CHANGES IN UNITED KINGDOM MEAT DEMAND

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SUMMARY

The United Kingdom remains the major market for New Zealand lamb. In order to understand the environment into which New Zealand lamb is sold, it is necessary to have some knowledge of the market structure, in terms of the impact of the other meats upon sales of New Zealand lamb and the impact of general economic factors upon the meat market.

In order to arrive at some assessment of the meat market structure, research has been undertaken to identify the price elasticities of demand for the various meats, and, from this research, arrive at some more overall view of the meat market.

Data on the meat consumption, income and price variables were obtained from the United Kingdom Food Survey. This was utilised in a simple least squares regression demand model developed by Philpott and Matheson (1965) and demand relationships were obtained using quarterly data from the 1970-77 period. Modifications to the model were attempted in the removal of bacon from the non carcase meat category and the inclusion of fish as a competing meat product. The model developed was used also to evaluate recent changes in the meat market through the use of varying time periods between 1970 and 1977.

As a result of the study, a price elasticity of demand for lamb and mutton on the United Kingdom market of -2.0 has been established. This is significantly higher than previous estimates of elasticities which have used data referring to earlier years. A possible reason for the higher value calculated herein is the effect of rapidly rising prices (inflation) on the price sensitivity of consumers. In support of this hypothesis, there have been significantly higher price elasticities of demand identified for the 1974-77 period than for 1970-73.

Lamb and mutton consumption per head has been falling over the past two decades and a negative income elasticity of demand has now become apparent. Poultry meat and pork consumption have both been rising while beef consumption has also fallen. Part of these movements can be attributed to changing real prices, but the significant movement to poultry meat reflects a continuing significant taste preference as well. Non carcase meat has now moved to a position of direct competition with lamb and mutton. Fish does not appear to be a significant competitor with any particular meat type, but does compete with meat as a whole.

Overall, the meat market has become more sensitive to price changes (both money and real) since prices began to increase rapidly (in money terms) and therefore pricing strategy has now become a more important component of any marketing plan. The implications of the study for the consumption of New Zealand lamb are unfavourable, in that with the expected real price rises for lamb resulting from the introduction of an EEC sheepmeat regime, consumption of sheepmeat is expected to fall (while domestic United Kingdom production rises as a result of higher farm prices) thereby significantly reducing the demand for New Zealand lamb. As rising real prices are also expected to affect beef, continued growth in both pork and (especially) poultry meat consumption can be expected.

1. INTRODUCTION

The research covered by this report was completed in order to allow an improved understanding of the United Kingdom retail meat market, with special emphasis on lamb and mutton. The report presents some reworked price elasticities of demand (using the meat demand model developed by Philpott and Matheson, 1965) for the United Kingdom market. The total market has been included in the study as it was not possible to obtain separate data for New Zealand lamb. This may have some bearing on the results, but it is considered that the overall picture will still be useful.

Section 2 of the report covers the background to the present United Kingdom/EEC - New Zealand lamb market relationship and reviews an important study completed in the United Kingdom in 1979. A full description of the demand model is given in the next section followed by a review of the methodology used, the results obtained and the conclusions. The final section discusses the implications of the findings.

2. THE MARKET

2.1 Background

The United Kingdom has, since the advent of refrigerated shipping, been the major export market for New Zealand lamb. Over recent years the degree of dependence on this market has lessened, with the introduction of the New Zealand Meat Producers Board's diversification policies and the subsequent emergence of new markets for lamb, especially in the Middle East. The present viability of New Zealand lamb production still, however, depends on the continuation of a substantial United Kingdom market for New Zealand lamb at remunerative prices.

The importance of this market has always been recognised in New Zealand, and the market has been subjected to extensive research effort to enable the identification of the critical variables that influence the consumption of lamb in the United Kingdom. The pioneer study in this field was completed in 1965 by B. P. Philpott and M. J. Matheson at Lincoln College. The theories of demand analysis were applied to the market, and relationships were established that attempted to explain the movements in the consumption of various meats as a function of the price of the dependent variable (meat), the price of competing meats, income and the season within which the consumption was occurring.

As a consequence of this type of model construction, the responsiveness of the dependent variable (meat consumption) to changes in the independent variables (meat prices and income) can be determined. This responsiveness, or elasticity, can be used to assess the possible future response of meat consumption to potential changes in the independent variables.

2.2 The EEC and New Zealand

At present the New Zealand lamb market in the United Kingdom is faced with the prospect of inclusion in the EEC Common Agricultural Policy (CAP). This inclusion is likely to be effected through the establishment of support prices for lamb to ensure adequate incomes for EEC lamb producers, higher consumer prices as a result, and import restrictions on third country suppliers (such as New Zealand) to ensure that EEC farmers are adequately protected from competition. The imposition of quantitative import restraints may occur at the introduction of a Sheepmeat Regulation, rather than additional tariffs on imported sheepmeat.

The effect of these measures will be to raise the consumer price of sheepmeat to a level which is considered adequate to ensure EEC sheepfarmers (especially French sheepfarmers) an adequate level of net income. According to economic theory it would be expected that these higher prices would reduce the demand for sheepmeat and, at the same time, induce sheep farmers to produce more sheepmeat. The combination of these two factors, a reduction in overall sheepmeat demand and an expansion of domestic EEC sheepmeat supply (especially in the United Kingdom), would lead to a reduction in demand for imported sheepmeat and so work to the considerable detriment of sheepmeat producers currently exporting to the EEC.

The United Kingdom is by far the largest market for sheepmeat in the EEC. Other countries where sheepmeat (especially lamb) is important are France and the Irish Republic. Within the French lamb industry, as currently structured, very high prices are paid to French farmers for lambs and as a consequence, consumer prices are also very high. This had made the French

market very attractive to other potential suppliers of lamb and the French have imposed significant quantitative restrictions against lamb imports from the United Kingdom and the Irish Republic. (Since 1978, however, the restrictions have operated in respect of imports only from the United Kingdom, as a bilateral agreement between the French and Irish Governments gave Irish exporters levy free access to the French market). Recently, these restrictions were declared illegal by the Court of the European Communities and France is now bound to remove such import restraints as they apply to other EEC members because under the Treaty of Rome, member states are not to inhibit the free flow of goods from one to another. Before this is done, however, an EEC Sheepmeat Regulation (within the CAP) will probably be brought into effect, sooner rather than later, as a result of the Court action. The result of this measure in terms of consumer prices is likely to be a reduction in French lamb prices and an increase in United Kingdom lamb prices. In terms of quantities, the demand for lamb is likely to increase in France, while it falls in the United Kingdom resulting in increased exports from the United Kingdom to France. Higher prices in the United Kingdom and access to the French market will result in increased United Kingdom production which will probably be greater than the net change in demand (greater in France and less in the United Kingdom). This would lead to a fall in imports from third countries as, overall, the EEC became more self sufficient in sheepmeat: the effect of increased total production and reduced demand.

2.3 Effect on New Zealand

It is important therefore that the possible effect on New Zealand of the EEC sheepmeat measures be evaluated. It would appear that the type of scenario described above is an inevitable

consequence of the present European line of activity and therefore New Zealand should be prepared for the consequences of such action. Even if it were to be assumed that no quantitative restrictions would be applied, and that only a tariff would be imposed on New Zealand lamb, to bring it from the current United Kingdom market level to a Common EEC level, the market forces, in terms of reduced demand in response to higher prices, will very significantly affect the requirement for imports of New Zealand lamb. The situation would be somewhat alleviated if other meat prices also moved in the same way. United Kingdom beef prices are likely to continue to rise significantly and this is expected to have a significant effect on sheepmeat demand also. Prices of chicken and pork are not expected to follow this movement, however, and therefore it could be expected that these two meats would significantly increase in relative importance.

2.4 Meat and Livestock Commission Study

Recent work by the United Kingdom Meat and Livestock Commission (MLC) (Bansback, 1977, 1978 and 1979) provides a useful starting point for an evaluation of the effect of the anticipated changes in the United Kingdom market. Bansback has estimated that by 1985 total United Kingdom meat consumption will have risen by 1.4 per cent from the 1978 level. Consumption of beef and veal is forecasted to fall by 2.9 per cent and sheepmeat consumption is expected to be down by 13.2 per cent (1985 versus 1978). The share of beef and veal in total meat consumption is forecasted to decline to 31 per cent in 1985 (33 per cent in 1978). Similarly for sheepmeat, the share is forecasted at 8 per cent in 1985 (10 per cent in 1978). Pork share is expected to increase to 35 per cent in 1985 (34 per cent in 1978) and chicken share is forecasted at 19 per cent in 1985 (17 per cent in 1978).

To place these forecasts into perspective, it is necessary to consider the assumptions made. Over the period 1978 to 1985, real disposable incomes per head were assumed to rise on average by 12.0 per cent versus 1978. This movement was translated into meat consumption using the United Kingdom National Food Survey (NFS) income elasticities (as below). The effect of price changes is the most important in these forecasts. The real consumer price of beef in 1985 was forecast at 5 per cent higher than in 1978. For sheepmeat, the price in 1985 was forecast at 14 per cent higher than in 1978, pork 1 per cent lower and chicken 3 per cent lower than in 1978. The price elasticities used were as follows:

	Own Price Elasticities	Income Elasticities
Beef and Veal	-1.46	0.25
Mutton and Lamb	-1.26	0.20
Pork	-1.64	0.30
Chicken	-0.88	0.15

(Source: R. J. Bansback, 1979)

These elasticities were based on National Food Survey estimates for the period 1970-1977. For beef and veal, mutton and lamb, and pork, the elasticities used were approximately 20 per cent below the NFS results.[1] (Further National Food Survey results are given in Appendix 1).

The effect of other factors was also considered (e.g. freezer ownership, increased supermarket selling, competition from other protein sources, technology, etc.). Overall, the impact was considered to be neutral for beef and veal consumption, adverse for lamb consumption and favourable for pork and chicken consumption.

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[1] Note: this reduction in the price elasticities has been made to allow for the manufacturing use of meat, an area where price elasticities are considered to be lower.

Forecasts of domestic production were also made. Combining these forecasts with those for consumption allows the calculation of estimated net trade figures and an assessment of the likely impact on New Zealand.

From 1978 to 1985, the results of the MLC study indicate a fall in imports of sheepmeat by 34 per cent (Table 1) with an import requirement of 150,000 tonnes. This conclusion indicates a most unsatisfactory result from the point of view of New Zealand. The forecasts must be considered in the light of the assumptions used, especially those for price and price elasticity. As indicated later in this report, there may be good reasons for viewing the price elasticity figures used by the MLC as being rather understated.

TABLE 1

United Kingdom Production and Consumption of Meat

(000 tonnes)

	Actual 1978	Projected 1985
Beef and Veal		
Production	1 029	1 110
Consumption	1 370	1 330
Imports	426	380
Exports	85	160
Self Sufficiency %	75	83
Sheepmeat		
Production	227	290
Consumption	403	350
Imports	226	150
Exports	50	90
Self Sufficiency %	56	83
Pigmeat		
Production	876	935
Consumption	1 423	1 500
Imports	565	605
Exports	18	40
Self Sufficiency %	62	62
Chicken		
Production	723	800
Consumption	722	810
Imports	20	30
Exports	21	20
Self Sufficiency %	100	99

Source: Bansback, R.J. (1979)
"United Kingdom Meat Consumption Forecasts to 1985"
from: "Meat Demand Trends"
October 1979
Meat and Livestock Commission.

3. DEMAND ANALYSIS

3.1 Description of Model

The main objective of the study was to rerun the model developed by Philpott and Matheson, using the most recent data available and to ascertain whether any changes have taken place in the identified meat market relationships since the previous study. The work was not intended as a re-evaluation of the model but rather as an attempt to identify any significant movement in the coefficients. However, some small alterations to the previous model format, have been made in that bacon has been excluded from the non carcase meat category.

The model used is structured in the normal demand analysis format using time series data. The hypothesis is that the consumption of a particular meat (C_M) is dependent upon the price of that meat (P_M), the price of competing meats (P_{SUBS}), income per head ($Y_{per\ hd}$) and season (S). The model can therefore be restated in the following format.

$$C_M = f(P_M, P_{SUBS}, Y_{per\ hd}, S)$$

The meats considered in this study are sheepmeat, beef, pork, chicken, non carcase meat[2] and fish. The main data source was the United Kingdom National Food Survey over the period 1970 to 1977.

3.2 Data and Method

A full presentation of the data used is given in Appendix 2. In summary, the consumption and expenditure data (on a per head per week basis) for the different meats were used to calculate

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[2] Non Carcase Meat includes liver, offals, canned meat, sausages, pies, frozen convenience meats, etc.

average implied prices for each calendar quarter. It was considered that the use of implied prices was more appropriate than observed prices as in this way, the impact of any home-production (especially of chicken) could be included. In addition, the implied prices would represent average prices for the period whereas the observed prices given in the National Food Survey are point in time data.

Income data were obtained as supplementary information from the National Food Survey on a per household basis and these were incorporated into the study.

All price and income data were deflated (where applicable) using the retail price index from the Great Britain Monthly Digest of Statistics.

The period over which data were analysed was from 1970 to 1977. In addition to analysis for the full period, shorter periods were also investigated in order to expose any significant movements in the relationships. In addition to a split of the data, (1970 to 1973 and 1974 to 1977) the analysis allowed the evaluation of the impact of specific years upon the results. Trends in the relationships were also revealed via this time period approach.

3.3 Results

The results are presented in accordance with a three stage procedure. The first stage covered the re-estimation of the Philpott and Matheson model coefficients for the period 1970-77. Some changes were then made to the model to bring it more into line with current thinking (second stage) and, finally, the analysis was completed for shorter periods as described above (third stage).

3.3.1 Comparison with Philpott and Matheson

The following tables give comparisons of the results for the two periods, using the same variables for each period.

TABLE 2

Comparison of Philpott & Matheson Results with Current Study - Lamb & Mutton

Variables[e]	Coefficients			
	Aggregated Prices		Disaggregated Prices	
	Philpott & Matheson (1955-1962)	Current (1970-1977)	Philpott & Matheson (1955-1962)	Current (1970-1977)
$P_{L\&M}$	-1.37[a] (0.21)[f]	-1.75[a] (0.30)	-1.43[a] (0.18)	-1.83[a] (0.29)
$P_{NL\&M}$	1.29[a] (0.25)	1.06[b] (0.60)		
P_B			0.28 (0.22)	1.04[a] (0.27)
P_{py}			0.24[b] (0.09)	-0.06 (0.28)
P_p			-0.54[b] (0.20)	-0.03 (0.26)
P_{NCM}			1.44[a] (0.30)	0.11 (0.42)
Y	-0.03 (0.14)	0.94[c] (0.56)	0.77[a] (0.20)	0.54 (0.50)
Q_1	-0.01 (0.02)	0.00 (0.02)	0.00 (0.02)	-0.01 (0.02)
Q_2	0.09[a] (0.02)	0.00 (0.02)	0.06[a] (0.02)	-0.02 (0.02)
Q_3	0.12[a] (0.02)	0.04[b] (0.02)	0.10[a] (0.02)	0.03[c] (0.02)
K	1.53	-0.50	4.09	-0.60
Statistical Parameters				
R^2	0.82	0.72	0.91	0.82
RB^2	N.A.	0.66	N.A.	0.75
d	N.A.	1.10[g]	N.A.	1.90[g]

Footnotes

a		Significant at the 1% level
b		Significant at the 5% level
c		Significant at the 10% level
d		Durbin-Watson Statistic
e		Variables
		All prices are implied, i.e. calculated by dividing expenditure on the product by the quantity consumed.
	$P_{L\&M}$	log price of lamb and mutton
	$P_{NL\&M}$	log weighted average price of meat other than lamb and mutton
	P_{B}	log price of beef and veal
	P_{py}	log price of poultry
	P_{p}	log price of pork
	P_{NCM}	log price of non carcase meat
	Y	log of income
	Q_1	Quarter 1 (January to March)
	Q_2	Quarter 2 (April to June)
	Q_3	Quarter 3 (July to September)
	K	Constant
	R^2	Per cent of variance explained
	RB^2	R^2 corrected for number of variables
f		( ) indicate the standard errors
g		d value is inconclusive at 5 per cent level.

Lamb and Mutton Commentary (See Table 2, p. 13)

Based on this comparison it would appear that the price elasticity of demand for lamb and mutton has risen from around -1.4 to -1.8 and that the significance of meat substitutes has declined overall with beef becoming the most significant single competitor for lamb and mutton. The continuation of a significant seasonal effect for the third quarter is also evident. The fact that the proportion of variance explained by the current equations (as evidenced by the R^2 values) is less than that achieved by Philpott and Matheson would tend to indicate that other factors, affecting the consumption of lamb and mutton, that are not included in the equations, have become more significant over time.

Beef and Veal Commentary (See Table 3, p. 16)

The price elasticity of demand for beef appears to have been lower over the 1970-77 period than in the 1955-62 period. The consistent results from the two equation forms tend to reinforce this conclusion. This decline in price sensitivity could be explained as a result of a fall in the importance of beef as a proportion of per capita meat consumption from 26 per cent in 1955-62 to 20 per cent in 1970-77 (and a fall in absolute per capita beef consumption from 9.36 oz/head/week in 1955-62 to 7.57 oz/head/week in 1970-77). (See Appendix 2, Table 4). Real beef prices have risen, however, and, under ceteris paribus conditions, this would have been expected to result in a higher price elasticity of demand. This has apparently been offset by the move to poultry consumption where a consumption increase of 300 per cent has occurred (a real price decrease of only 36 per cent was recorded). The effect of taste change can therefore be seen in a lower price elasticity of demand for beef and the significance of the poultry price coefficient in the disaggregated substitute prices equation.

TABLE 3

Comparison of Philpott & Matheson Results with Current Study - Beef & Veal

Variables	Coefficients			
	Aggregated Prices		Disaggregated Prices	
	Philpott & Matheson (1955-1962)	Current (1970-1977)	Philpott & Matheson (1955-1962)	Current (1970-1977)
P_B	-2.02[a]	-1.66[a]	-1.96[a]	-1.65[a]
	(0.16)	(0.15)	(0.19)	(0.16)
P_{NB}	0.47[b]	0.81[a]		
	(0.18)	(0.20)		
$P_{L\&M}$			0.38[b]	0.24[c]
			(0.16)	(0.18)
P_{py}			0.04	0.32[b]
			(0.07)	(0.17)
P_p			0.30[c]	-0.17
			(0.17)	(0.16)
P_{NCM}			-0.14	0.30
			(0.26)	(0.26)
Y	0.43[a]	0.57[b]	0.33[c]	0.85[b]
	(0.13)	(0.30)	(0.18)	(0.31)
Q_1	0.01	0.01	0.00	0.02[c]
	(0.02)	(0.01)	(0.01)	(0.01)
Q_2	-0.10[a]	-0.04[a]	-0.09[a]	-0.04[a]
	(0.01)	(0.01)	(0.01)	(0.01)
Q_3	-0.10[a]	-0.04[a]	-0.09[a]	-0.04[a]
	(0.02)	(0.01)	(0.02)	(0.01)
K	2.50	0.51	2.30	0.20
Statistical Parameters				
R^2	0.93	0.89	0.95	0.92
RB^2	N.A.	0.87	N.A.	0.88
d	N.A.	1.92[e]	N.A.	2.24[f]

a - significant at the 1% level
b - significant at the 5% level
c - significant at the 10% level
d - Durbin-Watson statistic
e - d value signifies rejection of autocorrelation hypothesis at 5% level
f - d value is inconclusive at 5% level
( ) - standard errors
N.A. - Not Available
P_{NB} - log weighted average price of meat other than beef and veal.

Poultry Commentary (See Table 4, p. 19)

No satisfactory statistical relationship for poultry could be identified for the 1970-77 period. This in itself may be a significant feature as with the virtual elimination of the usual factors (competing meat prices, income, seasonality) from the relationship, the "other" factors assume much greater importance. There has been a very significant increase in the per head consumption of poultry meat from the 1950-62 period (approximately 300 per cent) accompanied by a fall in the real (deflated) price of 36 per cent. This relationship, on its own, would imply a price elasticity of demand of approximately eight. However, the 1970-1977 models do not expose any such direct relationship and therefore it can be assumed that the effect of consumer preference (taste) is having a significant impact in this area. As a result of the evaluation, it can therefore be reasonably assumed that taste is the over-riding influence on chicken consumption and this outweighs any competitive effect from other meats.

Pork Commentary (See Table 5, p. 20)

A small rise in the price elasticity of demand for pork has been revealed by the current calculations. In addition, there has been a rise in the significance of the income variable which would also appear to be of some importance. The emergence of lamb and mutton as a significant competitor in place of poultry and non carcase meat could also be considered important. The non-existence of the previously highly significant, high value, cross price elasticity between pork and non carcase meat would tend to suggest that pork has now become established as a primary meat product rather than as an inferior competitor with non carcase meat.

The change in the sign of the relationship for the weighted average non-pork price (in the aggregated prices model) would tend to confirm this. The 45 per cent increase in consumption per head (Appendix 2, Table 4) would tend to confirm an increase in the desirability of pork and therefore its emergence as a more important meat product. Consumption levels are now much closer to those of lamb and mutton and this could be another reason for the emergence of lamb and mutton as a significant competitor. It should be noted that pork and poultry meat are the only major meat types to have increased their proportion of the total meat consumption per head.

3.3.2 Revision to Philpott and Matheson Model

In order to test the hypothesis that other factors may be significantly influencing the demand for the major meats (apart from those already included in the model), the model was tested for its response to changes in some variables. Two variable changes were proposed, viz. the deletion of bacon from the non carcase meat category and the addition of fish as a substitute meat.

The deletion of bacon was considered to be a useful revision as bacon is not normally eaten as a direct substitute for the main meat products nor is it considered a complementary product. In addition, the effect of bacon in the non carcase meat category was considerable, as bacon consumption is relatively high versus other non carcase meat products, and therefore deletion of bacon was considered an important change.

The addition of fish to the model was also considered constructive as fish is now a large part of the diet in the United Kingdom (see Appendix 2) and could therefore be considered as a substitute for meat products.

TABLE 4

Comparison of Philpott & Matheson Results with Current Study - Poultry

Variables	Coefficients			
	Aggregated Prices		Disaggregated Prices	
	Philpott & Matheson (1955-1962)	Current (1970-1977)	Philpott & Matheson (1955-1962)	Current (1970-1977)
P_{py}	-2.53[a]	-0.47	-1.80[a]	-0.66[c]
	(0.35)	(0.43)	(0.41)	(0.43)
P_{NPY}	0.38	0.78[c]		
	(1.21)	(0.47)		
P_B			2.26[b]	-0.28
			(1.06)	(0.41)
$P_{L\&M}$			-1.01	1.02[b]
			(0.87)	(0.44)
P_p			3.91[a]	0.29
			(0.96)	(0.40)
P_{NCM}			-5.42[a]	-0.63
			(1.45)	(0.65)
Y	3.57[a]	-0.78	0.87	-0.30
	(0.95)	(0.69)	(0.97)	(0.76)
Q_1	0.15	-0.04[c]	-0.01	-0.03
	(0.09)	(0.03)	(0.08)	(0.03)
Q_2	0.10	0.01	0.24[a]	0.02
	(0.09)	(0.03)	(0.08)	(0.03)
Q_3	0.09	0.01	0.33[a]	0.01
	(0.09)	(0.02)	(0.10)	(0.03)
K	9.85	1.63	0.73	1.10
Statistical Parameters				
R^2	0.93	0.20	0.96	0.33
RB^2	N.A.	0.00	N.A.	0.05
d	N.A.	1.07[e]	N.A.	1.43[e]

a - significant at the 1% level
b - significant at the 5% level
c - significant at the 10% level
d - Durbin-Watson statistic
e - value is inconclusive at 5% level
( ) - standard errors
N.A. - Not Available
P_{NPY} - log weighted average price of meat other than poultry.

TABLE 5

Comparison of Philpott & Matheson Results with Current Study - Pork

Variables	Coefficients			
	Aggregated Prices		Disaggregated Prices	
	Philpott & Matheson (1955-1962)	Current (1970-1977)	Philpott & Matheson (1955-1962)	Current (1970-1977)
P_p	-1.63[a] (0.55)	-1.74[a] (0.23)	-1.25[b] (0.48)	-1.72[a] (0.20)
P_{NP}	-1.24 (0.86)	1.05[a] (0.29)		
P_B			1.63[a] (0.53)	0.57[a] (0.20)
$P_{L\&M}$			-0.27 (0.43)	0.46[b] (0.22)
P_{py}			0.42[b] (0.20)	-0.13 (0.22)
P_{NCM}			-2.65[a] (0.72)	-0.10 (0.32)
Y	0.51 (0.46)	1.11[a] (0.42)	0.15 (0.48)	0.94[b] (0.38)
Q_1	0.09[b] (0.04)	0.02 (0.01)	0.04 (0.04)	0.01 (0.01)
Q_2	-0.12[b] (0.05)	-0.04[a] (0.01)	-0.12[a] (0.04)	-0.05[a] (0.01)
Q_3	-0.21[a] (0.05)	-0.05[a] (0.02)	-0.18[a] (0.05)	-0.05[a] (0.01)
K	0.09	-0.83	-0.69	-0.64
Statistical Parameters				
R^2	0.83	0.72	0.89	0.84
RB^2	N.A.	0.66	N.A.	0.77
d	N.A.	1.83[e]	N.A.	2.46[f]

a - significant at the 1% level b - significant at the 5% level
d - Durbin-Watson statistic
e - d value signifies rejection of autocorrelation hypothesis at 5% level
f - d value is inconclusive at 5% level
( ) - standard errors
N.A. - Not Available

(i) Exclusion of Bacon from Non Carcase Meat

A comparison of the results from excluding bacon with the updated Philpott and Matheson based model is given in Tables 6 through 9.

Lamb and Mutton Commentary (See Table 6, p. 22)

The deletion of bacon from the non carcase meat category has result in an increase in the coefficients for $P_{L\&M}$ as well as the coefficient for the aggregated price of substitutes ($P_{NL\&M}$). In addition, the proportion of variance explained by the model (excluding bacon) has improved. It is therefore considered that this revision has been useful and the model has therefore been improved.

Beef and Veal Commentary (See Table 7, p. 23)

The deletion of bacon from the non carcase meat category has resulted in a rise in the coefficients for the P_B and P_{NB} variables. This is a similar result to that for lamb and mutton. In addition, the degree of explanation of variance achieved with bacon deleted has marginally improved for the aggregated prices model and has not been reduced for the disaggregated prices model. Also, the Durbin-Watson statistic has moved closer to the ideal value of 2.00 in both cases. In the absence of any evidence indicating a less satisfactory result, the deletion of bacon from the model can be considered an improvement.

TABLE 6

Comparison of Lamb and Mutton Models with and without Bacon

(1970-1977)

Variables	Coefficients			
	Aggregated Prices		Disaggregated Prices	
	Updated Philpott & Matheson Model	Bacon Deleted	Updated Philpott & Matheson Model	Bacon Deleted
$P_{L\&M}$	-1.75[a]	-1.92[a] (0.25)	-1.83[a]	-1.92[a] (0.25)
$P_{NL\&M}$	1.06[b]	1.76[a] (0.58)		
P_B			1.04[a]	0.99[a] (0.26)
P_{py}			-0.06	-0.11 (0.28)
P_p			-0.03	-0.04 (0.23)
P_{NCM}			0.11	0.54 (0.50)
Y	0.94[c]	0.42 (0.54)	0.54	0.33 (0.52)
Q_1	0.00	-0.01 (0.02)	-0.01	-0.02 (0.02)
Q_2	0.00	-0.00 (0.02)	-0.02	-0.02 (0.02)
Q_3	0.04[b]	0.04[b] (0.02)	0.03[c]	0.02 (0.02)
K	-0.50	0.13	-0.60	0.21
Statistical Parameters				
R^2	0.72	0.77	0.82	0.83
RB^2	0.66	0.72	0.75	0.76
d	1.10	1.26[e]	1.90	2.00[f]

a - significant at the 1% level
b - significant at the 5% level
c - significant at the 10% level
d - Durbin-Watson statistic
e - d value is inconclusive at 5% level
f - d value signifies rejection of autocorrelation hypothesis at 5% level
( ) - standard errors

TABLE 7

Comparison of Beef and Veal Models with and without Bacon

(1970-1977)

Variables	Coefficients			
	Aggregated Prices		Disaggregated Prices	
	Updated Philpott & Matheson Model	Bacon Deleted	Updated Philpott & Matheson Model	Bacon Deleted
P_B	-1.66[a]	-1.77[a] (0.16)	-1.65[a]	-1.71[a] (0.16)
P_{NB}	0.81[a]	1.07[a] (0.24)		
$P_{L\&M}$			0.24[c]	0.26[c] (0.16)
P_{py}			0.32[b]	0.30[c] (0.17)
P_p			-0.17	-0.12 (0.15)
P_{NCM}			0.30	0.40 (0.31)
Y	0.57[b]	0.50[c] (0.29)	0.85[b]	0.77[b] (0.32)
Q_1	0.01	0.01 (0.01)	0.02[c]	0.02[c] (0.01)
Q_2	-0.04[a]	-0.04[a] (0.01)	-0.04[a]	-0.04[a] (0.01)
Q_3	-0.04[a]	-0.04[a] (0.01)	-0.04[a]	-0.04[a] (0.01)
K	0.51	0.65	0.20	0.32
Statistical Parameters				
R^2	0.89	0.90	0.92	0.92
RB^2	0.87	0.88	0.88	0.88
d	1.92	1.97[e]	2.24	2.19[f]

a - significant at the 1% level
b - significant at the 5% level
c - significant at the 10% level
d - Durbin-Watson statistic
e - d value signifies rejection of autocorrelation hypothesis at 5% level
f - d value is inconclusive at 5% level
( ) - standard errors

Poultry Commentary (See Table 8, p.25)

The deletion of bacon from the non carcase meat category, resulted in no useful improvement in the model. As the model is unsatisfactory in any case, no conclusions regarding the exclusion or inclusion of bacon can be drawn.

Pork Commentary (See Table 9, p. 26)

The deletion of bacon from the pork models had a negligible effect on the equations. This could be expected, however, as the non carcase meat category does not contribute greatly to the explanation of changes in pork consumption. Although the deletion of bacon did not contribute to the explanation, it also did not detract from it, and, therefore, the hypothesis regarding the exclusion of bacon as a non-competing product, can be considered not disproven.

Summary

Overall, the deletion of bacon from the non carcase meat category, can be regarded as a useful refinement of the model. In no case was the explanation worsened, and, for lamb and mutton, beef and veal, the situation was improved. This alteration to the model has therefore been incorporated in further analysis.

TABLE 8

Comparison of Poultry Models with and without Bacon

(1970-1977)

Variables	Coefficients			
	Aggregated Prices		Disaggregated Prices	
	Updated Philpott & Matheson Model	Bacon Deleted	Updated Philpott & Matheson Model	Bacon Deleted
P_{py}	-0.47	-0.41 (0.43)	-0.66[c]	-0.55[c] (0.41)
P_{NPY}	0.78[c]	0.75[c] (0.53)		
P_B			-0.28	-0.11 (0.38)
$P_{L\&M}$			1.02[b]	1.14[a] (0.37)
P_p			0.29	0.23 (0.34)
P_{NCM}			-0.63	-1.50[b] (0.73)
Y	-0.78	-0.78 (0.74)	-0.30	0.17 (0.76)
Q_1	-0.04[c]	-0.04[c] (0.03)	-0.03	-0.02 (0.02)
Q_2	0.01	0.01 (0.03)	0.02	0.03 (0.03)
Q_3	0.01	0.01 (0.03)	0.01	0.03 (0.03)
K	1.63	1.64	1.10	0.46
Statistical Parameters				
R^2	0.20	0.17	0.33	0.41
RB^2	0.00	0.00	0.05	0.17
d	1.07	1.01[e]	1.43	1.80[f]

a - significant at the 1% level
b - significant at the 5% level
c - significant at the 10% level
d - Durbin-Watson statistic
e - d value indicates presence of autocorrelation at 5% level
f - d value is inconclusive at 5% level
( ) - standard errors

TABLE 9

Comparison of Pork Models with and without Bacon

(1970-1977)

Variables	Coefficients			
	Aggregated Prices		Disaggregated Prices	
	Updated Philpott & Matheson Model	Bacon Deleted	Updated Philpott & Matheson Model	Bacon Deleted
P_p	-1.74[a]	-1.68[a] (0.21)	-1.72[a]	-1.74[a] (0.18)
P_{NP}	1.05[a]	1.17[a] (0.29)		
P_B			0.57[a]	0.59[a] (0.20)
$P_{L\&M}$			0.46[b]	0.44[b] (0.20)
P_{py}			-0.13	-0.13 (0.22)
P_{NCM}			-0.10	-0.09 (0.39)
Y	1.11[a]	0.92[b] (0.43)	0.94[b]	0.95[b] (0.41)
Q_1	0.02	0.01 (0.01)	0.01	0.01 (0.01)
Q_2	-0.04[a]	-0.04[a] (0.01)	-0.05[a]	-0.05[a] (0.01)
Q_3	-0.05[a]	-0.05[a] (0.01)	-0.05[a]	-0.05[a] (0.01)
K	-0.83	-0.59	-0.64	-0.65
Statistical Parameters				
R^2	0.72	0.74	0.84	0.84
RB^2	0.66	0.68	0.77	0.77
d	1.83	1.84[e]	2.46	2.46[f]

a - significant at the 1% level
b - significant at the 5% level
c - significant at the 10% level
d - Durbin-Watson statistic
e - d value signifies rejection of autocorrelation hypothesis at 5% level
f - d value is inconclusive at 5% level
( ) - standard errors

(ii) Fish

A comparison of the with and without Fish models is presented in Tables 10 through 13. (Note: Bacon has been excluded from the non carcase meat category for both models).

Lamb and Mutton Commentary (See Table 10, p. 28)

The results of this analysis were interesting but inconclusive. Changes in the proportion of variance explained were marginal with the aggregated prices model recording a decline from the non-fish model and the disaggregated prices model recording an increase. With the aggregated prices model, movements in the coefficients were also very small, but for the disaggregated prices model, a sharp decline in the coefficient for $P_{L\&M}$ and a lesser decline in the P_B coefficient were recorded. In addition, the P_F coefficient entered the equation at a significant level and negatively. This would indicate that fish is a highly preferred product over lamb and mutton in that fish would continue to be consumed in spite of a rise in fish prices and at the expense of lamb and mutton consumption.[3]

The evidence in favour of including the fish price as an independent variable did not appear to be strong, as little effect was observed in the explanation of variance change, and therefore it was decided to exclude fish as an independent variable in the models used in the third stage of the project.

Beef and Veal Commentary (See Table 11, p.29)

The addition of fish to the models resulted in no conclusive change to either model . The coefficient for the fish price was zero (in the disaggregated prices model) indicating no impact on beef consumption. It could therefore be concluded that fish is not a competitor with beef. The model explaining fish consumption did not include the beef price as a significant variable either (See Table 14, p. 33). It was therefore decided to exclude fish from the beef and veal model used in further analysis.

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[3] The model where fish consumption is the dependent variable does not include $P_{L\&M}$ as a significant variable. (Refer Table 14, p. 33).

TABLE 10

Comparison of Lamb and Mutton Models with and without Fish
(1970-1977)

Variables	Coefficients			
	Aggregated Prices		Disaggregated Prices	
	Without Fish	With Fish	Without Fish	With Fish
$P_{L\&M}$	-1.92[a]	-1.95[a] (0.30)	-1.92[a]	-1.47[a] (0.35)
$P_{NL\&M}$	1.76[a]	1.67[b] (0.67)		
P_B			0.99[a]	0.79[a] (0.27)
P_{py}			-0.11	-0.14 (0.27)
P_p			-0.04	-0.15 (0.23)
P_F			-	-0.68[b] (0.38)
P_{NCM}			0.54	0.91[b] (0.52)
Y	0.42	0.62 (0.56)	0.33	0.40 (0.49)
Q_1	-0.01	-0.00 (0.02)	-0.02	-0.02 (0.02)
Q_2	-0.00	-0.00 (0.02)	-0.02	-0.03 (0.02)
Q_3	0.04[b]	0.04[b] (0.02)	0.02	0.01 (0.02)
K	0.13	-0.13	0.21	0.25
Statistical Parameters				
R^2	0.77	0.75	0.83	0.85
RB^2	0.72	0.69	0.76	0.78
d	1.26	1.22[e]	2.00	1.99[f]

a - significant at the 1% level
b - significant at the 5% level
c - significant at the 10% level
d - Durbin-Watson statistic
e - d value is inconclusive at 5% level
f - d value signifies rejection of autocorrelation hypothesis at 5% level
( ) - standard errors
P_F - log price of fish

TABLE 11

Comparison of Beef and Veal Models with and without Fish

(1970-1977)

Variables	Coefficients			
	Aggregated Prices		Disaggregated Prices	
	Without Fish	With Fish	Without Fish	With Fish
P_B	-1.77[a]	-1.74[a] (0.15)	-1.71[a]	-1.71[a] (0.18)
P_{NB}	1.07[a]	1.02[a] (0.23)		
$P_{L\&M}$			0.26[c]	0.27 (0.24)
P_{py}			0.30[c]	0.29[c] (0.18)
P_p			-0.12	-0.12 (0.16)
P_F			-	-0.00 (0.25)
P_{NCM}			0.40	0.40 (0.35)
Y	0.50[c]	0.53[b] (0.28)	0.77[b]	0.77[b] (0.33)
Q_1	0.01	0.01 (0.01)	0.02[c]	0.02[c] (0.01)
Q_2	-0.04[a]	-0.04[a] (0.01)	-0.04[a]	-0.04[a] (0.01)
Q_3	-0.04[a]	-0.04[a] (0.01)	-0.04[a]	-0.04[a] (0.01)
K	0.51	0.58	0.32	0.32
Statistical Parameters				
R^2	0.89	0.90	0.92	0.92
RB^2	0.87	0.88	0.88	0.88
d	1.92	1.99[e]	2.19	2.19[f]

a - significant at the 1% level
b - significant at the 5% level
c - significant at the 10% level
d - Durbin-Watson statistic
e - d value signifies rejection of autocorrelation hypothesis at 5% level
f - d value is inconclusive at 5% level
( ) - standard errors

Poultry Commentary (See Table 12, p. 31)

The addition of fish to the poultry models did not lead to any improvement in the explanatory power of the models. The fish price was not significant in the models and therefore it was decided that fish would be left out of the models used in further analysis.

Pork Commentary (See Table 13, p. 32)

The pork models were not affected by the addition of the implied fish price as an independent variable. As a result, it was concluded that the addition of fish to the models was not important and therefore fish was deleted as an explanatory variable in further analysis.

Fish Commentary (See Table 14, p. 33)

In order to provide a cross check on the importance (or otherwise) of fish in the meat consumption area, a model was proposed to explain fish consumption. This was formulated on the same basis as those for other meats. It was hypothesised that the prices of individual meats would have little impact on fish consumption but that the combined effect of other meats may be more significant. This hypothesis was formulated on the grounds that fish is a competitor with meat as a whole but not with individual meats. On the basis of the results of the analysis, (Table 14, p. 33) it has been concluded that this hypothesis has been confirmed. Individually, the prices of other meats did not have a significant effect on fish consumption but, collectively (as shown by the P_{NF} variable coefficient significance) other meat prices do have an impact on fish consumption.

TABLE 12

Comparison of Poultry Models with and without Fish

(1970-1977)

Variables	Coefficients			
	Aggregated Prices		Disaggregated Prices	
	Without Fish	With Fish	Without Fish	With Fish
P_{py}	-0.41	-0.46 (0.43)	-0.55[c]	-0.53 (0.41)
P_{NPY}	0.75[c]	0.81[c] (0.51)		
P_B			-0.11	0.07 (0.42)
$P_{L\&M}$			1.14[a]	0.73[c] (0.54)
P_p			0.23	0.32 (0.36)
P_F			-	0.59 (0.58)
P_{NCM}			-1.50[b]	-1.83[b] (0.79)
Y	-0.78	-0.79 (0.71)	0.17	0.11 (0.76)
Q_1	-0.04[c]	-0.04[c] (0.03)	-0.02	-0.02 (0.02)
Q_2	0.01	0.01 (0.03)	0.03	0.04[c] (0.03)
Q_3	0.01	0.01 (0.02)	0.03	0.04[c] (0.03)
K	1.64	1.64	0.46	0.43
Statistical Parameters				
R^2	0.17	0.19	0.41	0.44
RB^2	0.00	0.00	0.17	0.17
d	1.01	1.05[e]	1.80	1.96[f]

a - significant at the 1% level
b - significant at the 5% level
c - significant at the 10% level
d - Durbin-Watson statistic
e - d value is inconclusive at 5% level
f - d value signifies rejection of autocorrelation hypothesis at 5% level
( ) - standard errors

TABLE 13

Comparison of Pork Models with and without Fish

(1970-1977)

Variables	Coefficients			
	Aggregated Prices		Disaggregated Prices	
	Without Fish	With Fish	Without Fish	With Fish
P_p	-1.68[a]	-1.65[a] (0.21)	-1.74[a]	-1.71[a] (0.19)
P_{NP}	1.17[a]	1.13[a] (0.28)		
P_B			0.59[a]	0.64[a] (0.23)
$P_{L\&M}$			0.44[b]	0.33 (0.30)
P_{py}			-0.13	-0.13 (0.22)
P_F			-	0.16 (0.32)
P_{NCM}			-0.09	-0.18 (0.43)
Y	0.92[b]	0.97[b] (0.42)	0.95[b]	0.93[b] (0.41)
Q_1	0.01	0.01 (0.01)	0.01	0.01 (0.01)
Q_2	-0.04[a]	-0.04[a] (0.01)	-0.05[a]	-0.05[a] (0.01)
Q_3	-0.05[a]	-0.04[a] (0.01)	-0.05[a]	-0.05[a] (0.01)
K	-0.59	-0.66	-0.65	-0.66
Statistical Parameters				
R^2	0.74	0.74	0.84	0.84
RB^2	0.68	0.68	0.77	0.76
d	1.84	1.87[e]	2.46	2.43[f]

a - significant at the 1% level
b - significant at the 5% level
c - significant at the 10% level
d - Durbin-Watson statistic
e - d value signifies rejection of autocorrelation hypothesis at 5% level
f - d value is inconclusive at 5% level
( ) - standard errors

TABLE 14

Fish Demand Models

(1970-1977)

Variables	Coefficients	
	Aggregated Prices	Disaggregated Prices
P_F	-1.62[a]	-1.66[a]
	(0.17)	(0.27)
P_{NF}	0.75[a]	
	(0.29)	
P_B		0.21
		(0.19)
$P_{L\&M}$		0.04
		(0.25)
P_{py}		-0.14
		(0.19)
P_p		-0.10
		(0.16)
P_{NCM}		0.77[b]
		(0.37)
Y	0.42[c]	0.32
	(0.31)	(0.35)
Q_1	0.00	0.00
	(0.01)	(0.01)
Q_2	0.02[b]	0.01
	(0.01)	(0.01)
Q_3	0.00	-0.01
	(0.01)	(0.01)
K	0.30	0.44
Statistical Parameters		
R^2	0.84	0.86
RB^2	0.80	0.79
d	1.50[e]	2.05[f]

a - significant at the 1% level
b - significant at the 5% level
c - significant at the 10% level
d - Durbin-Watson statistic
e - d value is inconclusive at 5% level
f - d value signifies rejection of autocorrelation hypothesis at 5% level
( ) - standard errors
P_{NF} - log weighted average price of meat other than fish.

3.3.3 Varying Time Series

In order to assess the impact of the most recent years on the equation coefficients, the data used in the analysis were divided into consecutive overlapping periods. It was considered that, with the advent of higher observed prices, rapid price changes, fluctuating real incomes and rapidly rising money incomes, the relationships between the dependent and independent variables (as given by the equation coefficients) may have changed. This was thought to be especially likely to be shown up by analysis using the post 1973 data. The results of the analysis (Tables 15 through 19) can be viewed either in terms of a steadily changing period over which the analysis took place or as two discrete blocks of data. The presentation herecoversboth types of viewpoint. Comparison of columns 1 and 9 give the discrete data blocks analysis while the continuum from column 1 through 9 reveals the steadily changing situation.

In view of the short time periods involved, it is suggested that the relationships presented in the tables are only useful for the purpose of comparing the coefficients resulting from the use of different time periods and thereby identifying any emerging trends, rather than as models in themselves (with the exception of the 1970-77 equation where the time period is sufficient for useful conclusions to be drawn).

Lamb and Mutton Commentary (See Table 15, p. 36)

The influence of the years from 1973 on can be identified in an increase in the $P_{L\&M}$ coefficient as more years are added (columns 1 to 5). With the addition of the 1977 year there also appears to have been a definite change in the $P_{NL\&M}$ and P_{B}

coefficients which continues for all time periods where 1977 is included. It can therefore be considered that the hypothesis of changing coefficients over the most recent period is valid and in fact a distinct trend of rising coefficients is exhibited.

Beef and Veal Commentary (See Table 16, p.37)

For the aggregated substitute prices, there is no clear trend of own price elasticity over the period of the analysis. However, for the disaggregated substitute prices equations, a clear movement of own price elasticity has been shown. As the more recent years were added to the analysis, a significant rise in the elasticity was recorded. This is most noticeable when columns 9 and 1 are compared for the disaggregated substitute prices equations. The result is consistent with that recorded for lamb and mutton and tends to confirm the hypothesis of steadily rising price sensitivity with higher inflation rates and, consequently, higher money prices.

Also of significance is the reduction in the size and significance of the poultry meat price variable over the period and the increase in the income elasticity of demand.

The importance of the seasonality feature of the beef market has remained consistent over the period.

TABLE 15

Varying Time Series - Lamb and Mutton

Variables	Coefficients 1 1970/73	2 1970/74	3 1970/75	4 1970/76	5 1970/77	6 1971/77	7 1972/77	8 1973/77	9 1974/77
1. Aggregated Prices									
$P_{L\&M}$	-0.97[a]	-1.15[a]	-1.48[a]	-1.54[a]	-1.92[a]	-2.09[a]	-2.11[a]	-1.95[a]	-2.00[a]
$P_{NL\&M}$	0.30	-0.42	0.26	0.45	1.76[a]	2.00[a]	2.12[b]	2.26[b]	2.22[a]
Y	0.18	1.49[b]	1.69[b]	1.55[b]	0.42	0.36	0.28	-0.04	-0.64
Q_1	-0.01	-0.02	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01	-0.02
Q_2	-0.01	-0.03	-0.01	-0.01	-0.00	0.00	-0.00	0.01	0.00
Q_3	0.02	0.02	0.03	0.03[c]	0.04[b]	0.04[b]	0.04[b]	0.05[b]	0.05[b]
K	0.59	-1.04	-1.41	-1.24	0.13	0.20	0.30	0.65	1.49
R^2	0.80	0.88	0.75	0.78	0.77	0.73	0.62	0.70	0.83
RB^2	0.67	0.82	0.67	0.71	0.72	0.66	0.48	0.55	0.72
d	1.85	1.81	1.13	1.47	1.26	1.11	1.06	1.67	2.12
2. Disaggregated Prices									
$P_{L\&M}$	-0.83[c]	-1.17[a]	-1.46[a]	-1.50[a]	-1.92[a]	-1.99[a]	-1.62[a]	-1.98[a]	-1.97[b]
P_B	0.59	0.41	0.67[c]	0.59[c]	0.99[a]	1.00[a]	0.88[a]	0.87[b]	0.33
P_{py}	0.12	-0.17	-0.09	-0.10	-0.11	-0.12	-0.47	0.26	0.33
P_p	0.14	0.04	-0.16	-0.22	-0.04	-0.03	0.12	0.13	0.04
P_{NCM}	-1.43	-0.56	-0.29	-0.14	0.54	0.64	0.70	0.87[c]	1.46[c]
Y	0.30	0.88	1.27	1.47[b]	0.33	0.30	0.10	-0.14	-0.56
Q_1	-0.02	-0.03[c]	-0.02	-0.01	-0.02	-0.02	-0.02	-0.01	-0.01
Q_2	-0.01	-0.03	-0.02	-0.02	-0.02	-0.02	-0.03[c]	-0.02	-0.02
Q_3	0.02	0.01	0.02	0.02[c]	0.02	0.02	0.02	0.03[c]	0.03
K	0.43	-0.33	-0.91	-1.16	0.21	0.25	0.46	0.80	1.48
R^2	0.85	0.90	0.82	0.82	0.83	0.80	0.77	0.77	0.83
RB^2	0.64	0.82	0.70	0.74	0.76	0.70	0.63	0.56	0.56
d	2.20	1.94	1.40	1.88	2.00	1.88	2.35	2.52	2.70

a - significant at the 1% level
b - significant at the 5% level
c - significant at the 10% level

TABLE 16

Varying Time Series - Beef and Veal

Variables	Coefficients 1 1970/73	2 1970/74	3 1970/75	4 1970/76	5 1970/77	6 1971/77	7 1972/77	8 1973/77	9 1974/77
1. Aggregated Prices									
P_B	-1.63[a]	-1.41[a]	-1.48[a]	-1.61[a]	-1.77[a]	-1.80[a]	-1.83[a]	-1.74[a]	-1.62[a]
P_{NB}	1.23[b]	1.15[a]	1.14[a]	1.08[a]	1.07[a]	1.02[a]	1.20[a]	0.95[a]	0.62
Y	-0.02	-0.46	-0.30	0.15	0.50[c]	0.56[b]	0.46[c]	0.57[c]	0.93[c]
Q_1	0.01	0.01	0.01	0.02[b]	0.01	0.01	0.01	0.01	0.01
Q_2	-0.05[a]	-0.04[a]	-0.05[a]	-0.04[a]	-0.04[a]	-0.04[a]	-0.04[a]	-0.04[a]	-0.03[c]
Q_3	-0.05[a]	-0.04[a]	-0.04[a]	-0.03[a]	-0.04[a]	-0.04[a]	-0.04[a]	-0.04[a]	-0.03[b]
K	1.29	1.84	1.64	1.06	0.65	0.58	0.69	0.56	0.06
R^2	0.93	0.92	0.93	0.92	0.90	0.91	0.92	0.92	0.86
RB^2	0.88	0.88	0.90	0.90	0.88	0.88	0.89	0.88	0.77
d	1.07	1.41	1.64	1.53	1.97	2.05	2.30	2.53	2.85
2. Disaggregated Prices									
P_B	-1.14[b]	-1.23[a]	-1.37[a]	-1.52[a]	-1.71[a]	-1.70[a]	-1.90[a]	-1.89[a]	-1.91[a]
$P_{L\&M}$	0.24	0.05	0.16	0.10	0.26[c]	0.12	0.58[c]	0.79[b]	0.76[c]
P_{py}	0.67[b]	0.48[b]	0.47[a]	0.35[b]	0.30[c]	0.38[b]	0.04	-0.38	-0.44
P_p	-0.31	-0.27	-0.16	-0.10	-0.12	-0.10	-0.03	-0.03	-0.09
P_{NCM}	-0.40	0.52	0.42	0.59[c]	0.40	0.47[c]	0.49[c]	0.38	0.33
Y	0.40	0.06	-0.04	0.32	0.77[b]	0.74[b]	0.69[b]	0.77[b]	0.97[c]
Q_1	0.01	0.01	0.01	0.02[b]	0.02[c]	0.01	0.02	0.01	0.02
Q_2	-0.05[b]	-0.06[a]	-0.05[a]	-0.05[a]	-0.04[a]	-0.05[a]	-0.04[a]	-0.05[a]	-0.04[c]
Q_3	-0.05[b]	-0.05[a]	-0.04[a]	-0.04[a]	-0.04[a]	-0.04[a]	-0.05[a]	-0.05[a]	-0.04[c]
K	0.80	1.20	1.35	0.87	0.32	0.37	0.39	0.26	0.02
R^2	0.96	0.93	0.94	0.93	0.92	0.92	0.94	0.94	0.91
RB^2	0.90	0.87	0.91	0.89	0.88	0.88	0.90	0.89	0.78
d	2.69	2.46	2.38	1.86	2.19	2.30	2.56	2,90	3.14

a - significant at the 1% level
b - significant at the 5% level
c - significant at the 10% level

Pork Commentary (See Table 17, p. 40)

The important features of this analysis are the generally higher own price elasticities of demand recorded where the latest years are included and the significant effect of the beef price on pork consumption. Also of note, is the marked seasonal nature of pork consumption, as indicated by the significance of the second and third coefficients. Income is also an important influence on pork consumption. Overall, the current price elasticity of demand would be given at around -1.7. This is significantly higher than the -1.4 that would be identified for the early 1970's.

The results for pork are therefore also consistent with the hypothesis of rising price elasticities of demand during periods of higher money prices.

Non Carcase Meat Commentary (See Table 18, p. 41)

Although, overall, the degree of variance explained by the models was not high, some interesting points emerged. During the early 1970's, it is apparent that the price of competing meats was a significant factor influencing non carcase meat consumption. This leads to the conclusion that non carcase meat was a poor competitor with other meats and was probably mostly consumed as a "fill-in" product rather than a serious competitor in the meat product area. Over the later period, however, the non carcase meat price has become established as a significant variable, indicating that consumers now rank this form of meat alongside other more conventional primary meat products. The own price elasticity of demand is still relatively low, however, indicating that consumption of non carcase meat is still relatively insensitive to price changes.

Other points of interest are the negative sign for the pork price coefficient over the latter part of the period and the change from a negative to a positive sign for the lamb and mutton price coefficient indicating that non carcase meat has now become a product type equivalent in ranking to lamb and mutton (rather than an inferior product as identified in the early 1970's).

Fish Commentary (See Table 19, p. 42)

The changing relationships for fish consumption are not as clear as for other meats. While it is possible to say that fish now competes more effectively with other meats, in that the column 9 cross price elasticity is significantly positive, whereas in column 1 it is significantly negative (aggregated prices model), the own price elasticity has not shown the movement identified for other meats. It may be, therefore that fish consumption is not so much affected by higher money (and real) prices, in terms of price sensitivity as are the other meats.

Another important feature is the declining income elasticity of demand, indicating that fish is becoming less responsive to income changes.

Overall, it could be said that fish now competes more effectively with other meats but, in view of the declining income elasticity of demand, fish is becoming a less desirable product or has now saturated potential consumers.

3.4 Conclusions

The first major conclusion that can be drawn from the analysis is that the variables identified by Philpott and Matheson are still the most significant parameters affecting meat consumption. The degree of variance explanation generated by those variables has fallen, however, and it is therefore apparent that other factors are now affecting

TABLE 17

Varying Time Series - Pork

Variables	1 1970/73	2 1970/74	3 1970/75	4 1970/76	5 1970/77	6 1971/77	7 1972/77	8 1973/77	9 1974/77
	Coefficients								
1. Aggregated Prices									
P_p	-1.31[b]	-1.52[a]	-1.41[a]	-1.60[a]	-1.68[a]	-1.66[a]	-1.70[a]	-1.66[a]	-1.70[a]
P_{NP}	0.66	0.97[a]	0.96[a]	1.31[a]	1.17[a]	1.11[a]	1.00[a]	1.12[a]	1.42[a]
Y	1.58[c]	1.40[b]	0.98[c]	0.60	0.92[b]	0.94[b]	1.05[b]	0.83[c]	0.22
Q_1	0.04[b]	0.05[a]	0.02[c]	0.01	0.01	0.01	0.01	0.01	-0.02
Q_2	-0.02	-0.01	-0.02	-0.04[b]	-0.04[a]	-0.04[a]	-0.05[a]	-0.05[b]	-0.07[a]
Q_3	-0.05[b]	-0.03[b]	-0.04[a]	-0.05[a]	-0.05[a]	-0.05[a]	-0.04[b]	-0.04[b]	-0.05[b]
K	-1.51	-1.27	-0.71	-0.19	-0.59	-0.61	-0.72	-0.45	0.34
R^2	0.71	0.77	0.69	0.73	0.74	0.74	0.77	0.79	0.87
RB^2	0.51	0.66	0.58	0.65	0.68	0.67	0.69	0.69	0.79
d	1.65	1.79	1.53	1.76	1.84	1.87	2.05	1.72	2.18
2. Disaggregated Prices									
P_p	-1.30[b]	-1.46[a]	-1.35[a]	-1.65[a]	-1.74[a]	-1.76[a]	-1.78[a]	-1.73[a]	-1.70[a]
P_B	0.32	0.53[c]	0.68[a]	0.81[a]	0.59[a]	0.59[a]	0.84[a]	0.84[a]	1.12[b]
$P_{L\&M}$	0.41	0.22	0.30	0.27	0.44[b]	0.51[b]	0.02	0.36	0.28
P_{py}	-0.22	-0.29	-0.34[c]	-0.12	-0.13	-0.13	0.21	-0.19	0.20
P_{NCM}	-0.12	0.49	0.27	0.25	-0.09	-0.16	-0.15	-0.29	-0.67
Y	1.13	0.68	0.12	0.21	0.95[b]	0.97[b]	0.92[b]	0.81[c]	1.28[b]
Q_1	0.03[c]	0.03[b]	0.01	0.01	0.01	0.01	0.00	-0.00	-0.01
Q_2	-0.02	-0.03[c]	-0.03[a]	-0.05[a]	-0.05[a]	-0.05[a]	-0.06[a]	-0.07[a]	-0.06[b]
Q_3	-0.05[b]	-0.05[a]	-0.05[a]	-0.06[a]	-0.05[a]	-0.05[a]	-0.05[a]	-0.04[b]	-0.03
K	-0.93	-0.38	0.34	0.26	-0.65	-0.68	-0.59	-0.48	-1.18
R^2	0.86	0.88	0.88	0.85	0.84	0.83	0.86	0.90	0.94
RB^2	0.65	0.78	0.80	0.77	0.77	0.75	0.77	0.82	0.84
d	3.00	3.13	2.32	2.63	2.46	2.57	2.56	2.37	3.20

a - significant at the 1% level
b - significant at the 5% level
c - significant at the 10% level

TABLE 18

Varying Time Series - Non Carcase Meat

Variables	Coefficients 1 1970/73	2 1970/74	3 1970/75	4 1970/76	5 1970/77	6 1971/77	7 1972/77	8 1973/77	9 1974/77
1. Aggregated Prices									
P_{NCM}	0.79[b]	-0.09	-0.14	-0.14	-0.13	-0.53[b]	-0.55[b]	-0.77[a]	-0.66[b]
P_{CM}	-0.85[a]	-0.42	-0.42[c]	-0.34[c]	-0.32[b]	0.16	0.25	0.64[b]	0.74[b]
Y	0.25	0.51	0.58[c]	0.37	0.28	0.25[c]	0.21	0.10	-0.34
Q_1	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	-0.01
Q_2	-0.03[a]	-0.01	-0.01	-0.01	-0.01	-0.00	0.00	0.02	0.01
Q_3	-0.02[c]	0.00	-0.00	-0.00	-0.00	0.01	0.01	0.02[b]	0.01
K	0.67	0.40	0.32	0.60	0.73	0.78	0.25	0.97	1.57
R^2	0.69	0.49	0.44	0.38	0.37	0.34	0.29	0.41	0.58
RB^2	0.49	0.26	0.24	0.20	0.22	0.16	0.03	0.14	0.30
d	1.06	0.77	0.97	0.89	0.88	1.20	1.16	1.62	1.96
2. Disaggregated Prices									
P_{NCM}	-0.21	-0.32	-0.26	-0.24	-0.47[b]	-0.75[a]	-0.75[a]	-0.75[a]	-0.73[b]
P_B	-0.62[b]	0.28	0.50[b]	0.51[a]	0.13[a]	0.32[a]	0.30[a]	0.28[a]	0.27
$P_{L\&M}$	-0.21	-0.30	-0.41[b]	-0.42[b]	0.13[b]	0.14[c]	0.20[c]	0.23	0.22
P_{py}	-0.15[c]	0.15	0.14	0.18	0.17	0.01	-0.01	0.03	0.05
P_p	0.84[b]	0.04	-0.01	-0.04	-0.10	-0.16[b]	-0.14[b]	-0.13[c]	-0.13
Y	0.58[c]	-0.11	-0.27	-0.30	0.08	0.18	0.15	0.15	0.09
Q_1	0.01	0.01	-0.00	-0.00	-0.00	0.00	-0.00	-0.00	-0.00
Q_2	0.00	-0.00	-0.01	-0.01	-0.01	-0.01[b]	-0.01	-0.00	-0.01
Q_3	0.02[b]	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.00
K	0.34	1.22	1.40	1.43	0.98	0.82	0.86	0.85	0.94
R^2	0.88	0.52	0.56	0.55	0.49	0.76	0.77	0.78	0.76
RB^2	0.70	0.09	0.27	0.33	0.28	0.64	0.62	0.58	0.39
d	1.96	0.89	0.86	0.92	0.93	2.31	2.49	2.70	2.65

a - significant at the 1% level
b - significant at the 5% level
c - significant at the 10% level

TABLE 19

Varying Time Series - Fish

Variables	Coefficients 1 1970/73	2 1970/74	3 1970/75	4 1970/76	5 1970/77	6 1971/77	7 1972/77	8 1973/77	9 1974/77
1. Aggregated Prices									
P_F	-0.81[a]	-0.89[a]	-1.29[a]	-1.45[a]	-1.62[a]	-1.53[a]	-1.49[a]	-1.12[a]	-1.09[a]
P_{NF}	-0.80[a]	-0.45[c]	0.13	0.43	0.75[a]	0.72[b]	0.72[b]	0.76[a]	1.13[a]
Y	1.22[a]	0.85[a]	0.77[c]	0.63[c]	0.42[c]	0.41	0.39	0.18	-0.17
Q_1	0.01[b]	0.02[b]	0.02[b]	0.01	0.00	0.01	0.01	0.01	-0.02
Q_2	0.01	0.02[b]	0.02[b]	0.02[b]	0.02[b]	0.02[b]	0.03[b]	0.03[b]	0.01
Q_3	0.01	0.01[c]	0.01	0.01	0.00	0.01	0.01	0.01	-0.00
K	-0.69	-0.23	-0.14	0.03	0.30	0.29	0.31	0.48	0.88
R^2	0.96	0.96	0.89	0.83	0.84	0.77	0.68	0.67	0.73
RB^2	0.93	0.94	0.85	0.78	0.80	0.70	0.57	0.52	0.55
d	1.81	2.09	0.90	0.87	1.50	1.44	1.41	2.19	2.94
2. Disaggregated Prices									
P_F	-1.26[b]	-0.92[a]	-1.37[a]	-1.56[a]	-1.66[a]	-1.51[a]	-1.45[a]	-1.18[b]	-1.11[b]
P_B	0.09	0.05	0.28[c]	0.32[c]	0.21	0.24	0.02	0.06	-0.24
$P_{L\&M}$	-0.08	-0.06	-0.17	-0.14	0.04	0.08	0.54	0.28	0.35
P_{py}	-0.25[c]	-0.14	-0.19	-0.10	-0.14	-0.23	-0.60[b]	-0.16	0.25
P_p	0.20	0.14	-0.01	-0.09	-0.10	-0.10	-0.03	0.05	0.14
P_{NCM}	-0.12	-0.23	0.58	0.80[c]	0.77[b]	0.64[c]	0.58	0.50	0.84[c]
Y	0.67	0.40	0.33	0.23	0.32	0.33	0.33	0.16	-0.39
Q_1	-0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.01	-0.01
Q_2	0.01	0.02[b]	0.01	0.00	0.01	0.01	0.02	0.02	0.00
Q_3	0.01	0.01	0.02	-0.00	-0.01	-0.01	-0.01	-0.00	-0.01
K	-0.02	0.31	0.38	0.54	0.44	0.39	0.34	0.51	1.26
R^2	0.96	0.97	0.92	0.87	0.86	0.81	0.78	0.69	0.80
RB^2	0.90	0.93	0.86	0.79	0.79	0.70	0.61	0.35	0.39
d	2.72	2.37	1.64	1.42	2.05	1.97	1.92	2.32	3.48

a - significant at the 1% level
b - significant at the 5% level
c - significant at the 10% level

the situation more than in the late 1950's and early 1960's. Some of these factors could be the shift in the United Kingdom to a greater use of home freezers, the tendency of people to eat more convenience foods and the growth of the supermarket as an outlet for meat (MLC, 1977). The effect of these factors has not been identified in the analysis but the MLC work (Bansback, 1977) reviewed earlier in this paper indicates that "other" factors may have a net adverse effect on lamb and mutton consumption, neutral for beef and veal, and favourable for pork and poultry consumption.

With regard to the deletion of bacon from the model, it can be concluded that bacon is not a significant competitor to the major meats and, therefore, the deletion of the bacon price variable was justified. In the case of the addition of fish, however, no conclusive comment can be made based on the data used and the results achieved. Fish does play an important role in the diet of United Kingdom consumers and therefore it could be expected that there would be some competition between fish and the other meats. This does seem to be the case for other meats taken as a whole, but there does not appear to be significant competition between fish and the other meats individually. The consumer decision would therefore apparently be between fish and meat, rather than fish and beef (for example). The evidence is inconclusive at present, however, and for this reason, fish was not included in the revised model. Further research and data gathering in this area, especially with regard to the role of "fish and chips" as a convenience meal, may lead to a better understanding of the relationship between fish and other meat type food products.

The own price elasticities of demand for lamb and mutton and pork have risen significantly since the 1955-62 period. This rise in elasticity can be attributed to an increasing consumer awareness with regard to purchases of these meats and a consequent

increase in purchase selectivity based on meat prices. This movement of consumer attitudes has important implications for meat marketers in that, previously the marketing of lamb and mutton and pork could place less emphasis on pricing strategies than is required now.

In the case of lamb and mutton, the rise in own price elasticity has special importance for New Zealand lamb supplies to the United Kingdom in view of the impending rise in lamb retail prices expected upon introduction of an EEC sheepmeat regime.

The own price elasticities of demand for beef and poultry meat have fallen since 1955-62. These movements are probably able to be linked as poultry meat has become a much more significant meat consumption item, at the expense of beef, while real poultry meat prices have fallen by 36 per cent and real beef prices have risen by 23 per cent. It could therefore be suggested that the replacement of beef consumption by poultry meat consumption has removed an element of discretionary buying from the beef sector and left a more stable, less price sensitive demand for beef than previously. The fall in real poultry meat prices would be expected to result in a lower own price elasticity of demand, as purchasers move to a lower point on the demand curve. This is reflected in the results achieved.

Amongst the major meat types (excluding non carcase meat), beef remains the major consumption item, followed closely by poultry meat with lamb and mutton falling back to third place and pork rising to a close fourth.

Poultry meat has shown a rise in per head consumption of approximately 300 per cent (average 1970-77 vs average 1955-62) and a real price fall of 36 per cent over the same period.

Over the 1970-77 period, the trend to poultry meat has been reflected in a poor explanation of variance, using conventional demand analysis, and suggests the importance of taste change as a significant factor in the meat market.

The period from 1970 to 1977 also covers some significant changes in the meat market. Analysis of the period in terms of two sets of data (1970-73 and 1974-77) allowed the evaluation of the effect of rapidly rising money prices and income upon consumer behaviour. As inflation became significant from 1973 on, the reaction of consumers has been an increase in the sensitivity to price changes. Although real (deflated) prices and income have remained relatively stable, observed prices and income have increased rapidly, and this may have led to consumers increasing their tendency to move from one meat to another when price differences emerge. The result has been a significant increase in ths price elasticity of demand for the various meat types since the early 1970's. If the present conditions continue (i.e. high inflation rates) a continuing high degree of price sensitivity can be expected and as a consequence, real changes in meat prices will be met with significant movements in consumer demand. This also has important implications for meat marketers as prices now play an even more important role in the demand for meat than previously. Marketing strategies must therefore be adjusted to take account of the increased consumer price awareness.

For sheepmeat, the most significant results of the analysis were achieved in the examination of changes in the relationships over the 1970 to 1977 period. It is apparent that the retail price elasticity of demand for lamb and mutton in the United Kingdom has risen significantly since the early 1970's. The equation for the 1970-77 period therefore represents an average situation of demand for lamb and mutton and, in fact, the current price elasticity, would appear to be in the region of -2.0.

Over the same period there has been a considerable increase in the coefficient for the aggregated price of substitute products ($P_{NL\&M}$) and a consequent movement to a position of significance. This has been a result of the increased significance of the beef price in the equation.

The conclusion can therefore be drawn that as meat prices (and incomes) have risen, consumers have become more price conscious with regard to sheepmeat, and the level of response to changing sheepmeat prices has therefore increased. This has occurred in both a negative and positive sense in that rises in sheepmeat prices are causing a more significant decline in consumption than before, but, as well, rises in prices of competing meats are causing greater increases in consumption of sheepmeat than before.

Also of importance could be the decreasing income elasticity of demand for sheepmeat. Although not a significant variable, the size of the coefficient has steadily decreased and, for the two most recent data groups, has become negative. This would indicate a movement away from sheepmeat as a desirable product in times of rising income and tends to confirm the predominantly negative sign of the cross price coefficients for poultry and pork. The conclusion could therefore be that sheepmeat is moving to a position as an inferior good. This conclusion must be treated as somewhat tenuous, however, as the analysis only gives an indication of support for the hypothesis.

Overall, the conclusions that can be drawn are that sheepmeat consumption is significantly influenced by the price of competing meats, especially beef, the degree of consumer responsiveness to price changes has increased since the early 1970's and there is an indication that sheepmeat may be taking up a position as an inferior product.

The relationships between the demand for different meats have also shown some interesting movements through the 1970's. The interaction between non carcase meat and sheepmeat is important. Over the early 1970's the cross price elasticities for both meats were negative. That is, a rise in the non carcase meat price would lead to a fall in sheepmeat consumption while a rise in sheepmeat prices would lead to a fall in non carcase meat consumption. This would imply that each meat was considered completely separate from the other and no substitution between the meats was considered. In the mid 1970's, however, the situation appears to have changed considerably with, in both cases, the cross price elasticities turning positive (implying a price rise for one would result in a consumption rise for the other). This situation indicates that both meat types are now considered direct competitors and the implications for meat marketing are significant. It is open to conjecture whether non carcase meat has risen or fallen to the same status as sheepmeat or vice versa. (The increased own price elasticity of demand for non carcase meat may indicate a rise in status).

For beef, the emergence of a negative cross price elasticity with poultry meat is also of importance as this would indicate an even stronger preference emerging for poultry meat than has been apparent up to now. If this is the case, the continued growth of poultry meat consumption can be expected to continue and this is likely to be at the expense of other meats with rising real prices (especially beef and sheepmeat). The negative cross price elasticity for pork may also be significant as, if a preference for pork continues, the consumption of this meat can also be expected to rise at the expense of beef and sheepmeat (very low cross price elasticity for sheepmeat also).

Pork and non carcase meat are apparently mutually exclusive products from the point of view of the consumer, with both exhibiting reciprocal negative cross price elasticities.

In conclusion, the meat market generally has become more price conscious, since inflation rates increased, and, therefore, meat prices are now more important demand factors than previously. Poultry meat has continued its move to a position of greater per head consumption as a result of lower real prices and a strongly favourable taste trend. Pork has also increased in consumption importance while beef and sheepmeat have both fallen. As a result of increased consumer price sensitivity, non carcase meat has now also become an important competitor for the other meats, especially sheepmeat.

4. IMPLICATIONS

This analysis has led to conclusions which can only be considered very damaging from New Zealand's point of view. The existence of a price elasticity of demand of -2.0 for lamb and mutton in the United Kingdom means that any increase in lamb prices would be reflected in consumption changes of twice the price change (in percentage terms). The anticipated real price rise of 14 per cent by 1985 (over 1978) for lamb and mutton, as a result of the introduction of an EEC sheepmeat regulation, would therefore result in a consumption fall of 28 per cent. This would be offset by any real increase in beef prices and it is anticipated that beef prices will rise (in real terms) in the United Kingdom by approximately five per cent by 1985 (over 1978). Such an increase would lift lamb and mutton consumption by approximately four per cent (assuming a cross price elasticity for beef at 0.9). The net effect of such a movement is therefore a fall in United Kingdom lamb and mutton consumption of approximately 24 per cent over the 1978 base level.

This analysis has been carried out in terms of total United Kingdom consumption, therefore the resulting elasticities refer to the total demand for lamb and mutton, not just to import demand. A reduction in United Kingdom lamb and mutton consumption of 24 per cent therefore refers to the total demand for the product rather than just the imported product. Such a reduction in demand will therefore be far more significant for imported products as domestic production can be expected to continue as before. This is especially so in view of the likely increases in support measures for United Kingdom farmers through the establishment of a sheepmeat regime. United Kingdom consumption of sheepmeat in 1978 was 403 000 tonnes; imports were 226 000 tonnes (Table 1, p. 9). A reduction in total consumption of 24 per cent is therefore approximately 97 000 tonnes which represents a fall in imports of 43 per cent to 129 000 tonnes.

The result of this movement would be consumption of 306 000 tonnes of sheepmeat, imports of 129 000 tonnes and local production of 177 000 tonnes. With the increased support policies for United Kingdom sheepfarmers, production could be expected to exceed this level but a large portion of any extra production would probably be exported to the French market. Bansback (1979) suggests domestic United Kingdom sheepmeat production will be about 290 000 tonnes in 1985. This implies exports of 113 000 tonnes (vs Bansback's estimate of 90 000 tonnes).

The possible situation as described above could be offset to a significant degree by an even more substantial increase in exports from the United Kingdom to the French market, thereby allowing continued imports by the United Kingdom from New Zealand. This is the situation feared by the French, however, and the possibility should therefore be discounted as any movement in this direction would probably be strongly resisted by the French and the imposition of third country quantitative import restraints under the sheepmeat regime would appear almost certain.

Income and population changes can also be expected to have some effect on the situation but these are likely to be minimal when compared to the possible price effect on lamb and mutton consumption.

The effect of a substantial real price increase for lamb and mutton could also be offset by any fall in the price elasticity of demand. It would appear, however, that circumstances similar to those currently pertaining are likely to continue for some time. There are no strong signs of inflation rates returning to less than an annual rate of five per cent (as existed in the past) and therefore a higher degree (than previously) of price sensitivity is likely to continue. It could be expected that, as consumers become accustomed to a situation of continuously moving prices, the price

sensitivity could decrease. This is a possibility, but it is considered that a return to levels of price elasticity of demand of around -1.0 are unlikely over the next five to 10 years.

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APPENDICES

TABLE 1 Appendix 1

Price Elasticities of Demand

(National Food Survey)
(1970-1977)

(Multivariate Analysis)

Item	Elasticity with respect to the price of:				
	Beef & Veal	Mutton & Lamb	Pork	Broiler Chicken	Bacon & Ham (uncooked)
Beef and Veal	-1.46	0.15	0.12	0.08	0.00
Mutton and Lamb	0.34	-1.26	-0.02	0.15	0.18
Pork	0.38	-0.02	-1.64	0.10	0.17
Broiler Chicken	0.34	0.28	0.13	-0.88	-0.83
Bacon and Ham (uncooked)	0.00	0.15	0.11	-0.39	-0.65

TABLE 2

Income Elasticities of Quantity Purchased

Used in MLC forecasts to 1985

Beef and Veal	0.25
Mutton and Lamb	0.20
Pork	0.30
Bacon and Ham	0.16
Poultrymeat	0.15
Offal	0.05

Source: (Both Tables) "Meat Demand Trends", MLC, October 1979 - United Kingdom Meat Consumption Forecasts to 1985; supplementary data.

TABLE 1 Appendix 2

United Kingdom Meat Consumption
(oz/head/week)
(average per quarter)

Year	Quarter	Lamb & Mutton	Beef	Pork	Chicken	Non Carcase Meat (excl. Bacon)	Fish	Bacon
1970	1	4.87	8.31	3.03	4.99	12.61	4.99	5.99
	2	5.51	7.27	2.68	4.85	12.66	4.85	6.25
	3	5.66	7.35	2.83	4.99	12.50	4.71	6.47
	4	5.33	8.27	2.79	4.54	12.50	4.71	6.35
1971	1	5.30	8.89	3.30	4.14	12.09	4.62	6.03
	2	5.31	7.51	3.11	5.11	11.37	4.62	6.02
	3	5.72	7.26	2.62	4.67	11.93	4.46	6.10
	4	5.30	8.18	3.14	4.91	11.97	4.59	6.01
1972	1	4.87	7.59	3.21	5.67	11.76	4.42	5.71
	2	5.11	6.51	3.20	5.10	11.55	4.68	5.61
	3	4.67	6.31	2.83	5.80	11.85	4.48	5.65
	4	5.21	7.18	3.16	5.25	11.94	4.32	5.57
1973	1	4.98	6.26	3.29	5.96	11.85	4.33	5.48
	2	4.36	5.71	2.90	6.45	11.46	4.35	5.53
	3	4.41	5.92	2.96	5.72	11.93	4.08	5.43
	4	4.02	7.34	2.85	5.28	11.41	3.65	4.93
1974	1	3.35	7.24	3.05	4.52	11.45	3.74	4.79
	2	3.71	6.74	3.82	5.17	11.35	3.73	5.27
	3	4.73	7.37	3.15	5.57	11.18	3.84	5.54
	4	4.65	8.30	2.76	4.69	10.54	3.74	4.85
1975	1	4.18	9.11	2.77	5.02	10.99	3.91	4.91
	2	4.24	7.45	2.37	5.47	11.38	3.96	4.97
	3	4.43	8.22	2.71	5.51	11.11	3.94	5.08
	4	4.14	8.49	3.08	6.21	11.65	3.74	5.00
1976	1	4.73	8.20	3.11	5.25	11.45	3.73	4.73
	2	3.84	7.30	2.10	6.45	10.96	4.06	5.13
	3	4.37	8.03	3.08	5.72	11.75	4.21	5.43
	4	3.87	6.93	3.26	5.76	11.99	4.00	4.79
1977	1	3.92	7.53	3.22	5.23	11.71	3.44	5.08
	2	3.85	7.66	3.10	6.31	11.55	3.92	5.45
	3	4.63	7.14	3.44	5.86	11.69	3.51	5.23
	4	3.46	10.67	3.50	6.45	11.94	3.54	5.71

Source: National Food Survey

TABLE 2 Appendix 2

United Kingdom Meat Expenditure
(Pence/person/week)
(average per quarter)

Year	Quarter	Lamb & Mutton	Beef	Pork	Chicken	Non Carcase Meat (excl. Bacon)	Fish	Bacon
1970	1	7.20	16.98	5.33	5.15	16.79	7.95	11.20
	2	7.76	15.30	4.81	5.09	17.92	8.17	11.86
	3	8.85	15.67	5.03	5.57	17.93	8.08	12.53
	4	8.20	17.85	5.27	5.36	17.99	8.37	12.72
1971	1	8.69	19.75	5.97	4.50	17.43	8.28	11.86
	2	9.03	17.77	5.73	6.42	17.36	8.69	12.04
	3	9.66	18.18	5.14	5.83	18.57	8.82	12.91
	4	9.18	20.13	6.26	5.95	18.73	9.02	12.98
1972	1	8.55	18.87	6.47	6.50	18.78	9.08	12.16
	2	9.52	17.21	6.59	5.78	18.98	9.80	12.37
	3	9.72	17.47	5.98	6.99	20.31	9.76	13.50
	4	10.85	20.29	7.17	6.41	20.61	9.73	14.05
1973	1	11.15	21.10	8.45	7.94	21.86	10.13	14.53
	2	10.29	19.46	7.46	9.48	22.78	10.95	16.23
	3	11.74	21.13	7.97	8.99	25.26	10.67	17.54
	4	11.42	25.97	8.37	9.14	24.71	10.22	16.73
1974	1	9.91	26.63	9.30	7.71	25.76	11.60	16.70
	2	10.64	24.58	9.20	8.73	27.12	11.80	18.12
	3	13.05	26.52	8.88	9.15	27.22	12.12	19.69
	4	13.13	28.75	8.67	8.45	25.92	12.34	19.07
1975	1	12.09	32.98	8.99	9.83	28.21	13.06	19.29
	2	13.17	29.36	8.89	11.38	29.84	14.03	20.54
	3	14.27	32.34	9.27	11.76	30.78	13.97	21.80
	4	12.93	35.37	11.28	13.02	32.01	13.82	22.43
1976	1	15.42	36.66	11.44	11.17	32.77	14.31	22.40
	2	13.86	33.16	8.90	14.36	33.27	15.60	24.97
	3	16.73	36.70	11.62	13.91	37.29	16.84	26.43
	4	15.72	36.59	13.53	15.21	38.10	17.09	24.14
1977	1	16.44	39.47	13.30	14.01	39.16	16.47	25.08
	2	16.78	40.84	12.57	17.64	39.79	19.20	26.94
	3	19.36	38.78	14.45	16.51	41.66	17.00	27.14
	4	15.48	53.22	15.42	18.58	41.86	18.45	29.27

Source: National Food Survey

TABLE 3 Appendix 2

United Kingdom Implied Meat Prices
(pence/oz)
(average per quarter)

Year	Quarter	Lamb & Mutton	Beef	Pork	Chicken	Non Carcase Meat (excl. Bacon)	Fish	Bacon
1970	1	1.48	2.04	1.76	1.03	1.33	1.59	1.87
	2	1.41	2.10	1.79	1.05	1.42	1.68	1.90
	3	1.56	2.13	1.78	1.12	1.43	1.72	1.94
	4	1.54	2.16	1.89	1.18	1.44	1.78	2.00
1971	1	1.64	2.22	1.81	1.09	1.44	1.79	1.97
	2	1.70	2.37	1.84	1.26	1.53	1.88	2.00
	3	1.69	2.50	1.96	1.25	1.56	1.98	2.12
	4	1.73	2.80	1.99	1.21	1.56	1.97	2.16
1972	1	1.76	2.49	2.02	1.15	1.60	2.05	2.13
	2	1.86	2.64	2.06	1.13	1.64	2.09	2.20
	3	2.08	2.77	2.11	1.21	1.74	2.18	2.39
	4	2.08	2.83	2.27	1.22	1.73	2.25	2.52
1973	1	2.24	3.37	2.57	1.33	1.84	2.34	2.65
	2	2.36	3.41	2.57	1.47	1.99	2.52	2.93
	3	2.66	3.57	2.69	1.57	2.12	2.62	3.23
	4	2.84	3.54	2.94	1.73	2.17	2.80	3.39
1974	1	2.96	3.68	3.05	1.71	2.25	3.10	3.49
	2	2.87	3.65	2.41	1.69	2.39	3.16	3.44
	3	2.76	3.60	2.32	1.64	2.43	3.16	3.55
	4	2.82	3.46	3.14	1.80	2.46	3.30	3.93
1975	1	2.89	3.62	3.25	1.96	2.57	3.34	3.93
	2	3.11	3.94	3.75	2.08	2.62	3.54	4.13
	3	3.22	3.93	3.42	2.13	2.77	3.55	4.29
	4	3.12	4.17	3.66	2.10	2.75	3.70	4.49
1976	1	3.26	4.47	3.68	2.13	2.86	3.84	4.74
	2	3.61	4.54	4.24	2.22	3.04	3.84	4.87
	3	3.83	4.57	3.77	2.43	3.17	4.00	4.87
	4	4.06	5.28	4.15	2.64	3.18	4.27	5.04
1977	1	4.19	5.24	4.13	2.68	3.34	4.79	4.94
	2	4.36	5.33	4.05	2.80	3.45	4.90	4.94
	3	4.18	5.43	4.20	2.82	3.56	4.84	5.19
	4	4.47	4.99	4.40	2.88	3.51	5.21	5.13

TABLE 4 Appendix 2

United Kingdom Deflated Implied Meat Prices
(pence/oz)
(average per quarter)

Year	Quarter	Lamb & Mutton	Beef	Pork	Chicken	Non Carcase Meat (excl. Bacon)	Fish	Bacon
1970	1	1.48	2.04	1.76	1.03	1.33	1.59	1.87
	2	1.38	2.05	1.75	1.03	1.39	1.64	1.86
	3	1.38	2.08	1.74	1.09	1.40	1.68	1.89
	4	1.46	2.04	1.79	1.12	1.36	1.68	1.89
1971	1	1.51	2.04	1.67	1.00	1.32	1.65	1.81
	2	1.51	2.11	1.64	1.12	1.36	1.67	1.78
	3	1.48	2.19	1.72	1.10	1.37	1.74	1.86
	4	1.50	2.42	1.72	1.05	1.35	1.71	1.87
1972	1	1.50	2.12	1.72	0.98	1.36	1.75	1.82
	2	1.56	2.21	1.72	0.95	1.37	1.75	1.84
	3	1.71	2.28	1.74	1.00	1.43	1.80	1.97
	4	1.67	2.27	1.82	0.98	1.39	1.80	2.03
1973	1	1.77	2.66	2.03	1.05	1.45	1.85	2.09
	2	1.81	2.61	1.97	1.13	1.52	1.93	2.24
	3	2.01	2.69	2.03	1.18	1.60	1.98	2.44
	4	2.07	2.58	2.14	1.26	1.58	2.04	2.47
1974	1	2.07	2.58	2.14	1.20	1.58	2.17	2.44
	2	1.90	2.41	1.59	1.12	1.58	2.09	2.27
	3	1.78	2.32	1.49	1.06	1.57	2.04	2.29
	4	1.74	2.13	1.94	1.11	1.52	2.04	2.42
1975	1	1.68	2.11	1.89	1.14	1.50	1.94	2.29
	2	1.65	2.09	1.99	1.11	1.39	1.88	2.20
	3	1.64	2.00	1.74	1.09	1.41	1.81	2.19
	4	1.54	2.05	1.80	1.04	1.35	1.82	2.21
1976	1	1.61	2.20	1.81	1.05	1.41	1.89	2.33
	2	1.65	2.08	1.94	1.02	1.39	1.76	2.23
	3	1.72	2.05	1.69	1.09	1.42	1.79	2.18
	4	1.74	2.26	1.78	1.13	1.36	1.83	2.16
1977	1	1.71	2.14	1.68	1.09	1.36	1.95	2.01
	2	1.70	2.08	1.58	1.09	1.35	1.91	1.93
	3	1.61	2.09	1.61	1.08	1.37	1.86	2.00
	4	1.69	1.89	1.67	1.09	1.33	1.97	1.94

TABLE 5 Appendix 2

United Kingdom Income Per Household and Retail Price Index

(average per quarter)

Year	Quarter	Income Per Household (pounds/week)[a]	Retail Price Index[b]	Deflated Income Per Household (pounds/week)
1970	1	23.56	1.000	23.56
	2	24.31	1.024	23.74
	3	24.75	1.036	23.89
	4	25.44	1.057	24.07
1971	1	25.59	1.086	23.56
	2	26.63	1.125	23.67
	3	27.37	1.140	24.01
	4	28.09	1.155	24.32
1972	1	27.32	1.173	23.29
	2	29.35	1.195	24.56
	3	29.09	1.214	23.96
	4	30.44	1.244	24.47
1973	1	31.68	1.266	25.02
	2	34.25	1.306	26.23
	3	35.75	1.326	26.96
	4	35.29	1.372	25.72
1974	1	35.89	1.428	25.13
	2	36.83	1.514	24.33
	3	38.35	1.552	24.71
	4	40.75	1.621	25.14
1975	1	42.35	1.718	24.65
	2	44.58	1.881	23.70
	3	47.18	1.963	24.03
	4	48.06	2.031	23.66
1976	1	49.58	2.104	23.56
	2	50.64	2.181	23.22
	3	50.69	2.232	22.71
	4	53.58	2.335	22.95
1977	1	54.82	2.452	22.36
	2	57.43	2.562	22.42
	3	62.51	2.601	24.03
	4	65.56	2.639	24.84

[a] Source: National Food Survey - Supplementary data

[b] Source: Monthly Digest of Statistics

TABLE 6 Appendix 2

United Kingdom Meat Consumption

1955-62 vs 1970-77
Average Period

oz/head/week

	Lamb & Mutton	Beef	Chicken	Pork	Non Carcase Meat (incl. Bacon)	Total
1955-62	6.64	9.36	1.34	2.07	16.32	35.73
1970-77	4.59	7.57	5.39	3.01	17.16	37.72
			As a Proportion of total (%)			
1955-62	18.6	26.2	3.8	5.8	45.6	100.0
1970-77	12.2	20.0	14.3	8.0	45.5	100.0

TABLE 7

United Kingdom Deflated Meat Prices and Income

1955-62 vs 1970-77
Average Period

A Deflated Price (Pence/oz)

	Lamb & Mutton	Beef	Chicken	Pork	Non Carcase Meat (excl. Bacon)
1955-62	0.897	1.062	1.011	1.052	0.942
1970-77	0.996	1.309	0.642	1.070	0.917
% change	11	23	-36	2	-3

B Deflated Income (Pounds/household)

1955-62	12.28
1970-77	14.36
% change	17

FIGURE 1 - Sheepmeat and Beef Consumption

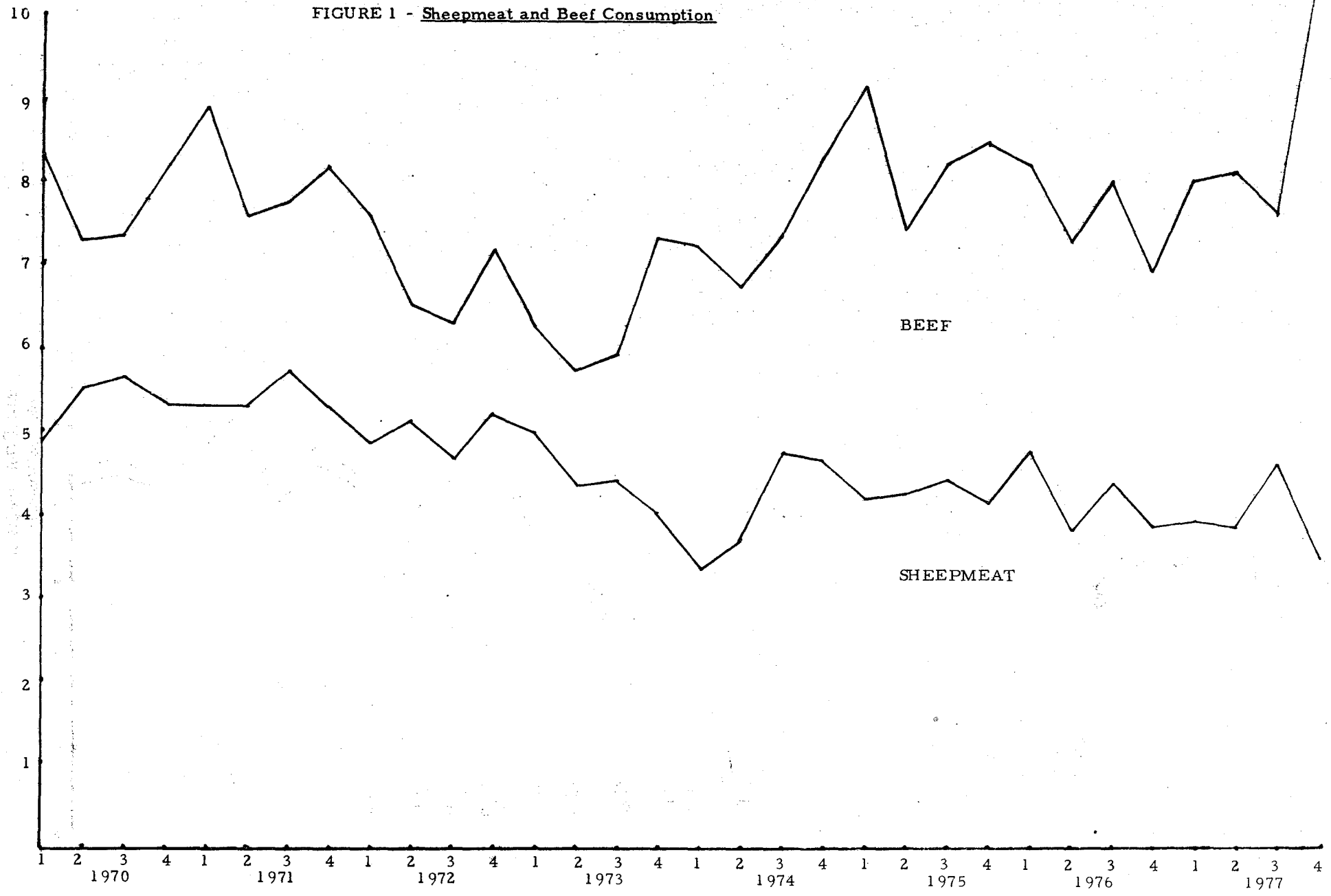


FIGURE 2 - Pork and Chicken Consumption

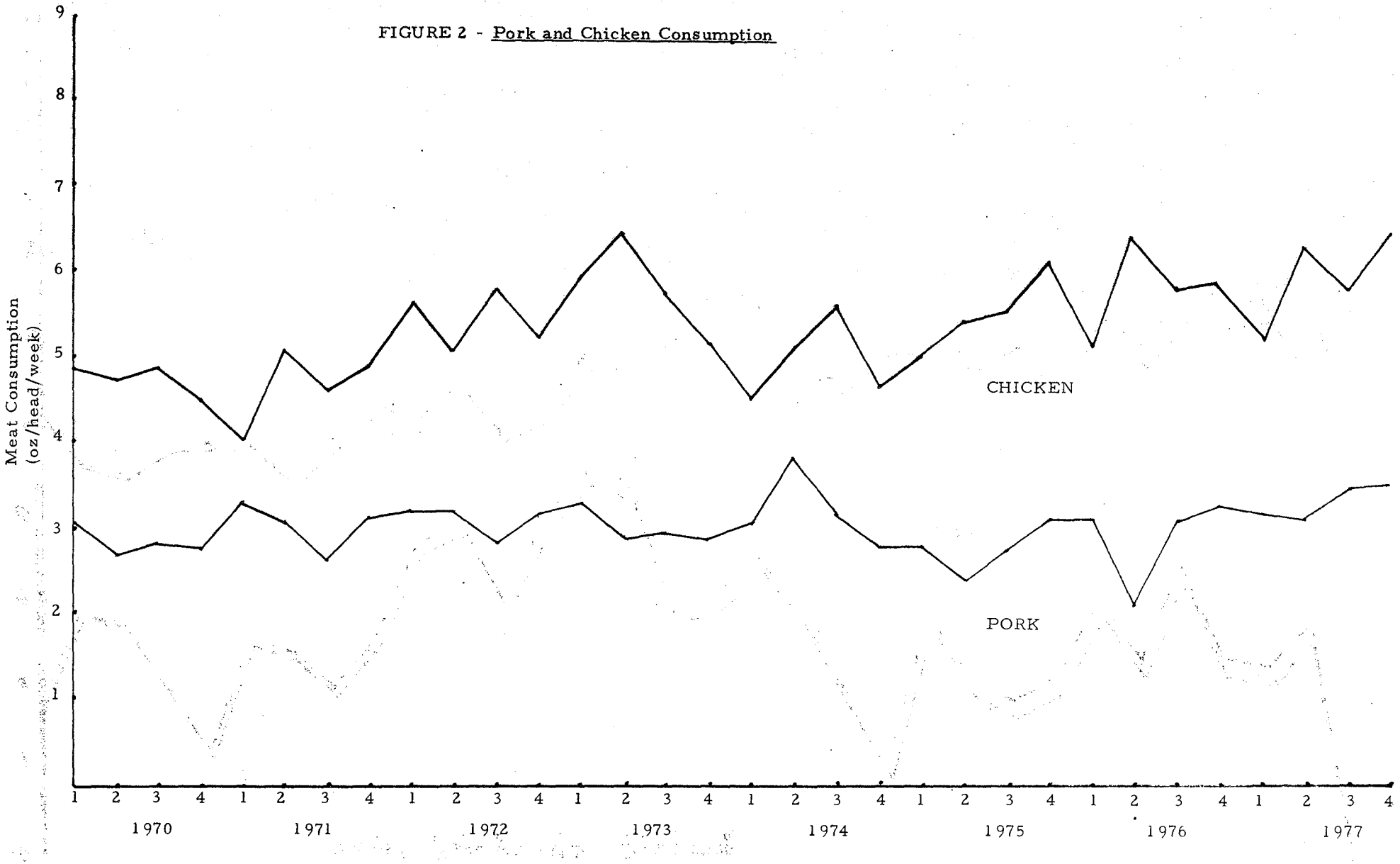


FIGURE 3 - Non Carcase Meat and Fish Consumption

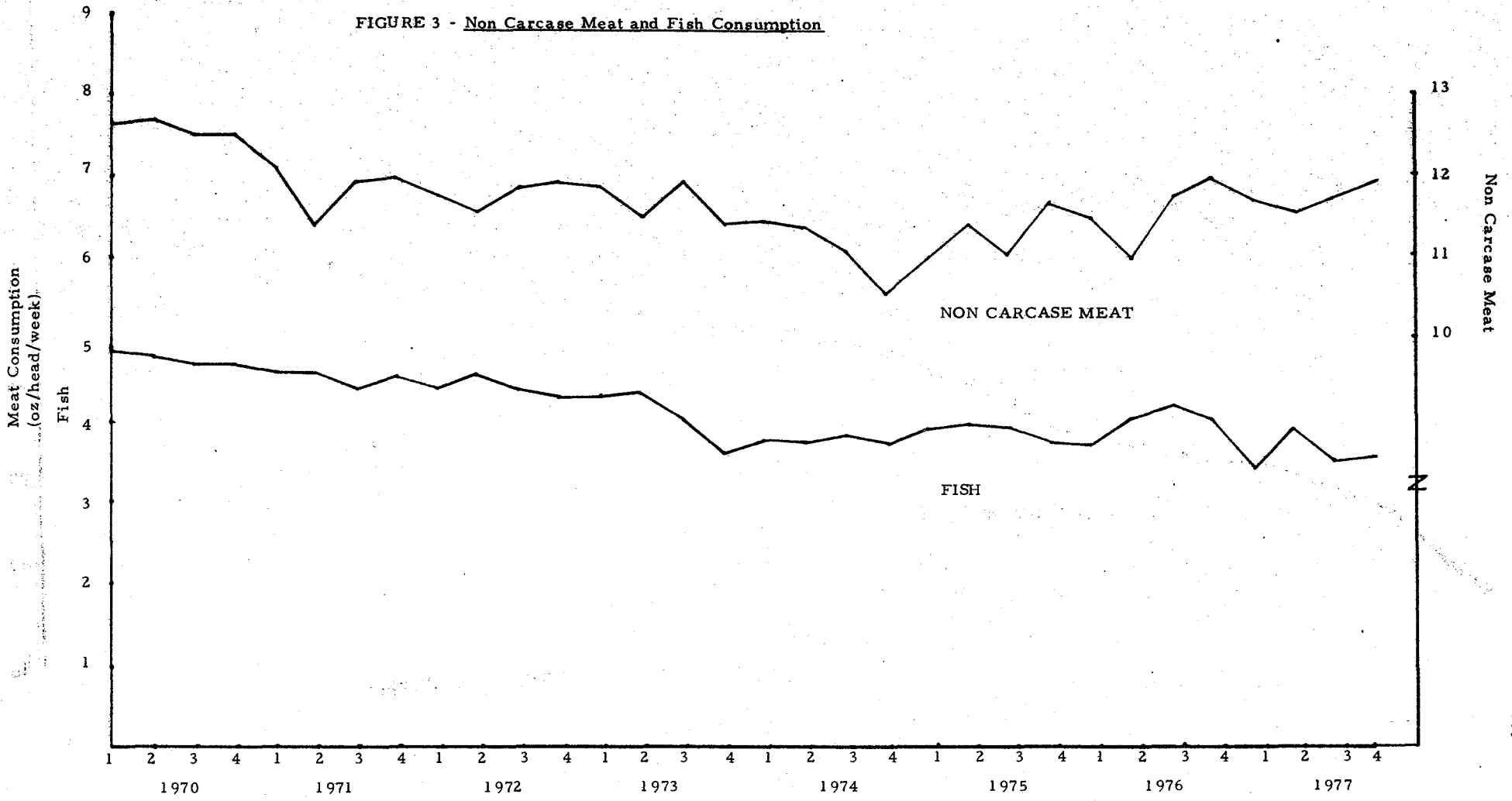


FIGURE 4 - Income

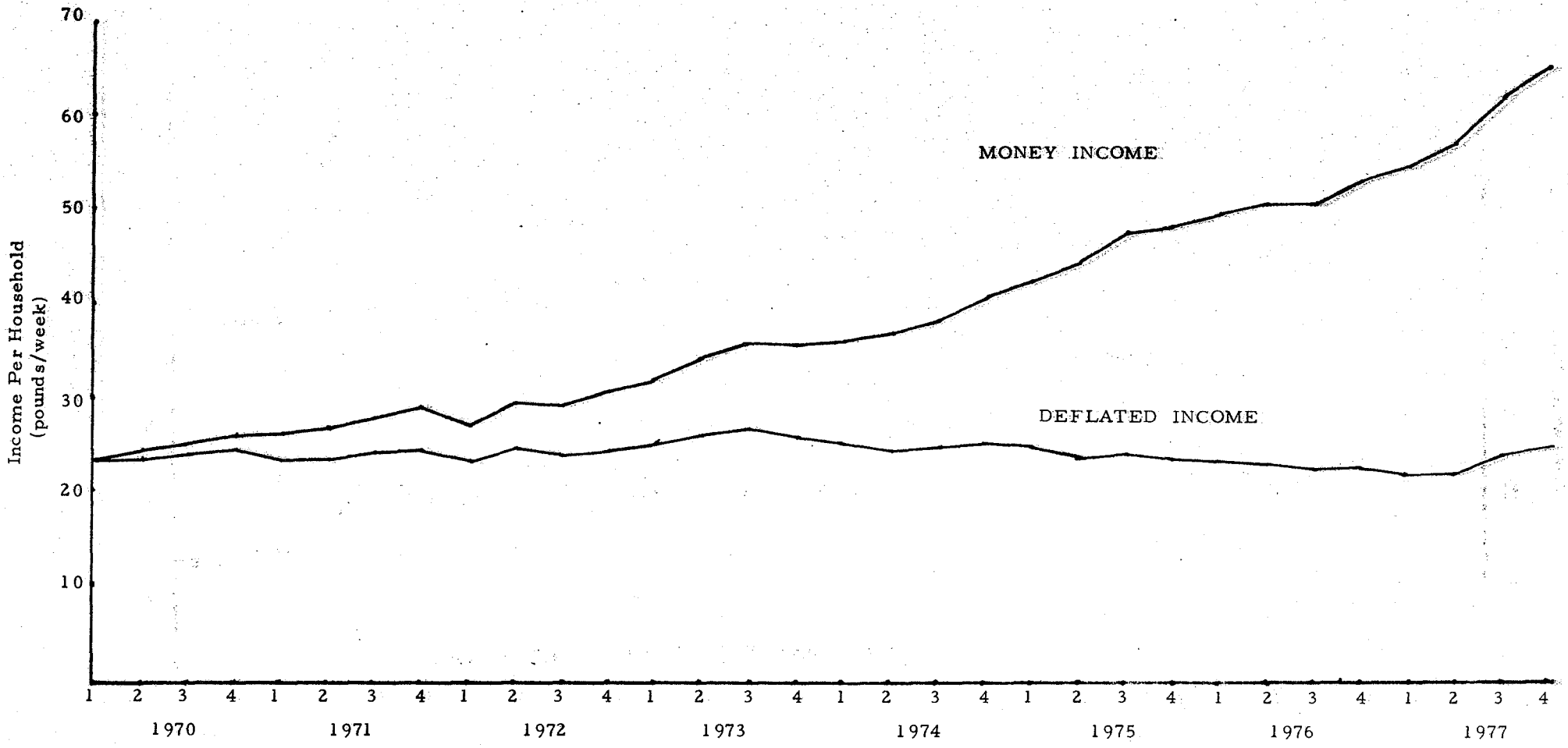


FIGURE 5 - Sheepmeat and Beef Prices

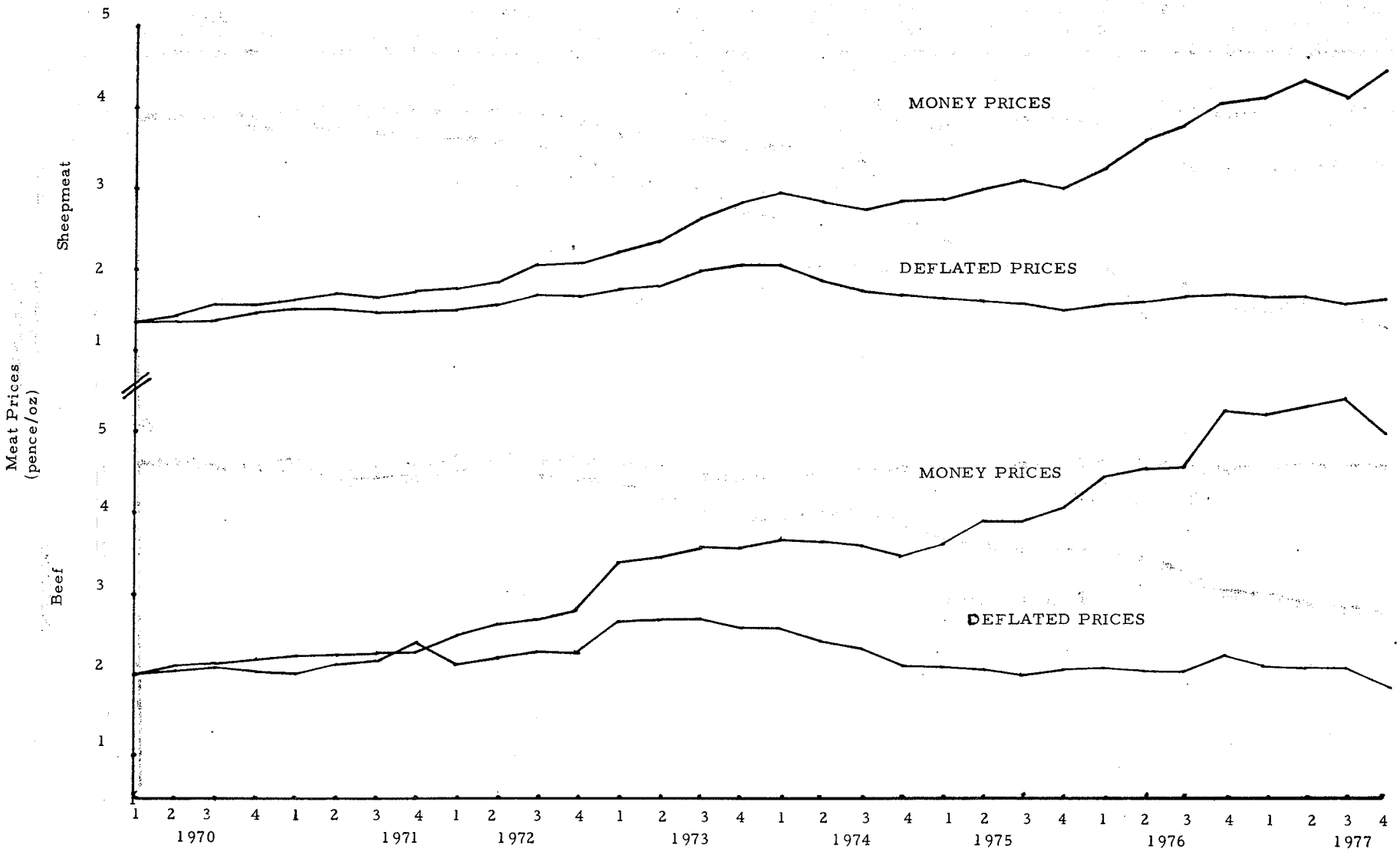
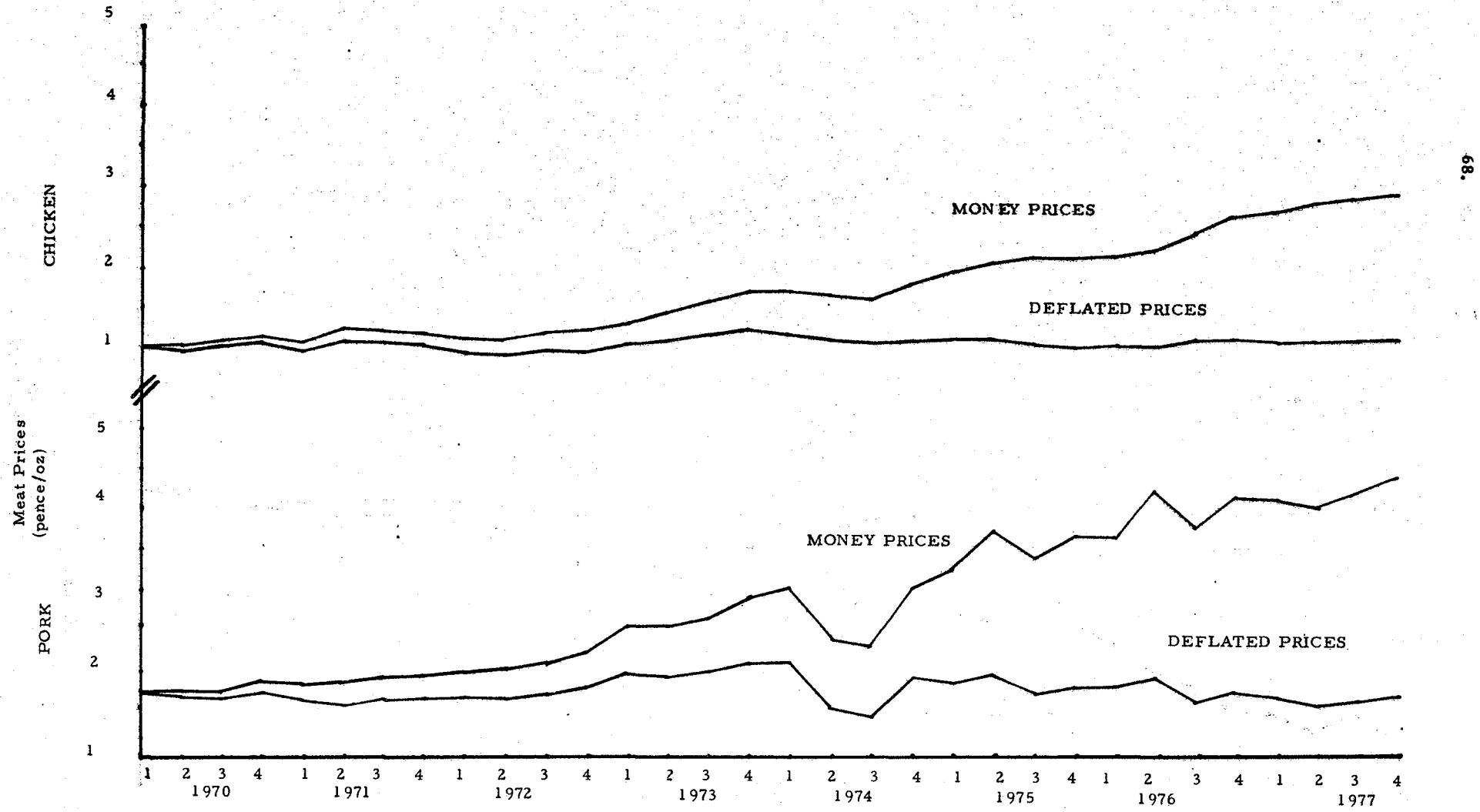


FIGURE 6 - Pork and Chicken Prices



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