

MARKETING MARGINS FOR NEW ZEALAND LAMB
AND FOR ALL LAMB AND MUTTON IN
THE UNITED KINGDOM

by

A. C. Lewis

&

S. M. C. Murray

Agricultural Economics Research Unit Discussion Paper No. 18
Lincoln College, Canterbury, N.Z.
July 1970

MARKETING MARGINS FOR NEW ZEALAND LAMB
AND FOR ALL LAMB AND MUTTON IN
THE UNITED KINGDOM

1. Introduction

The "marketing margin" is a general term used to cover all the multitude of costs and profit margins which make up the difference between the price paid for lamb by consumers in retail markets, and the price at some earlier point in the marketing chain. In this study we are concerned with the marketing margin between wholesale and retail prices for lamb in Great Britain.

Three aspects of the margin between wholesale and retail meat prices in two major retail outlets in the United Kingdom have been investigated. These are firstly, the closeness with which changes in wholesale prices are followed by changes in retail prices; secondly, the extent of the margin between these prices; and lastly, the type of margin that has existed during the period of analysis.

The retail outlets studied are firstly a large chain of supermarkets, chosen to be representative of supermarkets in general; and secondly, a sample of retail butcher shops. The relationship between prices in both these markets and the Smithfield wholesale price is investigated.

A pragmatic approach was adopted to answer the following four questions:

- (i) How long does it take for meat offered on the wholesale market to reach the consumer?
- (ii) What, on average, is the mark-up on meat between the wholesale and retail markets?
- (iii) Is there, at different levels, a consistent relationship between the wholesale and retail prices of meat?
- (iv) What is the nature of this relationship?

The nature of the marketing margin has important implications for the New Zealand lamb producer in so far as the retail price fluctuations reach down to him in the form of fluctuations in wholesale prices which in turn are reflected in the schedule price to the farmer.

If the margin is a fixed one then a given percentage price fluctuation induced by the consumer is exaggerated in the wholesale

market and further exaggerated at the farm gate. If it is a percentage mark-up then the percentage change in the wholesale market is the same as that in the retail market. The costs of marketing between the farm gate and the wholesale market are known to be fixed, and if, therefore, the wholesale-retail margin is a percentage one, the total mark-up from farm gate to retail will be a mixture and the fluctuations will be greater at the farm gate.

It has been suspected for some time that retail butchers in the United Kingdom exert a non-price influence on consumer demand. When supplies of one line of meat are short they tend to use promotional tactics to push other lines rather than adjusting prices to clear their stocks. A dampening of price fluctuations in this manner would tend to reduce the degree of association between wholesale and retail prices and if anything show up as a percentage mark-up.

2. The Procedure

To find the time lag between the markets, a simple correlation coefficient was computed between the wholesale and retail prices over a range of different time periods. The period which gave the highest correlation was accepted as the period of the lag.

The average mark-up was computed to be simply the difference between the average prices, taking into account the time lag.

To establish a relationship between the wholesale and retail prices the hypothesis was adopted that the relationship can be adequately described by the formula:

$$Y = a + b X$$

where Y = retail price

X = wholesale price

a and b are constants.

Estimates of \hat{a} and \hat{b} , denoted a and b , were obtained by least squares regression, the r^2 pointing to the closeness of the relationship and the standard error of \hat{a} to the consistency of the estimated relationship.

If it is established that Y and X are associated in the manner:

$$Y = a + b X$$

Then if,

\hat{a} is close to zero

and

$$\hat{b} > 1$$

then,

$100 (\hat{b} - 1)$ gives the percentage relationship, expressing the mark-up as a percentage of the wholesale price.

If \hat{b} is close to 1

and,

$\hat{a} > \text{zero}$ then the relationship has been a fixed one and \hat{a} gives the extent of the fixed margin.

For instance if $b = 1$ then,

$$\text{Retail Price} = a + \text{Wholesale Price}$$

and a is the fixed margin.

But if $a = 0$ then,

$$\begin{aligned} \text{Retail Price} &= b (\text{Wholesale Price}) \\ &= \text{Wholesale Price} + (b-1)(\text{Wholesale Price}) \end{aligned}$$

which gives a percentage relationship and values in between will give evidence of a mixed relationship.

3. The Margin Between a Supermarket Retail Price of New Zealand Lamb and the Wholesale Price of 29/36 lb. New Zealand Lamb at Smithfield Market.

As supermarkets do not buy all or perhaps even most of their meat at Smithfield, it would seem unwise to suggest that the price ruling at Smithfield represents the wholesale price paid by the supermarket. However, three points can be made in support of using the Smithfield price:

- (a) The assumption is made that for other sources of supply to remain competitive they must keep fairly closely to Smithfield prices or lose customers or money. And in fact most contractual arrangements have their price tied to Smithfield prices.
- (b) The Smithfield price is the basis of the effective price used to calculate the schedule price to New Zealand farmers.
- (c) It is the only published wholesale price series that exists.

The wholesale price¹ of 29/36 lb New Zealand Down Lamb is assumed to be close to the average price for all lamb on the grounds that the bulk of New Zealand lamb exported to the U.K. falls within this category. Also the average weight of lamb killed for export in New Zealand has been between 29 lb and 36 lb since before 1951.²

1. Prices quotes weekly by International Meat Traders Association.
2. N.Z. Meat Producers Board, 43rd Annual Report, 1965.

Where prices for both old season's and new season's lamb are quoted the new season's quote has been used. This is likely to lead to over-estimation of the average price. Where new season's prices were not quoted, the use of the old season's price would lead to error in the downward direction. The weekly retail prices of the supermarket's lamb was calculated as a weighted average of prices for quoted cuts and for imported kidney (since the lamb carcass is sold with the kidney).

In all years investigated a two week lag between wholesale price and retail price gave the highest correlation.

Average Mark-up

Table I presents the average prices, the mark-up and the mark-up calculated as a percentage of the wholesale price.

TABLE I

Average Supermarket Retail Prices and Mark-up on
New Zealand Lamb

Year	Av. Wholesale Price <hr/> pence/lb	Average Supermarket Retail Price <hr/> pence/lb	Av. Mark-up <hr/> pence/lb	Percentage Mark-up <hr/> %
1964	26.70	35.94	9.24	34.6
1965	27.66	38.54	11.88	39.33
1966	24.95	36.32	11.37	45.57
1967	25.22	37.16	11.94	47.34
1968	28.92	45.17	16.25	56.20
1969	32.14	51.05	18.91	58.84

There has not been a great increase in the extent of the mark-up in supermarkets over the period until 1968 and 1969 when the mark-up increased substantially when computed both as a fixed mark-up and as a percentage mark-up.

The Relationship Between Wholesale and Retail Prices (weekly quotations)

The relationship between wholesale and retail prices was assumed to be of the form:

$$\text{Retail Price} = a + b \text{ wholesale price.}$$

Least squares estimates of a and b are given in Table II.

TABLE II

Regression Estimates for the Mark-up on
New Zealand Lamb in Supermarkets

<u>Year</u>	<u>a</u>	<u>b</u>	<u>r²</u>
1964	5.43	1.14 (0.04)	0.95
1965	9.36	1.06 (0.07)	0.81
1966	2.23	1.36 (0.09)	0.83
1967	12.39	0.98 (0.04)	0.92
1968	21.42	0.82 (0.06)	0.79
1969	28.80	0.69 (0.11)	0.41

* Standard errors of the b's in parenthesis.

Diagrams I to III illustrate the closeness of fit for these equations, by comparing the actual retail price with that estimated from the regression equation for each of these six years.

There is a high degree of association between the wholesale and retail price of New Zealand lamb if these prices are measured at Smithfield and at supermarkets. If the supermarket chosen is typical of supermarkets in general then a good deal of the influence of changing consumer demand will find its way back to the lamb producer. There appears to be a high degree of consistency within years in the type of mark-up, as evidenced by the high r^2 's for each year. The type of mark-up varies between years from a fixed margin to a percentage one. Except for 1966 it seems that the supermarket has been moving towards a policy of following the wholesale market closely with little attempt to dampen the fluctuations.

4. The Margin Between Smithfield Average Price of all Lamb and Mutton and the Retail Price of all Lamb and Mutton as Estimated by the Ministry of Agriculture, Fisheries and Food's National Food Survey

In this section the margin between the wholesale and retail price of all lamb and mutton in the United Kingdom is studied. All retail outlets, supermarkets as well as retail butcher shops, are included in this analysis. There are no statistics available for the retail price of lamb and mutton in retail outlets excluding supermarkets nor are there any statistics for the price of New Zealand lamb and mutton in retail outlets other than that of the

DIAGRAM I

Comparison of Wholesale Prices and Actual & Estimated Retail Prices of Lamb Sold in a British Supermarket

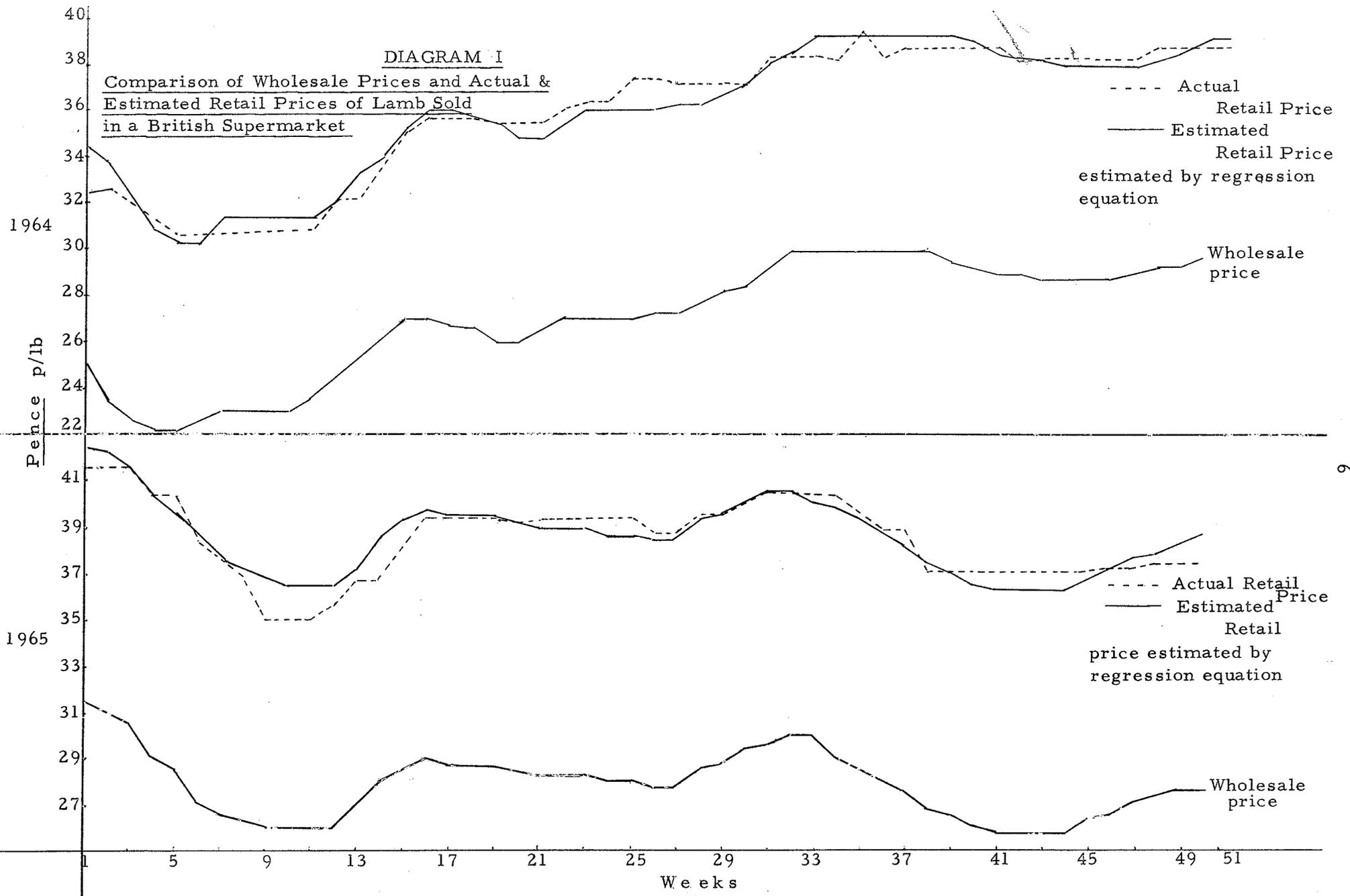


DIAGRAM II

Comparison of Wholesale Prices and Actual & Estimated Retail Prices of Lamb Sold in a British Supermarket

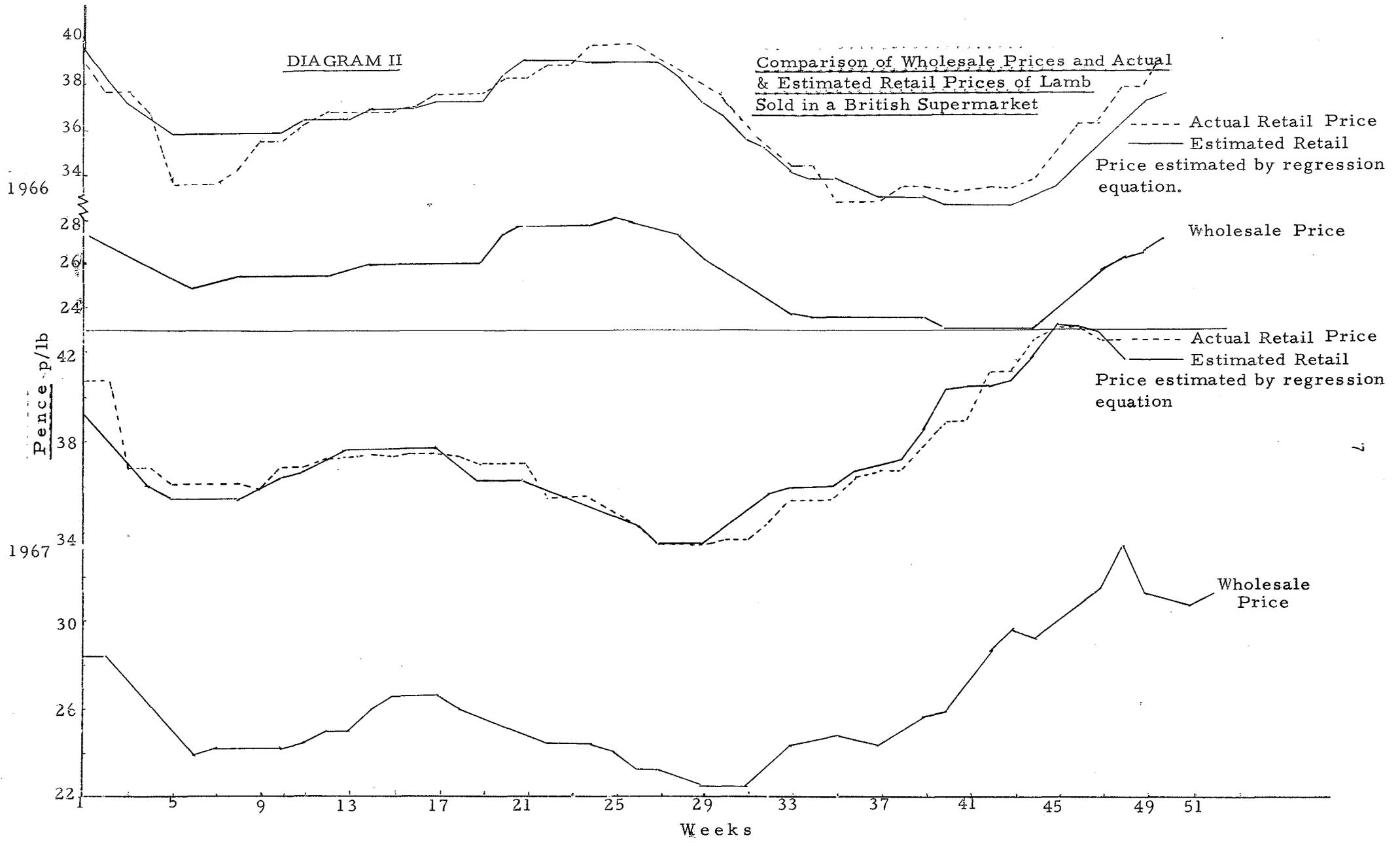
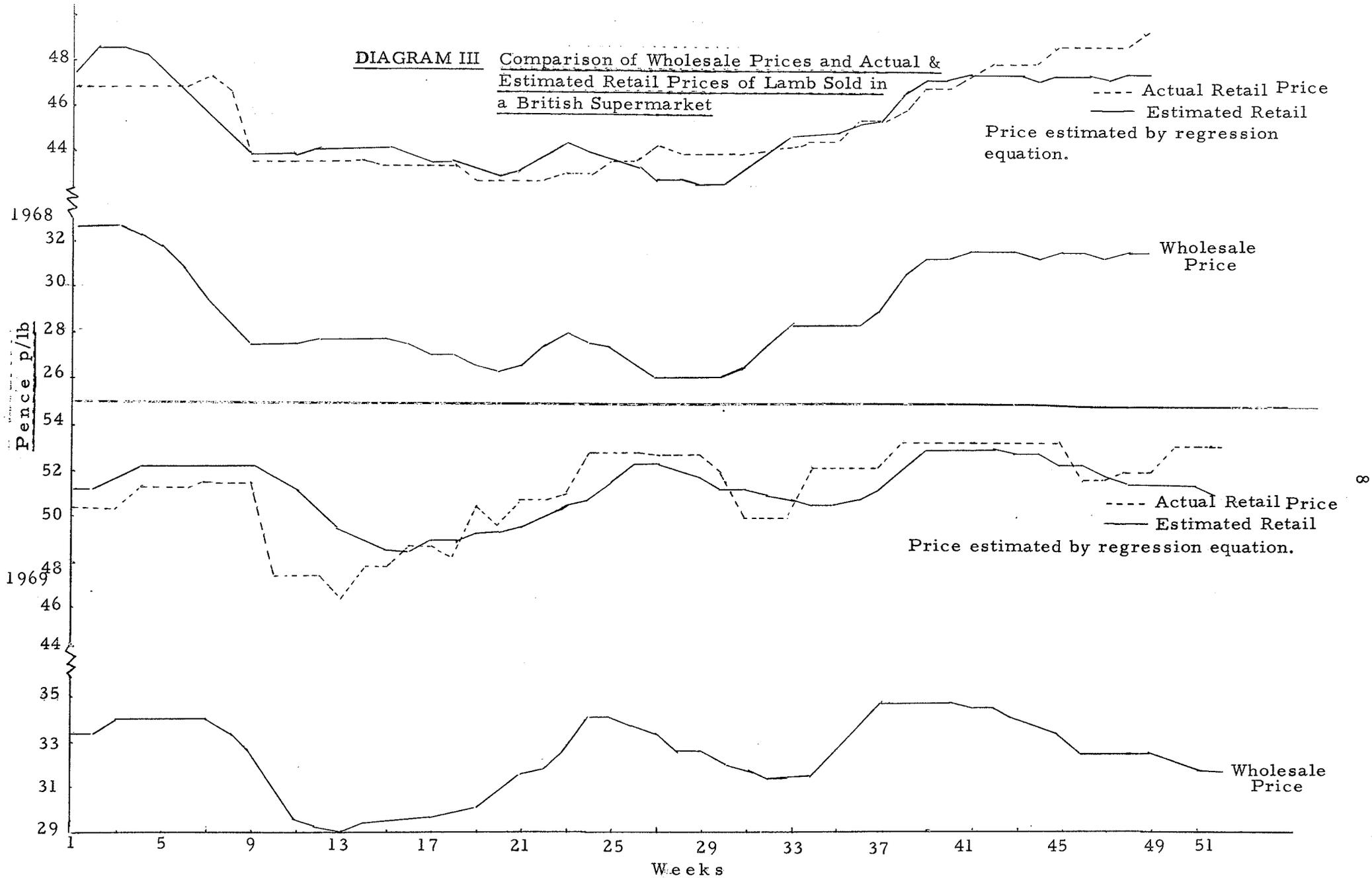


DIAGRAM III Comparison of Wholesale Prices and Actual & Estimated Retail Prices of Lamb Sold in a British Supermarket



supermarket used in the first part of the study.

The National Food Survey price data is derived from an expenditure/quantity ratio of household budget data. This gives a weighted average price of all lamb and mutton. The accuracy of the data depends on the size and representativeness of the survey sample. Quarterly prices were available from the third quarter of 1955 to the last quarter of 1968.

The Commonwealth Economic Committee's statistics from which the wholesale price of lamb and mutton was derived do not include quantities of English mutton, nor do they differentiate between sources of lamb held in store prior to auction. Neither is there any estimate of stocks held in privately owned stores. The first omission will cause the estimate of the weighted average price to be higher than the true weighted average. The second omission will cause some price variation due to one source of lamb to be attributed to another or will leave it out altogether. The quantities of Australian lamb and other less important imported lamb have not been included in the calculations of the weighted price.

It can easily be shown that if the error in estimation of either the wholesale price or the retail price or both is constant between observations then only the value of \hat{a} will be affected. Since there is not evidence this is so, or nearly so, indices of wholesale and retail price were used in the analysis, as well as using absolute values. The use of indices does not allow for the hypothesis that the margin may be a fixed one.

In the regressions using data in the form of indices the value of \hat{a} will depend on which observation is used as the base. For instance, if Y_1 and X_1 are the base period observations then the equation:

$$Y/Y_1 = a' + b' X/X_1$$

$$\therefore Y = a'Y_1 + b'X_1/X_1$$

$$\therefore a = a'Y_1 \quad \text{and} \quad b = b'X_1/X_1$$

Two regressions were run, the first with no lag and the second with one quarter lag. The non-lagged equation gave the highest correlation. It is likely that a lag of one quarter is too long and a better result would be secured with a lag of two to three weeks.

The results are given in Table III.

TABLE III

Regression Estimates for the Mark-up on Lamb
and Mutton in Butcher Shops
(Data in Index Form)

	<u>a'</u>	<u>b'</u>	<u>r</u> ²	<u>d</u>
No lag	.23	.90 (.09)	.63	.63
One Quarter lag	.85	.29 (.10)	.16	.28

The regression line consistently over-estimated the retail price index in early observations and under-estimated it in later observations. This evidence of serial correlation in the residuals was further substantiated by a Durbin-Watson statistic (d) of 0.6 and indicates that some important variable has been missed out. This could be due to the lack of some information in the wholesale price estimates. It could also be due to the changing cost structure in the retail meat industry. Whatever it is, it is possible to slough off some of the residual variance into a time trend; though this does not do away with the symptoms of autocorrelation it significantly improves the r^2 .

Table IV gives the results of the regression equation with a trend term included. The equation is:

$$Y = a' + b' X + cT$$

where,

T is 1 for the third quarter of 1955

c is the time coefficient.

TABLE IV

Regression Estimates with a Trend Term for the Mark-up
on Lamb and Mutton in Butcher Shops
(Data in Index Form)

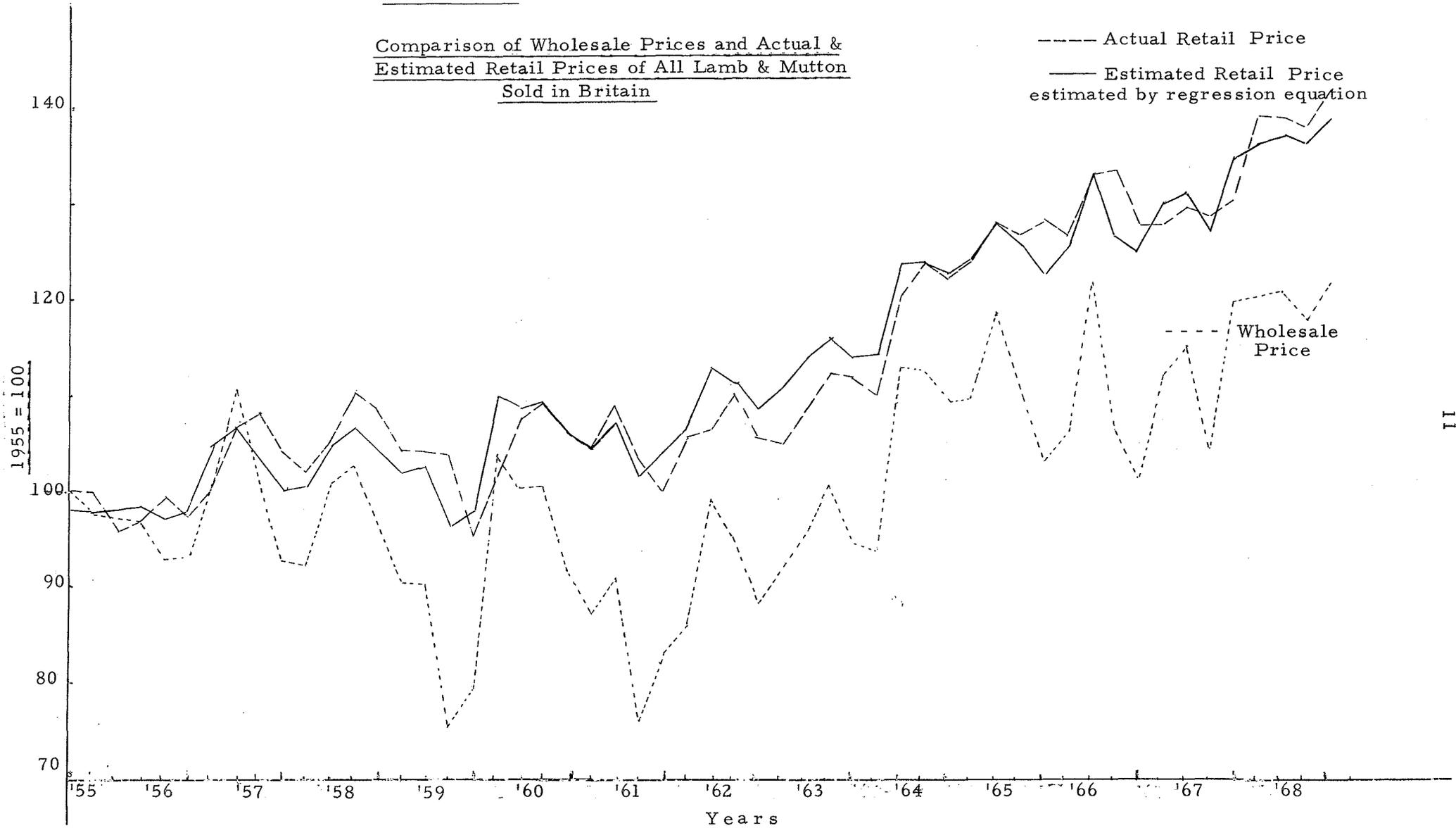
	<u>a'</u>	<u>b'</u>	<u>c'</u>	<u>r</u> ²	<u>d</u>
No Lag	.53 (.05)	.447 (.0004)	.005	.93	.112
One Quarter Lag	.90 (.005)	.176 (.00005)	.0005	.73	.29

Diagram IV illustrates the equation for the non-lagged data which apparently gives far better results than the equation incorporating a lag.

As with all trend analyses the inclusion of a linear trend

DIAGRAM IV

Comparison of Wholesale Prices and Actual & Estimated Retail Prices of All Lamb & Mutton Sold in Britain



in a regression equation contains within it an explicit and restrictive hypothesis. In this case the hypothesis is that the retail price index grows independently of the wholesale price index at the trend coefficient times the rate of the natural numbers.

The low value of the coefficient for the wholesale price index indicates that as a group, butchers tend to compensate for price changes in the wholesale market. That is, while they adhere to the direction of prices changes in the wholesale market, they dampen the magnitude of the changes.

The average wholesale price over the period was 28.0 pence per head, the average retail price was 43.5 pence per pound and the average mark-up was 15.5 pence per pound, or 55.36% of the wholesale price.

Two further regressions were run using absolute values of the data. Because of data inaccuracies previously mentioned, not too much reliance can be placed on the values of the coefficients. Table V presents the results of these regressions with a trend term included.

The equation is of the form:

$$Y = a + b X + cT$$

The value of c indicates the amount added to the fixed margins each quarter from the third quarter 1955.

Table V also presents the results of a regression of the form:

$$Y = a + b X + c_t XT$$

In this case the value of c_t indicates the amount added to the percentage margin each quarter from the third quarter 1955. An attempt to combine these two equations did not give satisfactory results.

TABLE V

Regression Estimate with a Trend Term for the Mark-up on
Lamb and Mutton in Butcher Shops
(Data in Absolute Values)

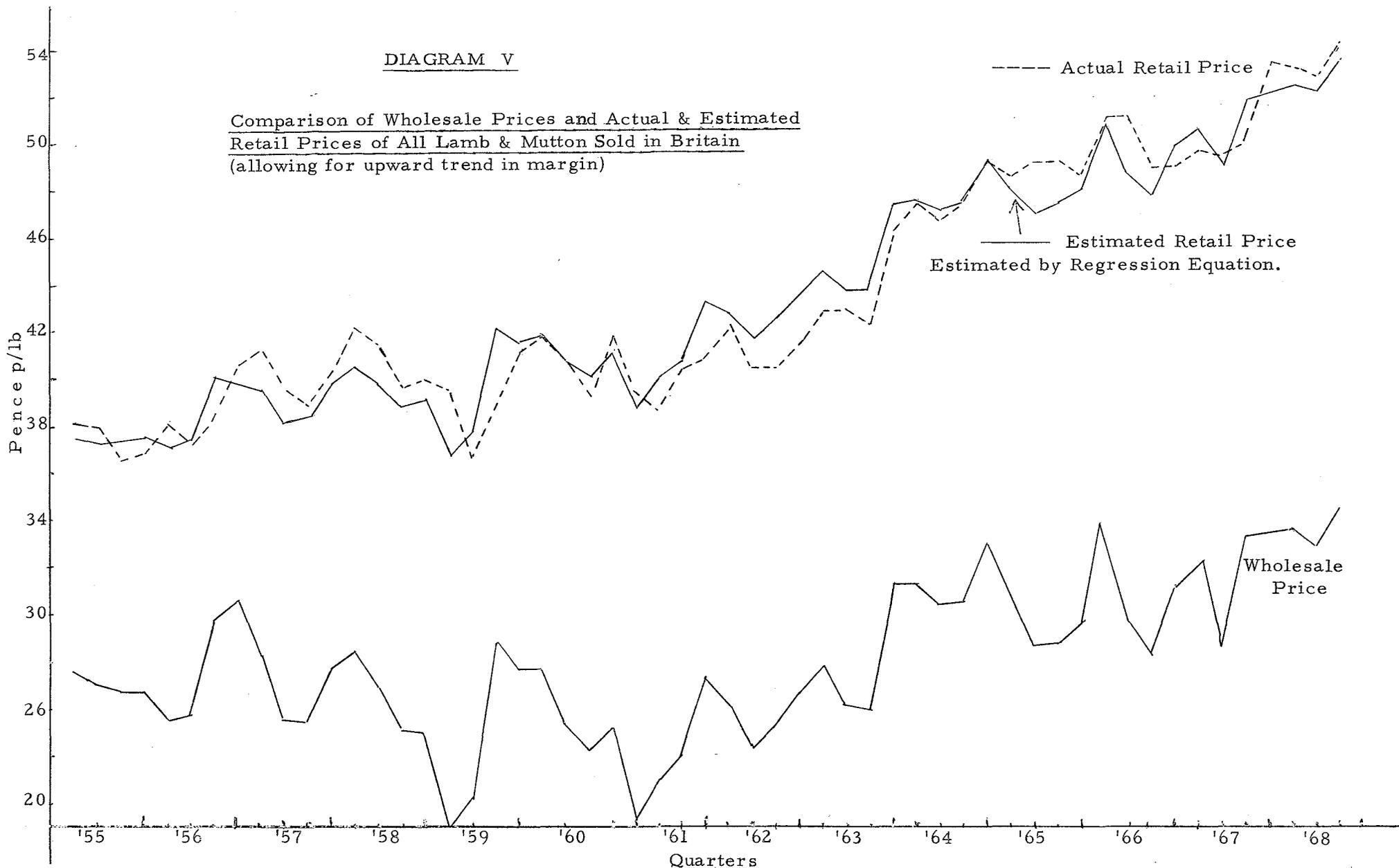
	<u>a</u>	<u>b</u>	<u>c</u>	<u>c_t</u>	<u>R²</u>
Equation 1	20.22	.62 (.07)	.22 (.01)		.93
Equation 2	26.99	.37 (.08)		.007 (.0005)	.93

Diagram V illustrates equation 1.

A negative percentage margin is derived from a \hat{b} value of less than unity. It indicates that the margin, expressed as a percentage, is less at higher wholesale prices than at lower prices.

DIAGRAM V

Comparison of Wholesale Prices and Actual & Estimated Retail Prices of All Lamb & Mutton Sold in Britain
(allowing for upward trend in margin)



The value for c indicates that the margin has been growing at the rate of about 0.2 pence per quarter or 0.8 pence per annum.

The value for c_t indicates that the fluctuation dampening effect of the negative percentage margin has been reduced (0.37 - 1.00 or 63% over the whole period) in each quarter so that by the last quarter of the analysis it is about -23%.

5. Comparative Variation in the Wholesale and Retail Prices

As an additional measure of the comparative fluctuations in the wholesale and retail prices, coefficients of variation for each were computed and compared. Table VI presents these.

TABLE VI

Coefficients of Variation of Wholesale
and Retail Prices

	<u>Wholesale Prices</u> %	<u>Retail Prices</u> %
N.Z. Lamb at Smithfield and Supermarkets		
1964	67	58
1965	36	30
1966	43	45
1967	70	48
1968	53	33
1969	39	26
Lamb & Mutton at Smithfield and Butcher Shops		
1955-65	85	86

Except for 1966 these figures support the contention that the relative price fluctuation is greater in the wholesale market than in the supermarket. For meat sold in butcher shops the relative price fluctuation is about the same in both markets. This is consistent with a percentage mark-up.

6. Conclusion

There is a marked difference between the pricing behaviour of the supermarket and the retail meat trade as a whole in the United Kingdom. The supermarkets follow the wholesale price closely and seem to be moving towards a fixed (and growing) margin. U.K. retail butchers as a whole tend to dampen the wholesale price fluctuation but

when a trend in the relationship is taken into account there is a close association between the wholesale and retail prices in this outlet also.

All figures support the contention that there is a greater relative fluctuation in the wholesale market than in the retail market. It is known that, because of the method of setting the schedule price to New Zealand meat producers, the margin between the farm gate and the wholesale market is a fixed one. On both these counts it is probable that price fluctuations induced by the consumer in the retail market will be exaggerated at the farm gate.