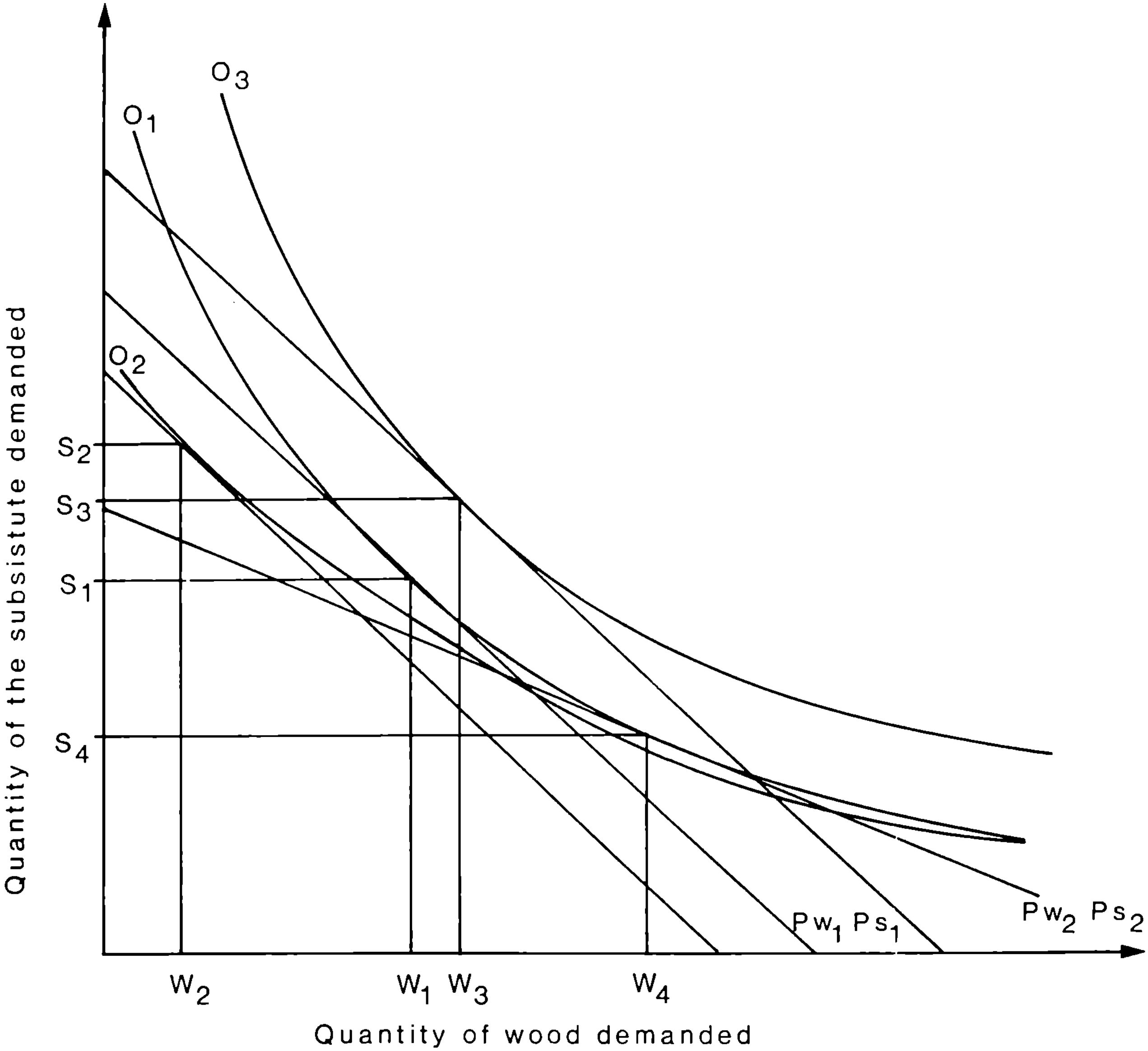



**Figure 4** Production isoquants for an industry using wood and a substitute input in its production process (see text for key to letters)

A change in technology would alter the production isoquant so that the same level of output could be obtained with a different set of input mixtures. In Figure 4 the case is shown where less of the substitute input is required to produce the same level of output (isoquant $O_2$). With the same relative prices (i.e. a new relative price line that is parallel to the original relative price line), the optimal input mix is now $W_2$ and $S_2$, requiring much less of the wood product and much more of the substitute product.

An increase in industry output would be represented by a shift in the production isoquant to $O_3$. With the same relative prices the input mix now changes to $W_3$ and $S_3$, requiring more of both inputs.

Finally, a change in relative prices would alter the slope of the relative price line and change the optimal mix of inputs. For example, in Figure 4, the wood product becomes relatively cheaper, which changes the slope of the relative price line to $Pw_2/Ps_2$. This results in the optimal mix of inputs changing to $W_4$ and $S_4$ which, not surprisingly, leads to an increase in the demand for the wood product at the expense of demand for the substitute input. Prices of other inputs may thus be helpful in explaining industries' demand for wood products, while prices of substitutes may help to explain final consumption.

It will be assumed throughout this analysis that markets clear. In other words, it will be assumed that the shortfall between domestic supply and demand at the world price is filled by imports and changes in stocks so that domestic demand is entirely satisfied. This means that estimated timber imports and changes in stocks do not have to be modelled, as they are the difference between domestic supply and demand.

Data on the production, imports, exports and (hence) overall consumption of wood and wood products in the United Kingdom from 1953 to 1986 were collected (United Nations 1988, and earlier) and models of demand for 11* of the final products identified in Figure 1 were constructed. These products are:

fuelwood and charcoal
other industrial roundwood
coniferous sawnwood
non-coniferous sawnwood
printing and writing paper
newsprint
other paper and paperboard
fibreboard
particleboard
veneer sheets
plywood

A detailed discussion of the models is given in Appendix 1. The Appendix also explains how the models were reduced to identify the most significant variables affecting demand over the period. The models were then used to generate forecasts for wood demand to 2050. This required projections for the explanatory variables, such as population and national income; these are set out in Appendix 2. Sensitivity of the models to national income was tested by assuming (1) that national income would continue to grow at a rate of 2½% per year and by assuming (2) that over the period to 2050 the growth in national income would slowly decline. It was also assumed that future prices would equal an average of prices over the past 10 years. While future price changes are likely to have an effect on demand, possible changes in price were not investigated in this exercise because the UK is a price-taker and it would have required an analysis of world supply and demand to make a sensible judgement about future world price. The plausibility of the long-run price assumption can be assessed by examining Figure 19.

The demand forecast for the major wood product groups is summarised in Figure 5. A table of demand is also presented in Table 7 in Chapter 6. No attempt was made to smooth out the bump in 2030, when for several products (see Appendix 1) it was assumed that total market saturation was achieved. This was because it was felt that, with the very long-term nature of these forecasts, it would be difficult to justify such a trivial adjustment.

*The demand for railway sleepers was studied, but removed as being insignificant in the future. The demand for dissolving pulp was also not studied which will mean that the aggregate demand forecast is a slight underestimate.

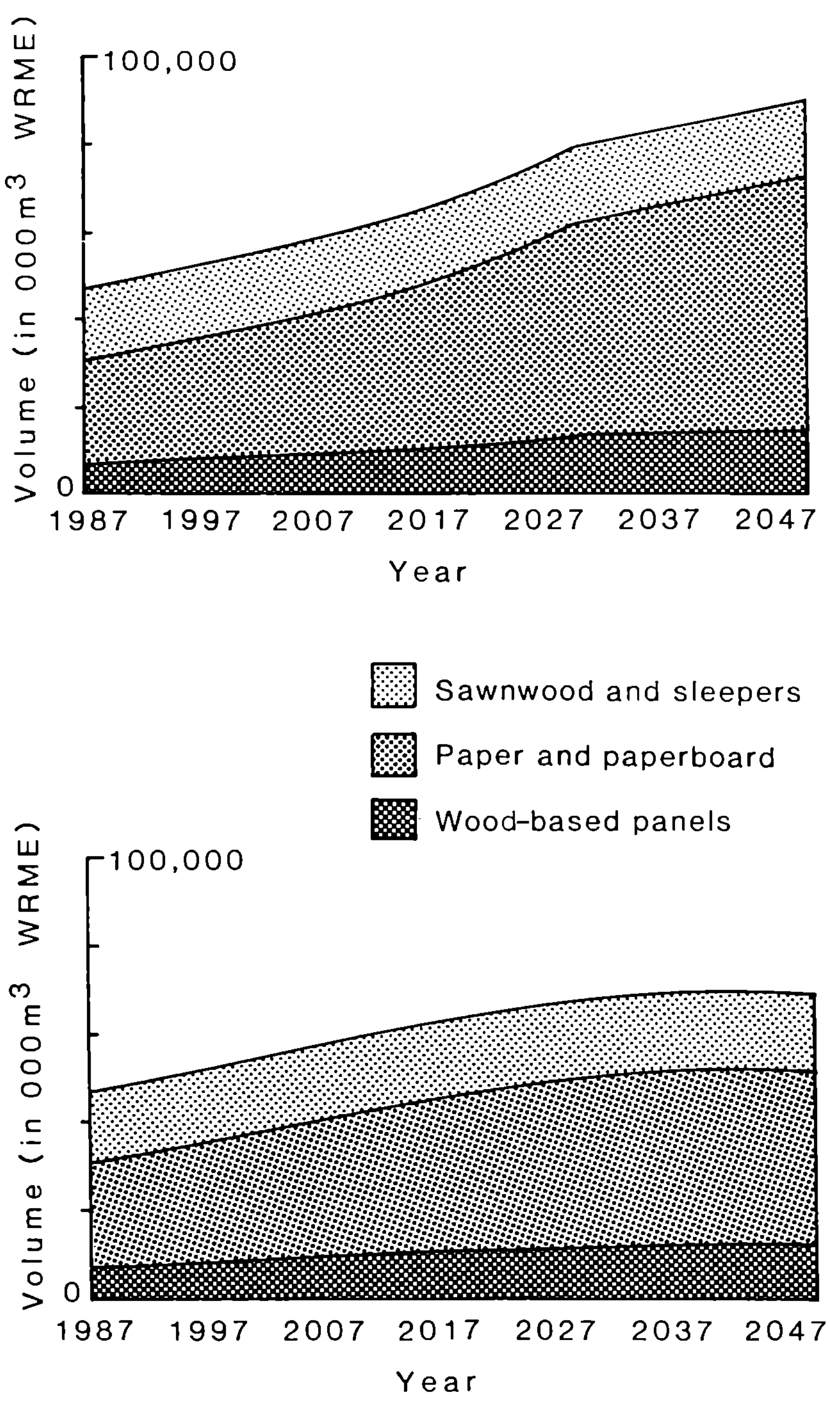



**Figure 5** The demand for the major wood product groups over the period 1987-2050 (expressed as wood raw material equivalent)

*Top:* High GDP growth scenario

*Bottom:* Low GDP growth scenario

# Chapter 4

# Previous studies of UK wood and wood product demand to 2050

Long run forecasting of the supply and demand balance is necessary for the intelligent management of a natural resource. This is particularly true in the case of forestry, where there is such a long lead-time between investment and production. Several national and international agencies have recognised this fact and have undertaken studies of timber supply and demand. These have been mainly short-term and partial, dealing with only one sector of the market or a few countries, and usually give only broad indications of what might happen in the long-term future. All these studies have relied on a UK production forecast from the Forestry Commission (covered in the following section) for their projections of roundwood supply, so it is not really necessary to compare their supply forecasts with those presented in this study. Very few studies have been concerned in any detail with the UK and most have used very general models that fit a range of countries. It is therefore, quite relevant to compare the results from the Forestry Commission's models with those projections given by other agencies.

Of the research done by international agencies, the United Nations ECE/FAO European Timber Trends Studies (ETTS) are the most comprehensive. Repeated about every 10 years, ETTS reports give projections of supply and demand for timber and products for 20-40 years into the future in all European countries and North America. The most recent study, ETTS IV (United Nations, 1986), gave predictions of demand for a range of products from 1908 to 2000. The forecasts for the UK from that study are given in Table 3.

**Table 3** ETTS IV predictions of wood and wood product demand in the UK

| *Demand* ‡ § | *Base period* * | *1990* | *2000* | *Actual 1989*† |
|---|---|---|---|---|
| Total sawnwood and sleepers | 8 560 | 9 040-9 590 | 9 680-11 200 | 11 270 |
| Sawn softwood | 7 230 | 7 660-8 090 | 8 050- 9 240 | 10 230 |
| Sawn hardwood | 1 310 | 1 360-1 480 | 1 610- 1 940 | 1 000 |
| Sleepers | 20 | 20 | 20 | 40 |
| Total wood based panels | 3 360 | 3 570-3 850 | 4 070- 4 910 | 4 500 |
| Veneer sheets | 60 | 60 | 60 | 80 |
| Plywood | 960 | 1 030-1 120 | 1 160- 1 430 | 1 240 |
| Particleboard | 1 940 | 2 090-2 250 | 2 430- 2 920 | 2 690 |
| Fibreboard | 400 | 390- 420 | 420- 500 | 490 |
| Total paper and paperboard | 7 140 | 7 520-8 830 | 8 640-12 310 | 7 450 |
| Newsprint | 1 410 | 1 520-1 670 | 1 740- 2 160 | 1 650 |
| Printing and writing paper | 1 730 | 2 250-2 520 | 2 980- 3 830 | 2 350 |
| Other paper and paperboard | 3 990 | 3 750-4 640 | 3 910- 6 320 | 3 450 |
| Other industrial wood | 240 | 240 | 240 | 210 |
| Fuelwood | 150 | 160- 380 | 300- 720 | 220 |

*Notes:* * Base period is: the annual average 1979-83 for demand estimates from the end-use elasticities model; and the annual average 1979-81 for demand estimates from the GDP model.

† Best estimates for 1989, subject to revision.

‡ Quantities are in thousand cubic metres product volume except figures for pulp and paper which are measured in thousand metric tonnes.

§ These figures are the best ETTS IV consumption scenarios. They are the most likely scenarios taken from the 'GDP' and 'end-use elasticity' models (see United Nations, 1986).

To appraise the ETTS IV model, the table also shows estimates of the 1989 figures for demand. It can be seen that only a few of the variables are close to or within their allotted range.

The International Institute for Applied Systems Analysis (IIASA) has also produced predictions of demand through its Forest Sector Project. Their model forecasts over the period 1980-2030. Unfortunately, IIASA results for the United Kingdom are not presented in any detail (Kallio *et al.,* 1987). However, the general trends put forward for Western Europe appear similar to those presented by the United Nations. Their model is discussed more fully in Arnold (1990).

The only major report from within the United Kingdom, to examine future demand, has been *The wood production outlook* from the Forestry Commission (1977). This followed on from earlier work done by Grayson (1969). It examined price, supply and demand and predicted that:

1. world prices would be similar in the year 2000 to the base period (1972), but may rise after that;

2. by 2000 the total demand for wood in Great Britain would be 55-60 million $m^3$ WRME (wood raw material equivalent), rising to 70-90 million $m^3$ WRME by 2025;

3. only 14-15% of this demand could be satisfied by domestic production.

A variety of demand scenarios were contemplated, assuming various levels of population growth and growth in GDP. These were used to give ranges of consumption for three aggregate product groups, and are presented in Table 4.

**Table 4** Projections of domestic wood demand from the wood production outlook

| *Product* | *1972* | *1985* | *2000* | *2025* |
|---|---|---|---|---|
| Sawnwood and sleepers ('000 $m^3$) | | | | |
| High | 10 027 | 10 237 | 10 481 | 10 800 |
| Low | 10 027 | 9 591 | 8 972 | 7 954 |
| Paper and paperboard ('000 metric tonnes) | | | | |
| High | 7 311 | 10 189 | 15 558 | 31 206 |
| Low | 7 311 | 8 912 | 11 578 | 17 742 |
| Wood based panels ('000 $m^3$) | | | | |
| High | 2 858 | 5 171 | 9 814 | 21 174 |
| Low | 2 858 | 3 896 | 5 369 | 8 228 |

*Source:* Forestry Commission (1977).

The results of these studies are compared with the results of this analysis in Chapter 6.

# Chapter 5

# The supply of roundwood in the UK to 2050

Roundwood supply was modelled using conventional production forecasting techniques (Johnston *et al.*, 1967; Johnston, 1973), starting from the assumption of rotation lengths set to maximise net present value at a 5% discount rate. For the Forestry Commission, the production forecast over the next 20 years was modified to allow for constraints arising from detailed local harvesting, landscaping or conservation plans. Another major consideration was wind, which was taken into account by using terminal heights appropriate to site conditions (Miller, 1985).

A tentative forecast for the private sector was produced based on the 1980 Census of Woodland (Locke, 1987) and discussions with organisations representing the private forestry sector. The degree of accuracy in this part of the analysis is unknown, but is probably quite low. It was not possible to produce a forecast for non-coniferous timber on this basis, but some guidelines presented in Oakley (1986), were used to make projections to 2050. The problems associated with private sector production forecasting are discussed more fully in Dewar (1988) and Kupiek and Phillip (1988).

The main difference between this and other production forecasts (Forestry and British Timber, 1987) is that it has been assumed throughout that crops will be restocked with the same crop, and attain the same level of productivity. This is probably a reasonable assumption: silvicultural improvements should increase yield and shorten rotation ages on restocking, but measures taken to increase forest diversity may have the opposite effect. This is quite different from what has been done before because previous production forecasts have only looked at the next 20 years, and have not had to deal with production from second rotations.

The projected production to the mid 21st century is tabulated in Table 5 and is shown diagrammatically in Figure 6.

**Table 5** Forecast of UK average annual roundwood production to 2050

| *Period* | *Coniferous sawlogs* | *Coniferous small roundwood* | *Non-coniferous sawlogs* | *Non-coniferous small roundwood* | *Total* |
|---|---|---|---|---|---|
| 1987-1991 | 2.6 | 3.2 | 0.9 | 0.2 | 6.9 |
| 1992-1996 | 3.4 | 4.0 | 0.9 | 0.2 | 8.5 |
| 1997-2001 | 4.8 | 4.8 | 1.0 | 0.1 | 10.8 |
| 2002-2006 | 6.1 | 5.7 | 1.0 | 0.1 | 13.0 |
| 2007-2011 | 8.1 | 6.5 | 1.0 | 0.1 | 15.8 |
| 2012-2016 | 9.6 | 6.9 | 1.0 | 0.1 | 17.7 |
| 2017-2021 | 10.4 | 6.8 | 1.1 | 0.1 | 18.4 |
| 2022-2026 | 11.5 | 6.9 | 1.1 | 0.1 | 19.6 |
| 2027-2031 | 11.0 | 6.3 | 1.1 | 0.1 | 18.4 |
| 2032-2036 | 10.2 | 5.7 | 1.1 | 0.1 | 17.1 |
| 2037-2041 | 8.4 | 4.7 | 1.1 | 0.1 | 14.3 |
| 2042-2046 | 6.5 | 4.4 | 1.1 | 0.1 | 12.0 |
| 2047-2050 | 6.6 | 4.6 | 1.1 | 0.1 | 12.4 |

All figures expressed in million cubic metres overbark.

This production forecast (which assumes restocking but no new planting) suggests that production will rise to a peak of 19.6 million $m^3$ in 2022-2026, and then fall back to 12 million $m^3$ in 2042-2046. Any influence that price may have on supply has not been taken into account. In practice, market forces may influence the shape of

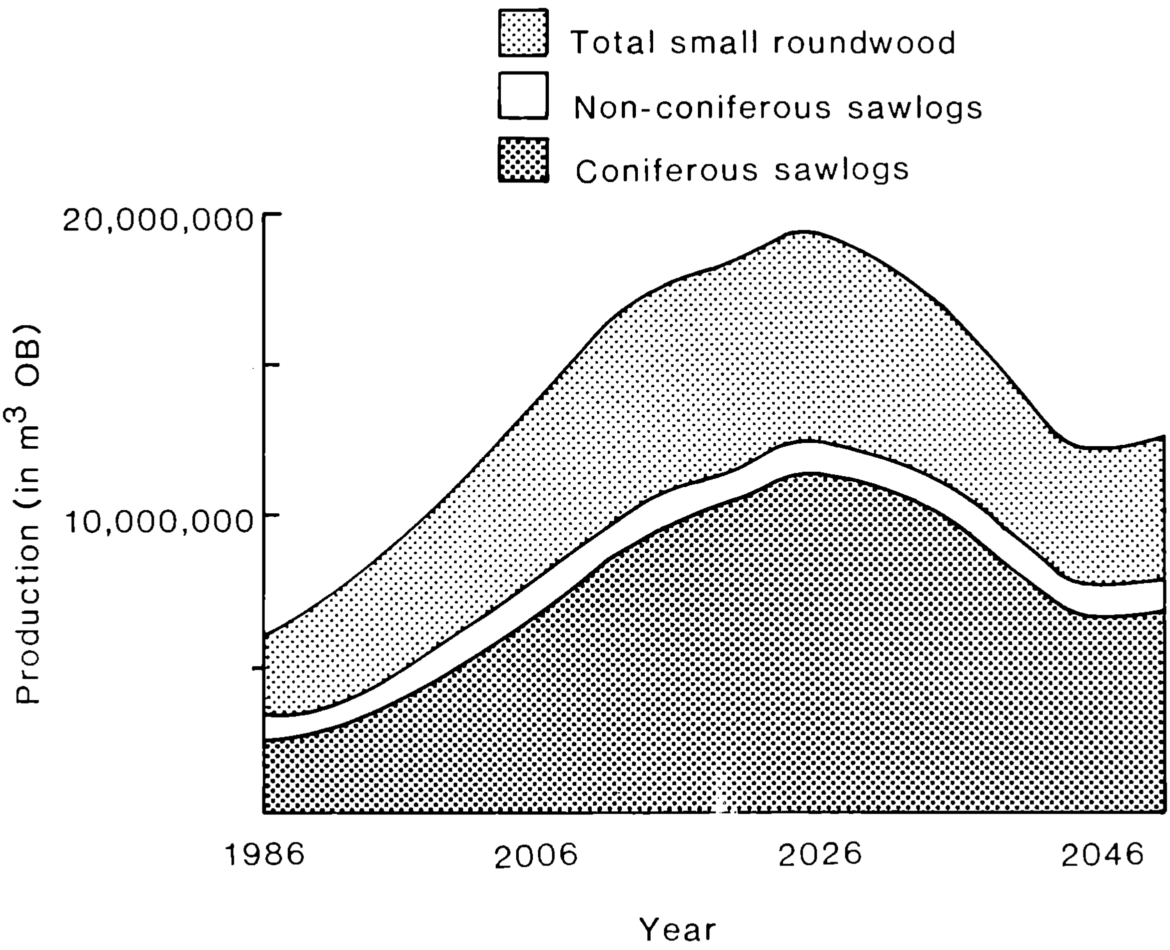



**Figure 6** Forecast of United Kingdom roundwood production to 2050

this peak. Comparison with Table 6 shows how this has changed from the long run supply forecast presented in the Wood Production Outlook, and also highlights how even a moderate level of new planting can substantially alter the future level of roundwood supply. The new forecast does not take into account new planting since 1986, so it is likely to be a slight underestimate in the long run. In the short run, it will also be slightly different to the forecast that is to be published in mid-1991, which will take into account more recent landscape plans, and supply contraints.

**Table 6** Potential domestic supply scenarios from the wood production outlook

| | *Million cubic metres per annum overbark* | | | |
|---|---|---|---|---|
| | *2000* | *2025* | *2050* | *Sustained* |
| Non-coniferous | | | | |
| No new planting | 1.3 | 1.4 | 1.6 | 2.3 |
| Low new planting | 1.3 | 1.5 | 1.7 | 2.6 |
| Moderate new planting | 1.3 | 1.5 | 1.7 | 3.0 |
| Coniferous | | | | |
| No new planting | 7.0 | 9.2 | 10.3 | 12.0 |
| Low new planting | 7.0 | 12.8 | 16.8 | 22.0 |
| Moderate new planting | 7.0 | 14.1 | 20.4 | 27.0 |
| Total | | | | |
| No new planting | 8.3 | 10.6 | 11.9 | 14.3 |
| Low new planting | 8.3 | 14.3 | 18.5 | 24.6 |
| Moderate new planting | 8.3 | 15.6 | 22.1 | 30.0 |

*Note:* No new planting = 0 ha after 1977; Low new planting = 1 m ha by 2025; Moderate new planting = 1.8 m by 2025.

*Source:* Forestry Commission (1977).

# Chapter 6

# Conclusions

The aggregation of the results of the modelling exercise presented in Appendix 1 was carried out, with all figures being converted to the common numeraire of wood raw material equivalent (WRME). (This is the amount of wood required to manufacture a specified volume or weight of product; see Appendix 4.) The projected demand for each of the products is given in Table 7 and the results, grouped into the four main product groups, are presented in Table 8 and Figure 5.

**Table 7** A summary of forecast UK demand for 11 wood products

| *Product* | *Actual 1989* | *GDP growth rate* | *Year* | | | |
|---|---|---|---|---|---|---|
| | | | *2000* | *2010* | *2025* | *2050* |
| Fibreboard | 490 | H | 536 | 663 | 925 | 1 222 |
| | | L | 536 | 633 | 749 | 811 |
| Particleboard | 2 690 | H | 3 254 | 4 081 | 5 721 | 6 355 |
| | | L | 3 254 | 3 903 | 4 679 | 5 124 |
| Plywood | 1 240 | | 1 058 | 1 069 | 1 084 | 1 109 |
| Veneer sheet | 80 | | 126 | 131 | 137 | 144 |
| Other paper and paperboard | 3 450 | H | 5 322 | 6 104 | 7 684 | 12 014 |
| | | L | 5 322 | 5 939 | 6 691 | 7 161 |
| Printing and writing paper | 2 350 | H | 3 037 | 3 880 | 5 620 | 6 450 |
| | | L | 3 037 | 3 695 | 4 507 | 4 979 |
| Newsprint | 1 650 | H | 1 608 | 1 677 | 1 781 | 1 970 |
| | | L | 1 608 | 1 666 | 1 727 | 1 779 |
| Other industrial roundwood | 210 | | 168 | 104 | 50 | 15 |
| Fuelwood and charcoal | 280 | | 354 | 364 | 369 | 370 |
| Non-coniferous sawnwood | 1 000 | | 1 276 | 1 285 | 1 297 | 1 317 |
| Coniferous sawnwood | 10 230 | | 8 362 | 8 469 | 8 601 | 8 831 |

*Note:* Figures for paper products are in '000 metric tonnes, all other figures are in '000 $m^3$ product volume.

**Table 8** Forecast supply and demand for wood in the UK to 2050 (expressed in '000 $m^3$ WRME)

| | *Actual 1989* | *GDP growth rate* | *Year* 2000 | 2010 | 2025 | 2050 |
|---|---|---|---|---|---|---|
| Supply* | | | | | | |
| Roundwood (assuming no new planting) | 6 630 | | 11 241 | 16 185 | 19 360 | 12 474 |
| Demand | | | | | | |
| Wood-based panels | 6 300 | H | 8 354 | 9 809 | 12 694 | 14 305 |
| | | L | 8 354 | 9 497 | 10 868 | 11 690 |
| Paper and paperboard | 20 860 | H | 28 436 | 33 536 | 43 864 | 58 125 |
| | | L | 28 436 | 32 443 | 37 338 | 40 308 |
| Sawnwood | 18 820 | | 16 840 | 17 041 | 17 288 | 17 722 |
| Other roundwood | 490 | | 523 | 467 | 419 | 385 |
| Total | 46 470 | | 54 153 | 60 853 | 74 265 | 90 537 |
| (low GDP estimate) | | | 54 153 | 59 448 | 65 913 | 70 105 |
| Self-sufficiency | | | | | | |
| High GDP growth | 12% | | 21% | 27% | 26% | 14% |
| Low GDP growth | | | 21% | 27% | 29% | 18% |

*Excludes re-use of residues or recycled fibre, which may be significant.

These results are similar to those presented in the other studies referred to in Chapter 5. The demand for wood-based panels forecast is slightly higher than that presented by the UN (to 2000), while the other forecasts are at the lower end of the ranges presented by the UN (to 2000). The supply forecast does not compare so well with the one presented in *The wood production outlook,* which showed a progressive increase in supply under most scenarios. The present forecast, which peaks in 2025-2030, assumes no new planting, but starts from a larger initial stock of forest than in the older study (i.e. about a quarter of a million hectares of new planting has taken place between *The wood production outlook* and this new study). The demand forecast for wood-based panels comes within the ranges presented in *The wood production outlook*, but the forecasts for paper and sawnwood are now higher than was projected in 1977.

A crucial problem associated with such forecasts is the question of what will happen to price in the future. If the constant price assumptions made in Chapter 3 failed to hold, then the large increases in demand (shifts in the demand curve) predicted in this paper would lead to large increases in price that would in turn restrict the final increase in quantity demanded at this new equilibrium price. The assumption of constant real prices made in this paper has led to anomalies where price history has shown increasing prices (and falling demand) and the forecasts now show stable or rising demand (from the implicitly constant prices). The importance of this assumption must be borne in mind when studying these forecasts, as future changes in price could have a large influence on the final outcome of demand in the future.

In conclusion, this paper shows that the situation of low self-sufficiency in timber is certain to continue, and probably become more apparent in the future (Figure 7), if there is no more afforestation in the UK. Domestically grown timber will continue to find a ready market so long as timber processors continue to locate in the UK. This paper has not analysed the supply side of wood products in any great detail, because that depends very much on the micro-economics of each industry. However, it does seem reasonable to assume that normal market forces will encourage processors to locate in the UK, in periods of increasing timber supply. What will happen after the peak of timber production is reached in 2025, is much less certain. Paper and paperboard is likely to be the largest growth area in demand in the future, closely followed by wood-based panels. Sawnwood demand will rise but only slightly.

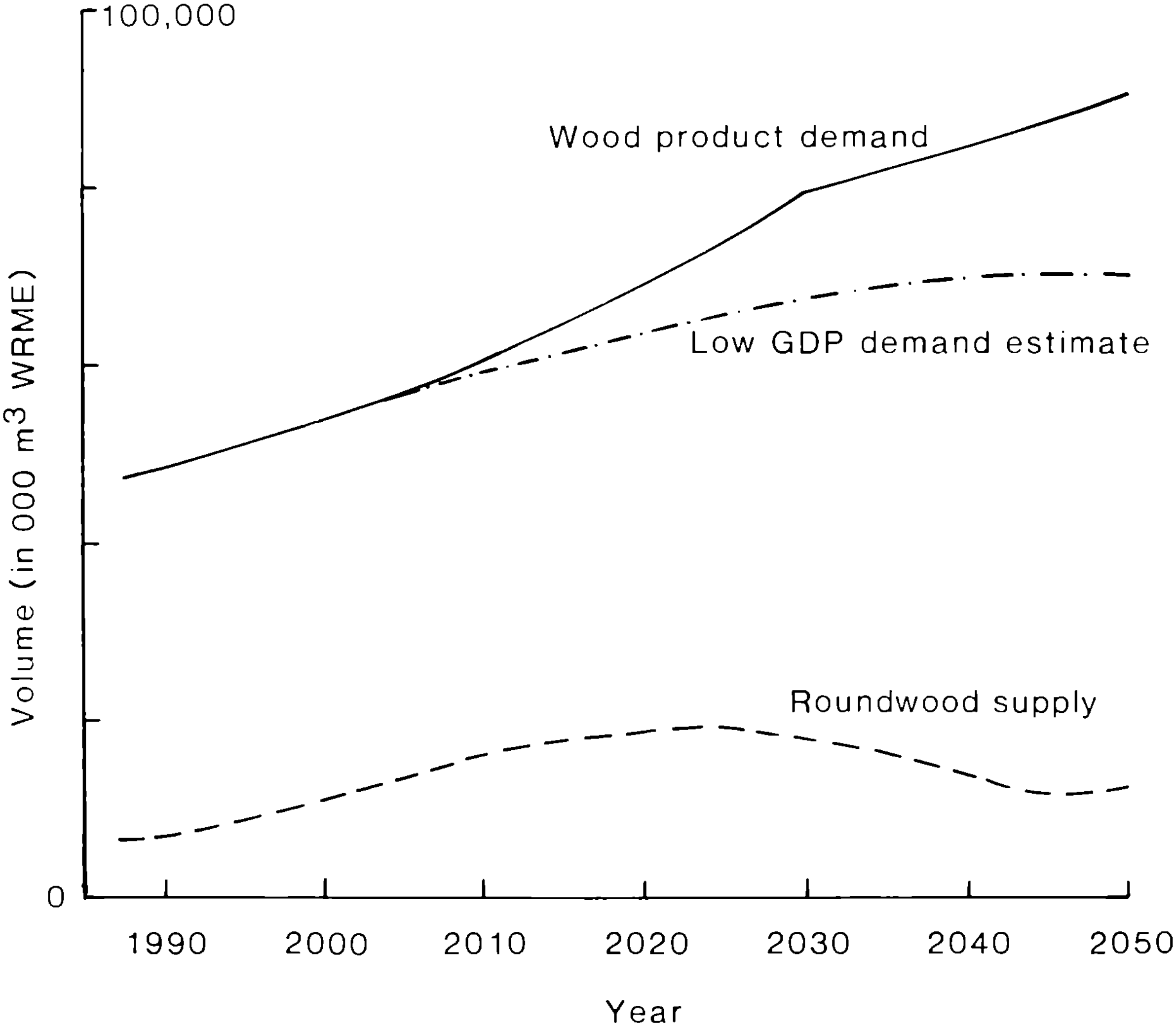



**Figure 7** Forecast of United Kingdom roundwood supply and wood product demand 1987-2050 (expressed as wood raw material equivalent)

# Appendix 1

# The demand models in detail

The following text reports on the models generated for each of the 11 products identified in Figure 1. As different model specifications and techniques were used for each product, the results are presented on a product by product basis. Simple, log-linear, and semi-logarithmic specifications of the regression models were examined, as these tend to have the most useful statistical and economic properties.

Accompanying each set of results are two graphs. The upper shows the set of real price and quantity combinations that have occurred over the period 1956-86 (1961-86 for particleboard). These provide some visual evidence for whether a stable demand curve exists or not. The lower shows production and consumption 1953-86 and the best forecast of consumption to 2050. Where applicable, the lower graphs show the effect of the reduced economic growth assumption (i.e. a rate falling gradually from 2½% in 1990 to zero in 2050).

The models were reduced to the most significant variables affecting demand (at a 5% significance level). Variables were rejected if they had signs that were judged to be incorrect. Thus, for example, coefficients on own price were expected to be negative (to give downward sloping demand curves), and those on the price of substitutes, output, national income and investment were generally expected to have positive coefficients. The $R^2$ statistic for most of the equations was reasonably high, and standard errors low, suggesting that the models performed quite well. The quality of data for the smaller product categories was quite doubtful. This is one reason why the model for railway sleepers was removed from the analysis. In particular, figures for fuelwood and charcoal and veneer sheets are likely to suffer from high errors. It would therefore, be sensible to take the forecasts for these two product categories as only indications of possible future trends.

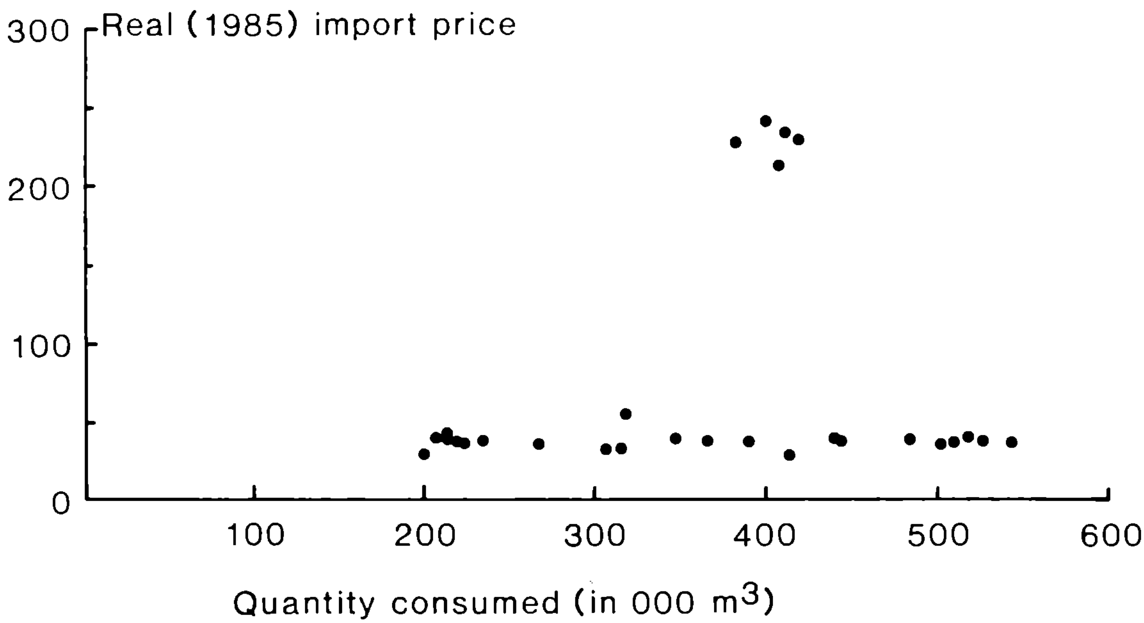
Autocorrelation is a recurring problem in econometric studies of time series; where necessary, tests for autocorrelation were carried out and remedies applied (Koutsoyiannis, 1977). The Durbin-Watson statistic was the main test statistic used for this, as it was thought unlikely that autocorrelation would be more serious than first-order autocorrelation. The preferred remedy was the Cochrane-Orcutt estimation of $\rho$, the autocorrelation coefficient. In the case of the minor product group fuelwood and charcoal, the inadequacy of explanatory variables made it necessary to drop all explanatory variables and build a pure time-series (ARIMA) model along the lines of Box and Jenkins (1976).

It was assumed in all the models except the one for coniferous sawnwood, that price and demand interacted simultaneously (the model for coniferous sawnwood had a one year lag between price changes and changes in demand). More complicated assumptions about the lag structure between prices and demand were not investigated, although such structures have been found to be useful in other studies (e.g. Adams and Haynes, 1980; Cardellichio *et al.*, 1989; Vincent *et al.*, 1990; Uusivuory and Buongiorno, 1990). A more detailed analysis of the time lag structure present in UK markets would be one way in which these models could be improved.

### Fuelwood and charcoal

An important feature of the use of wood for fuel is that the statistics do not rely on an industrial census or survey and probably underestimate the full extent of the activity. This casts doubt on the validity of building a demand model on data that could only be partial at best. However this was attempted, and simple, log-linear and semi-log specifications were examined for both models of aggregate consumption and per capita consumption of fuelwood and charcoal. All these models were highly autocorrelated, giving Durbin-Watson statistics of 0.5-0.8.

The price of coal (a substitute) was significant and the coefficient had the correct sign (+). Own price was also just significant, and had the correct sign (-), but, as the scatter diagram shows (Figure 8), there was little variation in price over the period and in any event, the import price statistics are probably highly unreliable. With the anomalous points in 1956-60 removed (the outlying points in the scatter diagram), price was no longer significant. It was thought that consumption may be supply rather than demand driven, as fuelwood is often a byproduct of harvesting roundwood for other uses. However, adding a variable for the total production of roundwood did not improve the model greatly. National income, population and income per head were also not significant.



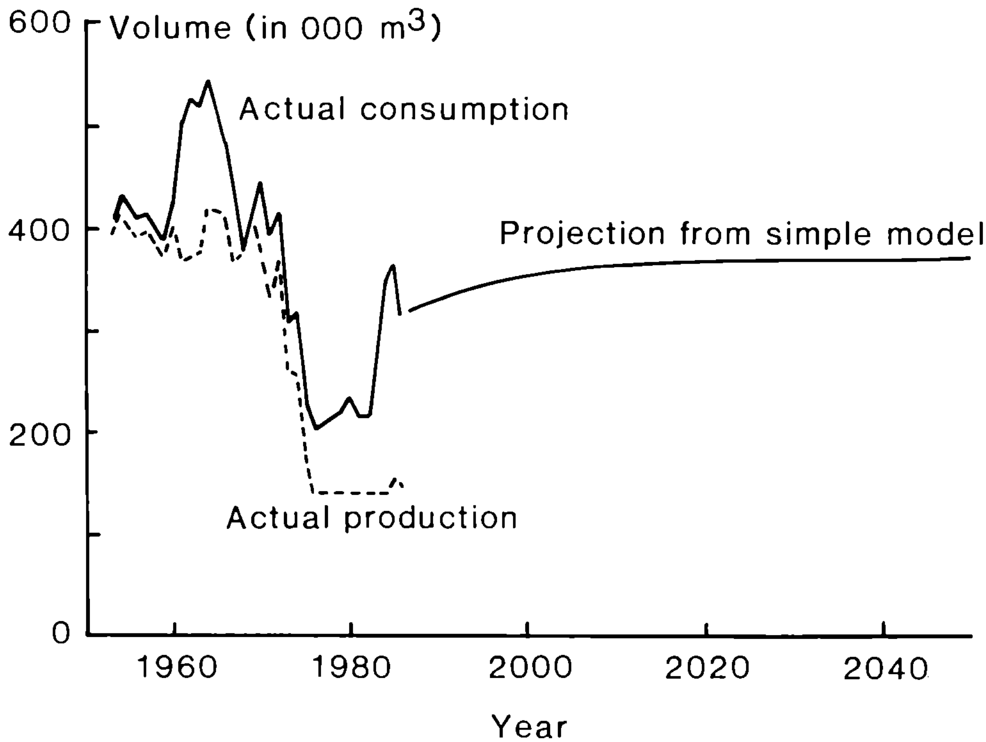




**Figure 8** Fuelwood and charcoal

*Top:* Scatter diagram of the price and quantity combinations over the period 1956-1986

*Bottom:* Production and consumption 1953-1986, with a forecast to 2050

Correction for autocorrelation resulted in all the coefficients, except the autocorrelation coefficient, becoming insignificant. Nothing could be found to explain consumption better than its own past history. So, an autoregressive or AR(1) model was constructed for aggregate and per capita consumption. The results of this are presented in Table 9.

**Table 9** Time series models

| Variable | *Aggregate model* | | *Per capita model* | |
|---|---|---|---|---|
| | *Estimate* | *t-statistic* | *Estimate* | *t-statistic* |
| AR(1) | 0.917 | 13.92 | 0.927 | 16.24 |
| Mean | 370.536 | 6.17 | 7.069 | 6.13 |
| Constant | 30.755 | | 0.514 | |
| $\chi^2$ or Portmanteau test | | 97.69% | | 97.44% |
| Residual standard error | | 42.05 | | 0.77 |

There is very little to choose between the two models, but the aggregate model was chosen as the best on the grounds of its slightly better tests statistic results. This model has been used to generate a forecast that is presented in Figure 8. This forecast is only a rough indication of what future demand might be, because in the future, fuelwood may become more attractive as a renewable source of energy, and tastes may change back in favour of open fires.

## Other industrial roundwood

The main constituents of this category are round mining timber and roundwood for stakes, poles, fencing and other agricultural uses. Because these are final products for industry, it was decided to model aggregate consumption only, as consumption per capita would not be a sensible variable.

Simple, log-linear and semi-log specifications were examined, and simple and log-linear appeared to be the best. Significant variables were the price of concrete (a substitute for wood in many cases), the output of deep-mined collieries, and a dummy variable reflecting the mineworkers strike of 1984/85. The last two variables reflect the importance of round mining timber in this category. Price was not significant, so the demand curve is either very inelastic or could not be identified. National income was also not significant. Because deep-mined coal production is falling while the rest of the economy is growing, this would not be a useful explanatory variable anyway. The results of the regression are shown in Table 10.

**Table 10** Aggregate models

| Variable | *Simple model* | | *Log-linear model* | |
|---|---|---|---|---|
| | *Estimate* | *t-statistic* | *Estimate* | *t-statistic* |
| (Log) Colliery output | 4.233 | 7.58 | 1.591 | 12.46 |
| (Log) Concrete price | — | — | 1.231 | 2.60 |
| Strike | — | — | 1.473 | 5.37 |
| Constant | — | — | - 7.022 | - 3.11 |
| $\rho$ | 0.684 | 5.14 | — | — |
| R-bar squared | | — | | 84.69% |
| Standard error of the regression | | 138.95 | | 0.21 |
| Durbin-Watson statistic | | 1.77 | | 1.30 |

A low Durbin-Watson statistic appeared for the simple model, which was at the boundary between definite and uncertain autocorrelation, so the model was corrected using Cochrane-Orcutt's iterative method to estimate the autocorrelation coefficient — $\rho$. The log-linear model had a Durbin-Watson statistic in the centre of the uncertain region, and a run-of-signs test (Gujarati, 1987) gave the probability of rejecting the null hypothesis (of no autocorrelation) incorrectly as 0.075, so the regression was accepted without adjustment.

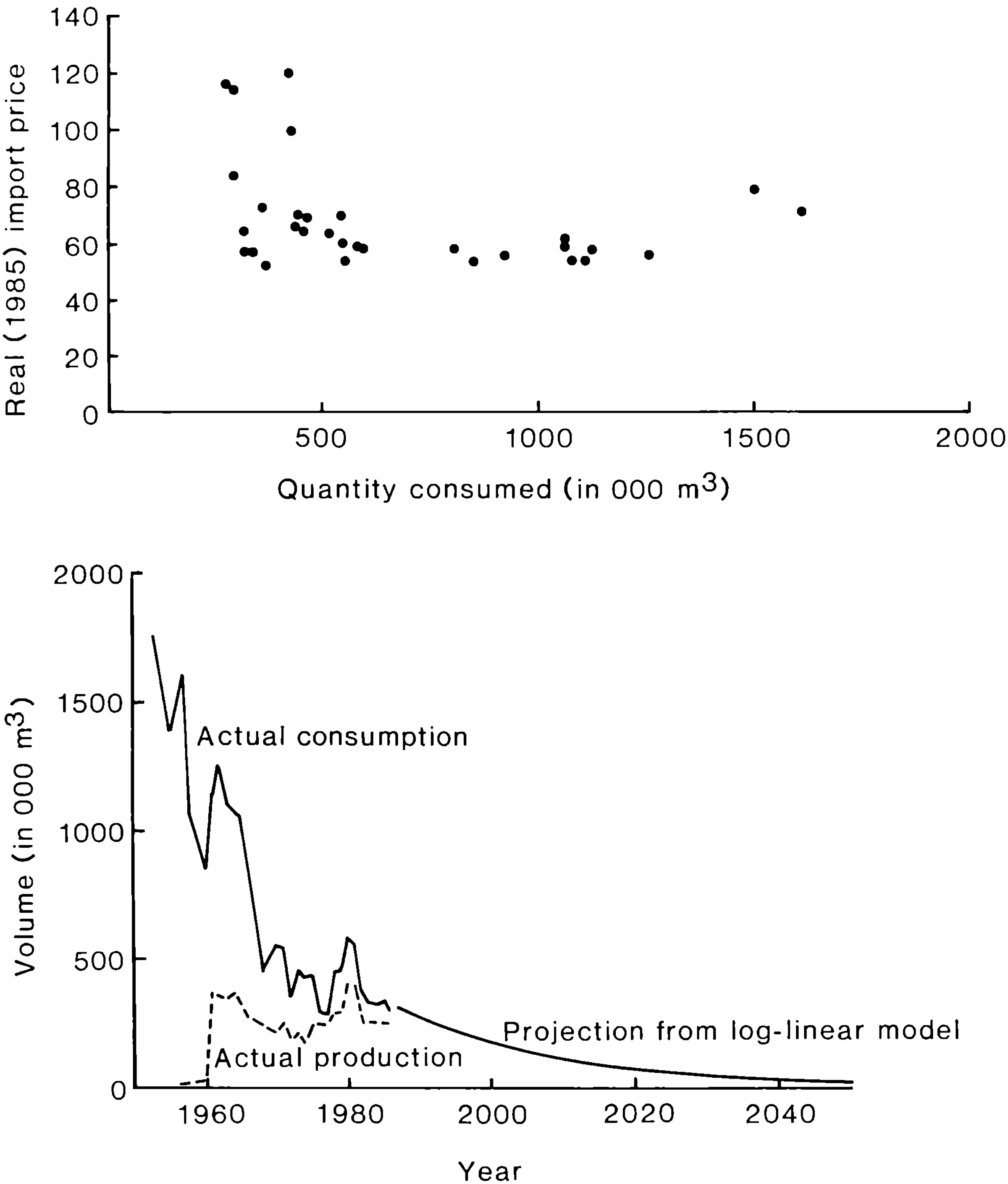



**Figure 9** Other industrial roundwood

*Top:* Scatter diagram of the price and quantity combinations over the period 1956-1986.

*Bottom:* Production and consumption 1953-1986, with a forecast to 2050.

A forecast from the log-linear model is presented in Figure 9. Because of uncertainties about a constant in the simple model* it was decided that this model would be better for forecasting purposes. Although the forecast indicates demand falling to virtually zero, it is plausible to assume that a small residual use of round timber (e.g. for estate and agricultural purposes) is likely to continue.

## Coniferous sawnwood

Coniferous sawnwood is a commodity primarily used in the construction industry (see Table 1). The level of activity in the construction industry was therefore taken to be the main non-price explanatory variable in the demand equations. Substitute prices of concrete products (SIC§ 2437), wood based panels (i.e. the aggregate of all four panel products) and non-coniferous sawnwood were also found to be significant variables in the models.

Aggregate and per capita consumption models were examined, and simple and log-linear forms appeared to give the best results. In most cases, the models improved significantly by using lagged own-price rather than current own-price. It is difficult to say why this should happen, but it might have something to do with the nature of stocks held by the construction industry. On average, this resulted in an improvement in $R^2$ of about 10 percentage points, and a reduction in the standard error of between 25-50%. Lagged-price was therefore, used in all the final models. The results of the four final models are presented in Tables 11 and 12.

**Table 11** Aggregate models

| *Variable* | *Simple* | | *Log-linear* | |
|---|---|---|---|---|
| | *Estimate* | *t-statistic* | *Estimate* | *t-statistic* |
| (Log) Lagged price | - 26.968 | - 6.56 | - 0.582 | - 9.64 |
| (Log) Construction | 78.090 | 14.49 | 1.265 | 24.16 |
| (Log) WBP price | 5.375 | 4.19 | 0.305 | 9.74 |
| (Log) Concrete price | 24.987 | 3.31 | 0.757 | 8.89 |
| (Log) Non-coniferous sawnwood price | — | — | 0.161 | 2.47 |
| Standard error of the regression | | 496.33 | | 0.05 |
| Durbin-Watson statistic | | 1.74 | | 2.41 |
| Adjusted SE† | | 496.33 | | 384.39 |

**Table 12** Per capita models

| *Variable* | *Simple* | | *Log-linear* | |
|---|---|---|---|---|
| | *Estimate* | *t-statistic* | *Estimate* | *t-statistic* |
| (Log) Lagged price | - 0.476 | - 6.56 | - 0.564 | - 9.35 |
| (Log) Construction per capita | 111.849 | 6.38 | 1.426 | 16.81 |
| (Log) WBP price | 0.143 | 4.99 | 0.304 | 9.68 |
| (Log) Concrete price | 1.124 | 2.83 | 0.902 | 10.91 |
| (Log) Non-coniferous sawnwood price | 0.098 | 2.08 | 0.202 | 3.17 |
| Constant | - 160.182 | - 2.13 | — | — |
| R-bar squared | | 81.63% | | — |
| Standard error of the regression | | 8.35 | | 0.05 |
| Durbin-Watson statistic | | 2.09 | | 2.38 |
| Adjusted SE† | | 460.08 | | 383.28 |

†Adjusted standard error is the standard error of the regression calculated over the period 1957-86 from the estimates and residuals transformed back from their logged or per capita states. This makes comparison between models easier, because $R^2$ is meaningless for models without a constant.

*The removal of the constant from the simple model after adjustment for autocorrelation was due to rejection at the 5% significance level. It was, however, significant at the 8% level.

§SIC = Standard International Trade Classification (Revision 2) see HM Customs and Excise, 1985.

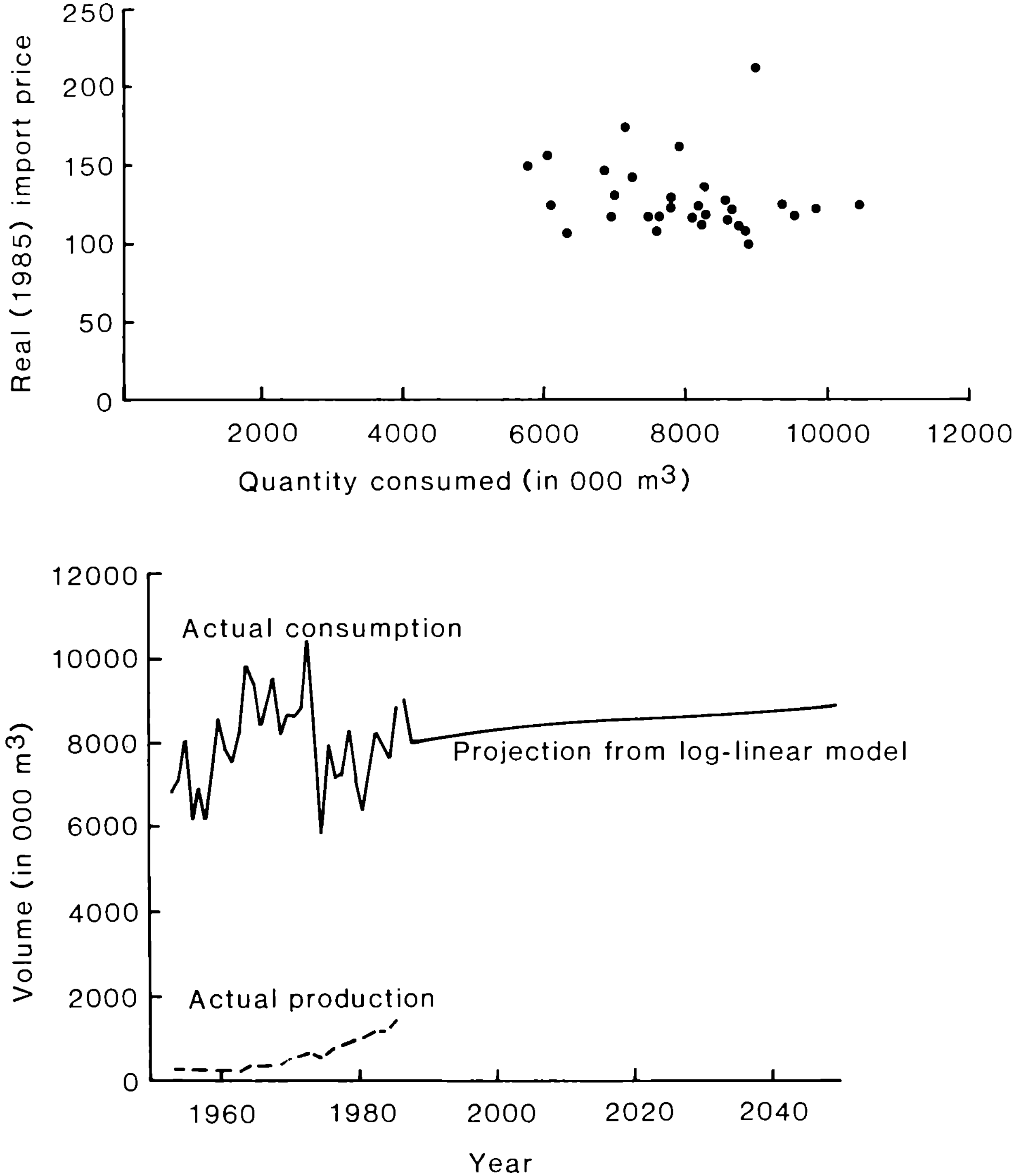



**Figure 10** Coniferous sawnwood

*Top:* Scatter diagram of the price and quantity combinations over the period 1956-1986

*Bottom:* Production and consumption 1953-1986, with a forecast to 2050

The log-linear per capita consumption model gave the best fit judging by the adjusted standard error and, generally, per capita models were better than aggregate models, and the log-linear specification better than the simple. However, the economic arguments behind the per capita models are not entirely convincing. While it may be argued that a proportion of construction is for housing, which is related to population, it could not really be defined as a final product for consumption. One would not therefore, necessarily expect a stable per capita demand function to hold over a long period of time. Construction depends on the level of economic activity, and the nature of that activity, as much as population, so it was decided to use the aggregate consumption models for forecasting purposes.

Because of its very low adjusted standard error, the log-linear model was chosen as the best available, and was used to forecast consumption to 2050. The results are presented in Figure 10. (Forecasts from both the per capita models and the simple model were close to this projection but showed slightly lower growth.)

## Non-coniferous sawnwood

Non-coniferous sawnwood consumption was modelled in essentially the same way as coniferous sawnwood consumption. Own price was significant in all cases, as was the level of construction activity, and the (substitute) prices of wood based panels and concrete products. Unlike coniferous sawnwood, lagged own price was not significant in any of the models, so current own price was used. This may be because the construction industry accounts for a much lower proportion of the end uses of sawn hardwood. The results from the best model specifications tried are given in Tables 13 and 14.

**Table 13** Aggregate models

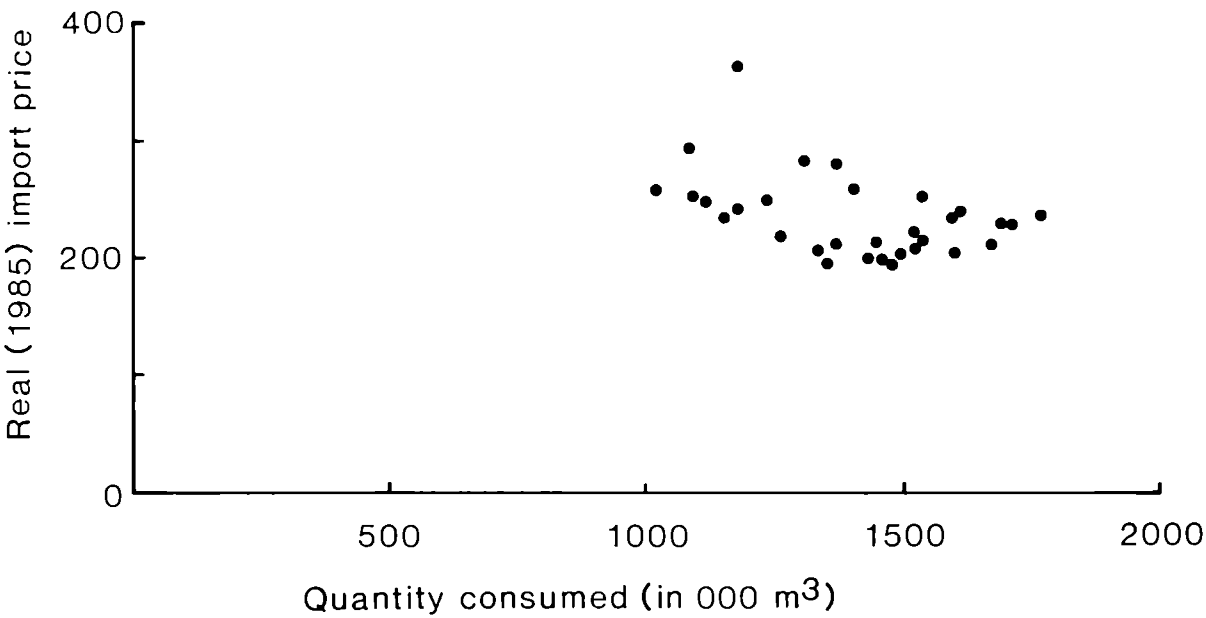
| *Variable* | *Simple* | | *Log-linear* | |
|---|---|---|---|---|
| | *Estimate* | *t-statistic* | *Estimate* | *t-statistic* |
| (Log) Price | - 2.055 | - 3.10 | - 0.370 | - 3.29 |
| (Log) Construction | 8.636 | 6.52 | 0.742 | 8.56 |
| (Log) WBP price | 2.114 | 7.28 | 0.478 | 9.76 |
| (Log) Concrete price | 5.054 | 2.34 | 0.707 | 4.85 |
| Standard error of the regression | | 127.46 | | 0.08 |
| Durbin-Watson statistic | | 1.79 | | 1.89 |
| Adjusted SE* | | 127.46 | | 124.15 |

**Table 14** Per capita models

| *Variable* | *Simple* | | *Log-linear* | |
|---|---|---|---|---|
| | *Estimate* | *t-statistic* | *Estimate* | *t-statistic* |
| (Log) Price | - 0.040 | - 3.38 | - 0.419 | - 3.79 |
| (Log) Construction per capita | 7.977 | 5.75 | 0.597 | 4.10 |
| (Log) WBP price | 0.043 | 8.25 | 0.477 | 9.57 |
| (Log) Concrete price | 0.100 | 2.52 | 0.557 | 3.94 |
| Standard error of the regression | | 2.30 | | 0.09 |
| Durbin-Watson statistic | | 1.82 | | 1.90 |
| Adjusted SE* | | 126.88 | | 126.58 |

*See note to Tables 11 and 12.

The models all gave roughly the same forecasts of future consumption, and the log-linear forecast is given in Figure 11. This was judged to be the best model on the grounds of its lowest adjusted standard error. The projection does not appear to fit in with recent history, which has shown a decline in consumption of its product. This is due to the assumption about constant long run prices in the future. Were price to continue to increase in the future, as it has in the recent past (see Figure 19), then consumption of this product would be likely to fall in the future.



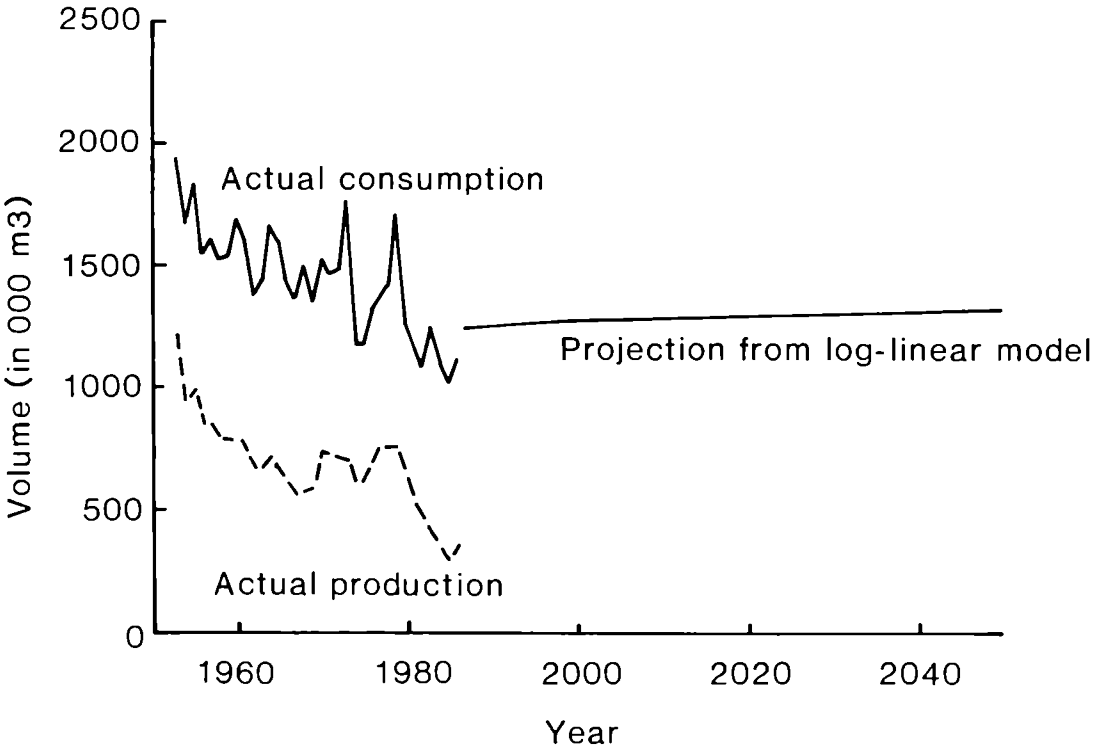




**Figure 11** Non-coniferous sawnwood

*Top:* Scatter diagram of the price and quantity combinations over the period 1956-1986

*Bottom:* Production and consumption 1953-1986, with a forecast to 2050

## Printing and writing paper

Printing and writing paper covers a wide range of products from poster paper to banknotes. This paper is of a much higher quality than newsprint and is, in many of the products, coated. There has been significant growth in this product group over the last 30 years, and consumption has increased from 700 000 t in 1953 to over 2 500 000 t in 1986.

With increased affluence, tastes have changed, and higher quality paper is often seen as preferable to newsprint. Consequently, there has been a move towards more colour supplements and a greater use of coated papers in newspapers and magazines. Also, computers have greatly increased the demand for paper, as advances in computer graphics, laser printing and desktop publishing, have enabled companies and individuals to produce higher quality documents and presentations at a much lower cost than would have been possible only a decade ago. It would therefore, seem likely that rapid growth in this product group will continue well into the future, possibly at the expense of growth in newsprint and other paper consumption.

The models of printing and writing paper consumption that were investigated all generated high growth rates for the future, and had income elasticities of greater than one. With such a strong growth trend present in the data, the models were all highly autocorrelated, and apart from income, no other significant variables could be found. Because price was not an explanatory variable, the longer run of consumption data back to 1953 could be used to determine the coefficients.

Although printing and writing paper is consumed by individuals in the form of books and magazines, it was felt that so much of it is used in industry and especially the service sector, that per capita consumption models would not be valid. Therefore, only the aggregate consumption models are presented in Table 15.

**Table 15** Aggregate models

| *Variable* | *Simple* | | *Log-linear* | |
|---|---|---|---|---|
| | *Estimate* | *t-statistic* | *Estimate* | *t-statistic* |
| Constant | — | — | - 6.441 | - 4.93 |
| (Log) GDP | 0.006 | 20.96 | 1.098 | 10.45 |
| $\rho$ | 0.741 | 6.34 | 0.589 | 4.18 |
| Adjusted $R^2$ | | — | | 44.05% |
| Standard error of the regression | | 113.25 | | 0.07 |
| Durbin-Watson statistic | | 1.98 | | 2.06 |
| Adjusted SE* | | 113.25 | | 114.38 |

*See note to Tables 11 and 12.

The above models gave high forecasts of future consumption and because of its lower standard error, the simple model was chosen as the best to forecast with. The forecast was checked against figures for consumption per head across a range of countries over the period 1964-1987 (see Appendix 3). From the cross-sectional evidence, it seemed very unlikely that consumption would rise above 0.12 t per head per year, which is roughly the level reached by 2030. The forecast from the model was therefore ended at 2030, and assumed to rise after that only in line with population (see Figure 12).

## Newsprint

Newsprint is the older, more established of the three paper product groups analysed in this work. Because of this, the supply and demand for the product has been much more stable over the last 30 years, as one would expect from such a mature industry. Price increased in the early 1970s, as did the price for all major commodities (see Figure 19), and the market consequently collapsed and fell into recession in the latter half of the decade. The market has now, however, recovered. Fears have been expressed about the future for newsprint, given the widespread use of radio and television to entertain and present news, and of computers to hold information electronically. Although these possibilities have not been explored in this paper, it would seem unlikely that this will happen, as many of the new forms of data storage and transmission media actually complement paper rather than replace it (Jakko Pöyry, 1984).

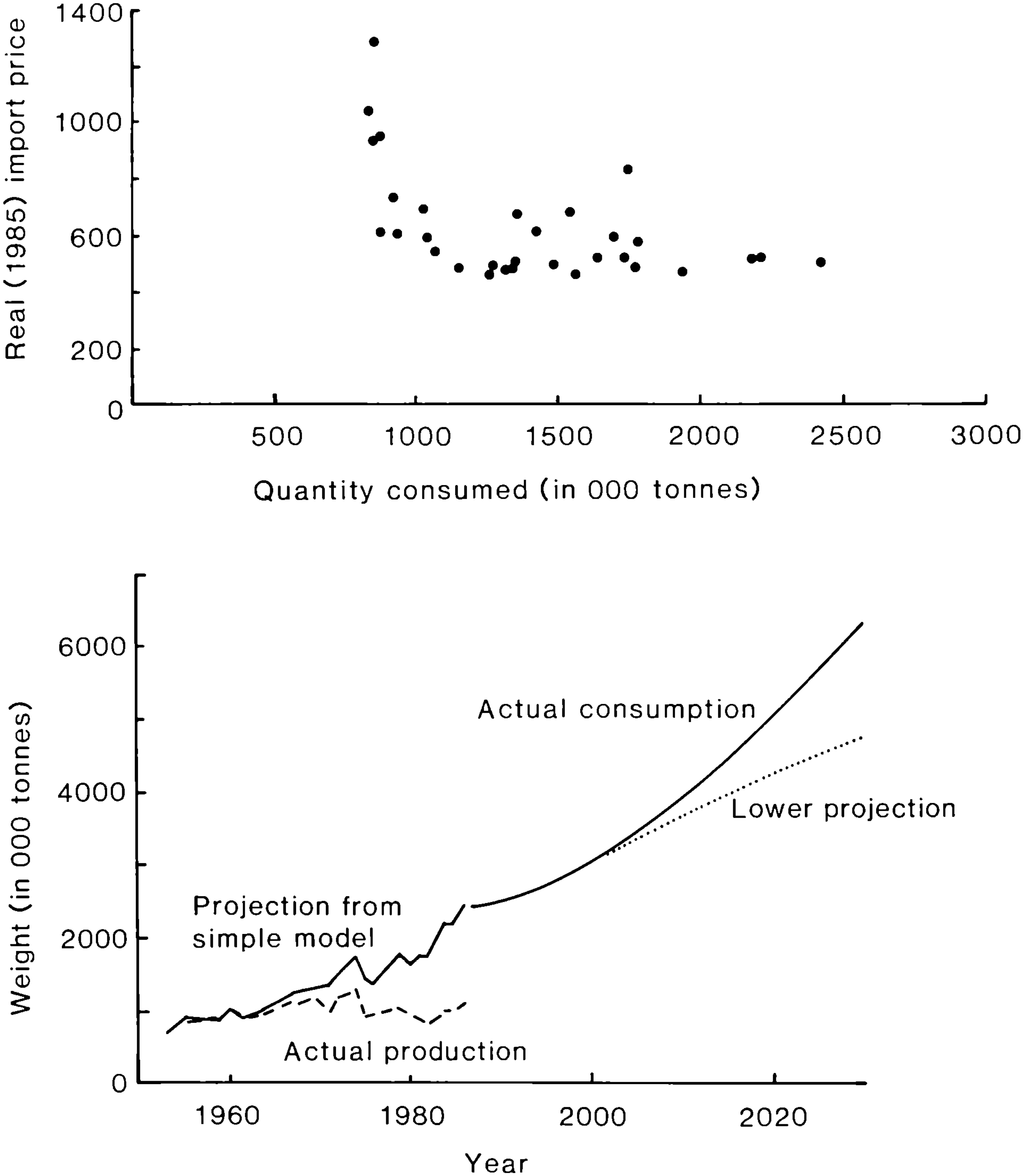



**Figure 12** Printing and writing paper

*Top:* Scatter diagram of the price and quantity combinations over the period 1956-1986

*Bottom:* Production and consumption 1953-1986, with a forecast to 2030

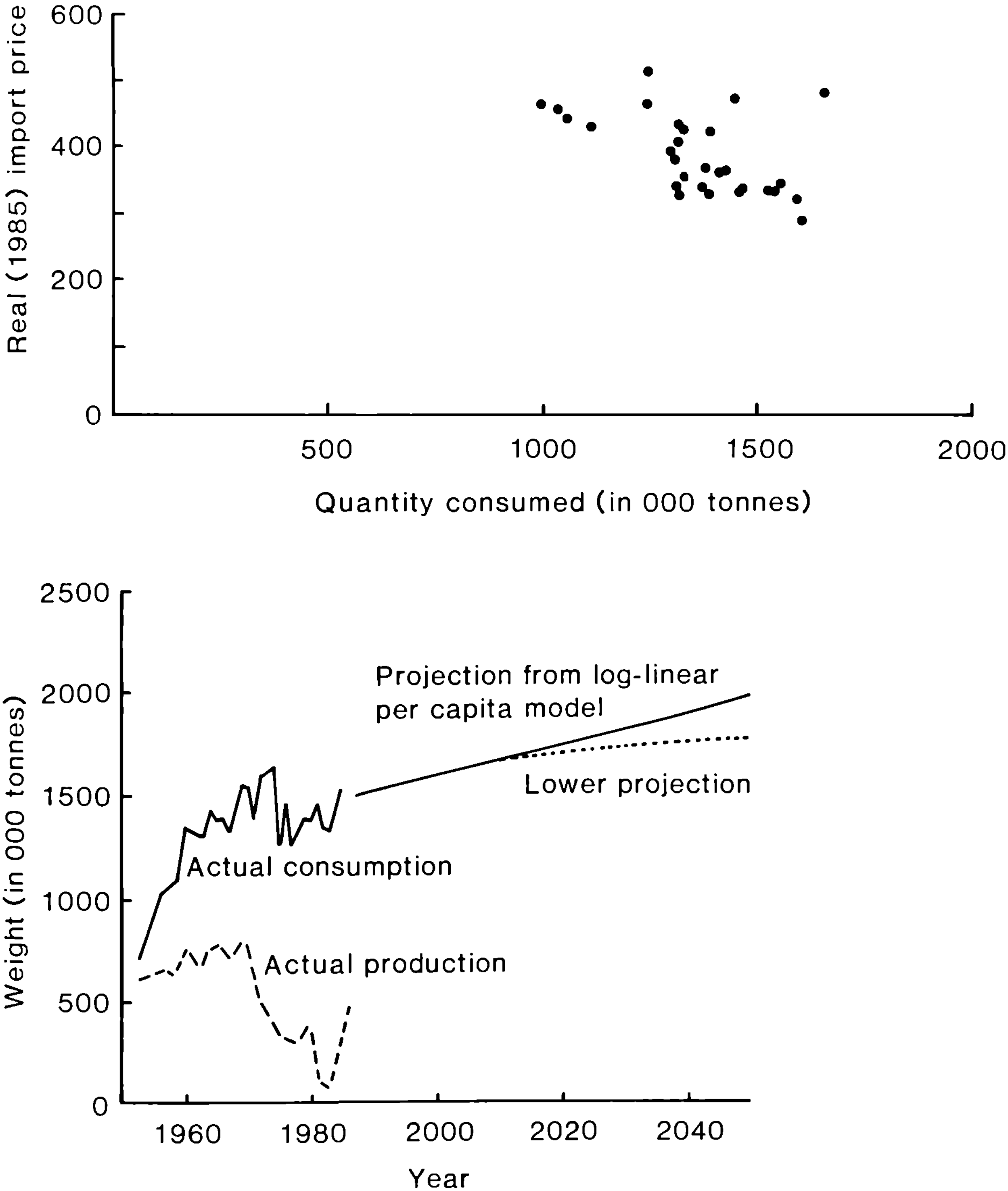



**Figure 13** Newsprint

*Top:* Scatter diagram of the price and quantity combinations over the period 1956-1986

*Bottom:* Production and consumption 1953-1986, with a forecast to 2050

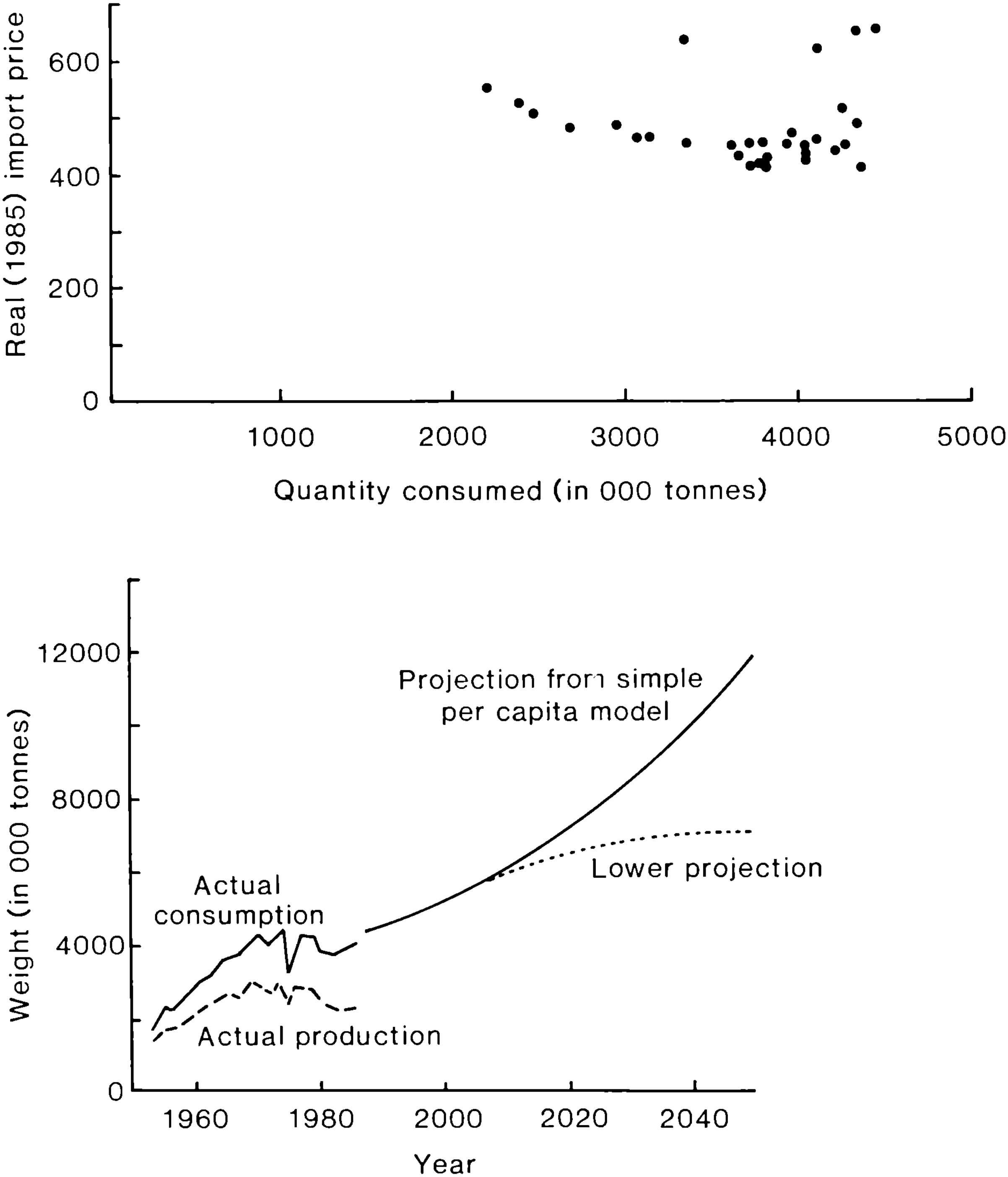



**Figure 14** Other paper and paperboard

*Top:* Scatter diagram of the price and quantity combinations over the period 1956-1986

*Bottom:* Production and consumption 1953-1986, with a forecast to 2050

Several model specifications were examined and the log-linear specifications appeared to give better results in terms of their test statistics and the credibility of their forecasts. The results of the two best models are presented in Table 16. Because newspaper is consumed by individuals and is not really a product for industry, and in view of the better test statistic results, the log-linear per capita model is to be preferred, and is used to produce the forecast shown in Figure 13. This forecast lies well within the expected limits discussed in Appendix 3.

**Table 16** Log-linear models

| *Variable* | *Simple model* | | *Per capita model* | |
|---|---|---|---|---|
| | *Estimate* | *t-statistic* | *Estimate* | *t-statistic* |
| Constant | 6.235 | 5.70 | 3.926 | 4.35 |
| Log price | - 0.334 | - 3.17 | - 0.316 | - 3.16 |
| Log GDP | 0.239 | 4.06 | 0.138 | 2.19 |
| Adjusted $R^2$ | | 54.28% | | 37.98% |
| Standard error of the regression | | 0.08 | | 0.08 |
| Durbin-Watson statistic | | 1.38 | | 1.49 |
| Adjusted SE* | | 115.35 | | 110.28 |

*See note to Tables 11 and 12.

## Other paper and paperboard

This product grouping includes all forms of paper tissues and towelling, paper for packaging, and construction paper. Consumption is therefore, split fairly evenly between individual and industrial use. Past growth has been strong and is expected to continue in the future. All forecasts were examined against consumption figures from other countries (see Appendix 3) and were found to be plausible. The two best forecasts were chosen on the grounds of their low adjusted standard error, and both turned out to be per capita consumption models. They are presented in Table 17.

**Table 17** Per capita models

| *Variable* | *Simple* | | *Log-linear* | |
|---|---|---|---|---|
| | *Estimate* | *t-statistic* | *Estimate* | *t-statistic* |
| Constant | 44.479 | 4.01 | — | — |
| (Log) per capita GDP | 0.005 | 2.31 | 0.499 | 116.93 |
| $\rho$ | 0.653 | 4.72 | 0.664 | 4.86 |
| Adjusted $R^2$ | | 73.00% | | — |
| Standard error of the regression | | 4.61 | | 0.07 |
| Durbin-Watson statistic | | 2.31 | | 2.26 |
| Adjusted SE* | | 257.69 | | 257.52 |

*See note to Tables 11 and 12.

The models were all corrected for the high degree of autocorrelation that was present in the data, and no significant price relationship could be found. In view of its slightly more plausible demand forecast, the simple model was used to produce the forecast given in Figure 14.

## Plywood

Plywood is used mainly in the construction industry as shuttering for manufacturing pre-cast concrete structures. A little is also used in the marine sector, where its strength properties and resistance to warping when wet, make it very useful. Such consumption is well established, and has shown low sustained growth over the period 1953-1986.

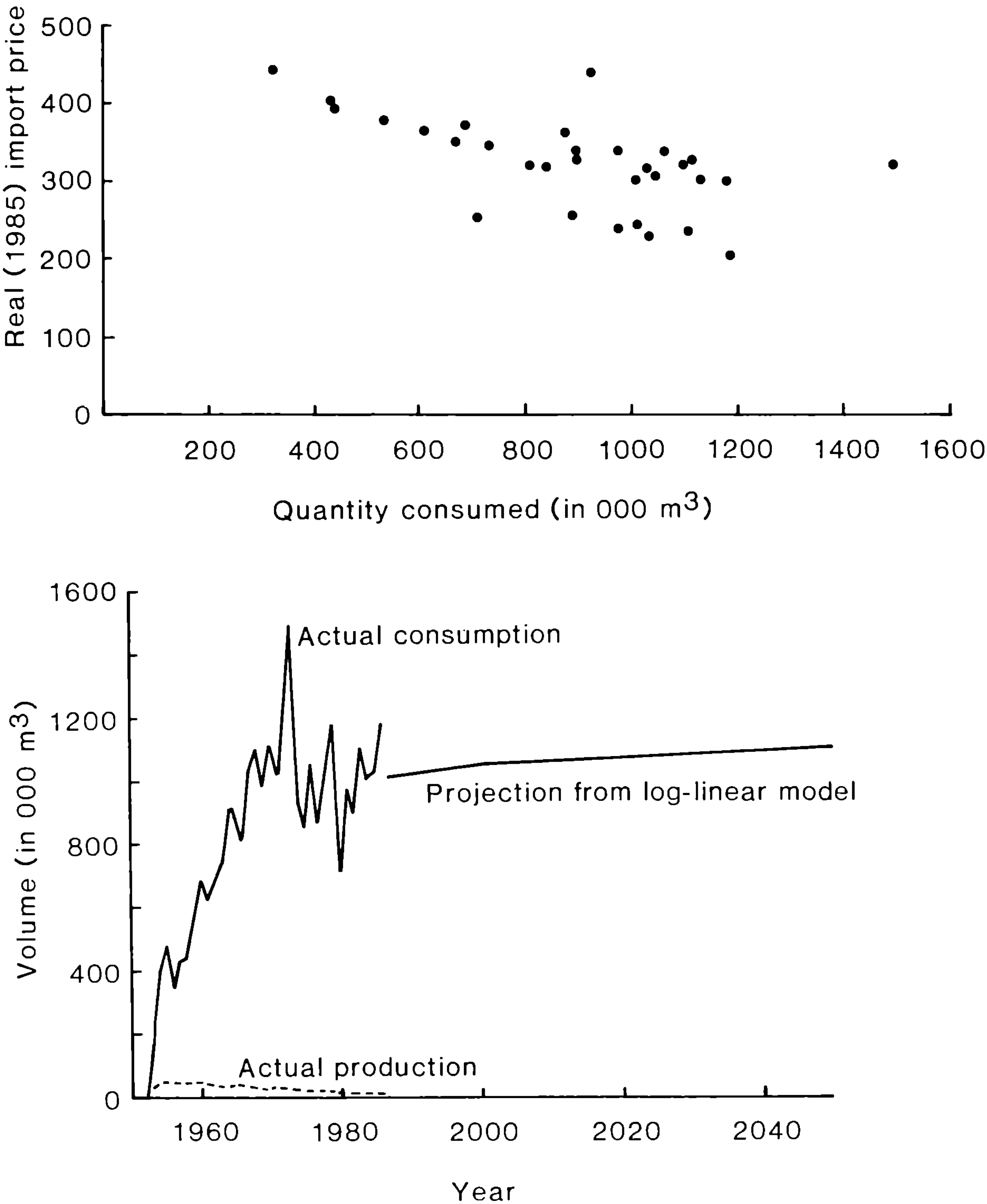



**Figure 15** Plywood

*Top:* Scatter diagram of the price and quantity combinations over the period 1956-1986

*Bottom:* Production and consumption 1953-1986, with a forecast to 2050

Simple, semi-log and log-linear specifications of the demand model were examined, and all appeared to give good results. Own price, the level of construction activity in the economy, and the price of non-coniferous sawnwood, were all found to be significant explanatory variables and had the correct sign. The results from the modelling exercise are presented in Tables 18 and 19.

**Table 18** Aggregate models

| *Variable* | *Simple* | | *Log-linear* | |
|---|---|---|---|---|
| | *Estimate* | *t-statistic* | *Estimate* | *t-statistic* |
| (Log) Price | - 2.119 | - 6.72 | - 0.761 | - 7.31 |
| (Log) Construction | 13.109 | 12.09 | 1.981 | 14.94 |
| (Log) Non-coniferous sawnwood price | 1.146 | 2.27 | 0.371 | 2.91 |
| Standard error of the regression | | 115.98 | | 0.13 |
| Durbin-Watson statistic | | 2.31 | | 2.13 |
| Adjusted SE* | | 115.98 | | 114.17 |

**Table 19** Per capita models

| *Variable* | *Simple* | | *Log-linear* | |
|---|---|---|---|---|
| | *Estimate* | *t-statistic* | *Estimate* | *t-statistic* |
| (Log) Price | - 0.037 | - 5.83 | - 0.808 | - 6.32 |
| (Log) Construction (per capita) | 17.278 | 8.03 | 2.351 | 9.11 |
| (Log) Non-coniferous sawnwood price | 0.037 | 3.45 | 0.616 | 3.38 |
| Constant | 12.082 | 2.09 | 2.647 | 2.02 |
| Standard error of the regression | | 2.02 | | 0.13 |
| Adjusted $R^2$ | | 78.32% | | 81.68% |
| Durbin-Watson statistic | | 2.60 | | 2.16 |
| Adjusted SE* | | 112.30 | | 114.35 |

*See note to Tables 11 and 12.

All the models gave forecasts that were well within the expected limits of consumption per capita (Appendix 3). Again, per capita consumption models did not seem appropriate, as plywood is mainly used industrially, so the best of the aggregate models, the log-linear specification, was used to generate the forecast presented in Figure 15. This forecast is quite different from those presented for fibreboard and particleboard because they were explained by general investment in the economy, which was assumed to grow much more rapidly in the future than construction.

## Fibreboard

Fibreboard has many uses in industry and has shown a steady but erratic growth in consumption over the past 30 years. The unsteady growth in demand for this product can in part be attributed to the inroads that particleboard has made into the traditional markets for fibreboard. Use of this product is not restricted to construction, so investment in the economy, gross domestic fixed capital formation (GDFCF) was used as an explanatory variable in the regression model. This did turn out to be more successful at explaining historical demand than either income or the index of construction output. Price was significant, and the price coefficient had the correct sign. Autocorrelation was very strong, so all the demand models examined had to be corrected using the Cochrane-Orcutt technique. The results of the four main specifications tried are presented in Tables 20 and 21.

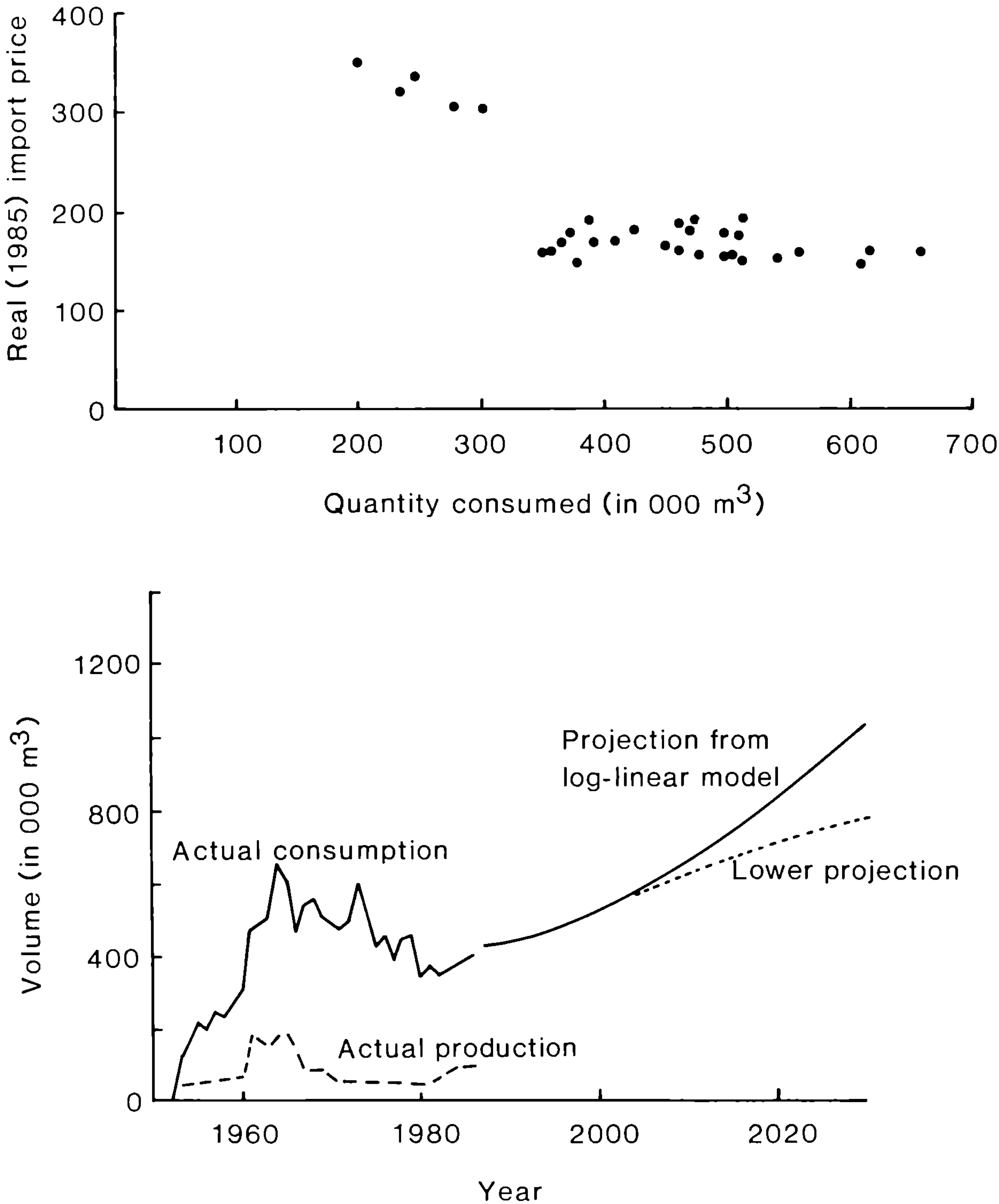



**Figure 16** Fibreboard

*Top:* Scatter diagram of the price and quantity combinations over the period 1956-1986

*Bottom:* Production and consumption 1953-1986, with a forecast to 2030

**Table 20** Aggregate models

| *Variable* | *Simple* | | *Log-linear* | |
|---|---|---|---|---|
| | *Estimate* | *t-statistic* | *Estimate* | *t-statistic* |
| (Log) Price | - 1.938 | - 6.03 | - 0.908 | - 6.28 |
| (Log) GDFCF | 0.012 | 7.09 | 0.957 | 14.16 |
| $\rho$ | 0.942 | 15.37 | 0.959 | 18.48 |
| Standard error of the regression | | 40.27 | | 0.09 |
| Durbin-Watson statistic | | 2.23 | | 2.39 |
| Adjusted SE* | | 40.27 | | 37.69 |

**Table 21** Per capita models

| *Variable* | *Simple* | | *Log-linear* | |
|---|---|---|---|---|
| | *Estimate* | *t-statistic* | *Estimate* | *t-statistic* |
| (Log) Price | - 0.036 | - 6.19 | - 0.927 | - 6.55 |
| (Log) GDFCF | 0.012 | 7.05 | 0.954 | 9.33 |
| $\rho$ | 0.942 | 15.37 | 0.956 | 17.75 |
| Standard error of the regression | | 0.72 | | 0.09 |
| Durbin-Watson statistic | | 2.21 | | 2.38 |
| Adjusted SE* | | 39.93 | | 37.83 |

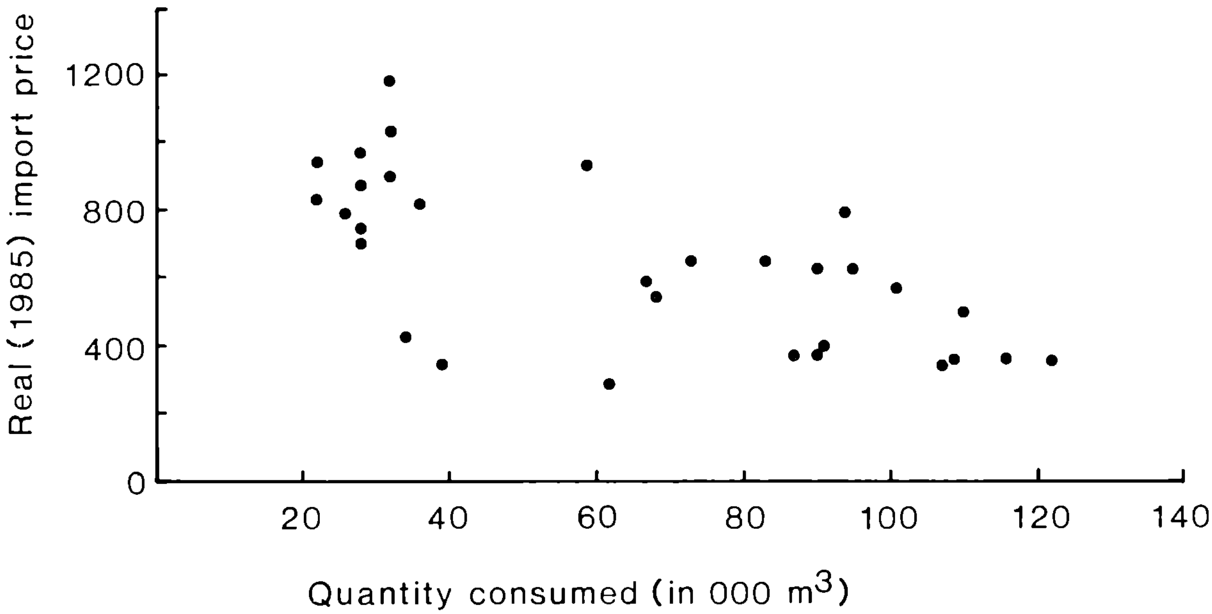
*See note to Tables 11 and 12.

The best model in terms of its test statistic results, was the aggregate log-linear specification, and this was chosen to generate a forecast to 2050. The model exhibited a very high growth rate in consumption, and the levels of future per capita consumption predicted were compared with those experienced in other countries (see Appendix 3). It was felt likely that the UK could only sustain levels of consumption at the lower end of the 0.02-0.04 t per head per year range in the future, a position that would be reached in the mid 2030s. The forecast was therefore altered to reflect this assumption, and consumption was only expected to grow in line with population once that point was reached. The forecast from the model, to 2030, is presented in Figure 16.

## Veneer sheets

Consumption of veneer sheets in the UK is quite small. The product is mainly used for laminating cheaper forms of processed wood such as chipboard and plywood, to make the finished product more attractive, and earn a higher price in the market place. The output index from the construction industry was found to be the best indicator of shifts in the demand curve, and was used, along with the price of non-coniferous sawnwood (a substitute to laminated products) in the demand specification. Own price was not significant as an explanatory variable.

Log-linear and simple specifications were examined in both aggregate and per capita consumption models. The simple specifications gave the best results, and are presented in Table 22. Of these, the simple aggregate model was chosen to forecast with because it was felt that veneer sheets are used in industry (e.g. for office furniture), as well as by individuals, which makes it difficult to justify using a per capita consumption model. This did however, go against the test statistic results, which indicated that the per capita model was better on the grounds of its lower adjusted standard error. The forecast (presented in Figure 17) fell within the limits of market saturation suggested in Appendix 3.



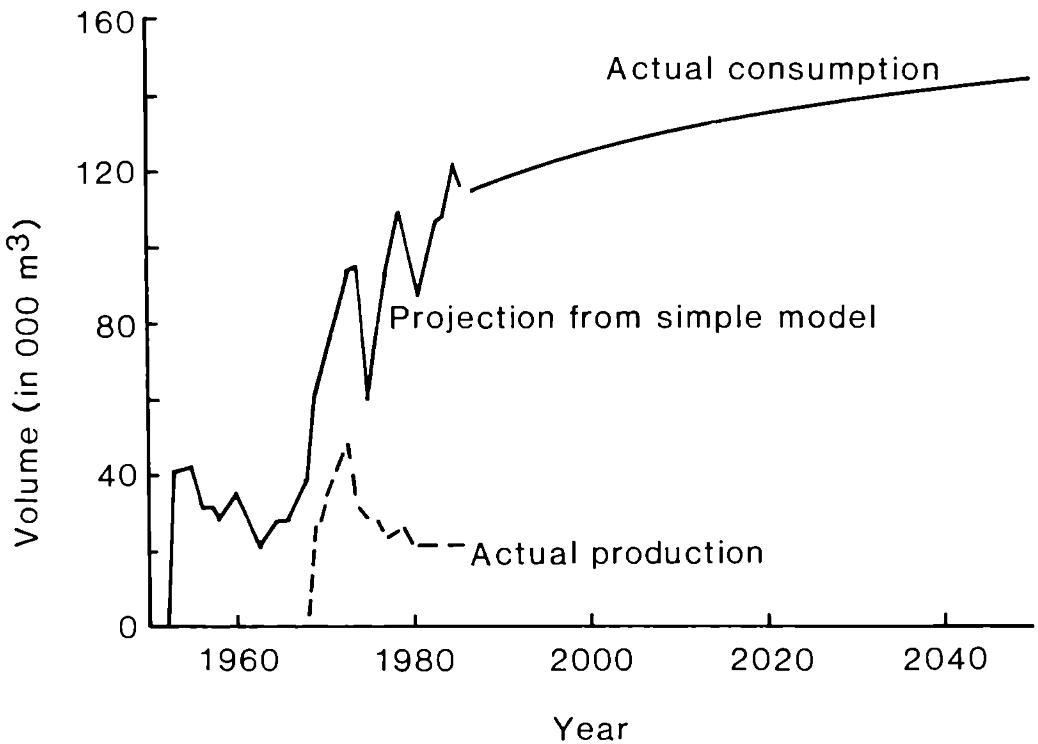




**Figure 17** Veneer sheets

*Top:* Scatter diagram of the price and quantity combinations over the period 1956-1986

*Bottom:* Production and consumption 1953-1986, with a forecast to 2050

**Table 22** Simple demand models

| Variable | Aggregate model Estimate | Aggregate model t-statistic | Per capita model Estimate | Per capita model t-statistic |
|---|---|---|---|---|
| Construction | 1.049 | 3.35 | 1.056 | 3.28 |
| Non-coniferous sawnwood price | 0.141 | 2.96 | 0.003 | 2.95 |
| $\rho$ | 0.976 | 24.30 | 0.975 | 23.86 |
| Standard error of the regression | | 9.59 | | 0.17 |
| Durbin-Watson statistic | | 1.90 | | 1.90 |
| Adjusted SE* | | 9.59 | | 9.57 |

*See note to Tables 11 and 12.

## Particleboard

Particleboard is the newest of the 11 product groups identified in this study. It is used in construction, furniture making and is quite a popular medium for DIY enthusiasts. Reliable price information only goes back as far as 1961, because before then, the amount of particleboard traded and manufactured was very small. So, a model was designed to explain consumption over the period 1961-1986.

Own price was a significant variable, and all three variables that could possibly shift the demand curve — GDP, GDFCF, and construction output — were significant in different models. GDFCF was chosen for the final model specification because it gave the best results of these three models. The models were all highly autocorrelated, and had to be adjusted to take this into account. The log-linear specifications performed better than others and are presented in Table 23. Of these, the aggregate model was chosen on the grounds that particleboard is used industrially as well as in the home, and also because this specification had better test statistic results.

The forecast showed rapid growth in consumption and, after a comparison with consumption in other countries (see Appendix 3), it was decided to halt the forecast at the year 2030, and assume that market saturation was reached at this point. Beyond that year, consumption was assumed to rise only in line with population. No attempt was made to smooth out the change in the rate of growth in consumption at 2030. The forecast to 2030 is presented in Figure 18.

**Table 23** Log-linear demand models

| Variable | Aggregate model Estimate | Aggregate model t-statistic | Per capita model Estimate | Per capita model t-statistic |
|---|---|---|---|---|
| Price | - 0.475 | - 2.30 | - 0.494 | - 2.45 |
| GDFCF | 0.911 | 9.66 | 0.874 | 6.00 |
| $\rho$ | 0.859 | 8.40 | 0.859 | 8.39 |
| Standard error of the regression | | 0.10 | | 0.10 |
| Durbin-Watson statistic | | 2.03 | | 2.01 |
| Adjusted SE* | | 119.76 | | 119.90 |

*See note to Tables 11 and 12.

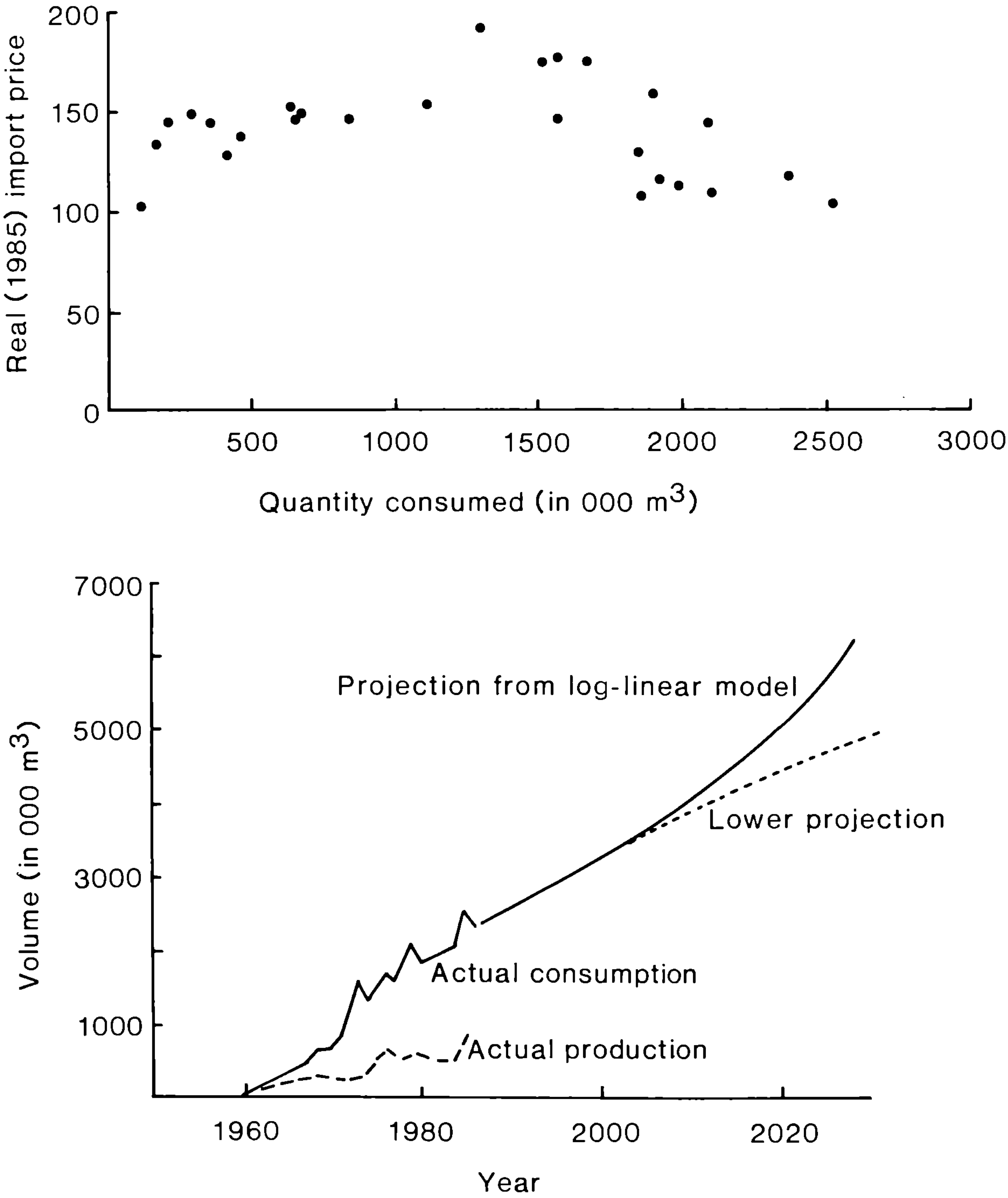



**Figure 18** Particleboard

*Top:* Scatter diagram of the price and quantity combinations over the period 1961-1986

*Bottom:* Production and consumption 1953-1986, with a forecast to 2030

# Appendix 2

# Projecting the explanatory variables for forecasting to 2050

The values of explanatory variables were obtained from the Central Statistical Office (1988) and United Nations (1988 and earlier). These figures were used to construct the models in Appendix 1. Forecasts of these variables were taken from existing sources where available, and time series models or averages of their past values were used, where not. These are presented in Table 24. The text below explains how each of the projections was calculated.

**Table 24** Projections of the explanatory variables used in the consumption forecasts 1987-2050

| *Variable* | *Years* | | | | | | |
|---|---|---|---|---|---|---|---|
| | *1990* | *2000* | *2010* | *2020* | *2030* | *2040* | *2050* |
| Resident population (in millions) | 57.291 | 58.859 | 59.338 | 59.798 | 60.233 | 60.668 | 61.103 |
| GDP (in £ millions, at 1985 market prices) | | | | | | | |
| Upper | 417 280 | 534 154 | 683 762 | 875 273 | 1 020 424 | 1 434 237 | 1 835 445 |
| Lower | 417 280 | 534 154 | 651 131 | 775 664 | 834 723 | 877 411 | 877 411 |
| GDFCF (in £ millions at 1985 market prices) | | | | | | | |
| Upper | 67 936 | 85 465 | 109 402 | 140 044 | 179 268 | 229 478 | 293 751 |
| Lower | 67 936 | 85 465 | 104 181 | 120 906 | 133 556 | 140 386 | 140 386 |
| Index of construction industry output (1990 = 100) | 100.6 | 103.4 | 104.5 | 105.3 | 106.2 | 107.1 | 108.0 |
| Production of deep mined coal (in million tonnes) | 80.0 | 59.0 | 43.5 | 32.1 | 23.7 | 17.5 | 12.9 |

*Note:* In all per capita consumption models, GDP, GDFCF, and construction output were converted to per capita figures by dividing through by population, and can be derived from the table above.

## Resident population

The Central Statistical Office publishes a forecast of resident UK population for every year to 1991, at 5-yearly intervals to 2015 and one for 2025 (Central Statistical Office, 1988, Table 2.7). These were used, along with straight line interpolations for the intervening years (where necessary), and a straight line extrapolation to 2050.

## Index of output of the construction industry

The ratio of output (Central Statistical Office, 1988, Table 14.6) to resident population was calculated. The average of this over the period 1977-86 was then used with the population projection to give a forecast of construction activity to 2050. This resulted in a much lower rate of growth when compared with growth of the general investment measure GDFCF.

## Production of deep mined coal

Examination of the production figures from 1950-1986 (Central Statistical Office, 1988, Table 8.4) suggested that a 3% per annum decrease in output would be most appropriate. This was extrapolated to 2050.

## Gross domestic fixed capital formation (GDFCF)

The proportion of gross domestic product (GDP) spent on this was calculated over the period 1950-1986 (Central Statistical Office, 1988, Table 14.1). Both numbers were deflated by the GDP deflator (at market prices) (Central Statistical Office, 1989, Table 1). Based on this evidence, an assumption that 16% of future GDP would be spent on GDFCF was used with the forecast of GDP (see below) to get a forecast to 2050.

## Gross domestic product

A Treasury forecast was available for growth in GDP to 1991 (HM Treasury, 1989, Table 2.1). Two growth assumptions were made beyond that date. The first was that there would be a constant real growth rate of 2½% per year throughout the period. The second was a declining rate of growth shown in Table 25.

**Table 25** Assumed lower growth rates in the UK economy to the year 2050

| *Years* | *Annual growth rate (%)* |
|---|---|
| 1991-2000 | 2½ |
| 2001-2010 | 2 |
| 2011-2020 | 1½ |
| 2021-2030 | 1 |
| 2031-2040 | ½ |
| 2041-2050 | 0 |

## Real price index of building products (referred to as concrete price)

Forecast set to the average of the last 10 years, 1977-86 (from Central Statistical Office, 1988, Table 18.3). The index was based on 1985 = 100, and the long run level was set at 99.9.

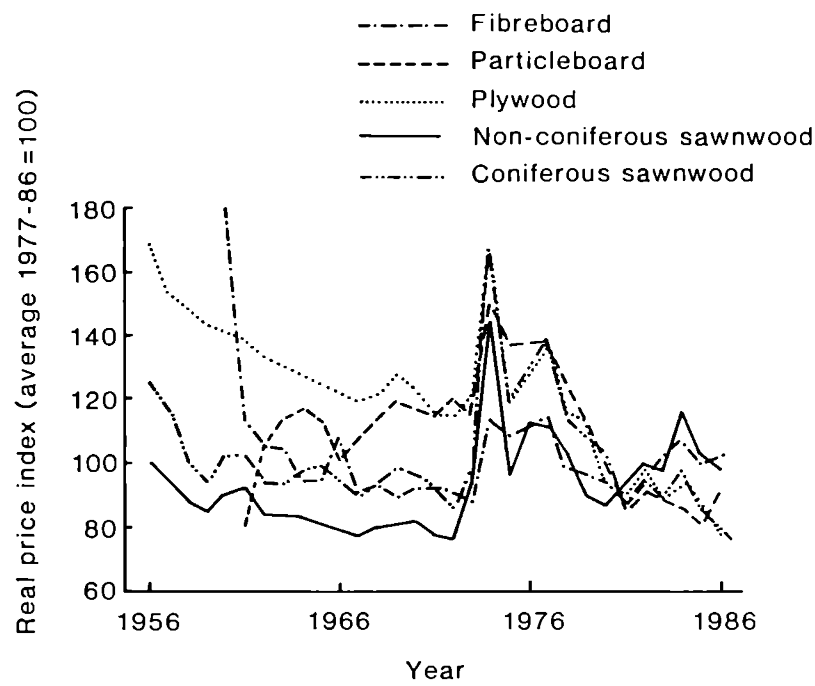
## Real price of wood

The average import price of each of the products was calculated (United Nations, 1988) for the period 1977-86. These averages were taken to be the long run price of those products and were used as the price projections to 2050. They are presented below in Table 26. The history of prices of the main product groups are shown in Figure 19. It seemed reasonable to use the 10-year average as a prediction of future prices because, with the exception of 1974, prices have been fairly stable since 1962 at about that level, and have shown no overall tendency to rise or fall. The influence of price on demand is discussed in Chapters 3 and 6.

**Table 26** The long-run price of wood products at 1985 prices

| | | | |
|---|---|---|---|
| Fibreboard | £168.50 per $m^3$ | Printing and writing paper | £538.82 per metric tonne |
| Particleboard | £127.03 per $m^3$ | Newsprint | £376.57 per metric tonne |
| Plywood | £262.89 per $m^3$ | Other paper and paperboard | £478.92 per metric tonne |
| Veneer sheet | £423.86 per $m^3$ | Total paper and paperboard | £464.65 per metric tonne |
| Wood based panels | £188.44 per $m^3$ | Non-coniferous sawnwood | £251.74 per $m^3$ |
| Fuelwood* | £38.40 per $m^3$ | Coniferous sawnwood | £124.80 per $m^3$ |
| Other industrial roundwood | £67.92 per $m^3$ | | |

*The import price for fuelwood is dubious, because it is possible that some roundwood destined for other used is ostensibly imported as fuelwood.



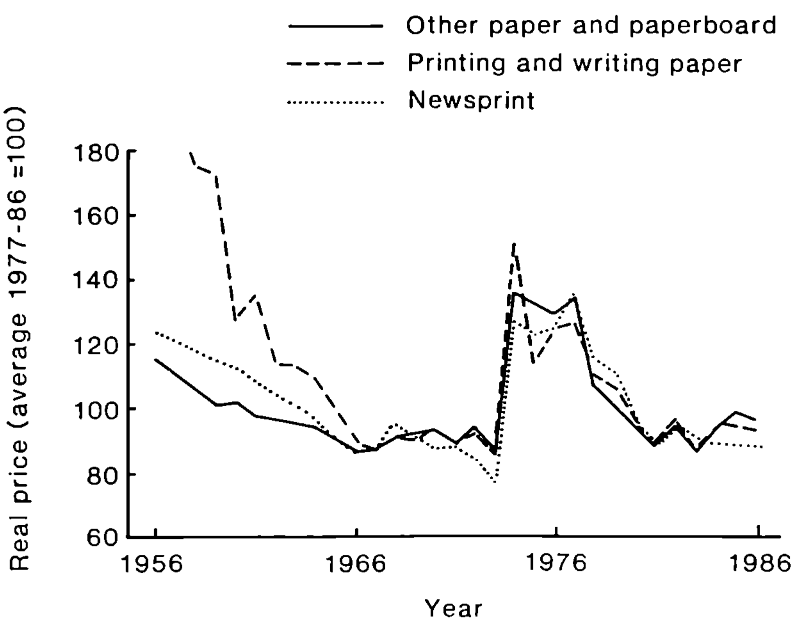




**Figure 19** Real price history 1956-1986

*Top:* Sawnwood and panel products

*Bottom:* Paper products

# Appendix 3

# Cross-sectional studies of consumption per head to 2050

Some of the models of demand for wood panels and paper products exhibited very rapid rates of growth in future demand. This is probably because, in many cases, the products are relatively new, and are still capturing the market from competing products. It could be expected that, in a more mature product market, growth would be rather slower, as demand for all goods increased with income, and the product in question merely held its ground. This is certainly the case for sawnwood and newsprint, two very well established products. Such rapid growth must, therefore, tail-off as product market-shares stabilise with maturity, but this makes forecasting future demand quite difficult.

There are two main problems:

1. When will market-shares stabilise, and growth rates come down?
2. At what level of consumption will this happen?

Through answering the second question it may be possible to get some idea of the answer to the first. If a figure for market saturation can be derived, then the demand models themselves will indicate when such levels of demand will occur if the model holds. This is what has been attempted in this study.

Several techniques may be used to estimate the fully saturated level of consumption. A microeconomic analysis could be used to examine how much of a product could physically be consumed, comparisons could be made with the consumption-growth curves of similar products that are now well established, or other countries could be examined to see if consumption in their markets had now settled down. The latter was chosen as the best course of action in this study.

Figures 20 to 26 compare consumption per head over the period 1964-1987, in Canada, the USA, Finland, Sweden, Japan and the UK. The other countries were chosen for comparison because they all have very well developed forest industries and (with the exception of Japan) their own extensive forest reserves. Brief notes below detail what can be drawn from these pictures.

## Printing and writing paper

Remarkable growth in consumption per head of this product has occurred over the period. Starting from a range of 0.01-0.04 tonne per year in 1964, consumption has risen to 0.04-0.09 tonne per year in 1987, with rates of growth being lowest in Japan and highest in Sweden and Finland. There is no sign that consumption per head has reached a plateau in any of these countries. In comparison, consumption per head in the UK has increased from 0.02 tonne per year to 0.04 tonne per year over the same period, indicating a much lower rate of growth. The data would suggest that consumption per head could be easily sustained at 0.1 tonne per year and there is some evidence that it could even go higher to say, 0.12 tonne per year. There is no evidence however, that a higher level of consumption could be sustained, so 0.12 tonne per year must remain the highest plausible level of future consumption per head given current data.

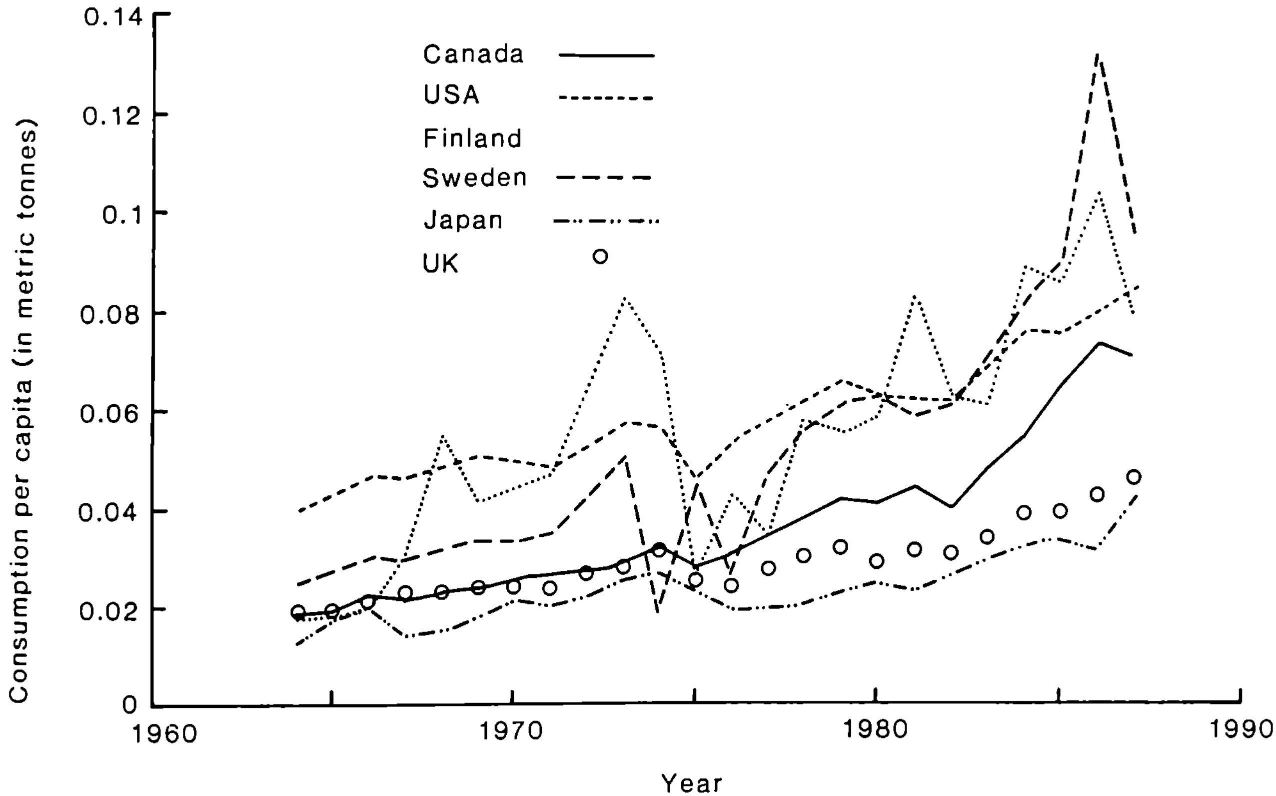



**Figure 20** Printing and writing paper; per capita consumption in a cross-section of countries 1964-1987

## Newsprint

In contrast to the other paper products, consumption per head of newsprint has been relatively stable over the period. Very slow growth has occurred, with the range of consumption per head having increased from 0.01-0.04 tonne per year to 0.02-0.05 tonne per year over the period. UK consumption has remained stable over the period at 0.03 tonne per year. There is unlikely to be any future significant growth in consumption per head of this product, as the market is quite mature. Consumption per head would not be expected to exceed 0.05 tonne per year in the future.

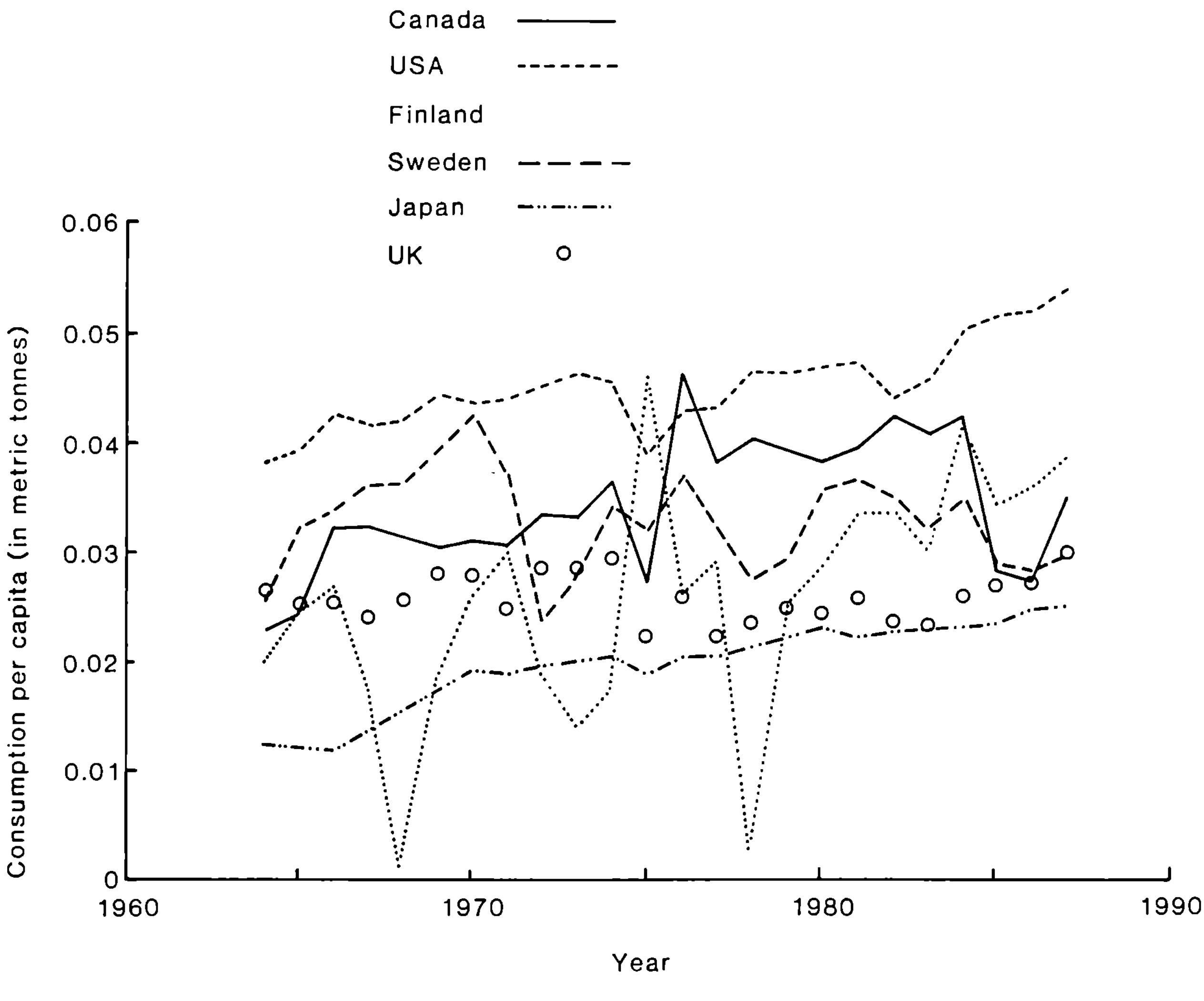



**Figure 21** Newsprint; per capita consumption in a cross-section of countries 1964-1987

## Other paper and paperboard

Growth in consumption per head of this product has occurred over the period, but now seems to be levelling off for the countries with the highest levels of consumption. Consumption per head has risen from 0.05 tonne per year to 0.1-0.17 tonne per year while it has remained constant in the UK, at 0.07 tonne per year. The UK is therefore, now consuming much less per head of these products than in the other five countries. The trends would seem to indicate that consumption per head should level off at 0.12-0.17 tonne per year in the future, which is well above the current UK level of consumption.

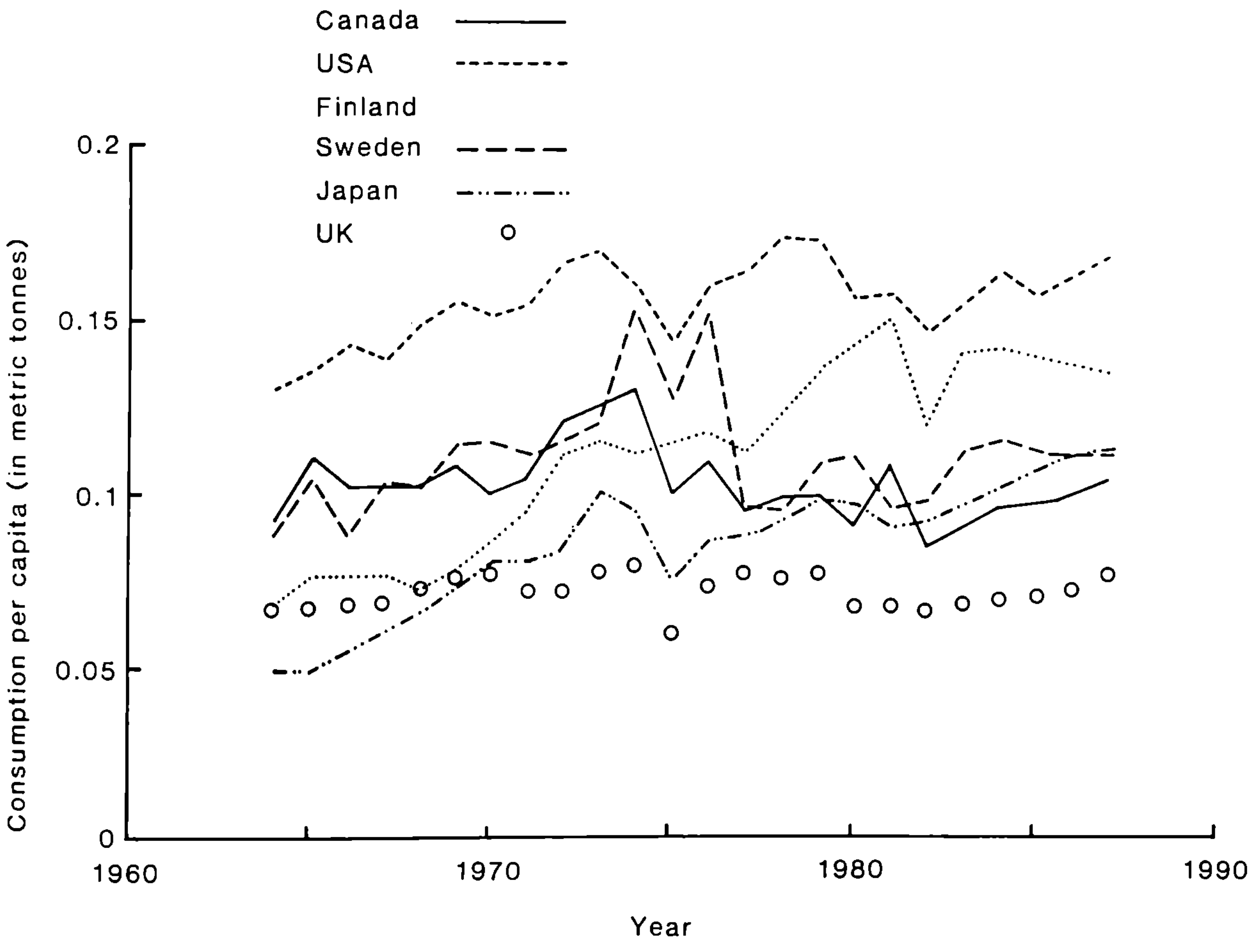



**Figure 22** Other paper and paperboard; per capita consumption in a cross-section of countries 1964-1987

### Veneer sheets

Consumption of veneer sheets has remained relatively stable over the period, at 0-0.005 $m^3$ per head per year, in four out of the five countries. Canada however, has displayed a very unusual consumption pattern compared with the other countries, with consumption having increased from a low of 0.002 $m^3$ per head per year in 1965 to 0.025 $m^3$ per head per year in 1987. This is not typical, so it would seem reasonable to suggest that future consumption per head of veneer sheets would lie somewhere between 0 and 0.005 $m^3$ per head per year, as in the past.

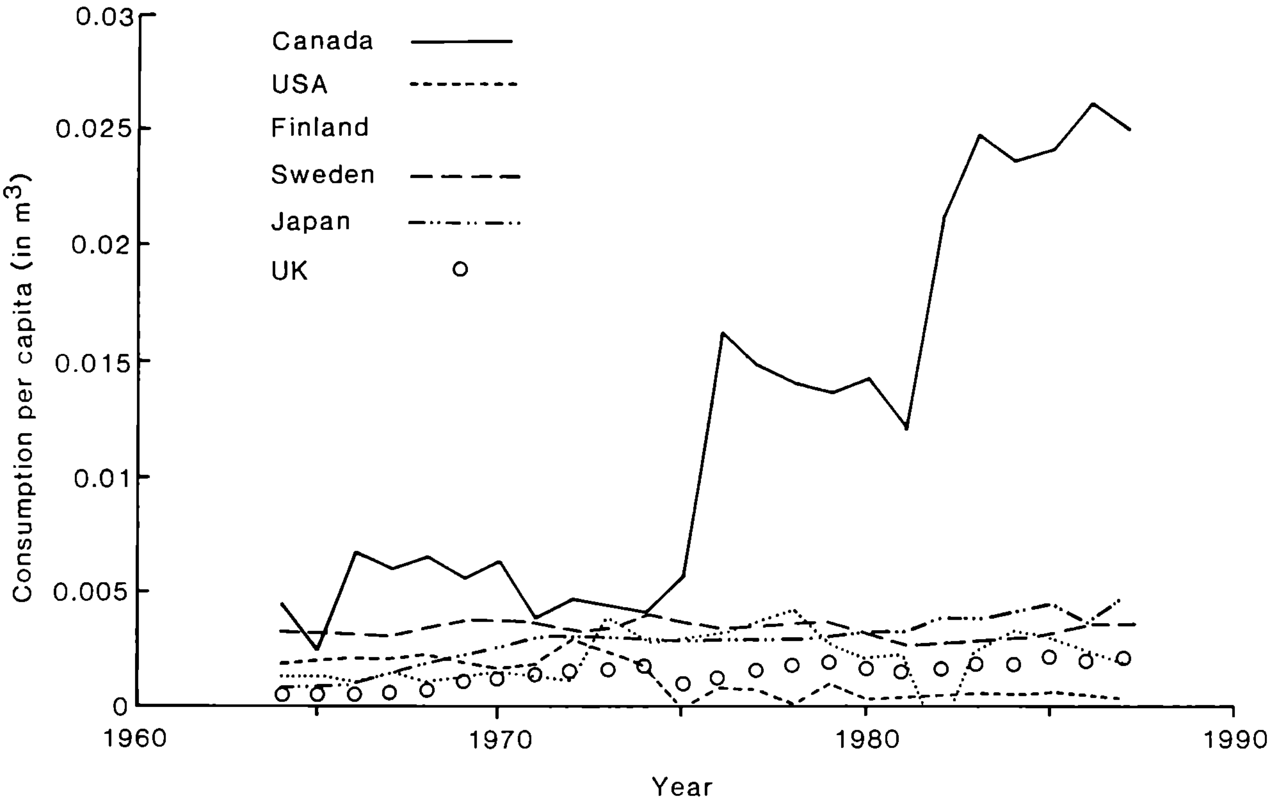



**Figure 23** Veneer sheets; per capita consumption in a cross-section of countries 1964-1987

## Plywood

Plywood, is a well established product, and consumption per head has been stable over the past 20 years. Finland and Sweden have been at the lower end of the consumption range, around 0.02 $m^3$ per head per year and the USA and Canada at the higher end, around 0.08 $m^3$ per head per year, with Japan moving from the former level to one nearer the latter. No trends are present in the data, and this has lead to the conclusion that future consumption is likely to be somewhere in the region of 0.02-0.08 $m^3$ per head per year.

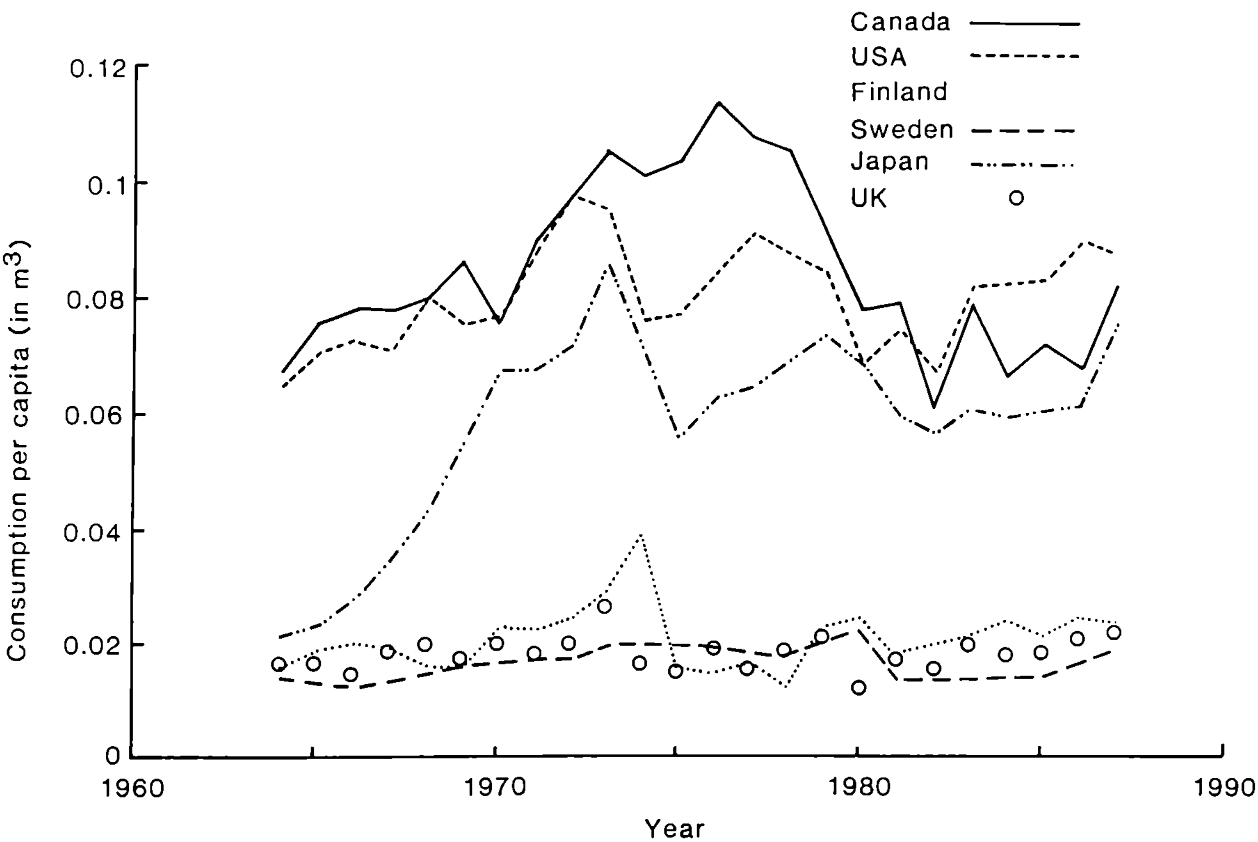



**Figure 24** Plywood; per capita consumption in a cross-section of countries 1964-1987

## Fibreboard

Fibreboard has exhibited a wide variation in consumption patterns across the five countries examined and Canada, for example, still has a consumption rate four times that of Japan. Consumption has been stable, if not slightly declining, over the past 20 years, and it is likely to continue at between 0.02 and 0.04 $m^3$ per head per year in the future.

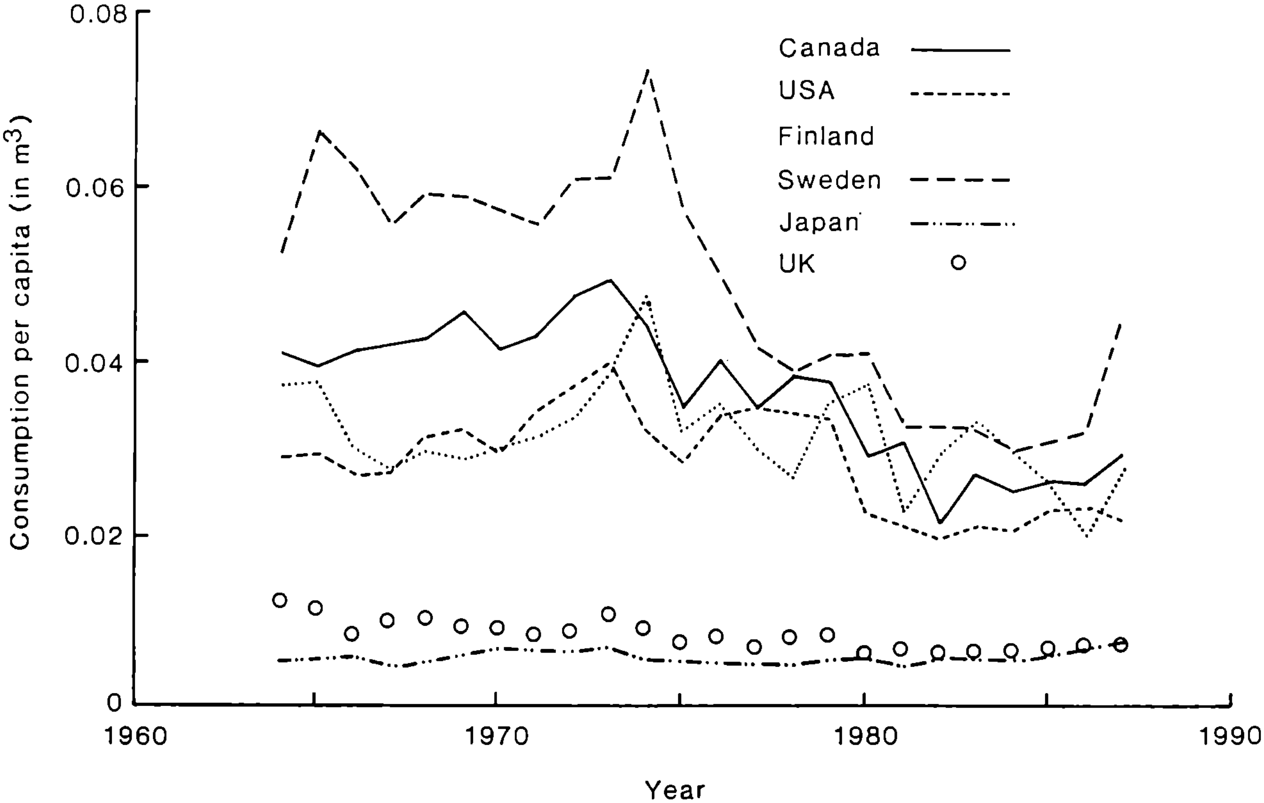



**Figure 25** Fibreboard; per capita consumption in a cross-section of countries 1964-1987

## Particleboard

Particleboard is the least mature of all the products examined and per capita consumption has consistently grown over the past 20 years in all the countries examined. On the basis of the very weak evidence presented in the diagram, a judgement was made that consumption of this product would be unlikely to rise above 0.1 $m^3$ per head per year in the foreseeable future. This may be quite conservative judging by the fact that consumption in (West) Germany, one of the countries to lead in the use of particleboard, has already arrived at sustained levels of consumption of over 0.1 $m^3$ per head per year.

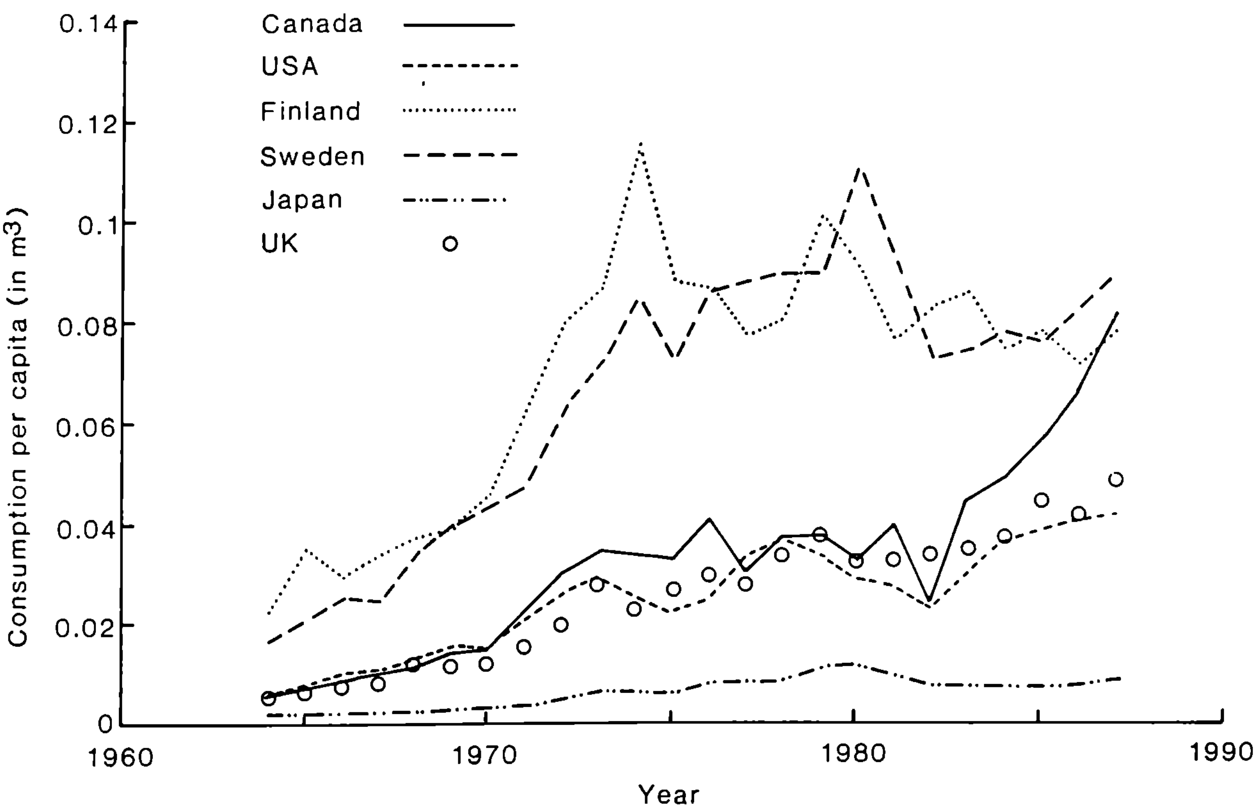



**Figure 26** Particleboard; per capita consumption in a cross-section of countries 1964-1987

# Appendix 4
# Conversion factors

To compare domestic supply and demand, demand for each of the 12 final products was converted to their wood raw material equivalents (WRME) using the conversion factors in Table 27 below. Total demand could then be compared with total supply of roundwood from UK forests.

**Table 27** Conversion factors — volume of roundwood (in $m^3$ overbark) required to get one unit of product (one metric tonne of paper, otherwise one cubic metre of product)

| | | | |
|---|---|---|---|
| Plywood | 2.30 | Newsprint | 2.80 |
| Veneer sheets | 2.00 | Printing and writing paper | 3.50 |
| Fibreboard | 2.26 | Other paper and paperboard | 2.50 |
| Particleboard | 1.37 | | |
| Fuelwood and charcoal | 1.00 | Non-coniferous sawnwood | 1.72 |
| Other industrial roundwood | 1.00 | Coniferous sawnwood | 1.75 |

*Sources:* United Nations (1987), updated from Forestry Commission sources.

Inaccuracies may arise from using these figures to predict supply and demand balances for several reasons:

1. The inter-relationships detailed in Figure 1 are not the whole picture. For example, sawmill residues are pulped and burned, and go into making fibreboard and particleboard, and paper is recycled. These other more complicated relationships have not been included in the model. The conversion factors above ignore the source of fibre so actual WRME demand from wood sources is likely to be lower than total demand presented in the forecast.

2. The conversion factors are the most recent available. It is probable that these will improve over the next 60 years. So, expected consumption in WRME (predicted from the factors in Table 27) may be lower than predicted.

3. The products that go into each of the categories have very different conversion factors. For example, wood pulp comprises mechanical pulp, thermomechanical pulp, semi-chemical pulp, chemical pulp, and dissolving pulp, all of which have their own conversion factors. Any change in the composition of one of these categories in the future will lead to changes in the conversion factor overall.

4. Changes in stocks and work in progress may result in a different material balance in any particular year.

Point 4 above is only likely to have a small effect from year to year, but the other three points are likely to be significant in the future, and will affect the long-term trends. Increased recycling for example, could reduce the future demand for small roundwood to make paper and paperboard, the product grouping showing the highest rates of growth in the future. This would significantly improve the UK's self-sufficiency, and reduce future reliance on imports of wood products.

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