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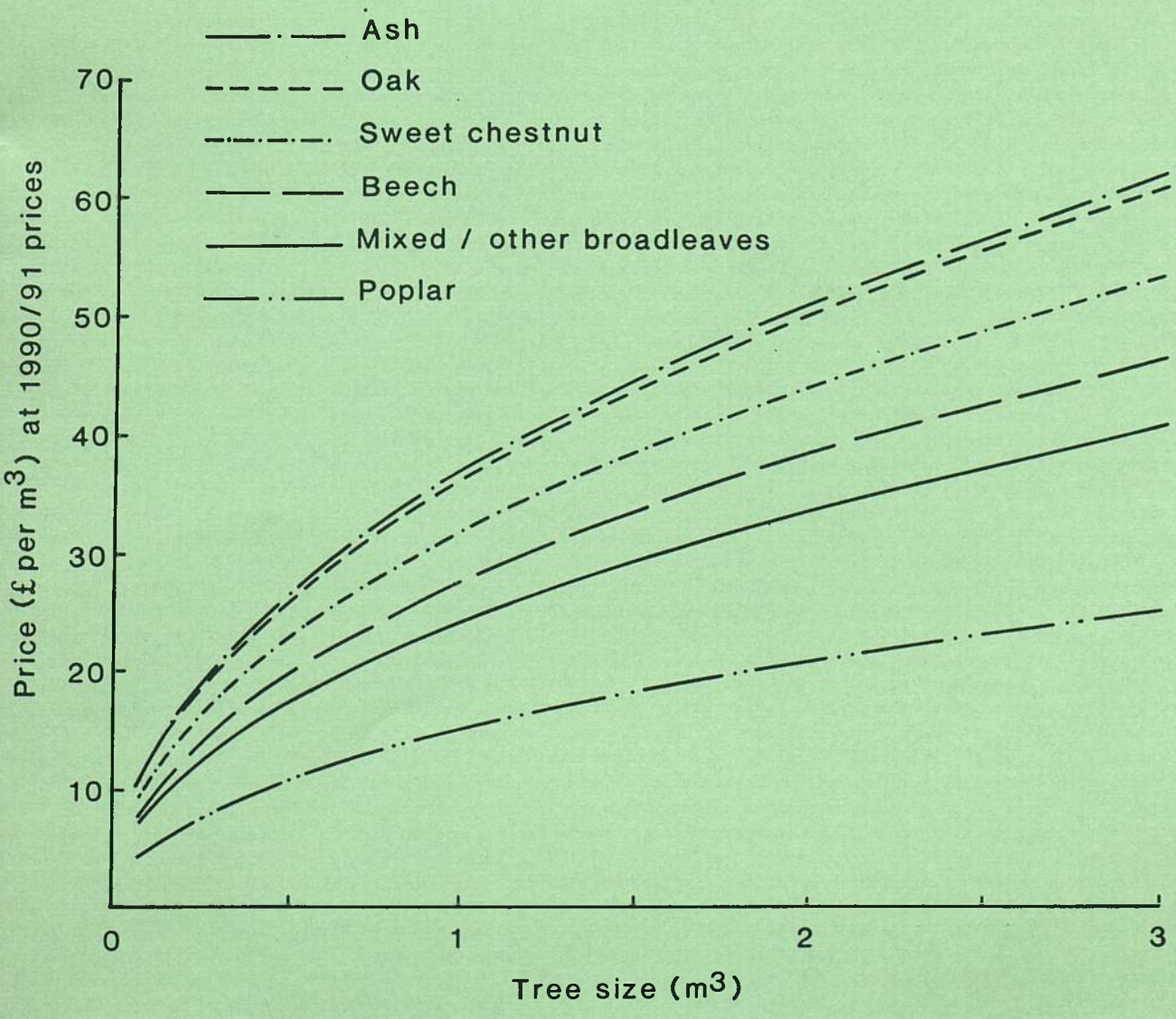

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Price-Size Curves for Broadleaves

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Contents

Summary

In 1989, the Forestry Commission carried out an extensive survey and evaluation of the prices received for roundwood from domestically grown broadleaves. The purpose of this was to construct price-size curves for standing sales of broadleaves, similar to those available for conifers. This would then facilitate more accurate economic appraisal of the various options available for planting broadleaves.

The work was essentially exploratory in nature, but arrived at some potentially useful results. At the same time it also highlighted some serious problems in estimating the value of broadleaves, of which forest managers should be aware. This paper sets out the techniques used to survey and analyse prices, discusses the relevant factors in the price formation process, and presents price-size curves for a variety of crops.

Because the private forestry sector is responsible for most of the production of hardwood in Britain, data had to be collected from a range of sources, including: private estates; forest management companies; timber merchants; wood processors; as well as the Forestry Commission. This was done by means of a postal questionnaire organised by John Clegg & Co. on behalf of the Commission. The survey yielded 854 records of price and tree size that could be analysed to produce a price-size curve.

At first, a simple analysis was performed to construct a general price-size curve for all broadleaves. This was used for valuing the productive broadleaf component of the Forestry Commission's estate (see Figure 1). However, while this may be adequate for a large broad-brush exercise, it was felt that there were also factors other than tree size which affect price, and should be investigated. This was done with further statistical and economic analysis.

The price-size curves were constructed using multiple regression techniques. Regression calculates the relationship between a dependent variable and an independent variable (for example roundwood price and average tree size) in such a way that the relationship best reflects the actual data recorded in the survey. Multiple regression extends this to allow more than one independent variable (i.e. causal factor) to be examined at once. The economics used in the exercise included the development of rules based on the way markets operate that had to be satisfied by the regression results. So, for example, one such rule would be that the structure of harvesting costs, which decrease per m^3 harvested as tree size increases, are such that the price-size curve must be upward sloping over at least part of its length.

Multiple regression allows the analyst to take into account many factors that are suspected of influencing the price paid for a parcel of timber. Because of this, the survey also requested information about the method and point-of-sale of the crop, its species composition, the mixture of products that would be made from the roundwood, the total size of the sale parcel, the location of the sale, and the ease of harvesting (see Appendix 1). Unfortunately, not every respondent could comment on all of the above factors, but enough information was obtained to construct separate price-size curves for ash, beech, oak, sweet chestnut, and for thinnings and clear fellings. The figures on point-of-sale were also useful, because they enabled all the sales that were sold felled, at roadside, or delivered, to be included as data points by implicitly converting the prices received for them into standing sales prices in the regression analysis.

The price-size curves were adjusted so that they represented the average level of hardwood prices in the past, as recorded in the home-grown hardwood price index from 1957 to 1987. This assumption, that prices will be roughly the same as they have been in the past, is borne out by the data which show no overall trend upwards or downwards. This is a rather conservative view of the future compared with predictions from some management companies and other national forest services.

The price-size curves that resulted from this exercise are shown in Figure 9, and Tables 10 to 15. The analysis indicated that prices were above the average for mixed and other hardwoods by 51% for ash; 46% for oak; 34% for sweet chestnut; 19% for beech, and below them by 37% for poplar. The average reduction in prices for standing crops to be thinned compared with those to be clear felled was £6 per m^3. Put another way, the prices paid for thinnings were on average 24% below those paid for clear fellings. To simplify revenue calculations, another set of price-size curves was derived from all sales that excluded this difference, and they are also presented in the tables and Figure 10.

Economic theory suggests that quality would be a significant factor in determining the price paid for hardwoods. However, information on roundwood quality in the survey was quite sparse. Six quality classes were used in the survey, but less than 20% of the records included adequate quality data for analysis. Because quality could not be quantified and had to be recorded in classes, the data on quality did not lend itself to regression analysis. However, it was possible to calculate some price multipliers for the different quality classes based on the information available, and these are presented in Table 8.

It is also probable that the size of parcel offered for sale would affect the price paid for standing timber. Large parcels offer economies of scale in harvesting and delivery, so that bid prices should be higher for these. However, the survey provided insufficient information to allow analysis of the effect of parcel size on price.

The data used in the main part of the analysis were obtained from growers and timber merchants. The results were validated by the information received from the wood processors questionnaires, which broadly corroborated the findings of the analysis.

Problems that were highlighted as the work proceeded tended to reflect the diverse nature of broadleaved woods. The distinction between thinning and clear felling a crop was not noted in some of the responses. Presumably this was because the distinction between the two types of working is not very clear cut in the silviculture of broadleaved woodlands. From the lack of data, it also appeared that quality was difficult to assess, and many of the crops that did identify quality covered a wide range of timber qualities within one sale parcel. Most noticeable, however, was the problem of measuring timber volume.

For the purposes of forest planning and management, it is desirable to have a price-size curve that relates to the Forestry Commission timber yield models (Edwards and Christie, 1981). These are metricated, and predict both total stand and average tree standing timber volume. Average tree volume is main stem volume measured to 7 cm top-diameter (overbark) or to the point at which no main stem is distinguishable, whichever comes first (an important point in the measurement of broadleaves). However, unlike conifers, broadleaves do not tend to grow in uniform single stem stands, and standing volume is often difficult to measure (for further conventions, see Hamilton, 1975). The survey recorded a variety of measurement conventions in both metric and imperial measures, all of which had to be converted to fit the yield models. The conversion factors applied, while being the best available, probably lead to some inaccuracies in the data.

A diameter to volume relationship was used to convert the records where only diameter at breast height was given to average tree volume. This relationship is subject to wide variation, so the confidence that can be placed on the results it gave is not very high. Secondly, there was a problem with sales of felled logs. The volume recorded against each of these was probably not measured in the same way as standing volume is recorded in the yield models. However, part of any error caused by conversion loss should have been taken into account in the regression analysis as it tried to adjust the results to take into account the different prices paid for felled as opposed to standing timber generally.

The results of this exercise will provide forest managers with an important piece of information required for planning and decision making in relation to broadleaved woods. It is also hoped that the sections on timber quality and measurement problems will stimulate further work in these areas, so that the economics of broadleaved woodlands might be better understood.

Introduction

A price-size curve for broadleaves is required to carry out economic appraisals of investment in broadleaved woodlands. For national valuation purposes, the Forestry Commission has assumed in the past that all broadleaved species would fetch prices similar to the best prices received for conifers. This assumption is acceptable, because broadleaves do not form an important part of the estate valuation. They account for only 1% of the Commission's future revenue, which reflects the fact that a significant proportion of broadleaved stands are not scheduled for harvesting, but are retained for landscape or conservation purposes. Nevertheless, with closer interest now being taken in the management of broadleaved woods after the introduction of the policy for broadleaved woodlands in 1985, it was thought desirable to study the economics of broadleaves more accurately. One of the crucial aspects of this is the price that could be expected for timber from broadleaved species.

For historic reasons, the majority of broadleaved woodland in Great Britain is privately owned. Table 1 below shows the area under broadleaves and the volume of hardwood removed by the Forestry Commission over the 10 years to 1989 compared with the private sector. It can be seen that the Forestry Commission only accounts for about 10% of the market for domestically grown hardwood. In contrast to Forestry Commission timber sales, most privately produced timber is sold by negotiation rather than on the open market by tender or auction, and this has traditionally been the method for selling hardwood. A survey of private growers was therefore, necessary to increase the quantity and quality of data available on hardwood prices in Great Britain.

Two features separate the trade in domestic hardwood and softwood. Firstly, conifers usually grow in fairly homogenous stands with little overall variation in tree quality. Because of this, softwoods are nearly always marketed by the stand with price standing being determined by species, average tree size and quality, offset by harvesting cost, with the tariff system being used to determine volume. In contrast, in broadleaved woods a wide variation in quality is frequently found between individual stems. Consequently, buyers generally assess every single tree before negotiating a price. This variation is most noticeable in mature stands of hardwoods, and is accentuated because of the small specialist markets for better quality hardwoods.

The second feature in which hardwood marketing varies from softwoods is in the amount of secondary marketing which occurs, which is partly a result of the variation in quality. It is not uncommon for the initial buyer to select and resell parts of the overall parcel with, for example, high value veneer logs being resold, or at the other extreme, a sawmiller specialising in furniture quality sawn timber reselling the lower quality logs to one dealing with mining or fencing timber. These features

Table 1 A comparison of the areas of hardwoods owned by the Forestry Commission and private sector and the volumes produced by each

Year	*Area under broadleaved high forest (in thousand hectares)*		*Volume of hardwood produced (in '000 m^3 overbark)*	
	*Forestry Commission**	*Private sector*	*Forestry Commission*	*Private sector*
1980	49	318	88	1212
1981	50	319	86	1214
1982	51	505	122	1178
1983	50	506	129	771
1984	51	506	103	797
1985	50	509	102	898
1986	51	513	96	1014
1987	50	517	94	1002
1988	50	519	109	1151
1989	50	526	111	1165

Source: Forestry Commission (1990 and earlier).

Note: *This figure has varied between 50 and 51 thousand hectares over the last 10 years reflecting the planting of broadleaves and the Commission's disposals policy.

make the process of price setting much more complicated for hardwoods than for softwoods.

The following two sections of this paper describe the collection of the price data from the private sector, where the largest holdings of broadleaved woods exist. The fourth section describes the data collected in detail. The results of the analysis are presented in the next three sections (pages 15-25) and the main points are summarised in the conclusions.

Due to the very variable nature of broadleaved stands, the curves derived are presented with the warning that they only reflect an average of many sales throughout Great Britain. For valuations of individual stands of a given species, the prices that can be achieved will principally depend on: stem size; the quality of the timber; availability of markets; total volume available; and site conditions. It is recommended that competent advice is sought before any hardwood timber is sold. This publication is intended only as a **guide to prices** as much depends on local circumstances.

The initial survey

John Clegg & Co. were appointed to conduct a survey of hardwood timber prices in December 1988, and the initial results were required by the following March for the Forestry Commission 1990 triennial valuation exercise. With such a short timescale, it was decided to use a postal questionnaire to conduct the survey, and five separate sources of data were identified:

a. woodland owners in the private sector,

b. woodland managers,

c. the Forestry Commission,

d. harvesting contractors,

e. wood processors.

Addresses of individuals and companies in the private sector were provided by the three main trade associations: Timber Growers UK; the British Timber Merchants' Association; and the Home Timber Merchants' Association of Scotland (now known as the UK Softwood Sawmillers' Association). All three organisations gave their full support to the survey, and urged their members to supply all the necessary information. Private woodland owners, managers and contractors were invited to complete one questionnaire, while wood processors were given a slightly different questionnaire. The Forestry Commission's three English Conservancies also supplied information on prices, as did a small number of Forest Districts in Scotland and Wales. Copies of the questionnaires used are given in Appendix 1.

By 28 February 1989, the designated date for preparing the results, 226 replies had been received (22% of the total sent), which was considered a very good rate of response to the survey. These were then collated into a database (John Clegg and Co., 1989) and analysed to produce a curve for the 1990 revaluation of the Forestry Commission's estate (see Figure 1). This single curve to cover all broadleaves was simplistic, but satisfactory for the broad purpose for which it was required. Because of the variability in the data, the goodness of fit was quite low (r^2 = 46%), and it was felt that it could be improved after more analysis.

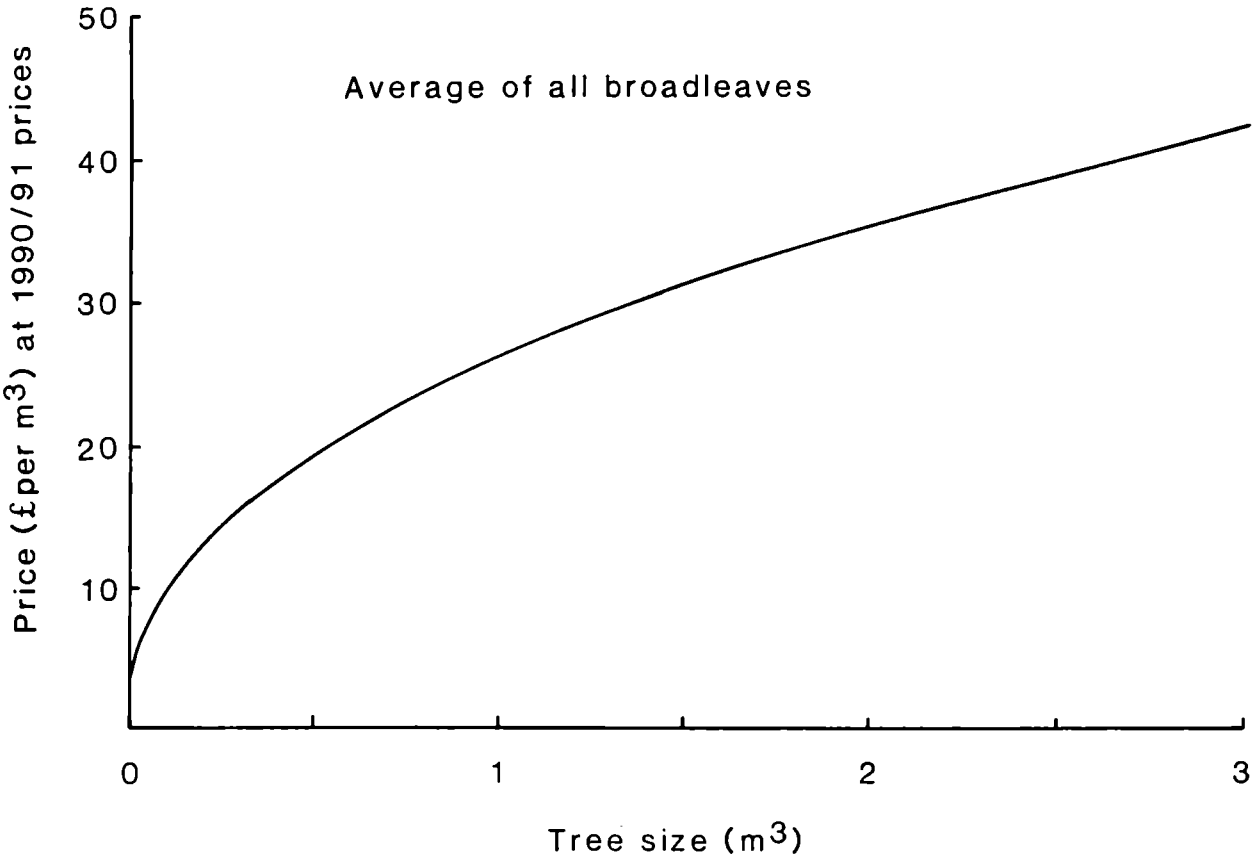

Figure 1 Price-size curve for broadleaves used by the Forestry Commission in its 1990 revaluation of the estate.

The follow-up survey

Amongst other things, the report from John Clegg & Co. noted that data were still being supplied by the private sector and that some of the questionnaires returned could not be included in the analysis because of the lack of one or two critical parameters (often mean tree size). John Clegg & Co. were therefore asked to follow-up the incomplete questionnaires to see if the missing data could be obtained. This follow-up work took place between March and May 1989 by letter and telephone. Of the questionnaires followed up, 21 provided data which could be used, and eight questionnaires, received after 28 February, were also usable, providing a further 29 questionnaires in total that could be added to the database.

The full details of the response to both the initial and follow-up surveys are presented below in Table 2. The final total of 110 questionnaires containing usable information covered 875 records of individual sales that included both size and price, giving sufficient data points with which to conduct a regression analysis. The survey also supplied 22 returns from wood processors, which were dealt with separately, and are presented later.

Table 2 The response to the initial and follow-up surveys on hardwood prices

	Questionnaires to growers and related organisations (sources a to d)	*Questionnaires to wood processors (source e)*	*Total*
Questionnaires sent	718	287	1005
Initial survey results			
Questionnaires returned of which	192	34	226
Nil entry	83	12	95
Usable results	63	20	83
Unusable results	46	2	48
Follow-up survey results			
Questionnaires followed-up of which	46	2	48
Nil entry or unusable	15	0	15
Usable or partly usable	17	2	19
No response to follow-up	10	0	10
Questionnaires returned late (all usable)	8	0	8
Final total of usable returns	88	22	110

The data in more detail

The main analysis was of the 875 records from timber growers. Of these 21 records were deleted because of erroneous data (e.g. negative prices or sizes) to leave 854 records for analysis. The coverage of the different attributes of the sales was varied, and is reported below.

Species

All returns recorded the crop species involved in the sale. The largest species group was oak, followed by beech and then sales of mixed species. It was decided to put groups of species containing less than 10 records into the mixed group to make a mixed/other group. Figure 2 shows the proportion of records in each of the nine species categories that were finally identified. Many of the records contained sales of simple mixtures of just two species. These were treated as mixed hardwood sales because it was not possible to apportion the revenues from these sales to the different components of the crop.

Tree size

The trade in hardwoods is still conducted in old imperial measures. Hoppus feet, true cubic feet, and imperial length and quarter girth were the principal measures encountered in the survey. A further complication was that some of the measures were tree volume and some tree diameter. Because it was necessary to convert size to one common measure it was decided to convert all the records to mean tree volume in cubic metres. This follows the convention set in the yield models published by the Forestry Commission (Edwards and Christie, 1981). Diameter measures were converted to volume in cubic metres using a mensurational function, and a dummy variable was used to indicate which diameter measures were estimates. In all, 622 records were true volume measures, and the other 232 were estimated from diameter. The distribution of tree sizes in the sample is shown in Figure 3.

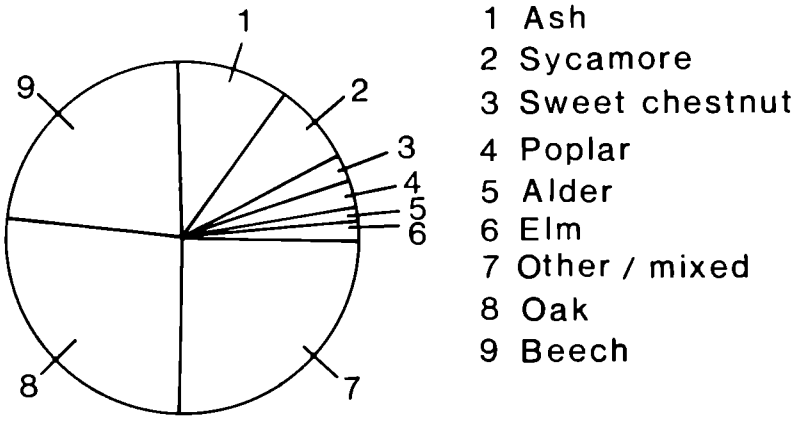

Figure 2 Coverage of tree species recorded for broadleaf price-size curves.

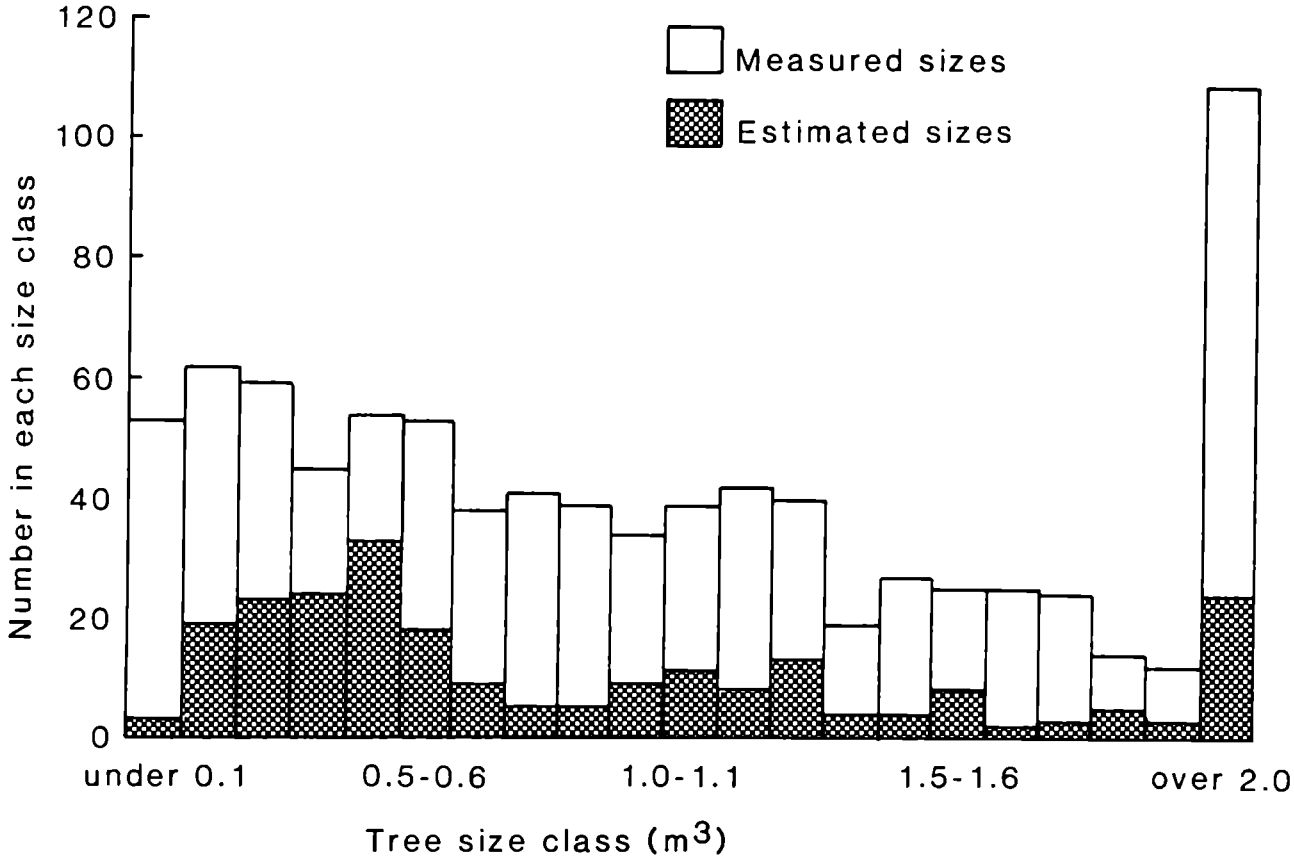

Figure 3 Distribution of tree sizes recorded in the 1989 hardwood price survey.

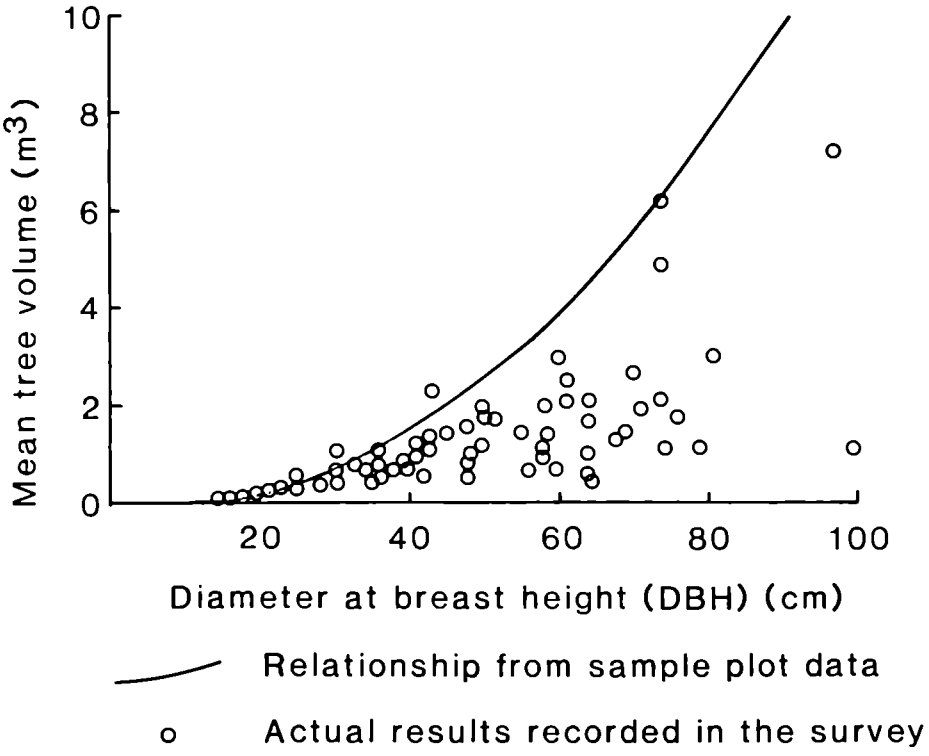

Figure 4 Mean tree volume and diameter relationship.

The conversion from diameter to volume was one of the major problems that occurred in this work. Figure 4 shows the relationship obtained from Forestry Commission sample plot data (which was in any case, restricted to quite small tree sizes), and compares it with the records in the survey where both diameter and volume had been measured. It can be seen that the relationship does not match the evidence from this survey at all. To overcome this problem, new regression lines were estimated from the survey data set, to get a different relationship between tree size and volume. Using dummy variables to represent species differences, the following relationships were obtained:

$V_{beech} = 0.000706632\ d.b.h.^{1.87954}$

$V_{oak} = 0.000688565\ d.b.h.^{1.87954}$

$V_{other\ broadleaves} = 0.000951852\ d.b.h.^{1.87954}$

where:

V = volume, in cubic metres

d.b.h. = diameter at breast height in centimetres

Number of observations = 174 $r^2 = 87.8\%$

These relationships (see Figure 5) were then used to estimate volume where only diameter had been recorded on the questionnaire.

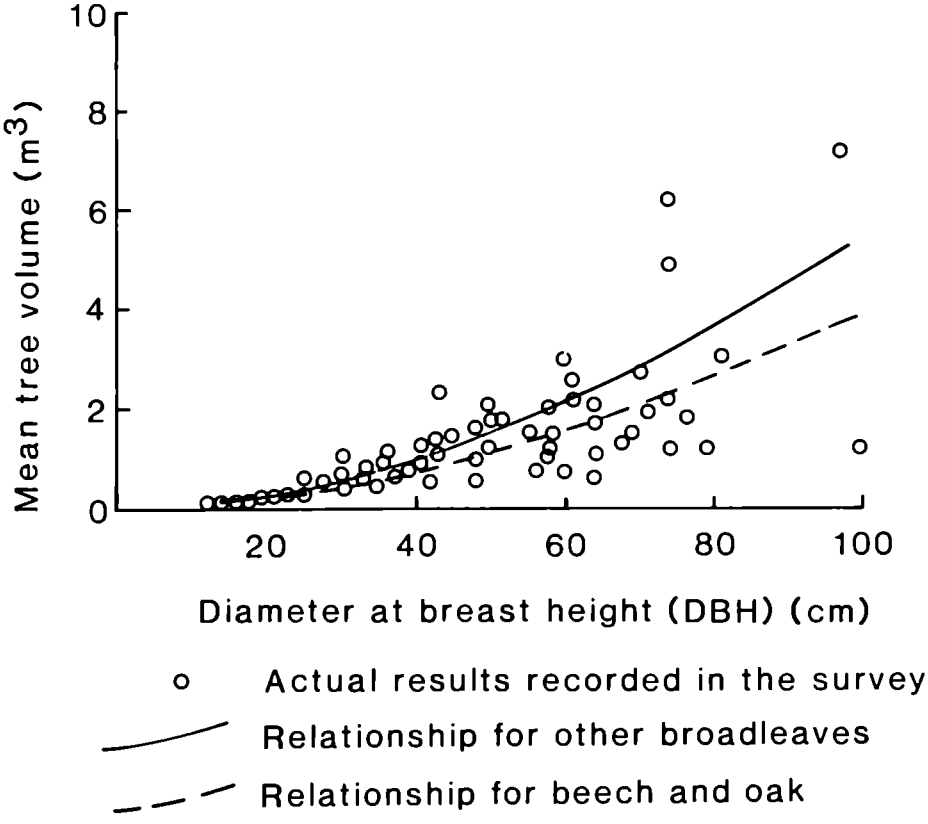

Figure 5 Mean tree volume and diameter relationship.

Why there should be such a difference between Forestry Commission sample plot data and this private estate data it is difficult to say. It is likely however, that much of the volume recorded in the survey has come from overmature, widely spaced, short fat trees much of which will have been grown in understocked woodland. This is in contrast to the younger plantation-grown narrow and tall trees, which would be typical of the Commission's sample plot data. It is also possible, that whereas the Commission's relationship is from 'd.b.h.' to standing volume as measured in yield models, some of the data recorded in the survey were 'd.b.h.' and felled tree or product volume, which would be significantly less because of conversion losses. If the latter is true, then this would put into question the integrity of the data in this survey, although the questionnaire did specifically ask for average tree size rather than product volume (see Appendix 1).

Another interesting point to note is that beech and oak had significantly different volume to 'd.b.h.' relationships compared with other broadleaved species. The reason for this is not known, and such a difference could not be supported by evidence from the Forestry Commission's own sample plots. However, these differences were included in the estimates of volume from diameter measures in the data.

Quality

The data recorded on timber quality were patchy, because often a woodland owner just receives a price for the sale parcel, while the merchant records the information on quality. This lack of knowledge is further exacerbated with standing sales, where quality is very difficult to judge. Overall, 289 records (34%) gave quality information completely split into the six categories identified (see Appendix 1). Furthermore, only 162 records (20%) gave figures for price against each measure of quality which came reasonably close (within 10%) to the quoted average price of the parcel as a whole when calculated.

Because of the inadequate coverage, and the difficulty in quantifying timber quality from a stand, the effect of this on the price-size curves could not be measured. However, this is so important when valuing hardwoods that a separate analysis was conducted which points the way towards some quantification of the effect of quality on hardwood prices. This is presented in a later section.

Method and point-of-sale

This question on the questionnaire was also completed by every respondent. Most of the sales were sold standing, a large number at roadside, and small amounts were delivered or felled at stump. The distribution of these factors is shown in Figure 6. Prices would be expected to rise (and recorded volumes fall), all other things being equal, as timber went through the sequence from standing, to felled, to extracted, to delivered.

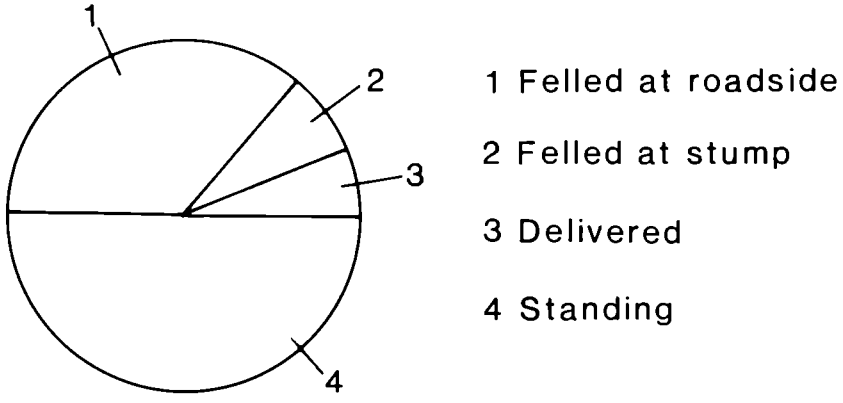

Figure 6 Method and point-of-sale recorded for broadleaf price-size curves.

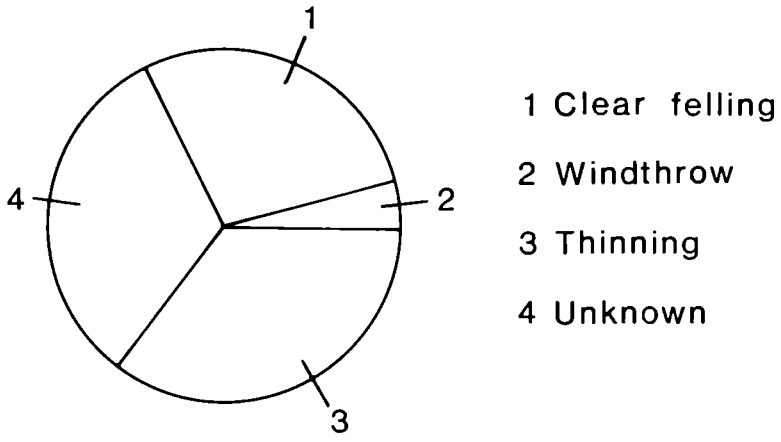

Figure 7 Ease of harvesting recorded for broadleaf price-size curves.

Ease of harvesting

Much of the hardwood recorded in the survey came from clear fellings (see Figure 7), which are relatively easy to harvest, require less supervision, and offer more straightforward extraction than thinnings. One would expect the value of thinnings to be lower than the value of clear fellings of an equivalent tree size because of the greater difficulties of harvesting and extraction. This notion is taken to its extreme in windthrown timber which is often dangerous and very costly to cut and would therefore be expected to attract the lowest prices of all. In the survey, 239 records were from sales of clear felled timber, 302 from thinnings, 35 from windthrown timber, and the remaining 279 were of unknown origin.

An interesting point was that 279 records did not or perhaps could not identify whether the crop was a thinning or clear felling. This is not surprising because in the management of many broadleaved woods the distinction between a thinning and certain types of felling may be unclear, especially when only a small number of trees are being harvested. Because there were so many unknown records, it was decided to treat an indeterminate thinning/felling as the norm and quantify any significant effect of pure clear fellings, thinnings or windthrow clearance.

Location

Nearly all of the returned questionnaires were from a clearly identified location which could be put into one of the Forestry Commission's Conservancies (see Table 3). Location was recorded to see if this factor had any effect on prices, because some areas are far from good markets and it would be expected that prices would be lower there. However, a very large proportion of the returns came from southern England, which is probably a good reflection of the actual relative importance of the region to the hardwood trade. This meant that too few sales were recorded in other regions to pick-up any significant regional difference. This is partly also as a result of the sampling strategy. It was known that many of the growers on the list of estate addresses in Scotland would not have any significant broadleaved woods. Obvious estates in this category were removed from the sampling frame. The response rate in Scotland could be quite high therefore, even with the small number of returns received, as so few estates grow broadleaves. This may change in the future if the financial viability of species such as birch is improved, but there will still be a lack of data about the prices one could expect for broadleaves in Scotland for some years to come.

Table 3 Location of sales on hardwood price database

East England	319	37%
West England	339	40%
Wales	34	4%
North England	84	10%
Scotland	57	7%
Unspecified	21	2%

Sale volume

Total sale volume (i.e. the amount offered for sale) was recorded in 644 or 75% of the records. It would be expected that larger sales would attract economies of scale and therefore, higher prices. However, for hardwoods, each tree is often valued and examined separately, so this effect might not be very significant. Because sale volume was not known for each record, the importance of this factor could not be analysed.

Despite this, using the figures on sale volume that were recorded and the figures from Table 1, it was possible to estimate the minimum coverage of the survey in terms of the volume recorded compared with market size. This is presented in Table 4. Because some returns did not indicate sale volume, coverage must be higher than is shown in the table. The low coverage reflects the problem encountered in this survey of a large number of small timber growers in the hardwood market.

Table 4 Total volume of sales recorded in hardwood price survey

Year	*Volume (in '000 m^3 overbark)*	*Coverage*
Pre-1977	6.4	—
1978	2.8	0.2%
1979	1.4	0.1%
1980	2.4	0.2%
1981	3.8	0.3%
1982	5.9	0.5%
1983	25.6	2.8%
1984	16.2	1.8%
1985	9.7	1.0%
1986	36.9	3.3%
1987	31.6	3.2%
1988	31.6	2.5%
1989	5.8	—

Price-size curve results

Price-size curves for broadleaves were thought to be more complicated to analyse than the price-size curves for conifers because of the factors discussed above. That is why more explanatory data were collected in the survey. Nevertheless, the same three fundamental questions were posed about the price-size curves.

a. What shape is the price-size curve?

b. How has it moved in the past?

c. At what level will it be in the long-run?

As well as location, which was taken into account in the analysis of conifers, it was also thought that species would affect price, and adequate data were collected about this. Quality was considered another major determinant of price, but unfortunately the data collected on quality were not comprehensive enough for a complete statistical analysis.

A similar regression model to that used by Mitlin (1987) was developed. A log-linear relationship was built-up between price and size, with the effect of other variables being introduced through the use of dummy variables. The model specification was:

$$\ln P = a + b \ln S + c_i T_i + d_j L_j + e_k O_k + f_L E_L + TRUE$$

where:

$\ln P$ = the natural logarithm of the real price from a sale

lnS = the natural logarithm of estimated average tree volume in cubic metres

and the dummy variables* were:

T_i = set of tree species identified in the survey, i = 1-8

L_j = set of locations, j = 1-5

O_k = point of sale, k = 1-3

E_L = ease of harvesting, L = 1-3

$TRUE$ = dummy variable to record whether volume was recorded or estimated from diameter

This model was used to answer the first question, and determine the overall shape of the price-size curve (i.e. the effect of size on price), and the effect of the other parameters.

Movement in general of hardwood prices in the past was taken into account by deflating the recorded prices by the price index for domestically-grown hardwood logs (CSO index number: 4610111000). This was the same as, in effect, adding a term for the logarithm of the price index and restricting its value to one. This does not seem unreasonable, because the index is supposed to measure changes in the level of prices of the sort that were recorded in the survey. This took out the effect of historic price changes raised by the second question.

The evidence of the home-grown hardwood price index for the period 1958-88 (see Figure 8) suggests that in the long-run prices are stable and have not shown an upward or downward trend over a period of 30 years. The long-run level was estimated by taking the unweighted average of price levels over this period.

The above model was very large, having 19 dummy variables to reflect all the various facets of species etc that were recorded in the sample. Some of these were found to be insignificant and were removed from the model. This brought the model down to a more manageable size. The variables that did remain significant are shown in Table 5. The two different models presented reflect the difference between the general price-size curve and the curve adjusted to take into account the different values of thinnings and clear fellings. The addition of the follow-up survey data brought down the goodness of fit even after adding further explanatory variables (r^2 = 43-45%). This reflects the great variability in prices within the data set, which is due to factors such as quality which are difficult to quantify. Quality is examined and accounted for in a later section of this paper, so undue weight should not be attached to the low r^2 statistic from the regression analysis.

*A dummy variable takes the value 1 or 0, depending on whether record meets a criterion or not. This partitions the data into sections which have or have not any particular attribute. For example, on point-of-sale, 0_1 = 1 if the sale was felled at stump, 0_2 = 1 if at roadside, and 0_3 = 1 if delivered. Records not meeting any of these criteria were from standing sales.

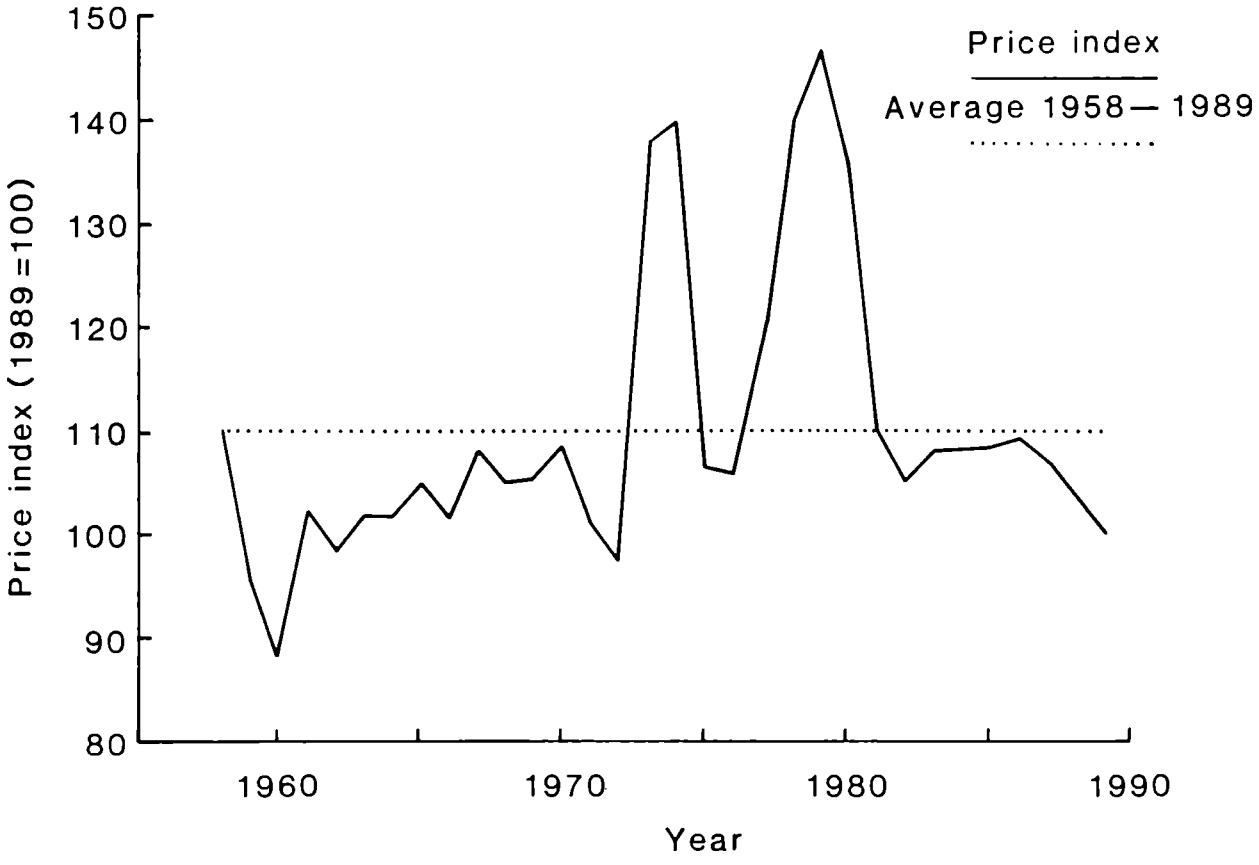

Figure 8 The real price of home-grown hardwood logs. (Source: Central Statistical Office.)

Table 5 The results from the regression analysis

Variable	*Full model including the thinning and felling price differential*		*Simple model of prices from all types of harvest*	
	Co-efficient	t-*statistic*	*Co-efficient*	t-*statistic*
Constant	2.33	—	2.24	—
Logarithm of tree size	0.43	17.99	0.47	20.72
True volume dummy	- 0.32	- 5.66	- 0.35	- 6.17
Ash dummy	0.41	5.01	0.42	5.04
Beech dummy	0.17	2.73	0.13	2.01
Oak dummy	0.38	6.33	0.40	6.71
Sweet chestnut dummy	0.29	1.98	0.27	1.79
Poplar dummy	- 0.46	- 3.07	- 0.48	- 3.18
Roadside sale dummy	0.12	2.20	0.20	3.90
Delivered sale dummy	0.41	4.22	0.46	4.62
Thinning dummy	- 0.27	- 4.90		
r-squared		45%		43%
Durbin-Watson statistic		1.96		1.95

The model can be transformed into a more usable form by transforming the variables and coefficients out of their log-linear forms. The equation then becomes:

$$P = \exp(a + \Sigma d) S^{b}$$

where

P = price

S = tree size

a = constant

Σd = the sum of the significant and relevant dummy variable coefficients

b = the coefficient on the logarithm of tree size

Because prices were deflated by an index based on 1975=100, it was necessary to multiply the price-size relationship by an appropriate factor to set it to the long-run average at 1990/91 prices. The average of real prices over the period was 1.034 times the price in 1975. To update from 1975 to 1990/91 prices, this had to be multiplied by a further 3.5571, to give the resultant factor for multiplication of 3.6780. So, for example, the price-size relationship for mixed/other broadleaves without the effect of the thinning and clear felling price differential would be:

$$P = 3.6780 \times \exp(2.01) S^{0.43}$$

$$= 27.4516 S^{0.43}$$

The original constant of 2.33 is reduced to 2.01 because of an apparent under estimate of volume from data based on diameter measures, as shown by the true volume dummy variable which was significant and had a value of -0.32. This indicated that the price-size curve derived from true measures of size was lower than that the one based on estimated measures of size. The former resulted in prices at levels of about three-quarters of the latter. This further highlights the problems in the conversion of diameter to volume. The fact that this was negative would suggest that the conversion used to move from tree diameter to size in this exercise was an underestimate, consequently inflating the price-size relationship.

The other significant dummy variables allowed this simple relationship to become more flexible, explaining for example, the difference in prices for different species (see Figure 9). These dummy variables can be converted to a more usable form by taking the exponential of each; they then become multipliers to apply to the above function. The multipliers are set out in Table 6. For example, with beech the prices given by the above equation would all have to be multiplied by 1.19, representing an increase of 19% above the price of mixed/other hardwood timber.

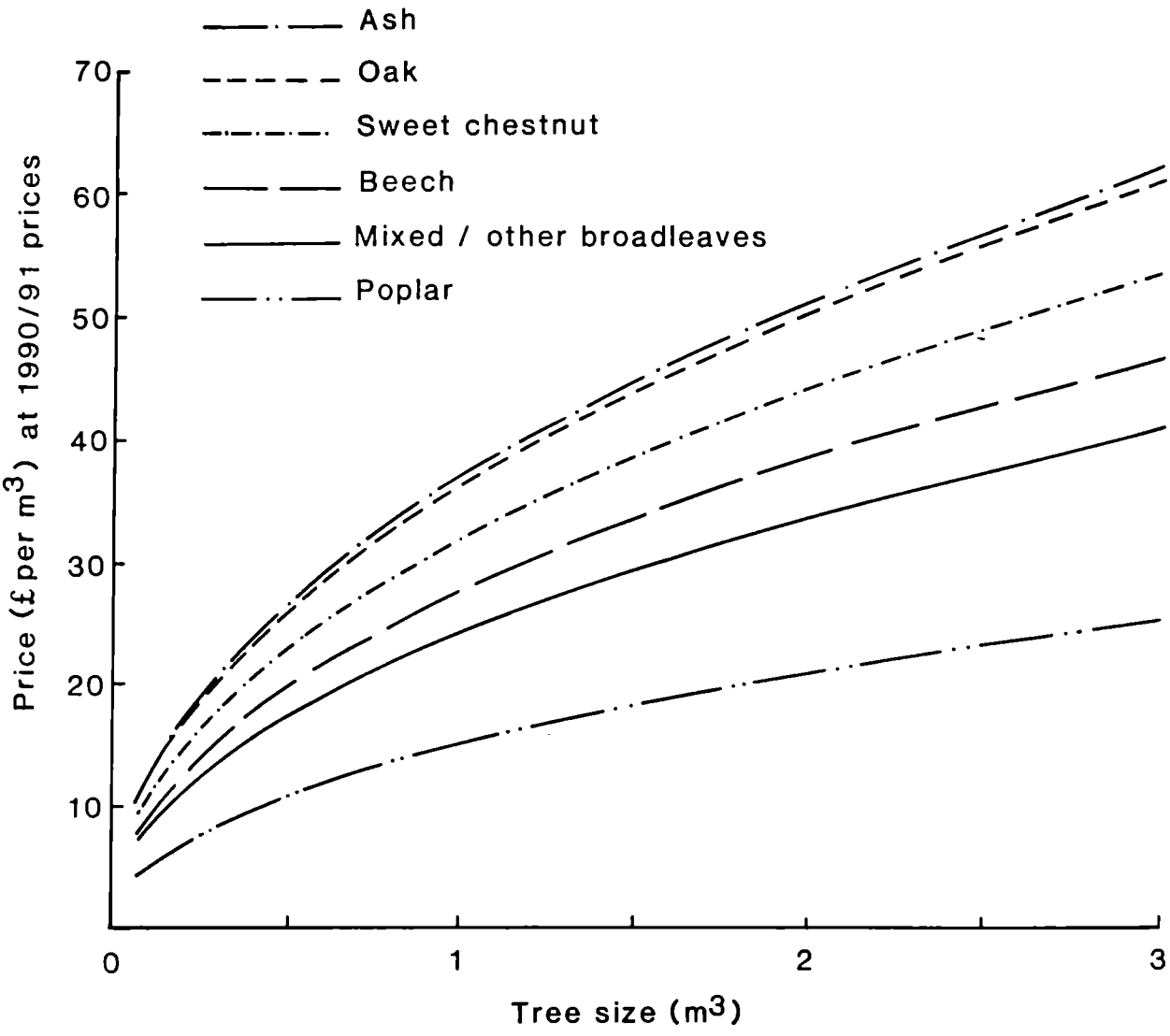

Figure 9 Comparision of price-size curves for different species.

Table 6 Multipliers to the mixed/other broadleaves price-size relationship to account for the effect of species on price

Species	*Multipliers*	
	Model 1	*Model 2*
Ash	1.51	1.52
Oak	1.46	1.49
Sweet chestnut	1.34	1.31
Beech	1.19	1.14
Poplar	0.63	0.62

The other dummy variables which were significant were on point-of-sale and ease of harvesting. For point-of-sale, the variables were used to 'correct' the data set for sales which were not standing. However, the premiums on roadside and delivered sales of 13% and 51% respectively (derived from the coefficients) are not useful because they indicate only that this was the premium paid for timber at that point-of-sale in this sample. They do not reflect the higher price from selling timber at roadside or delivered generally. Such benefits would depend on ease of harvesting, extraction, and the length of delivery, all of which would vary from case to case. They will also capture in part, some of the measurement error that might have occurred, if sales not sold standing recorded volume as something other than average tree volume.

On the other hand, the coefficient on ease of harvesting was useful. Its value of -0.27 indicated that on average, sales that could be clearly identified as thinnings only earned 76% of the revenue which timber of the same size harvested in other ways would have done. This is presumably because of the higher working costs. Figure 10 shows the difference between the price-size curves for thinning and other methods of harvesting over the interdecile range of sizes for each method, as well as the average price-size relationship. It could be expected that prices for windthrown timber would be even lower than those for thinnings *ceteris paribus*.

This difference, while being significant, makes calculation of revenue for a crop quite complicated. The species variations apply to every cubic metre of crop and the multipliers presented in Table 6 can be applied to discounted revenue, total revenue, annual equivalent revenue, or any other measures of the value of a crop. Unfortunately however, this modification is not that simple. Only thinnings earn the lower revenue represented by the lower price-size curve. Fellings are worth the higher amount. For calculating revenue, this could be dealt with in three ways:

1. The calculation could be done properly, using the two different price-size curves for thinnings and clear fellings. This would almost certainly have to be done by hand, because none of the generally available computer programs for forest management, allow the use of different price-size curves for thinnings and clear fellings.

2. An average thinning price differential could be applied to all thinning volumes. On average, thinnings earn £6.80 per m^3 less than clear fellings (at 1990/91 prices). This could be useful because some computerised forest investment appraisal programs identify thinnings and would allow a simple thinning price differential to be used.

3. A much simpler method of calculation would be to use the single curve presented in the second model. This would lead to bias however, because thinning volumes would be overvalued and the much larger felling volume would be undervalued. On the whole, the effect of discounting would mean that this would produce estimates on the high side, unless the rotation age or discount rate are low.

To give plenty of scope for calculating revenue, the results from both models are presented in Tables 10 to 15, which give the price at a range of tree sizes for all the species examined in the survey.

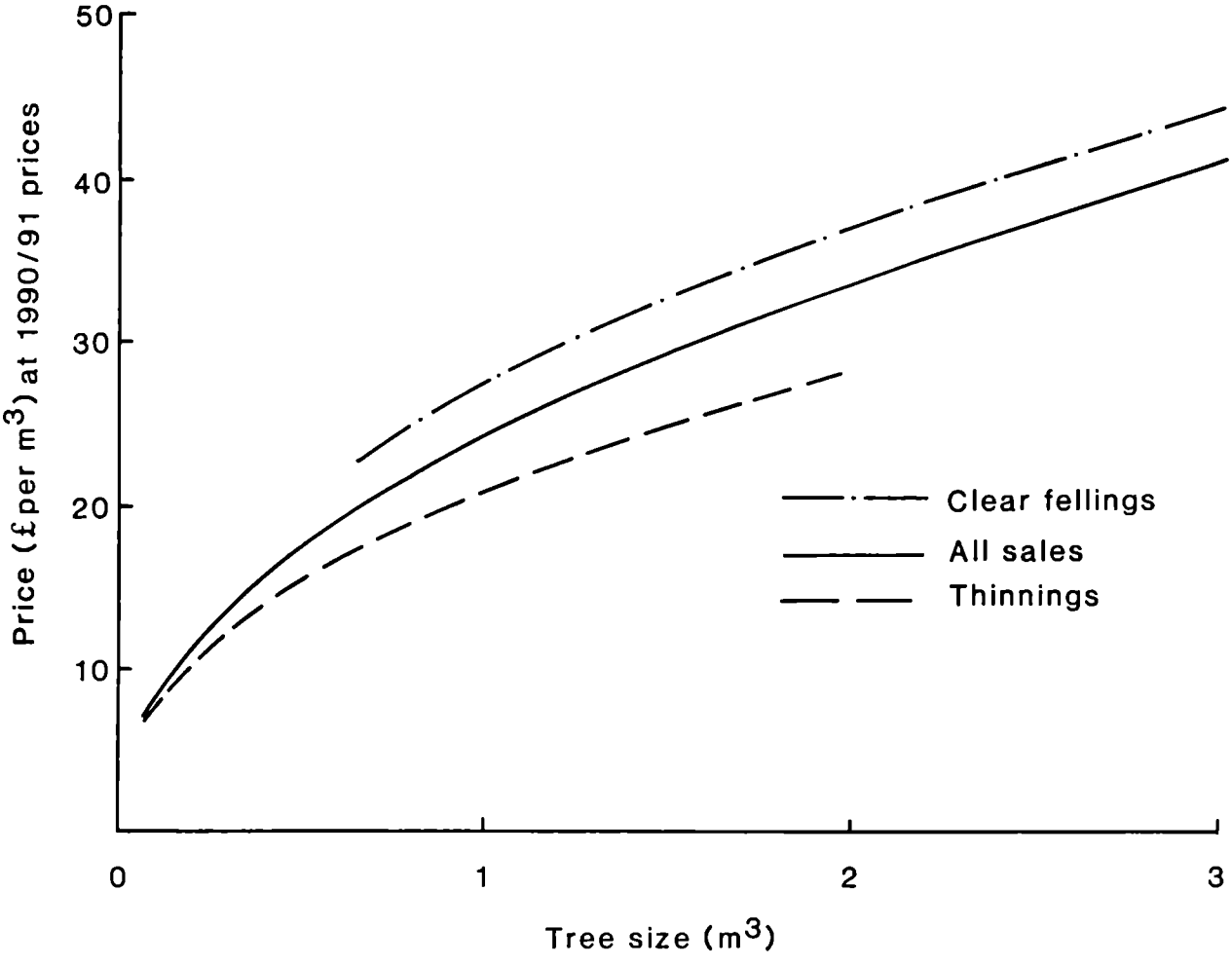

Figure 10 Comparison of price-size curves for thinnings, clear fellings and all sales of mixed/other broadleaves.

Analysis of individual sales for quality

As has already been mentioned, quality is a very important factor in determining the value of broadleaves. Quality will partly be reflected in tree size with larger trees having a higher proportion of timber suitable for sawing, furniture making and veneer purposes, than smaller trees. However, also important are factors such as the amount of branching, shake, straightness of the butt, colour and clarity of the timber, attractiveness of the grain, and strength. Faults in any of these areas can be found in large as well as small trees, therefore downgrading the value of the timber.

For the purpose of making sense of the broadleaf price-size curves, several questions must be asked:

1. What is the 'average' level of quality which the curves represent?
2. How can quality be measured, and what effect does it have on prices?
3. How can the price-size curves be adjusted to account for variations in timber quality?

Six quality classes were used in the survey and these were:

1. fuelwood, pulpwood, boardwood, stakes,
2. poles for refinery and turnery,
3. wood for packaging, fencing, mining and pallets,
4. second quality sawlogs,
5. first quality sawlogs,
6. veneer logs.

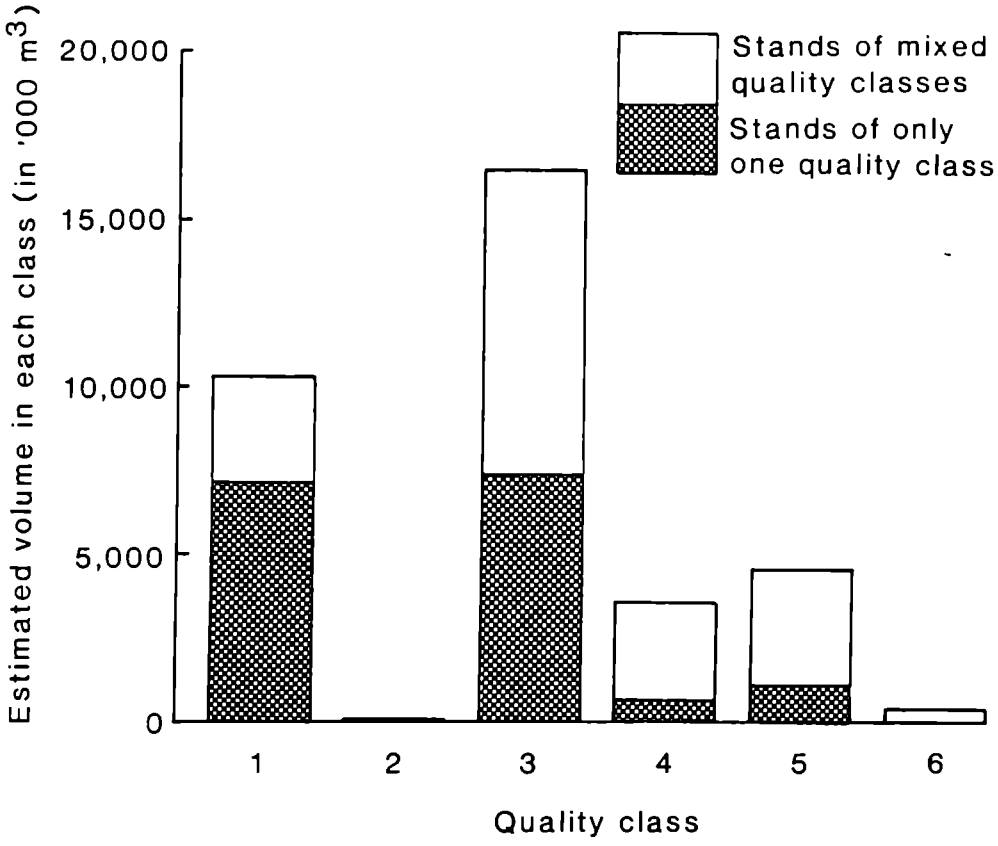

Figure 11 The distribution of timber quality reported in the 1989 hardwoods survey.

Of the total of 854 records used to determine the price-size curves, 162 records were suitable for detailed analysis. Assuming that these records reflect the general levels of quality of the timber sold and recorded in the survey, several observations about the effects of timber quality can be made.

Figure 11 shows the distribution of the quality classes recorded in the survey by estimated* volume. About one-quarter of the volume is in class 1, half in class 3 and the remainder split between classes 4 and 5. Classes 2 and 6 are insignificant accounting for only about 1% of sales each. The 'average' class is 2.8, but these classes cannot realistically be averaged because it cannot be assumed that there is a linear relationship between them (i.e. timber in class 2 is not necessarily twice as good as timber in class 1, and neither is timber in class 4 compared with that in class 2). This is shown by the prices received for different qualities of timber (see Figure 12).

*Total sale volume was not recorded in every one of these records, so for records where volume was not known, the average for timber in that quality class was used for the pure stands, and the average of all known volumes was used for the mixed stands. These figures were then used to calculate aggregate volumes and averages.

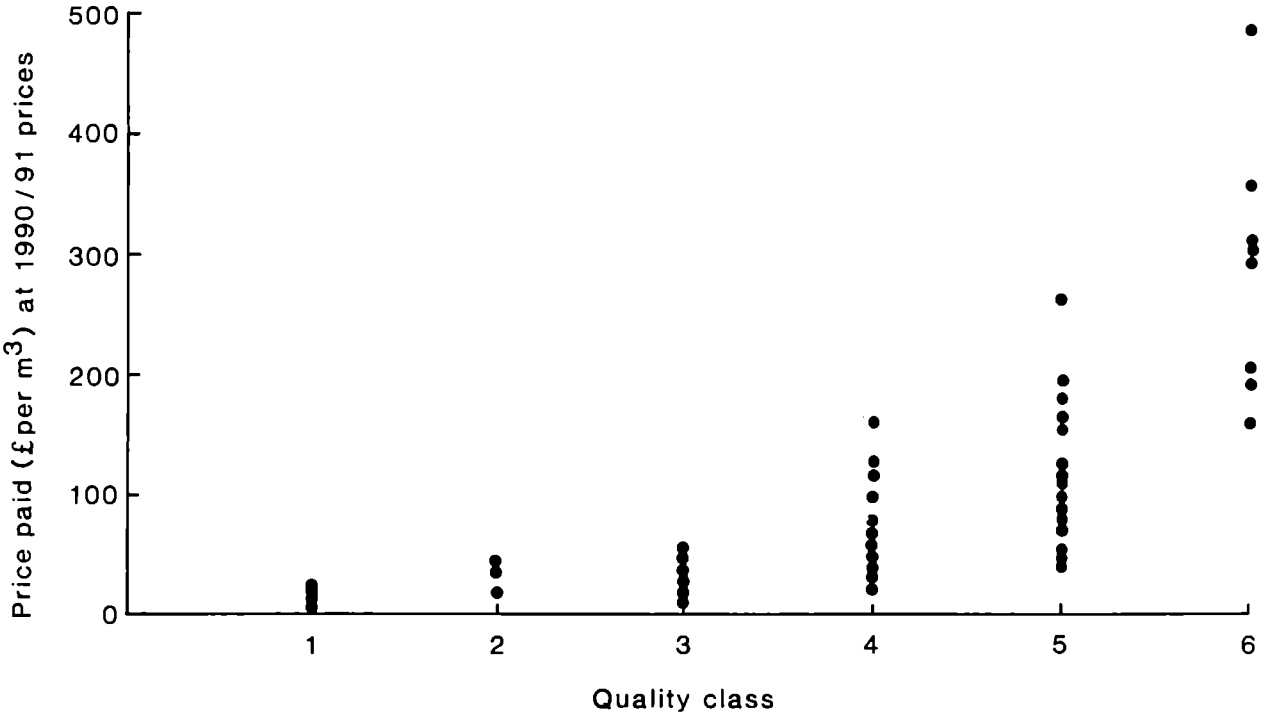

Figure 12 The effect of quality on the prices paid for hardwoods recorded in the 1989 survey.

Table 7 Prices recorded for different qualities of timber in the 1989 hardwood survey (in £ per m^3 at 1990/91 prices)

Quality class	*Lower decile**	*Mean price+*	*Upper decile**
1	5.50	14.00	23.50
2	18.50	35.50	44.00
3	12.50	32.50	34.00
4	37.00	84.00	115.00
5	71.50	125.00	151.50
6	—	298.00	—
Average	—	47.50	—

Notes: *Upper and lower deciles calculated on the basis of estimated volume from stands of only one quality class.

+Mean price calculated as the average weighted by estimated volume of the prices paid in both mixed and pure quality stands.

The average price paid for timber in each of the quality classes is given in Table 7, along with the interdecile range of prices. These average prices are not, however, adjusted to take into account tree size, location, method of harvesting or point-of-sale. It can be seen that prices do not follow an even improvement from the lower to higher quality classes.

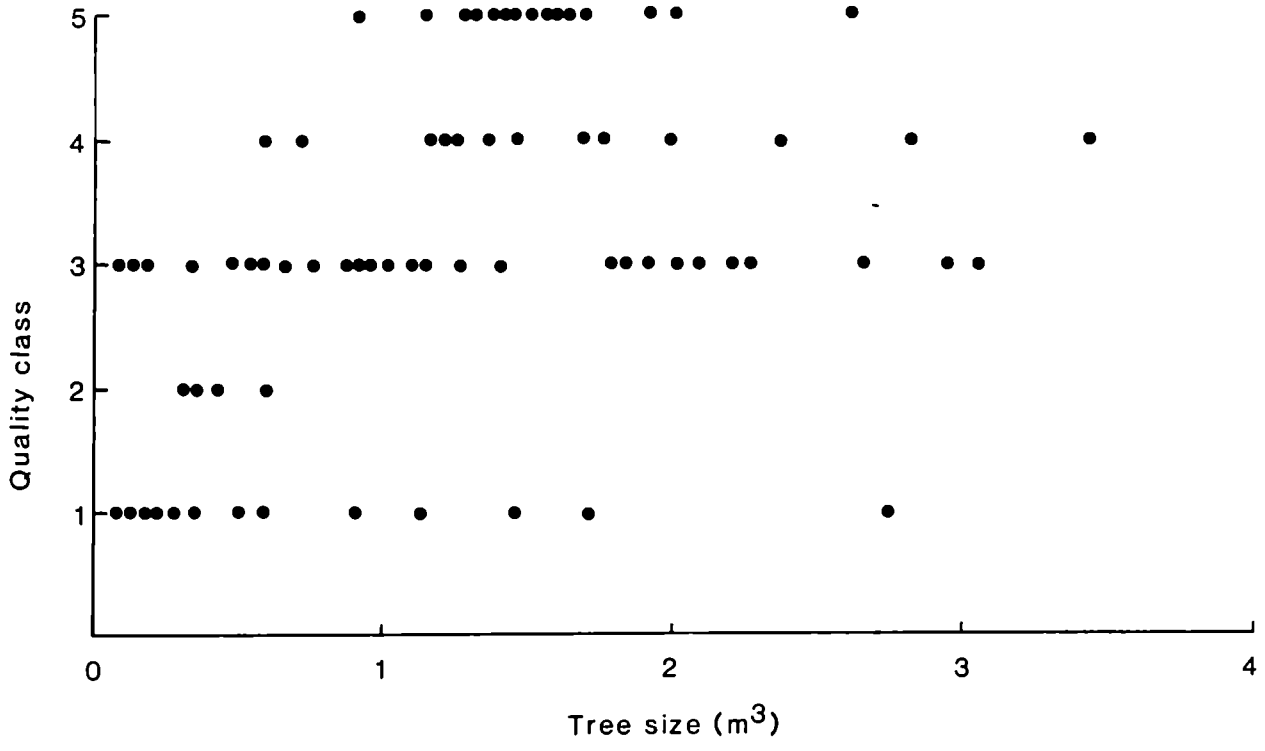

Figure 13 The effect of tree size on the quality of timber recorded in the 1989 hardwoods survey.

The fact that quality is not strongly related to tree size is shown in Figure 13 where, for sales of stands of only one quality class, tree size and quality class are compared. There is only a weak relationship between the two variables present in the data. (Veneer quality timber is not included in the picture because there was only one sale of pure veneer quality timber unmixed with other levels of quality.) However, it was felt necessary to remove all other effects on price to see exactly what effect quality has on price, and this was done by comparing the price-size curve price for each sale or component of a sale with the price actually received. The price was divided by the price-size curve prediction to get a range of multipliers for quality, and the average for the whole sample came out to equal to 1. For illustrative purposes, this is shown along with some other scenarios reflecting the mix of quality that might be expected from a range of sites, in Table 8. These results are similar to other work done in this field such as that reported in Venables (1985).

Table 8 The effect of quality on price from the 1989 hardwood price survey, with some scenarios for a range of other sites

Product quality class	*Multiplier to price-size curve*	*Distribution of quality in sample*	*Other possible quality scenarios*			
			Very poor	*Poor*	*Good*	*Very good*
1	0.64	29%	100%	50%	25%	10%
2	1.08	<1%	—	—	—	—
3	0.70	46%	—	50%	25%	20%
4	1.35	10%	—	—	25%	30%
5	2.19	13%	—	—	25%	30%
6	4.58	1%	—	—	—	10%
Average multiplier to price-size curve		1.00	0.64	0.67	1.22	1.72

It can be seen from Table 8 that quality has a significant effect on the final value of the crop. When planting broadleaves, serious consideration should be given to the likely timber quality of the crop, as this may have as much of an effect on crop value as other factors such as yield class and thinning regime.

Analysis of the wood processors' questionnaires

The 22 returns from wood processors reported on 270 individual sales of varying species, parcel sizes and quality. Of these records 231 contained delivered prices for timber, and this was the sample that was analysed. Of the 231 records, only 10 came from Scotland and Wales, again showing the importance of England and particularly southern England, in the processing of hardwoods.

Five species accounted for almost all of the timber processed. Volume was estimated from average volume purchased where it was not indicated, and the sample comprised (by volume): 27% oak; 21% ash; 21% sycamore; 18% beech and 13% elm. Mean tree size was not required on this questionnaire because it was intended to draw-up a table of product prices for different qualities of log. This was done, and the results are presented in Table 9. The results for the individual species, with the exception of oak, are likely to be subject to error because of the small sample sizes used to arrive at the figures in each cell of the table. This may account for the fact that oak is shown to be consistently higher in value than ash which is contrary to the overall results for the species price-size curves (see Figure 9). Alternatively a further explanation could be that the ash in the main sample is of a higher quality than the oak, which results in higher prices. Whatever the case, this serves to illustrate the complicating effect of quality in the analysis of hardwood prices.

It can be seen that the prices are quite close to those presented in Table 7, and this has, therefore, provided a useful check on the price-size curves, and statements about quality that have been made in earlier sections of this work.

Table 9 Prices paid for wood of different species and qualities delivered to wood processors (in £ per m^3 at 1990/91 prices)

Quality class (and corresponding number in Tables 7 and 8)		*All*	*Oak*	*Ash*	*Elm*	*Beech*	*Sycamore*	*Other*
Fuelwood, pulpwood	(1)	25.00	-	-	-	-	-	-
Mining and fencing timber	(3)	30.50	33.00	26.00	33.00	29.50	26.00	30.50
Second quality sawlogs	(4)	49.50	57.50	45.00	39.00	43.50	49.00	46.50
First quality sawlogs — coloured	(5a)	78.00	151.50	92.00	84.00	53.50	55.50	114.00
First quality sawlogs — white	(5b)	138.50	185.50	130.00	128.50	69.50	103.50	158.00
Veneer logs	(6)	255.00	284.00	216.00	165.00	—	281.50	—

Conclusions

This work has been a first attempt at estimating price-size curves for broadleaves, and the results are presented in Tables 10 to15. There is a wide range of variability in the price of hardwoods, due to such factors as species and timber quality, and separate curves and multipliers have been estimated to allow for this. The price of thinnings has been shown to be significantly below other prices *ceteris paribus*, but insufficient data have meant that the effect of location on prices could not be investigated. Valuing hardwoods is more difficult than valuing softwoods, because the timber is much more likely to be of mixed species and quality, two factors which have been shown to significantly affect price. One major problem that has been highlighted in this work is the measurement of volume from broadleaved stands. The measurement problems that have been identified make it very difficult to carry out economic research on data from broadleaved stands.

Table 10 Price-size relationship for mixed and other broadleaves at 1990/91 prices

	Thinnings only £	*Clear fellings only* £	*Average of all fellings* £
0.05	5.78	7.57	5.96
0.10	7.79	10.20	8.25
0.15	9.27	12.14	9.98
0.20	10.49	13.74	11.43
0.25	11.55	15.12	12.69
0.30	12.49	16.36	13.83
0.35	13.34	17.48	14.86
0.40	14.13	18.51	15.83
0.45	14.86	19.47	16.73
0.50	15.55	20.38	17.58
0.55	16.20	21.23	18.38
0.60	16.82	22.04	19.15
0.65	17.41	22.81	19.88
0.70	17.98	23.55	20.59
0.75	18.52	24.26	21.27
0.80	19.04	24.94	21.92
0.85	19.54	25.60	22.56
0.90	20.03	26.23	23.17
0.95	20.50	26.85	23.77
1.00	20.95	27.45	24.35
1.05	21.40	28.03	24.91
1.10	21.83	28.60	25.46
1.15	22.25	29.15	26.00
1.20	22.66	29.69	26.52
1.25	23.06	30.21	27.04
1.30	23.46	30.73	27.54
1.35	23.84	31.23	28.03
1.40	24.22	31.72	28.52
1.45	24.58	32.21	28.99
1.50	24.95	32.68	29.46
1.60	25.65	33.60	30.36
1.70	26.33	34.49	31.24
1.80	26.98	35.34	32.09
1.90	27.62	36.18	32.92
2.00	28.23	36.98	33.72
2.50	31.07	40.71	37.45
3.00	33.61	44.03	40.80
3.50	35.91	47.04	43.87
4.00	38.03	49.82	46.71
4.50	40.01	52.41	49.37

Table 11 Price-size relationship for ash at 1990/91 prices

	Thinnings only £	*Clear fellings only* £	*Average of all fellings* £
0.05	8.78	11.51	9.05
0.10	11.83	15.50	12.54
0.15	14.09	18.45	15.17
0.20	15.94	20.89	17.37
0.25	17.55	22.99	19.29
0.30	18.98	24.86	21.01
0.35	20.28	26.57	22.59
0.40	21.48	28.14	24.06
0.45	22.59	29.60	25.43
0.50	23.64	30.97	26.72
0.55	24.63	32.27	27.94
0.60	25.57	33.50	29.11
0.65	26.47	34.67	30.22
0.70	27.32	35.79	31.29
0.75	28.15	36.87	32.33
0.80	28.94	37.91	33.32
0.85	29.70	38.91	34.28
0.90	30.44	39.88	35.22
0.95	31.16	40.81	36.12
1.00	31.85	41.72	37.01
1.05	32.53	42.61	37.86
1.10	33.18	43.47	38.70
1.15	33.82	44.31	39.52
1.20	34.45	45.13	40.32
1.25	35.06	45.93	41.10
1.30	35.66	46.71	41.86
1.35	36.24	47.47	42.61
1.40	36.81	48.22	43.35
1.45	37.37	48.95	44.07
1.50	37.92	49.67	44.77
1.60	38.98	51.07	46.15
1.70	40.01	52.42	47.49
1.80	41.01	53.72	48.78
1.90	41.97	54.99	50.04
2.00	42.91	56.21	51.26
2.50	47.23	61.87	56.93
3.00	51.08	66.92	62.02
3.50	54.59	71.51	66.68
4.00	57.81	75.73	71.00
4.50	60.81	79.67	75.04

Table 12 Price-size relationship for oak at 1990/91 prices

	Thinnings only £	*Clear fellings only* £	*Average of all fellings* £
0.05	8.61	11.28	8.87
0.10	11.60	15.20	12.29
0.15	13.81	18.09	14.87
0.20	15.63	20.47	17.03
0.25	17.20	22.53	18.91
0.30	18.61	24.37	20.60
0.35	19.88	26.04	22.15
0.40	21.05	27.58	23.58
0.45	22.15	29.01	24.92
0.50	23.18	30.36	26.19
0.55	24.14	31.63	27.39
0.60	25.07	32.84	28.53
0.65	25.94	33.99	29.63
0.70	26.78	35.09	30.68
0.75	27.59	36.14	31.69
0.80	28.37	37.16	32.66
0.85	29.12	38.14	33.61
0.90	29.84	39.09	34.52
0.95	30.54	40.01	35.41
1.00	31.22	40.90	36.28
1.05	31.88	41.77	37.12
1.10	32.53	42.61	37.94
1.15	33.16	43.43	38.74
1.20	33.77	44.24	39.52
1.25	34.37	45.02	40.29
1.30	34.95	45.79	41.04
1.35	35.52	46.53	41.77
1.40	36.08	47.27	42.49
1.45	36.63	47.99	43.20
1.50	37.17	48.69	43.89
1.60	38.22	50.06	45.24
1.70	39.22	51.38	46.55
1.80	40.20	52.66	47.82
1.90	41.15	53.90	49.05
2.00	42.06	55.10	50.25
2.50	46.30	60.65	55.80
3.00	50.08	65.60	60.79
3.50	53.51	70.09	65.36
4.00	56.67	74.24	69.60
4.50	59.61	78.09	73.56

Table 13 Price-size relationship for sweet chestnut at 1990/91 prices

	Thinnings only £	*Clear fellings only* £	*Average of all fellings* £
0.05	7.57	9.92	7.80
0.10	10.20	13.36	10.81
0.15	12.14	15.91	13.08
0.20	13.74	18.00	14.97
0.25	15.12	19.81	16.62
0.30	16.36	21.43	18.11
0.35	17.48	22.90	19.47
0.40	18.51	24.25	20.73
0.45	19.47	25.51	21.91
0.50	20.38	26.69	23.03
0.55	21.23	27.81	24.08
0.60	22.04	28.87	25.09
0.65	22.81	29.88	26.05
0.70	23.55	30.85	26.97
0.75	24.26	31.78	27.86
0.80	24.94	32.67	28.72
0.85	25.60	33.53	29.55
0.90	26.23	34.37	30.35
0.95	26.85	35.18	31.13
1.00	27.45	35.96	31.89
1.05	28.03	36.72	32.63
1.10	28.60	37.46	33.35
1.15	29.15	38.19	34.06
1.20	29.69	38.89	34.75
1.25	30.22	39.58	35.42
1.30	30.73	40.25	36.08
1.35	31.23	40.91	36.72
1.40	31.72	41.56	37.36
1.45	32.21	42.19	37.98
1.50	32.68	42.81	38.59
1.60	33.60	44.01	39.78
1.70	34.49	45.18	40.93
1.80	35.34	46.30	42.04
1.90	36.18	47.39	43.12
2.00	36.98	48.45	44.18
2.50	40.71	53.33	49.06
3.00	44.03	57.67	53.45
3.50	47.04	61.63	57.47
4.00	49.82	65.27	61.19
4.50	52.41	68.66	64.67

Table 14 Price-size relationship for beech at 1990/91 prices

	Thinnings only £	*Clear fellings only* £	*Average of all fellings* £
0.05	6.59	8.63	6.79
0.10	8.88	11.63	9.40
0.15	10.57	13.84	11.38
0.20	11.96	15.66	13.03
0.25	13.16	17.24	14.47
0.30	14.23	18.65	15.76
0.35	15.21	19.93	16.95
0.40	16.11	21.10	18.04
0.45	16.95	22.20	19.07
0.50	17.73	23.23	20.04
0.55	18.47	24.20	20.96
0.60	19.18	25.12	21.83
0.65	19.85	26.00	22.67
0.70	20.49	26.84	23.47
0.75	21.11	27.65	24.24
0.80	21.70	28.43	24.99
0.85	22.28	29.18	25.71
0.90	22.83	29.91	26.41
0.95	23.37	30.61	27.09
1.00	23.89	31.29	27.75
1.05	24.39	31.96	28.40
1.10	24.89	32.60	29.03
1.15	25.37	33.23	29.64
1.20	25.84	33.85	30.24
1.25	26.29	34.44	30.82
1.30	26.74	35.03	31.40
1.35	27.18	35.60	31.96
1.40	27.61	36.17	32.51
1.45	28.03	36.71	33.05
1.50	28.44	37.25	33.58
1.60	29.24	38.30	34.62
1.70	30.01	39.31	35.62
1.80	30.76	40.29	36.59
1.90	31.48	41.24	37.53
2.00	32.18	42.16	38.44
2.50	35.42	46.41	42.69
3.00	38.31	50.19	46.51
3.50	40.94	53.63	50.01
4.00	43.36	56.80	53.25
4.50	45.61	59.75	56.28

Table 15 Price-size relationship for poplar at 1990/91 prices

	Thinnings only £	*Clear fellings only* £	*Average of all fellings* £
0.05	3.58	4.69	3.69
0.10	4.83	6.32	5.11
0.15	5.75	7.53	6.19
0.20	6.50	8.52	7.08
0.25	7.16	9.38	7.87
0.30	7.74	10.14	8.57
0.35	8.27	10.84	9.22
0.40	8.76	11.48	9.81
0.45	9.22	12.07	10.37
0.50	9.64	12.63	10.90
0.55	10.05	13.16	11.40
0.60	10.43	13.66	11.87
0.65	10.80	14.14	12.33
0.70	11.14	14.60	12.76
0.75	11.48	15.04	13.19
0.80	11.80	15.46	13.59
0.85	12.11	15.87	13.98
0.90	12.42	16.27	14.37
0.95	12.71	16.65	14.73
1.00	12.99	17.02	15.09
1.05	13.27	17.38	15.44
1.10	13.54	17.73	15.79
1.15	13.80	18.07	16.12
1.20	14.05	18.41	16.45
1.25	14.30	18.73	16.76
1.30	14.54	19.05	17.08
1.35	14.78	19.36	17.38
1.40	15.01	19.67	17.68
1.45	15.24	19.97	17.97
1.50	15.47	20.26	18.26
1.60	15.90	20.83	18.83
1.70	16.32	21.38	19.37
1.80	16.73	21.91	19.90
1.90	17.12	22.43	20.41
2.00	17.50	22.93	20.91
2.50	19.27	25.24	23.22
3.00	20.84	27.30	25.30
3.50	22.26	29.17	27.20
4.00	23.58	30.89	28.96
4.50	24.81	32.50	30.61

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References

EDWARDS, P.N. and CHRISTIE, J.M. (1981). *Yield models for forest management.* Forestry Commission Booklet 48. Forestry Commission, Edinburgh.

FORESTRY COMMISSION (1990). *Forestry facts and figures 1988-1989.* Forestry Commission, Edinburgh.

HAMILTON, G. J. (1975). *Forest mensuration handbook.* Forestry Commission Booklet 39. HMSO, London.

JOHN CLEGG & Co. (1989). *Prices of broadleaved timber.* Report to the Forestry Commission.

MITLIN, D. (1987). *Price-size curves for conifers.* Forestry Commission Bulletin 68. HMSO, London.

VENABLES, R. (1985). What the timber merchant wants. *Timber Grower* 96, 14-21.

Table A **BROADLEAVED PRICES SURVEY — TIMBER SALES**

1. Name of owner/estate/contractor _____ 2. Location of woodland: _____

3. Units of measurement used a. imperial: e.g. feet, inches, hoppus cubic feet ☐

tick as appropriate

b. metric: e.g. metres, cm, cubic metres ☐

PART 1									PART 2												
Date of sale	Species	Volume (1) (overbark)	Enter whether S - standing F - felled at stump R - roadside D - delivered	Average tree size at breast height (2) DBH ins/cm	Q Girth ins	Volume H ft or m^3	Thin (T) CF (C)	Unit price £/H cu ft or m^3 OB	If likely product out-turn known please complete the following: Fuelwood pulpwood boardwood stakes % vol	unit price	Poles for refinery and turnery % vol	unit price	Packaging fencing mining pallets % vol	unit price	Planking/ furniture/joinery 2nd quality % vol	unit price	1st quality % vol	unit price	Veneer butts % vol	unit price	REMARKS e.g. ease of extraction, transport distance, and any special circumstances which might have affected prices significantly upwards or downwards

Footnotes: (1) If the sale was by weight please give an estimate of the volume.
(2) Please enter details for as wide a range of tree sizes as possible from say 3" QG to 40 " QG where possible.

Table B

BROADLEAVED PRICES SURVEY — WOOD USING INDUSTRIES

Confidential

1. Name of company

2. Local Authority Region

3. Units of measurement used a. imperial: e.g. feet, inches, hoppus cubic feet

tick as appropriate

b. metric: e.g. metres, cm, cubic metres

Date	Species	Enter whether prices are: S - standing F - felled at stump R - roadside D - delivered	Mill Throughput (TH'PUT)												Average working costs of sales			Remarks e.g. typical conversion losses
			Small roundwood tops, branchwood e.g. fuelwood pulpwood			Low quality logs e.g. fencing packaging		Joinery/planking & furniture quality logs: Second quality e.g. fencing beams		First quality coloured		First quality white		Venner butts		Felling/ burning	Cross-cutting & extraction	Haulage	
			vol th'put	unit **	unit price*	vol th'put	unit price*	vol th'put	unit price*	vol th'put	unit price*	vol th'put	unit price*	vol th'put	unit price*				
Latest year for which data are available	Oak Beech Ash Sycamore Elm Others†																		
3 years ago	Oak Beech Ash Sycamore Elm Others†																		
10 years ago	Oak Beech Ash Sycamore Elm Others†																		

Footnotes:
*Enter unit, i.e. £ per h.cu ft
**If the sale was by weight please give an estimate of volume.
†Please specify.
Th'put = throughput.

Please return by 13.2.89, if possible but not later than 28.2.89

Guy Watt,
John Clegg & Co
2 Rutland Square
Edinburgh EH1 2AS
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