THE SUPPLEMENTARY MINIMUM PRICE SCHEME:

A RETROSPECTIVE ANALYSIS

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PREFACE

This study was conducted by Dr G.R. Griffith, Visiting Research Fellow, on leave from his position as Senior Research Scientist with the New South Wales Department of Agriculture, and Mr T.P. Grundy, Assistant Research Economist, both in the Agribusiness and Economics Research Unit.

The research reported here continued the AERU's programme of pastoral sector production and policy analyses as typified by R.L. Sheppard and J.M. Biggs in Discussion Paper No. 63, M.T. Laing and A.C. Zwart in Research Report No. 137 and Discussion Paper No. 70 and G.R. Griffith and S.K. Martin in Discussion Paper No. 116.

A.C. Zwart
DIRECTOR

ACKNOWLEDGEMENTS

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SUMMARY

This study reports an ex post evaluation of the impact the Supplementary Minimum Price (SMP) Scheme had on the New Zealand pastoral livestock sector over the period 1978/79 to 1984/85, and for a forecast following five year period.

The SMP Scheme was introduced to complement the price stabilisation schemes operated by the New Zealand Meat Producers' Board and the New Zealand Wool Board, and to guarantee prices at a level appropriate for income adequacy and for the encouragement of increased farm production and export earnings. Over the six years of the Scheme, plus one year of transitional payments, approximately $1192 million dollars was distributed to pastoral sector producers under the provisions of the Scheme. The great majority of payments went to the sheep industry, especially during 1981/82 - 1983/84.

In this study an established econometric model of the New Zealand pastoral livestock sector is used to provide some answers to the question "what would have been the short- and long-run impacts on the New Zealand pastoral sector if there had not been an SMP Scheme?" The model is solved over the period 1978/79 - 1989/90 for the two cases of the SMP payments being included, then excluded, from the prices received by producers. The differences in the simulation solutions are due only to the impact of the SMP Scheme.

The results of this analysis conform to and re-emphasise those from previous research. First, the immediate impact of not paying SMP's would have been financial adjustments associated with the loss of income. Second, the initial financial adjustments would have resulted in subsequent adjustments in enterprise choices and output levels over a number of years, extending far beyond the year in which the SMP Scheme actually terminated. Third, over the entire period when the SMP Scheme was operative, plus a further five years to enable some of the long run dynamic adjustments to evolve, there is considerable doubt as to whether the Scheme achieved its stated objectives. The total value of all pastoral sector exports would have been some $168 million lower in aggregate (about $13 million lower per year on average) if there had not been a SMP Scheme. Thus it is by no means certain that the Scheme could be classified as successful in "stimulating agricultural production and exports and raising foreign exchange earnings".

Two additional factors cast further doubt on the efficacy of the SMP experiment. One, the contribution of the Scheme to export earnings occurred after its termination. Two, the $168 million boost to foreign exchange earnings due to the SMP Scheme must be compared to the $1192.4 million expenditure required to achieve it - a return of approximately $0.14 in export revenue for every $1 invested in the Scheme.

SECTION 1

INTRODUCTION

There have been some fundamental changes in the economic environment facing the New Zealand agricultural sector over the past decade. In response to increasing instability in the world markets for pastoral sector products during the mid 1970's, a range of incentive schemes were implemented in the livestock pastoral sector as a means of " stimulating agricultural production and exports and raising foreign exchange earnings," (NZ Government, 1978). These included price stabilisation and price support schemes, subsidised overdraft facilities with the Reserve Bank to allow marketing boards to operate their buffer fund/buffer stock policies, fertiliser and transport subsidies, and various schemes aimed at developing pastoral land or increasing the number of livestock carried*. The cost of these agricultural support measures was substantial, increasing and rapidly becoming too much for the domestic economy to sustain however, and the process of dismantling the subsidy scaffold began about 1983.

The assistance measure which stimulated most debate during its operation, and which ultimately was responsible for the need to re-appraise the whole structure of assistance to agriculture, was the Supplementary Minimum Price (SMP) Scheme. The Government introduced the SMP Scheme at the start of the 1978/79 season to provide product prices to pastoral sector farmers at a level thought to be appropriate for income adequacy and for the encouragement of increased farm production (Sheppard and Biggs 1982). For the 1978/79 - 1980/81 seasons the SMPs were largely ineffective in influencing producer returns, as although they rose slightly in nominal terms, they were either exceeded by market prices or matched by the Producers' Board minimum prices. Only for dairy products was a supplementary payment made under the Scheme during this period.

However the SMPs announced for the 1981/82 season were substantially increased over the previous season, and, more importantly, were far greater than the then expected market returns. Significant supplementary payments were made to farmers during 1981/82 and this led to a growing concern as to the appropriateness of the SMP Scheme in achieving its stated objectives, and to the manner in which the Scheme was being implemented. For example, the Agricultural Review Committee (1983, p.10) warned of the "...difficulties in trade policy, in administration of the schemes, and distortions of allocations of resources within the sector". The SMP Scheme continued in a similar fashion however and by the end of the 1983/84 season SMP subsidies had risen to over $NZ500m on sheep meats alone, some 80 per cent of all direct farm subsidies to this industry, and equivalent to a payment of approximately $NZ9000 per farm (MLC 1986). This level of budgetary outlay and its transparency as an assistance measure led the Government to terminate the SMP Scheme at the end of 1983/84, although

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1   A full account of the objectives, implementation and operation of some of these policies, especially those relating to the meat industries, is given in Griffith and Martin (1987).

transitional payments were still made for sheepmeats throughout 1984/85 to ease the effect of their removal.

Several analyses of the SMP Scheme were conducted during its operation. Sheppard and Biggs (1982) in discussing the objectives and implementation of the Scheme, suggested that SMPs were an inefficient means of increasing farm output because the payments were not "tied" to productive expenditure. They argued that farm income levels were less closely related to investment in land than to investment in other factors of production, yet increased land investment was necessary for increased production levels. Further they noted that because SMPs were being set at levels unrelated to market conditions, price relativities would be affected and production distortions would result. Laing and Zwart (1983b) utilised an econometric model of the NZ pastoral sector and simulation analysis in an attempt to empirically evaluate the short-term and long-term impacts of the removal of the SMP policy. They concluded that "the productive capacity of the pastoral sector would not have been seriously run-down in the absence of SMP payments", and that "SMP payments cannot be justified solely on the grounds that without them export receipts would fall dramatically" (p.1.).

However, since both these evaluations were undertaken while the Scheme was still in operation, there were obvious uncertainties about the future implementation of the Scheme and in particular the future levels of the SMPs relative to expected market prices or to any minimum prices set by the Meat Board or the Wool Board. Thus the implicit question posed by Laing and Zwart (1983b) was "what would be the short -and long-run impacts on the NZ pastoral sector of removing the SMP Scheme if the current (1982) relativities between SMP and market or Board minimum prices were maintained?".

Now that the Scheme has terminated though, we know the actual relativities between the SMP, market and/or Board minimum prices for each of the affected products over the history of the Scheme. We can now ask the more precise, retrospective question, "What would have been the short- and long-run impacts on the NZ pastoral sector if there had not been an SMP Scheme?" Answering that question is the objective of this analysis.

Section 2 briefly outlines the implementation and operation of the SMP Scheme over the period 1978/79 to 1984/85. This is essentially a summary of parts of Griffith and Martin (1987). Section 3 describes the econometric model of the pastoral sector employed in the analysis and summarises the simulation methodology used in measuring the effects of not having a SMP Scheme. Section 4 reports the results of this analysis, while Section 5 presents the conclusions and relates them to the previous work in this area.

SECTION 2

THE SUPPLEMENTARY MINIMUM PRICE SCHEME

2.1   Objectives of the Scheme

The operation of the price stabilisation schemes administered by the NZ Meat Producers Board and the NZ Wool Board over the 1975/76, 1976/77 and 1977/78 seasons was viewed with concern by Government. (Details of the Boards' Stabilisation Schemes can be found in Griffith and Martin (1987)). It had been anticipated that the schemes would provide for both the stabilisation of farm product prices and the achievement of an adequate level of farm income based on market returns. In the opinion of the Government, neither of these objectives were met over the three years of operation and it was therefore decided that a new scheme should be introduced with the objectives of improved stabilisation and farm income adequacy.

In the 1978 Budget, the Government expressed the opinion that there was a considerable need to induce a higher level of confidence in the agricultural sector. It was expected that such confidence would result in an expansion of output and so lead to continued growth in the export earnings from the agricultural sector. The Minister of Finance stated that the most appropriate remedy to the problem was to guarantee to farmers "prices for primary products which will give them a more adequate return for their efforts" (NZ Government 1978, p.16), and that this was to be achieved by establishing and underwriting new minimum prices to supplement those operated by the various Producer Boards. The Minister expressed the view that these Supplementary Minimum Prices (SMPs) would more adequately provide for farmers' reasonable requirements for living expenses, farm operating expenditure and new development than the Producer Boards' schemes. It was hoped that in setting the minimum prices for two years ahead, rather than the single season orientation of the Producer Board schemes, the farmer would have an assured and realistic base on which to plan.

It was announced that the Boards would administer the Scheme using Government funds. These funds, drawn in the event of market prices falling below the SMP, would be provided temporarily from Reserve Bank overdraft and ultimately from Government revenue. The Scheme was not designed to be self-balancing and was to be "no more than an interim measure".

It was stated by the Minister in the 1979 Budget: "The guaranteed prices will be moved closer to next season's expected market levels, and the scheme will continue to operate in parallel with the minimum prices scheme and price smoothing arrangements operated by the Producer Boards." (NZ Government 1979, p.12). This suggests that the emphasis had moved from providing income adequacy to farmers, to a slightly more market orientation designed to protect the farmer from short-term price recessions. The Government claimed that the successful introduction of the Supplementary Minimum Prices Scheme had meant that farmers could plan and invest to increase production knowing in advance the minimum prices they will receive for the next two seasons, and that this knowledge should allow the agricultural sector to "play its full part in generating export-led growth".

The cautious interpretation of the role of the SMP Scheme continued in the 1980 Budget announcement with the Government indicating that the SMP Scheme was more intended to provide a guaranteed price to farmers for a two year period rather than including any mention of income adequacy. However, this attitude was reversed with the announcement in the 1981 Budget, of prices for the 1981/82 and 1982/83 seasons, when the Government moved well ahead of the market price levels in the setting of the Supplementary Minimum Prices. This shift in interpretation can perhaps be seen as a return towards the income adequacy orientation of the SMP Scheme. Although income adequacy had been announced by the Government in 1978 to be one of the objectives of the SMP Scheme, it was apparently ignored in subsequent budgets in favour of price stability objectives.

No changes were made to SMPs for the 1983/84 season, and the scheme was terminated at the close of that season, although transitional arrangements for sheepmeats were negotiated. A summary of payouts under the scheme is provided in Table 2.1.

2.2 Operation of the Scheme

2.2.1. Lamb

The introduction of the SMP Scheme at the beginning of the 1978/79 season had very little impact on the prices for lambs received by farmers. Although the SMP was well above the previous season's minimum price, the Board minimum price exceeded the SMP. In the following season, the real level of SMP was maintained but this was matched by the Board minimum price. In the 1980/81 season, the Board minimum price again exceeded the SMP. The real increase in the minimum price was 5 per cent while the SMP rose by 3 per cent. Again, neither the minimum price nor the SMP had any impact on producer returns as schedule prices remained on or above their level (Figure 2.1).*

For the 1981/82 season, however, the SMP was raised by nine per cent in real terms, and this was well above the current market returns and some 29 cents above the largely unaltered Board minimum price.

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2   Note that the "maximum" prices shown in Figures 2.1 - 2.5 are actually "trigger" prices. If the market price exceeded the trigger price, a certain proportion of the difference was taken as a levy and paid into the stabilisation account. See Griffith and Martin (1987) for a more complete description of these mechanisms.

Table 2.1: Payments to Farmers Under the SMP Scheme ($M)

Commodity	Year							Total
	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85(a)	
Lamb	0	0	0	93.9	146.5	213.5	93.8	547.3
Mutton	0	0	0	8.7	11.5	48.4	37.8	106.4
Wool	0	0	0	184.2	176.7	78.8	0.0	439.7
Sheep Industry	0	0	0	286.8	334.7	340.3	131.6	1093.4
Beef	0	0	1.9	53.3	25.0	0.0	0.0	80.2
Dairy	18.8	0	0	0.0	0.0	0.0	0.0	18.8
Total	18.8	0	1.9	340.1	359.7	340.3	131.6	1192.4

Sources: Laing and Zwart (1983b); Durbin (1985); Grundy (1987)

(a) payment from a transitional lump sum grant.

Figure 2.1:   LAMB PRICES
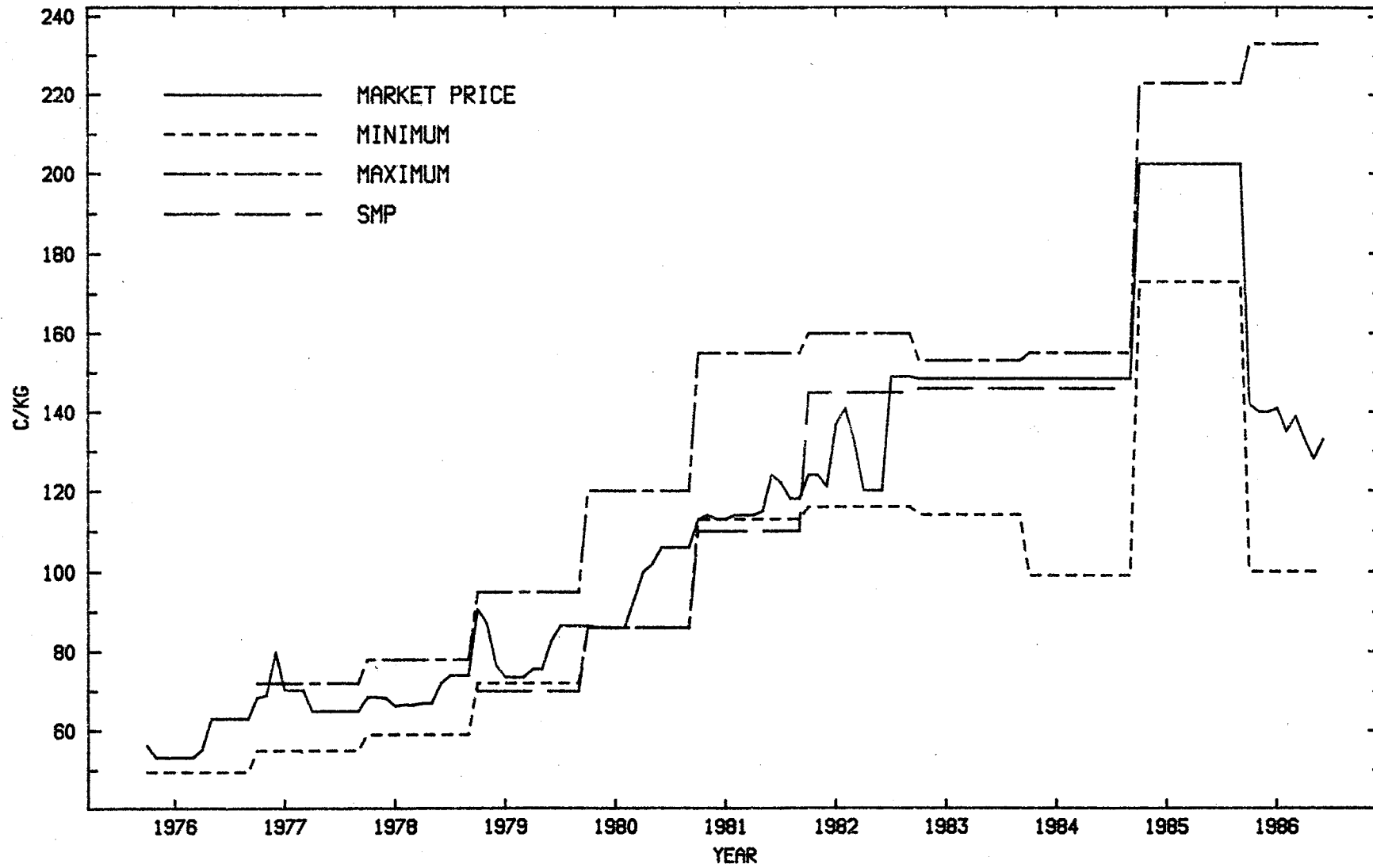
After several unsuccessful attempts to stabilise the price of lamb the Board offered its own schedules in April 1982 to purchase the remainder of the seasons kill at the minimum price. Supplementary payments on lamb during this season exceeded $115M, including $93.9M in SMP payments and the remainder from the Meat Income Stabilisation Account as trading losses.

For 1982/83 both SMP and Board minimum prices were little changed from the previous year, with the SMP for lamb some 32 cents higher than the Board minimum. Exporters could not match the Board's minimum price, so it was agreed with exporters and the Government that the Board would sell the sheepmeat using the traditional exporters as commission agents. The Board purchased all lamb at the SMP with the Government paying the 32 cents difference between the SMP and the Board's minimum price or some $145M. The deficit of market returns under the minimum price came out of the Stabilisation Account. A similar situation held in 1983/84 with SMPs unchanged but the minimum price reduced, so that the SMP now exceeded the minimum by 47 cents. Again all lamb was purchased by the Board and SMPs were paid by the Government for the 47 cent difference, which totalled some $213M or $6.40 per head. Another large loss was added to the Stabilisation Account as well.

During 1983/84 agreement was reached on dismantling the SMP Scheme for sheepmeats on September 30, 1984. It was to be replaced for one year by a grant equal to an estimate of the amount which would have been paid if SMP had been continued. An amount of $110M was set as the lump sum for 1984/85.

In 1984/85 the rapidly increasing deficits in the Stabilisation Account and the problem of having to pay market interest rates led the Board to set very low minimum prices. The Board operated a system of national pools for export sheepmeat. Farmers received an advance payment from the national grade pools and a supplement from the lump sum, which had been increased to $131.7M. Lamb prices required supplementation all year and some 19.5 c/kg or $2.50/head was paid out. This totalled $93.8M.

With both the SMP and Board stabilisation scheme being effectively terminated at the end of the 1984/85 season, significant falls in prices paid to producers resulted. Durbin (1985) reports one estimate of a 50 per cent fall in works door return per lamb.

2.2.2 Mutton

The SMP announced for mutton for the 1978/79 season was matched by the Board minimum price and therefore the SMP did not have any impact on the prices received. The SMP for the 1979/80 season was increased by nine per cent in real terms. This was close to, but below, market prices throughout the season. A small increase was made for the 1980/81 season but market prices remained well above the SMP level. The SMP announced for 1981/82 was significantly raised and above both minimum prices and ruling market price levels (Figure 2.2).

With the high likelihood of extensive supplementation, the Board would only agree to pay supplements at levels above the minimum price, and since exporters could not set schedules matching the minimum prices, the Board issued its own schedule early in the season. Eventually they assumed ownership of over 90 per cent of the season's mutton production. The Government paid about $8.7M on the 7c/kg difference between the SMP and the minimum price, and the Board had a loss of around $25M on mutton trading. In 1982/83 a similar situation occurred with SMP and Board minimum prices little changed; the Board purchasing all mutton at the SMP level; the Government paying the 9c/kg supplement of $12M; and the Board paying the deficit on mutton trading from the Stabilisation Account. The total loss on lamb and mutton trading for this season was almost $288M.

The procedure was repeated in 1983/84 with SMP unchanged but the minimum price reduced to only 12c/kg. Thus the Government was required to supplement $48M (39c/kg or $7.60 per head), while the Board activities resulted in a trading loss on both lamb and mutton of over $150M. Further support was required in 1984/85 of $38M - 31.5c/kg or $4.60 per head, from the lump sum payment by Government.

The market, stabilisation and supplementary minimum prices for sheepmeat are provided in Figures 2.1 and 2.2.

Figure 2.2:   MUTTON PRICES

——————— MARKET PRICE

‐ ‐ ‐ ‐ ‐ MINIMUM

‐·‐·‐·‐ MAXIMUM

‐ ‐ ‐ ‐ SMP

C/KG

YEAR
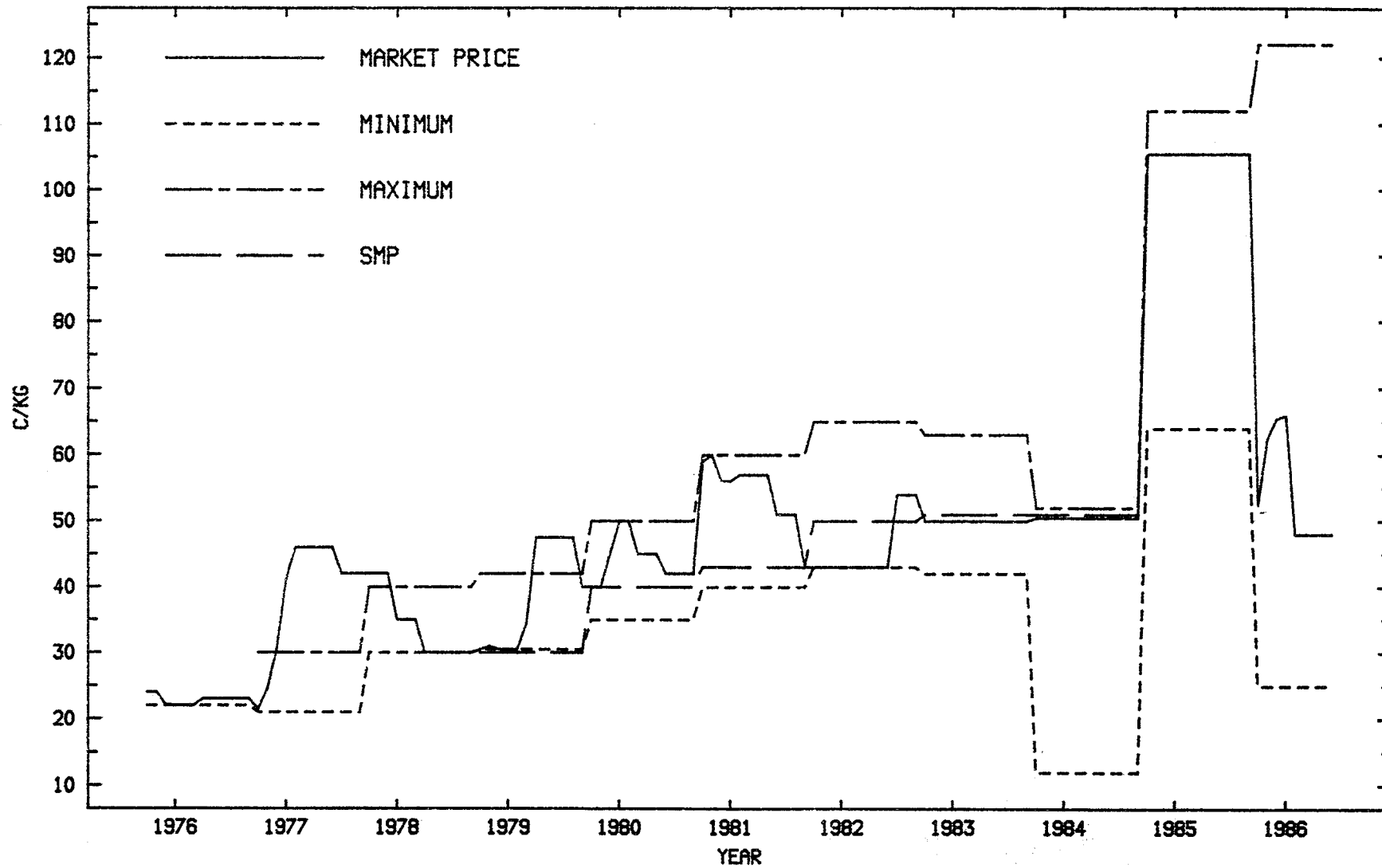
2.2.3. Beef

The manufacturing beef and prime beef market prices move in a similar manner as do the stabilisation prices and SMPs (Figures 2.3 and 2.4).

The SMPs introduced for beef for the 1978/79 season were substantially above the Board minimum prices, reflecting the Government's desire to ensure income adequacy, but were exceeded by market prices. For the 1979/80 season, the manufacturing beef SMP was the same as the Board minimum price while the prime beef SMP was slightly below the Board minimum. In the 1980/81 season, the situation was reversed, and the Government was required to pay 2c/kg or about $1.9M. Therefore, over the period up to 1980/81, the SMPs were largely ineffective in influencing returns to farmers.

In 1981/82 the SMPs were increased sharply away from both the market price and the Board minimum price. Supplementary payments on beef totalled $57.7M of which $53.3M was from SMP payments and $4.4M from the Stabilisation Account. For cows, the level of total supplements was up to 40 per cent of producer returns. During the following year the SMPs and Board minimum prices were largely unchanged, but market prices varied widely, averaging well above the SMPs. Supplements were required early in the season - some $17.3M in SMP payments and $0.3M in Stabilisation Account payments - then levies were applied in April totalling some $2.3M.

SMPs were unchanged for 1983/84 but minimum and trigger prices were raised. No SMPs were required and stabilisation levies were collected during July - September, totalling $5.7M.

The market, stabilisation and supplementary minimum prices for beef are provided in Figures 2.3 and 2.4.

Figure 2.3:   PRIME BEEF PRICES
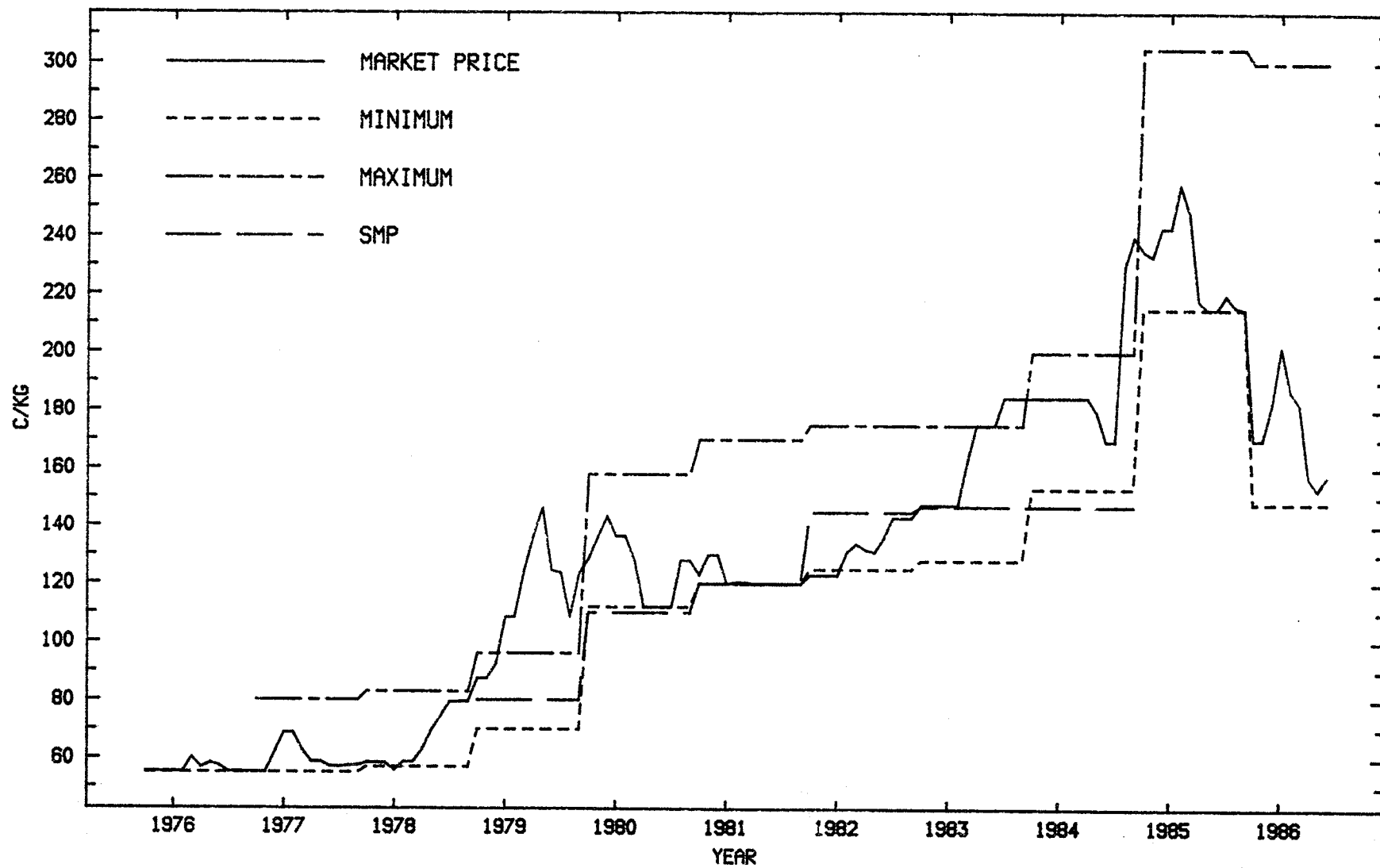
Figure 2.4: MANUFACTURING BEEF   PRICES
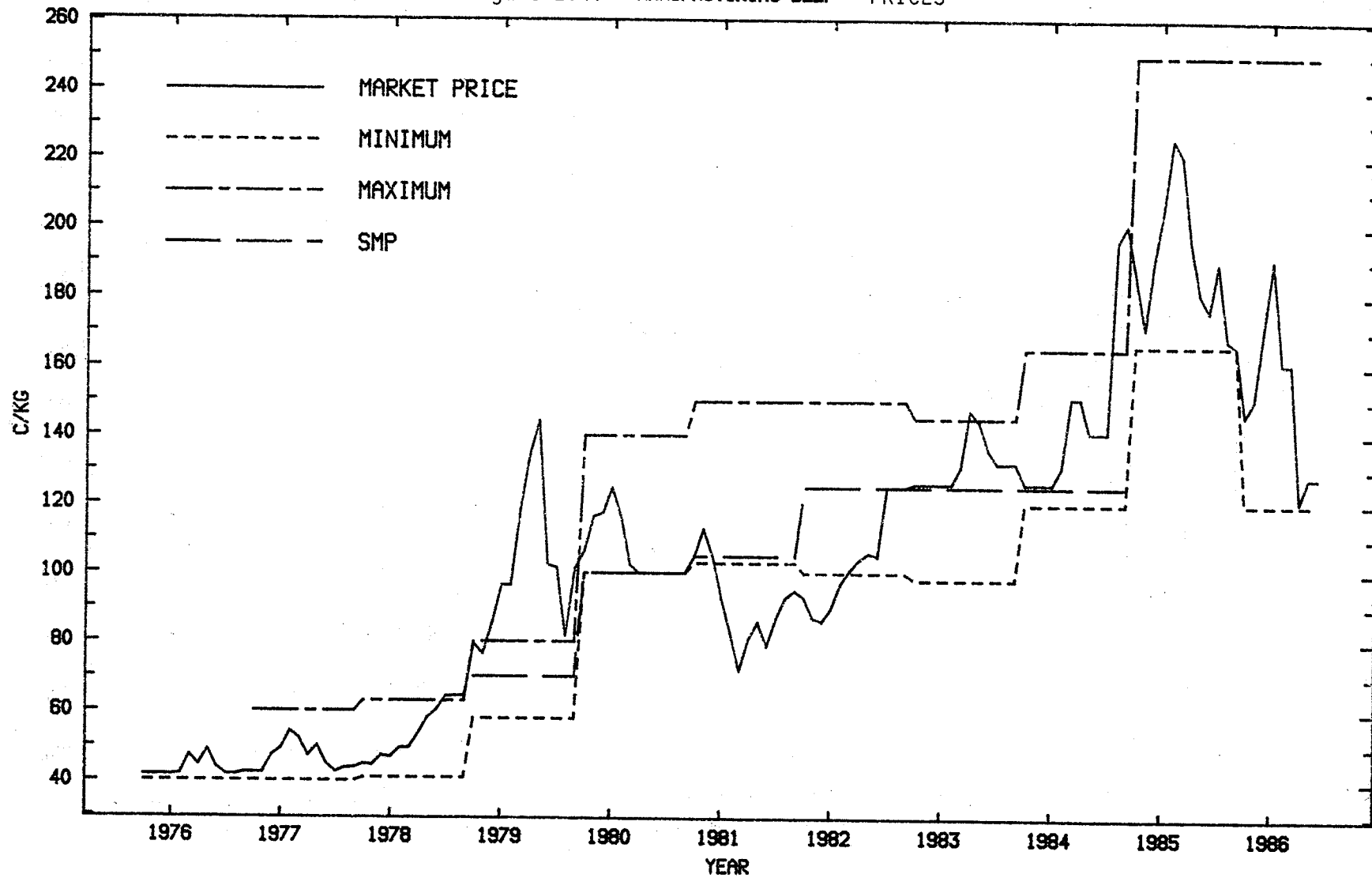
2.2.4 Wool

The SMP for wool for the 1978/79 season was set at a level 20 per cent higher than the Wool Board minimum, but had minimal effect as the market price average exceeded the SMP. For the two subsequent seasons the SMP was still set higher than the Board minimum, but each year the gap between them decreased. Again no payments were required, but the reduction in the real SMP level reflected the change in attitude of the Government away from the income adequacy objective toward a more market oriented approach.

However for the 1981/82 season, income adequacy objectives regained primary status and the SMP was raised over 30 per cent to 320c/kg. With the market price averaging only 256c/kg, a SMP payment of some 64c/kg was required. The pattern was repeated in 1982/83 and 1983/84 and large SMP payments were necessary in both years. Some $440M was provided in SMP supplements during those three years (Table 2.1).

Payments from the Stabilisation Account were made in addition during 1981/82 and 1982/83, and the intervention activities of the Board were also important factors influencing the returns received by producers.

The market, stabilisation and supplementary minimum prices for wool are provided in Figure 2.5

2.2.5 Dairy

The SMP announced for the dairy industry for the 1978/79 season was set at a level some 14c/kg above the basic milkfat price, and a SMP payment of 7.1c/kg was required when the end-of-season surplus payment did not cover the difference. The total payout was $18.8M.

No further SMP payments were required for the dairy industry, as although the SMP was set just above the initial basic price, either the basic price was adjusted upward during the season to match or exceed the SMP, or the end-of-season surplus distribution more than made up the difference. The exception was in 1983/84 when the SMP was actually set 15c/kg below the basic milkfat price.

The Dairy Board advance and total end-of-season milkfat prices and the supplementary minimum prices are provided in Figure 2.6

Figure 2.5:   WOOL PRICES
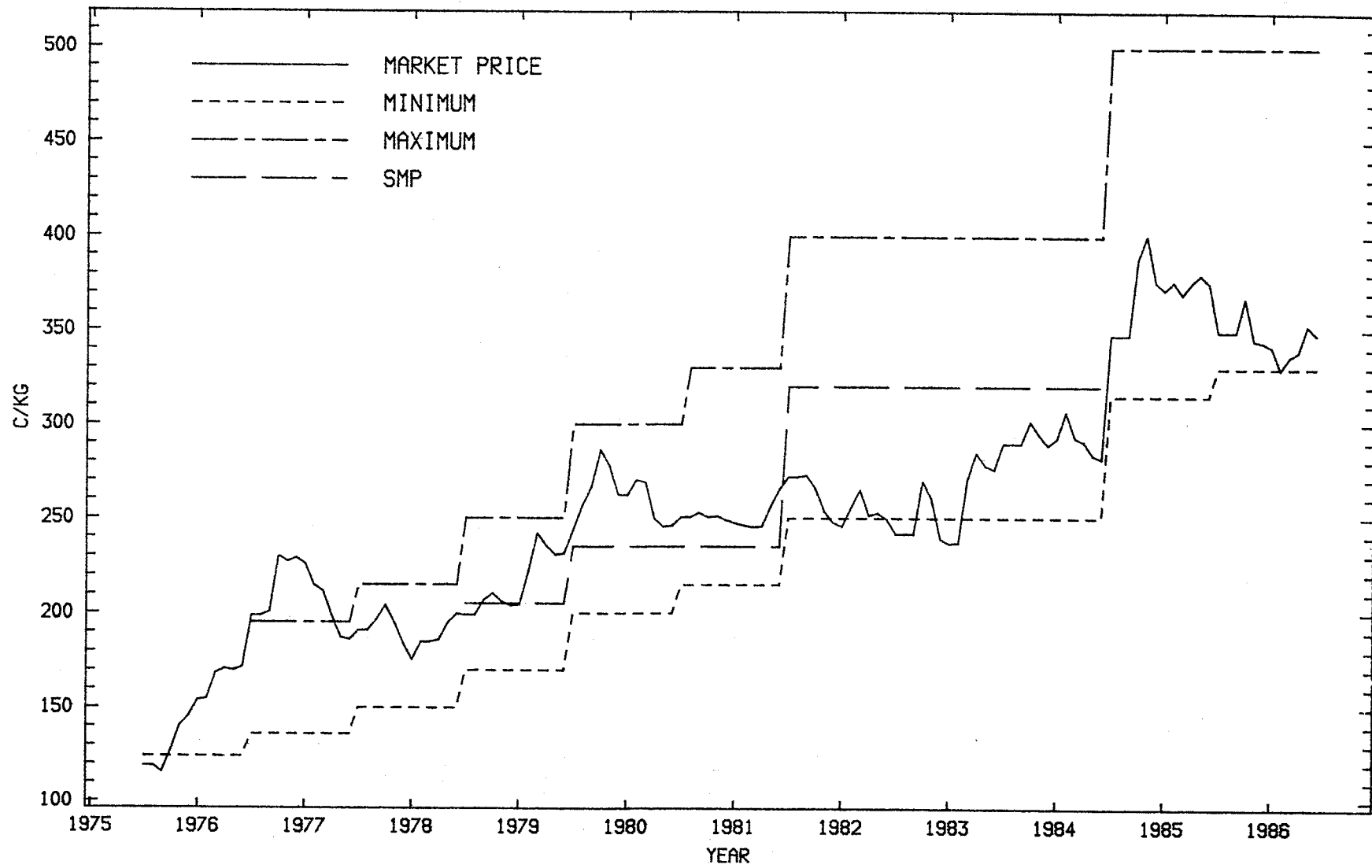
Figure 2.6:   MILK FAT PRICES
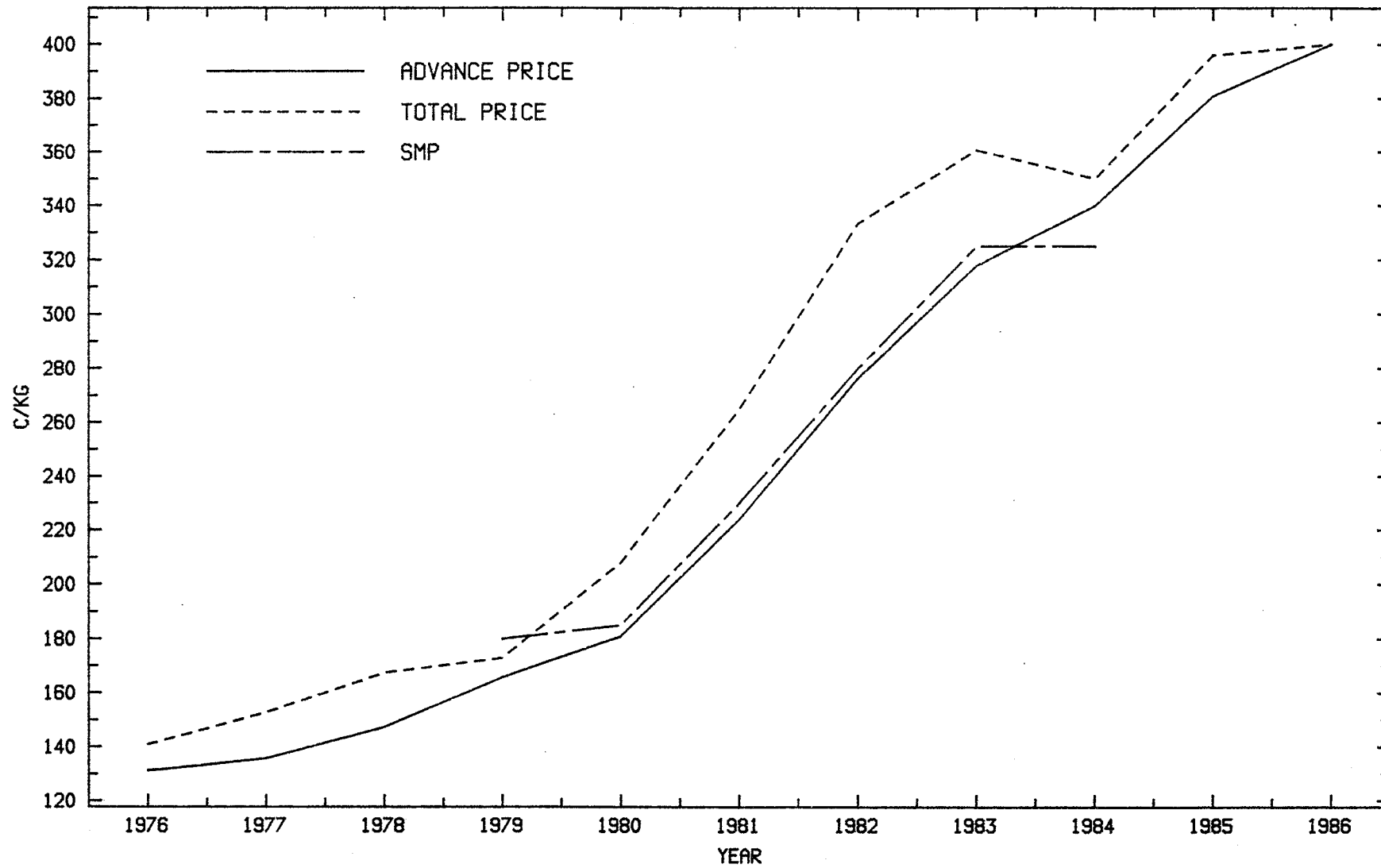
SECTION 3

METHODOLOGY

3.1   Overview of the Econometric Model

Laing (1982) and Laing and Zwart (1981, 1983a) have reported the development of an econometric model of the pastoral livestock sector, ie, farming enterprises that involve sheep, beef cattle, or dairy cattle. The latest developments in the model's structure are reported in Grundy (1988). This model is aimed at describing changes in livestock numbers and farm production, as well as the financial position and decisions of the farm units making up the sector. The model also follows the flow of product produced in the pastoral sector through to the export level, after account is taken of domestic consumption and stock changes.

Figure 3.1 presents a schematic summary of the model's structure, where three sub-models can be identified: the farm income and investment sub-model, the livestock numbers and production sub-model, and the consumption, stocks and export sub-model.

Individual income and investment sub-models have been developed for sheep and beef, and dairy farms. To a large extent these models are based on farm level data rather than on national aggregates. Gross income per farm is generated from a number of simple price - quantity relationships representing the individual components of farm income. Four current expenditure categories are then estimated as a function of the level and change in both gross income and total stock units carried, as well as the farm's capital intensity (measured by capital stock per stock unit). Farmers do not adjust every expenditure category to the same extent when farm incomes and other variables change from year to year.

Net income, the difference between gross income and total expenditure, is then allocated between consumption (drawings), investment, and tax payments. The range of investment decisions includes off-farm investment (shares, debentures), land purchase, capital investment in buildings, plant, machinery, land development, and debt. Drawings and each investment decision are described in this framework as being determined by the level and change in net income, the returns to each investment relative to the cost of making that investment, and the opening level or stock of each asset held. Thus, it is recognised that a high degree of inter-relationship exists between individual investment decisions, and between investment decisions and consumption. A change in the level of any asset, or in the returns to that asset, has therefore inevitable consequences on the future levels of every other asset, and on the level of consumption possible.

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3   This section is taken with only minor alterations from Section 2.1 in Laing and Zwart (1983b).

FARM INCOME
AND INVESTMENT SUB–MODEL

(FARM LEVEL)

LIVESTOCK NUMBERS
AND PRODUCTION SUB–MODEL

(AGGREGATE LEVEL)

CONSUMPTION STOCKS
AND EXPORT SUB-MODEL

(AGGREGATE LEVEL)

18
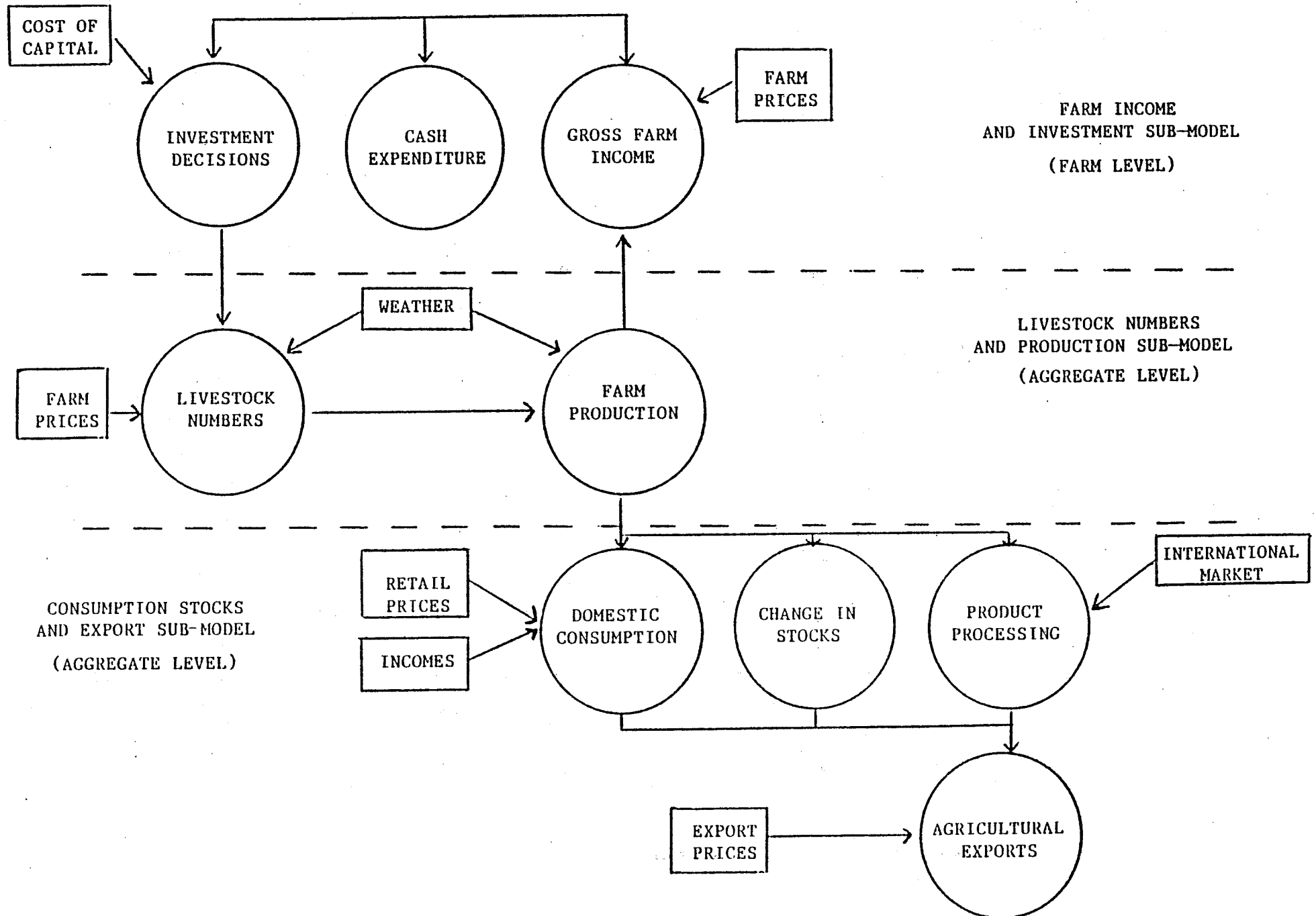
Investment in land development is a key variable in the overall model, since strong links are found between land development and the livestock numbers and production sub-model, as such development work changes the overall carrying capacity of farmland. Total livestock numbers are subdivided into a number of age and sex categories, reflecting their different economic functions within the flock or herd. Each category is affected in different ways and to varying degrees by both economic and environmental factors. In addition, each individual demographic category's ability to respond to economic stimuli is influenced by current and past responses in other demographic categories. The major economic variables affecting livestock numbers are the relative returns to individual farm enterprises. These are represented in the model by relative farm-gate prices for farm outputs such as wool, lamb, beef and milkfat. Environmental factors are represented by a variable measuring the annual number of days of soil moisture deficit. Nine livestock categories are recognised in the model: breeding ewes, ewe hoggets, other sheep, beef breeding cows, beef heifers over one year old, beef heifers under one year old, other beef cattle (including steers and bulls), dairy cows, and dairy heifers.

Having modelled changes in livestock numbers over time, production trends are found as a consequence. Total production is determined simply by the numbers of animals slaughtered (or milked or shorn) and the carcase weight (or yield or woolweight). In the production relations livestock demographic variables are in the form either of the opening number of animals, or the change in livestock numbers, since these account for whether numbers are being built up, or alternatively whether the flocks or herds are in a liquidation phase.

Additional variables are included in the production equations to account for changing per-head production of animals. Relative product returns guide the allocation of current resources among the various enterprises, while the capital stock per stock unit measures the capital intensity of per head production. Finally, since a major determinant of carrying capacity and per-head performance is pasture growth, the variable measuring soil moisture deficit is included to explain these effects.

The third major component of the overall model explains the level of domestic consumption and stocks of the major agricultural products which are derived from the pastoral sector. Consumption is estimated as a function of retail prices and per-capita disposable income while stock changes are determined by production levels, and market prices. From the knowledge of domestic consumption and stocks, and the production level determined earlier, exports are derived as a residual. Utilising the level of export prices for individual pastoral products, it is then possible to evaluate the f.o.b. value of exports. The main function of the consumption, stocks and exports sub-model described above is to allow the foreign exchange implications of policies affecting farm production to be evaluated. This sub-model is particularly important in identifying the time taken for a policy change to eventually affect the volume and value of exports.

Export prices, along with domestic farm-gate and retail prices, are taken to be exogenous in this model.

3.2   Empirical Characteristics of the Econometric Model

The empirical implementation of the pastoral livestock sector model is accomplished by using a combination of OLS and SUR regression techniques. The calculated elasticity estimates in Appendix X of Laing and Zwart (1983a, pp.179-91) provide a convenient summary of the responsiveness of the endogenous variables in the model to the main exogenous variables - the various farm-gate and retail prices and the export unit values. A summary of these elasticities is reported in Table 3.1. Although such calculations are not repeated in Grundy (1988), the estimated coefficients did not vary very much from the earlier version of the model so the calculated elasticities would not be expected to vary much either.

Several observations concerning these elasticities may be made. First, the impact own price elasticities are in general very inelastic. This is especially so for livestock numbers and farm and factory production, most domestic consumption variables, and export volumes. Exceptions occur in some of the income and expenditure variables where farm price changes are distributed across the various income and expenditure categories, the stocks of dairy products, and some of the export values.

Second, over the longer term (ten years) the own price elasticities are substantially increased and many are now in the elastic range. Particularly elastic production responses are shown for wool prices and to a lesser extent beef prices, while lamb, mutton and dairy price elasticities tend to remain inelastic. Lamb and mutton stocks respond markedly to sheepmeat prices, as do many of the export volumes and values. Domestic consumption of meats responds little different in the long run than in the short run.

Third, there are several important instances of cross-price elasticities not according with prior expectations, as pointed out by Wood-Belton and Lattimore (1985). There are also some specification problems in the dairy products component, especially concerning dairy stocks.

Another measure of the appropriateness of the estimated model as a representation of the pastoral livestock sector is how well the complete model solves. Such results are provided in Appendices VIII and IX of Laing and Zwart (1983a) and show that the majority of turning points in the endogenous data series were also generated by the simulations; and that the majority of summary statistics are at acceptable levels - all Theil statistics are well less than 1.0, most correlation coefficients are high and most regression coefficients from the regression of actual and predicted series are within the range 0.8 to 1.2. Overall, the historical simulation results suggest that this quite complex, dynamic model "is able to produce a time path for the endogenous variables similar to that from which it was estimated" (Laing and Zwart 1983a, pp. 98-9).

This encouraging result provides some confidence for using the model to examine the impacts of past policy decisions or the potential effects of possible future policy decisions.

Table 3.1: Elasticity Values in the Laing and Zwart Model

Endogenous Variable	Farm-gate, Retail or Unit Value Prices									
	Wool		Lamb		Mutton		Beef		Milkfat	
	Imp	LR	Imp	LR	Imp	LR	Imp	LR	Imp	LR
Sheep S.U	0.02	1.10	-0.01	0.17	-0.01	-0.14	0.02	-0.03	-0.03	-1.23
Beef S.U		-0.29		-0.90		0.09	0.01	1.86		-0.27
Dairy S.U	-0.09	-0.18					0.05	0.09	0.08	0.17
Wool output	0.05	1.38		0.23	0.05	-0.11		-0.08		-1.43
Mutton output	0.01	0.80		0.20	0.02	-0.06	-0.04	-0.13		-0.71
Lamb output	0.07	1.28	-0.06	0.18		-0.16		-0.12		-1.29
Beef output		-0.35	-0.20	-0.69		0.05	0.19	1.29	-0.08	-0.05
MF output		0.10	-0.01					0.04	0.04	0.44
Butter output									0.04	0.49
Cheese output									0.06	0.70
SMP									0.06	2.21
Sheep and beef gross income	0.38	0.10	0.05	0.14	0.13	0.04	0.14	0.18	-0.01	-0.80
Sheep and beef net income	0.93	2.14	0.14	0.43	0.33	0.15	0.32	0.09	0.02	-1.28
Dairy gross income		0.03	-0.01	-0.03			0.13	0.20	0.35	0.75
Dairy net income	0.04	0.14	-0.01	-0.05			0.19	0.22	0.55	0.88
Beef demand			0.53	0.53	0.53	0.53	-0.30	-0.30	0.28	0.28
Mutton demand		0.09	-0.42	-0.39	-0.42	0.37	0.62	0.60	0.62	0.54
Lamb demand	0.08	1.56	1.11	1.40	1.18	0.98	-0.65	-0.79	0.66	-0.92
Butter demand									0.06	0.06
Cheese demand			-0.55	-0.55	-0.55	-0.55			-1.04	-1.04
SMP demand									0.66	0.66
Lamb export	0.06	1.15	-0.21	-0.73	0.10	-0.25	0.05	-0.05	-0.05	-1.21
Mutton export	0.01	1.27	0.27	0.60	0.20	-0.32	-0.44	-0.62	-0.40	-1.52
Beef export		-0.52	-0.48	-1.29	-0.26	-0.19	0.34	2.07	-0.23	-0.21
Wool export	0.16	1.41		0.25	0.04	-0.12		-0.08		-1.59
Butter export		0.12		-0.01				0.05	0.07	0.55
Cheese export		0.20	0.19	0.17	0.19	0.19		0.08	0.58	1.28
SMP export		0.38		-0.03				0.16	0.02	2.35

Source: Laing and Zwart (1983a, Appendix X)

3.3   The Simulation Methodology

Two dynamic simulation solutions of the econometric model were undertaken to achieve the objectives of this paper. First, the model was solved over the 13 year period 1978-1990, using actual exogenous data for the period 1978-1985 and 1985 values of the exogenous variables for the period 1986-1990. Since the model was estimated on the basis of prices actually received by producers, including SMP and/or Board supplements, this first solution incorporates the influence of the SMP Scheme on the pastoral sector. Second, the model was solved over the same period but using prices for 1978-1985 that were nett of SMP payments, as shown in Table 3.2. This second solution represented the hypothetical situation of there not being a SMP Scheme in operation. Since the SMP values were the only changes between the two simulation runs, any changes in the simulation solutions can be due only to the impact of the SMP Scheme.

A major assumption is that NZ pastoral sector producers would respond to the SMP-removed "market" prices in exactly the same manner as they actually responded to the SMP-inclusive prices on which the parameters of the econometric model were estimated. Martin and Urban (1984) suggest that the elasticity of supply with respect to a guaranteed price is only about half of the corresponding elasticity with respect to a market price. Further, there is some econometric evidence that producers do respond differently to guaranteed and market prices (Griffith and Meilke 1982). However in most instances these results are derived for the situation where the guaranteed price is an underwritten price which would only rarely become effective - typically the market price would exceed the guaranteed price. In the present case of course the opposite occurred during a number of the seasons the SMPs were in operation, so it is unclear whether the previous results would hold. An interesting avenue for research would be to attempt to re-estimate the livestock inventory and production blocks of the Laing, Zwart and Grundy model separating out the SMP, Board minimum and market prices where appropriate.

Both short-run and long-run effects of the SMP Scheme can be evaluated from the results of the simulation experiment. First, the short-term period-by-period responses to not having SMP payments can be assessed from the different solutions for the period 1978-1985 when the Scheme was actually in operation. Naturally, some longer term dynamic responses were set in motion by the SMP payments whenever they became effective, especially for 1982/83-1984/85. Thus these years include both the immediate effects of the SMP payments in those seasons plus the evolving dynamic effects of payments and responses in previous years. The projected solutions for the period 1985/86-1989/90 include the cumulative dynamic impacts of all previous SMP payments and the pastoral sectors' responses to those payments.

Table 3.2:   Commodity Prices Used in the Simulation Experiments

Year	Dairy		Wool		Lamb (b)		Mutton (b)		Prime Beef		Manuf. Beef	
	With	With Out(a)	With	With Out	With	With Out	With	With Out	With	With Out	With	With Out
1978/79	180.00	172.90	218.85		74.7		38.7		111.6		101.3	
1979/80	208.00		265.09		92.9				120.2		103.3	
1980/81	265.00		249.71		115.8				120.2		105.0	103.0
1981/82	333.48	·	312.08	261.34	145.0	128.5	50.0	43.0	143.0	131.0	125.0	102.6
1982/83	360.75		312.19	264.55	148.5	114.0	50.0	42.0	163.8		136.9	
1983/84	350.00		318.06	296.39	148.5	99.0	50.5	12.0	181.2		143.0	
1984/85	396.00		377.43		202.5	183.0	105.5	74.0	232.8		200.0	

(a) Only prices that are altered are shown in the 'without' columns.
(b) For lamb and mutton, 1984/85 values are quoted on an ex-scale basis and are not comparable to earlier years.

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SECTION 4

RESULTS

This section reports the results of the simulation experiment for selected variables. These results for each year are provided in Tables A.1-A.7 and Figures A.1-A.10. In the Tables, the differences between the 'with' and 'without' SMP simulations have been converted to percentage differences taking the 'with' SMP results as the base, and a reasonably wide cross-section of the endogenous variables have been included. In the Figures, both the 'with' and 'without' solution values have been graphed, with the solid lines representing the 'with' SMP case and the dotted lines the 'without' SMP case, and a more limited range of variables have been included.

The discussion of the results falls naturally into two sections - the impacts of the SMP Scheme during the years 1978/79-1984/85 when it was in operation, and the long term impacts following the Scheme's termination.

4.1   Effects of Removing SMPs During 1978/79-1984/85

Examination of the data in the Figures and the Tables indicates negligible impacts of the SMP Scheme during its first three years of operation (1978/79-1980/81), with the exception of dairying where a SMP payment was made in 1978/79 (Table 3.2).

If this payment had not been made, total dairy stock units, milkfat production and factory production of dairy products are all lower in that year (Table A.5), but by less than half of one percent. Additionally export volumes and export values (Table A.7) of dairy products are marginally reduced. Gross and net incomes of dairy-farms are around two percent lower (Table A.6, Figure A.5), and net capital investment on plant and machinery has declined as a consequence as this category is particularly responsive to current income levels. However gross investment on buildings is greater without SMPs. Further, some fairly large changes in the mix of dairy product stocks occurs as a result of their different availabilities. Cross-effects of the absence of dairy industry SMPs in 1978/79 are restricted to extra beef output and exports, but no effect is greater than half of one percent.

Thus the immediate impacts of removing SMP payments, as noted by Laing and Zwart (1983b, p. 13), "are confined largely to financial adjustments associated with the loss of income". This is due to the short run production inflexibility of livestock producers once current inventory decisions are made. The financial adjustments do however result in subsequent adjustments in production levels and enterprise choices over a number of years. Since the initial dairy SMP payment was quite small however (about four percent of the market price), and was only maintained for one year, the subsequent production adjustments are minor and short-lived.

If the 1978/79 dairy SMP payment had not been made, in the following two years there are further reductions in dairy stock units, though the impact on dairy heifers is delayed two years, and further falls in output of milkfat and dairy products. Skim milk powder output

in particular falls over one percent annually, and the impact on stocks is very variable. Export volumes and values are reduced, the latter increasingly so, and net income and most net investments are lower. The cross-effects on the beef industry in particular are now more numerous but still very small in magnitude.

During the second phase of the SMP Scheme (1981/82-1983/84), and the transitional arrangements negotiated for sheepmeats during 1984/85, SMPs represented a substantial component of farm-gate returns for the sheep and cattle industries. If those payments had not been made, gross incomes from sheep and wool are reduced considerably, and with downward adjustments in current farm expenditure, net income of sheep and beef farms falls by over 20 percent in one season (Table A.2). Also reduced are most components of gross and net capital investment, and total liabilities (Table A.2, Figures A.3, A.4). Of some concern is the result that gross investment in land development is reduced (Figure A.4), but net investment expands (Table A.2). This is important as investment in land development is a major factor in the carrying capacity of pastoral farms.

Total sheep stock units are down almost six percent as is wool output. Mutton and lamb production are increased during the flock liquidation phase, but are reduced by the end of the period (Table A.1, Figures A.1, A.2). Conversely, total beef stock units are ten percent higher without SMPs, beef output is greater and beef income tends to be higher (Table A.1, A.2). Lamb and wool stocks are substantially lower, while beef and mutton stocks are higher (Figure A.7), and this pattern is generally reflected in export volumes except for lamb. In terms of cross effects, dairy income tends to be lower without SMP payments for beef and sheep farms, and since milkfat payments do not change, the effect must be caused by the lower prices received for surplus cows and calves.

In terms of export values without SMPs, meat is higher, wool is lower and dairy products are unchanged, over this period, so that in aggregate the export value of all pastoral sector products is predominantly higher.

Two observations on this seemingly counter-intuitive result are worthy of mention. First, although the information in the Tables and Figures indicates the changes in the relevant variables due to the removal of the SMP payments, we need to know whether those changes are statistically significant. In Tables 4.1 and 4.2, the mean values for selected variables are reported for the period 1978/79-1984/85, and are tested for significant differences according to the following test:

For the hypotheses $H_0 : \mu_1 = \mu_2$ and $H_1 : \mu_1 \neq \mu_2$, the test statistic is:

$$t^* = (X_1 - X_2) / \sqrt{(\sigma_1^2 / n_1) + (\sigma_2^2 / n_2)}$$

Compare the calculated t^* with the relevant t value for the various n. If $t^* > t$, reject H_0 of no significant difference in the means. For n=5, t=2.57; for n=8, t=2.31; and for n=13, t=2.16 on a two-tailed test at the five percent level.

Table 4.1: Mean Values for Selected Sheep and Beef Farm Sector Variables

Variable	Period					
	1978 - 1985		1986 - 1990		1978 - 1990	
	With	Without	With	Without	With	Without
Sheep numbers (m)	66.987	65.990	65.734	63.340	66.505	64.971
Beef cattle numbers (m)	4.574	4.659	5.144	5.762*	4.793	5.083
Lamb production (kt)	412.8	412.6	408.4	375.2*	411.1	398.2
Mutton production (kt)	186.2	186.9	185.7	167.9	186.0	179.6
Beef production (kt)	466.4	475.9	449.2	502.3*	459.8	486.1
Wool production (kt)	361.0	359.1	354.7	337.7*	358.6	350.9
Beef exports (kt)	199.2	205.3	192.3	223.3*	196.5	212.2
Lamb exports (kt)	362.9	368.6	345.1	314.0*	356.1	347.6
Mutton exports (kt)	93.9	94.4	71.2	62.3	85.1	82.1
Wool exports (kt)	346.2	344.4	379.8	360.0*	359.1	350.4
Value meat export ($M)	1289.9	1321.1	1788.4	1830.1*	1481.6	1516.9
Value wool export ($M)	974.3	967.3	1489.3	1411.5*	1172.4	1138.1
Gross income ($000)	44.3	42.7	43.8	42.7	44.1	42.7
Net income ($000)	14.3	13.3	11.9	11.4	13.4	12.5
Net invest land ($)	-6.3	-8.3	-9.4	-14.2	-7.5	-10.6
Net invest PMV ($)	15.1	12.7	17.4	19.7	16.0	15.4
Beef stocks (kt)	78.6	80.5	80.7	91.1*	79.4	84.6
Mutton stocks (kt)	52.8	53.4	49.3	38.6	51.5	47.7
Lamb stocks (kt)	131.7	114.6	139.0	106.5*	134.5	111.5*
Wool stocks (kt)	41.2	40.8	40.7	37.0*	41.0	39.3

*   Means significantly different at the five percent level.

Critical t values are 2.57 (n=5), 2.31 (n=8), 2.16 (n=13)

Monetary variables in 1977 $.

Table 4.2: Mean Values for Selected Dairy Farm Sector Variables

Variable	Period					
	1978 - 1985		1986 - 1990		1978 - 1990	
	With	Without	With	Without	With	Without
Dairy cattle numbers (m)	2.964	2.995	3.067	3.069	3.004	3.023
Butter production (kt)	260.7	260.5	289.6	286.1	271.8	270.4
Cheese production (kt)	114.4	114.4	121.9	120.3	117.3	116.6
WMP production (kt)	94.8	94.8	140.4	139.8	112.4	112.1
SMP production (kt)	227.0	226.2	214.5	201.8	222.2	216.8
Casein production (kt)	56.2	56.2	67.9	67.1	60.7	60.4
Butter exports (kt)	212.0	211.9	241.6	238.2	223.4	222.0
Cheese exports (kt)	86.2	86.1	89.8	88.2	87.6	86.9
WMP exports (kt)	88.9	88.9	134.0	133.5	106.2	106.0
SMP exports (kt)	242.8	242.0	239.0	227.3	241.4	236.4
Casein exports (kt)	52.9	52.8	63.3	62.6	56.9	56.6
Value dairy exports ($M)	1165.9	1165.2	1841.4	1806.4	1425.7	1411.8
Gross income ($000)	31.1	30.9	38.7	38.7	34.0	33.9
Net income ($000)	11.4	11.2	10.8	10.8	11.2	11.1
Net invest land ($)	-11.6	-11.4	-12.7	-12.5	-12.0	-11.8
Net invest PMV ($)	7.1	6.8	7.6	7.9	7.3	7.2
C. Butter stocks (kt)	4.0	3.9	4.0	3.8	4.0	3.9
C. Cheese stocks (kt)	4.0	4.0	2.5	2.4	3.4	3.4
C. WMP stocks (kt)	-0.9	-0.9	-2.9	-2.9	-1.7	-1.7
C. SMP stocks (kt)	-19.7	-19.7	-26.1	-27.0	-22.2	-22.5
C. Casein stocks (kt)	3.4	3.4	4.6	4.5	3.8	3.8
Value all pastoral exports ($M)	3430.2	3453.6	5119.1	5048.0	4079.8	4066.8

Monetary variables in 1977 $.

The data in the first two columns of both Tables 4.1 and 4.2 indicate that over the period when the SMP scheme was in operation, there are no significant differences in the mean values of those selected pastoral sector variables between the situations where SMP payments were made or were not made. So although the simulated removal of the SMP payments would have resulted in year-to-year adjustments in farm incomes, financial decisions, livestock numbers, output, and export volumes and values etc, some particularly large in individual seasons, over the whole period of the SMP scheme none of these adjustments were at a statistically significant level.

The second observation is that the result does not allow for some of the longer term dynamic adjustments that the pastoral sector would make to the relatively large SMP payments of 1983/84 and 1984/85 especially, and it is to those longer term impacts that we now turn.

4.2 Long Run Effects of Removing SMPs

Examining the simulation results for the period after the SMP Scheme was in operation provides a perspective on the long run impacts of pricing policies brought about by the dynamics of investment and supply response in the pastoral livestock sector. Laing and Zwart (1983a, p.103) suggest that it took a period of ten years before all adjustments were made to a one year shock in an exogenous variable, so perhaps some of these long-run impacts may be under-estimated by examining only five years after the last SMP payment.

If the SMP Scheme had not been implemented, the information in the Tables and Figures suggest that there would have been only minor changes in dairy industry output and receipts during 1985/86-1989/90, and these changes would have been due mainly to cross-elasticity effects with the beef industry. Milkfat production and factory output are lower without SMPs (Table A.5), as are the volume and value of dairy product exports (Table A.7). Dairy farm net income fluctuates over the period, investment in land is curtailed but other categories of investment are higher (Table A.6). However all changes are relatively small, with maximum impacts of only - 1.6 percent in milkfat output, - 0.6 percent in net farm income and -2.3 percent in the export value of all dairy products. These small effects are confirmed in Table 4.2 where there are no significant differences in the means between the 'with' and 'without' SMP simulations over the period 1985/86-1989/90.

Much larger and more long lived impacts are seen in the sheep and beef industries during 1985/86-1989/90 if there had not been a SMP Scheme. Total sheep stock units are considerably lower, although the gap between the 'with' and 'without' solutions is declining rapidly, with most effect in the breeding ewe category. Consequently production of and gross income from wool and sheepmeats are reduced, and although again the gap between the solutions is declining, it is still quite substantial, for example for mutton, in 1989/90.

The opposite occurs in the beef industry - numbers of all categories of beef cattle, production of beef and gross income from beef are all substantially higher, in the absence of the SMP Scheme.

Total gross income of sheep and beef farms is heavily weighted by the sheep industry, so this variable falls and is then magnified in net farm income which is up to six percent lower. The results for net capital investments are somewhat confusing with switching of signs and large changes in values, and only investment in buildings and total liabilities show a consistent, negative long run effect from removing the SMP Scheme.

Stocks and export volumes of most sheep industry outputs are substantially lower in the 'without' SMP solution, while the opposite occurs for beef. Because of the higher value of beef compared to sheepmeats, export values of all pastoral sector meat products are up to four percent higher without SMPs. The export value of all pastoral sector output is lower without SMPs, but the difference in the two solutions is diminishing so that by 1989/90 there is a zero long run impact of the SMP Scheme.

Some of these observations are confirmed in Table 4.1. There, for the period 1985/86-1989/90, a significant difference in the mean values of the 'with' and 'without' solution is evident for beef and sheep industry output, export volume and value, and stocks, with the exception of mutton. Note however that none of the farm income nor investment variables show any significant differences between the two simulation solutions.

There are some problems with the variances used in the calculation of significant differences in these circumstances however, and a more appropriate procedure may be to use the prediction accuracy analyses as reviewed in Pesaran et al (1986) although the model would need to be re-estimated to accomplish this.

SECTION 5

CONCLUSIONS

The results of the analysis reported in this paper conform to and re-emphasise those from previous research. First, the immediate impact of not paying SMPs would have been financial adjustments associated with the loss of income. This is due primarily to the short run production inflexibility of livestock producers once current inventory decisions are made.

Second, the initial financial adjustments result in subsequent adjustments in enterprise choices and output levels over a number of years. The dynamic nature of investment and supply response in livestock industries means that responses to changed economic circumstances are spread over many years. Further, the pattern of these dynamic responses is different for different enterprises, eg sheep and cattle. Also, the investment and supply response decisions for any one enterprise are made in the light of information on the relative profitability of all enterprises competing for the same set of resources. Thus the levels of assistance provided across different industries and the timing of payments between different seasons have an important impact on the eventual mix of pastoral livestock sector enterprises. So the longer term impact of not paying SMPs, which heavily favoured the sheep industry, would have been a substantial reduction in sheep industry inventories and output, and a substantial increase in beef industry inventories and output. These impacts would have extended far beyond the year in which the SMP Scheme actually terminated.

Third, over the entire period when the SMP Scheme was operative plus a further five years to enable some of the long run dynamic adjustments to evolve, there is some considerable doubt as to whether the SMP Scheme was effective in achieving its stated objectives. As the last two columns of Tables 4.1 and 4.2 show, for none of the major economic variables related to the pastoral livestock sector (except lamb stocks) are the mean values significantly different in the 'with' and 'without' simulations. In the dairy farm sector, gross income per farm would have been only $100 lower per annum without the SMP Scheme; the total value of all dairy product exports would have been $13.9m (less than one percent) lower per annum; and the number of dairy cattle would have been 19,000 higher per annum. In the sheep and beef farm sector, gross income per farm would have been $1400 lower per annum without the SMP Scheme; and the value of wool exports would have been $34.3m (three percent) lower, although the value of meat exports would have been $35.3m (over two percent) higher, per annum. Additionally, there would have been some changes in the enterprise mix away from sheep (lamb output and exports reduced by almost three percent annually on average) and toward beef (beef output and exports increased by some eight percent). The total value of all pastoral sector exports would have been $13.0m (a third of one percent) lower per annum if there had not been a SMP Scheme. Thus it is by no means certain that the SMP Scheme could be classified as successful in "stimulating agricultural production and exports and raising foreign exchange earnings".

Instead of looking at the individual season impacts or the annual average effects, an alternative is to examine the aggregate income and export revenue effects of the policy and compare these to the costs incurred. Table 5.1 shows the aggregate values of these variables over the two sub periods and the whole period, for both 'with' and 'without' simulation solutions. The total value of all pastoral sector exports would have been some $168m lower in aggregate if there had not been a SMP Scheme. Of this total, dairy product exports would have been $182m lower, wool exports $445m lower, and meat exports $459m higher. Thus again there is evidence of the off setting impacts across industries and within industries. This $168m boost to foreign exchange earnings due to the SMP Scheme can be compared to the $1192.4m expenditure required to achieve it - a return of approximately $0.14 in export revenue for every $1 invested in the Scheme. During the period when the Scheme was implemented, the total value of all pastoral sector exports would have been $187m higher if there had not been SMP's. Thus the contribution of the Scheme to export earnings occurred after the Scheme was terminated.

In terms of farm income, gross sheep and beef farm income would have totalled $18,400 less if there had not been a SMP Scheme, and gross dairy farm income would have totalled only $1,800 less.

Table 5.1: Aggregate Values for Selected Variables (1977$)

Variable	Period					
	1978-1985		1986-1990		1978-1990	
	With	Without	With	Without	With	Without
Value meat exports ($M)	10319	10569	8942	9150	19261	19720
Value wool exports ($M)	7795	7738	7446	7057	15241	14796
Value dairy exports ($M)	9327	9321	9207	9032	18535	18353
Value all pastoral exports ($M)	27442	27629	25595	25240	53037	52869
Gross sheep and beef income ($000)	354.6	341.6	219.0	213.6	573.6	555.2
Net sheep and beef income ($000)	114.7	106.1	59.6	57.0	174.3	163.1
Gross dairy income ($000)	248.6	247.3	193.6	193.3	442.3	440.5
Net dairy income ($000)	91.1	89.8	54.0	53.9	145.1	143.7

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A P P E N D I X

Variable and Units	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Livestock Numbers	(000 hd, or 000 s.u.)												
Breeding Ewes	0.0	0.0	0.2	0.3	0.1	-0.9	-3.1	-5.2	-5.8	-5.6	-4.8	-3.5	-2.0
Ewe Hoggets	0.0	0.5	0.6	0.5	-2.2	-5.2	-6.8	-6.3	-4.9	-3.0	-1.0	0.8	2.3
Total Sheep	0.0	0.1	0.3	0.4	-0.3	-1.7	-4.5	-5.9	-5.8	-5.1	-3.9	-2.5	-1.0
Total Sheep Stock Units	0.0	0.1	0.2	0.4	-0.2	-1.6	-4.3	-5.8	-5.8	-5.2	-4.1	-2.7	-1.1
Beef Breeding Cows	0.0	0.0	0.0	0.0	0.4	1.2	4.5	9.5	11.8	11.4	11.7	11.6	11.1
Beef Heifers	0.0	0.0	0.0	0.0	0.0	0.3	4.8	10.6	10.5	11.9	13.1	13.2	13.1
Total Beef Cattle	0.0	0.0	0.2	0.2	0.3	0.4	4.3	9.7	11.1	11.7	12.2	12.4	12.4
Total Beef Stock Units	0.0	0.0	0.2	0.2	0.3	0.4	4.3	9.8	11.2	11.7	12.2	12.4	12.4
Total Sheep and Beef s.u.	0.0	0.1	0.2	0.3	-0.1	-1.1	-2.1	-1.7	-1.0	-0.3	0.8	1.9	3.0
Farm Production	(000 tonnes)												
Wool	0.0	0.0	0.1	0.2	0.3	-0.3	-0.5	-3.9	-5.6	-5.8	-5.3	-4.3	-2.9
Mutton	0.0	0.0	-0.5	-0.2	0.7	2.5	2.5	-2.1	-6.9	-9.3	-10.7	-11.3	-10.3
Lamb	0.0	0.0	0.0	0.3	-0.5	1.1	2.3	-3.4	-7.5	-9.1	-9.4	-8.3	-6.4
Beef	0.0	0.5	-0.8	0.1	1.4	9.1	8.1	-0.6	9.9	11.9	12.0	12.3	12.7

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Table A.2

Sheep and Beef Farm Sector

Variable and Units	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Income and Expenditure per Sheep and Beef Farm (1977$)													
Gross Sheep Income	0.0	0.0	-0.1	0.1	-5.7	-7.3	-19.2	-13.9	-3.7	-4.5	-4.7	-4.4	-3.7
Gross Wool Income	0.0	0.0	0.1	0.3	-13.9	-13.5	-6.3	-4.4	-6.4	-6.7	-6.1	-4.9	-3.3
Gross Beef Income	0.0	0.2	-0.3	0.1	-6.5	4.8	3.7	-0.3	4.1	5.0	5.1	5.4	5.7
Total Gross Income	0.0	0.0	0.0	0.1	-8.7	-6.9	-8.2	-6.2	-2.9	-3.0	-2.8	-2.2	-1.3
Fertiliser	0.0	0.1	0.1	0.2	-5.8	-4.1	-5.1	-2.7	-0.7	-0.9	-0.6	-0.1	0.4
Repairs and Maintenance	0.0	0.1	0.0	0.1	-7.4	-8.7	-9.5	-7.8	-5.4	-5.2	-5.6	-5.6	-5.1
Interest	0.0	0.0	0.0	0.0	0.0	0.3	-1.9	-0.7	-0.1	-0.2	-0.6	-2.0	-3.0
Other Expenditure	0.0	0.0	0.0	0.1	-2.6	-3.2	-3.9	-3.9	-2.5	-1.9	-1.6	-1.1	-0.3
Total Cash Expenditure	0.0	0.0	0.0	0.1	-3.0	-3.3	-4.3	-3.6	-2.1	-1.8	-1.8	-1.7	-1.4
Net Farm Income	0.0	0.1	-0.1	0.2	-23.2	-16.0	-17.8	-12.4	-5.3	-6.1	-5.5	-3.6	-1.3
Drawings	0.0	0.0	0.0	0.0	-3.8	-6.9	-7.4	-7.3	-7.0	-5.9	-5.6	-4.8	-3.6
Net Capital Investment													
Off-farm Investment	0.0	0.0	0.0	0.0	-1.9	-1.0	-0.8	-1.7	-1.0	0.2	2.4	6.2	8.9
Buildings	0.0	0.0	0.0	0.1	-4.9	-13.0	-30.3	-35.1	-14.3	-15.7	-11.8	-8.1	-5.2
Plant, Machinery and Vehicle	0.0	0.1	0.0	-0.1	-43.7	-176.2	-25.5	-8.0	10.8	******	22.0	4.7	6.1
Land Development	0.0	0.1	-0.2	0.1	44.1	577.3	36.7	13.5	18.4	39.9	-209.2	-128.8	29.7
Total Liabilities	0.0	0.0	0.0	0.0	0.3	-1.9	-0.7	-0.1	-0.2	-0.6	-2.0	-3.0	-3.4

Variable and Units	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Domestic Consumption (000 tonnes)													
Beef	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mutton	0.0	0.0	0.0	-0.1	0.0	0.1	0.4	0.5	-0.1	-1.0	-1.5	-1.8	-2.0
Lamb	0.0	0.0	0.0	0.2	-0.3	0.8	1.9	-3.5	-7.7	-9.4	-9.7	-8.6	-6.6
Wool	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stocks (000 tonnes)													
Beef	0.0	0.5	-0.6	0.0	1.5	10.3	10.5	1.1	9.5	13.0	13.7	14.0	14.4
Mutton	0.0	0.0	-0.8	-0.6	0.9	4.2	5.0	-1.1	-10.5	-19.3	-26.3	-30.7	-28.0
Lamb	0.0	0.0	0.0	0.2	-10.3	-18.5	-26.1	-27.7	-25.1	-24.4	-23.9	-22.7	-20.3
Wool	0.0	0.0	0.2	0.4	0.5	-0.3	-0.8	-6.0	-9.9	-11.2	-10.5	-8.6	-5.8
Export Volume (000 tonnes)													
Beef	0.0	0.6	-0.9	0.1	1.8	11.8	12.7	1.1	12.2	16.3	16.9	17.1	17.5
Mutton	0.0	0.0	-0.4	-0.4	0.5	2.4	3.2	-0.8	-6.1	-10.8	-14.6	-16.7	-16.2
Lamb	0.0	0.0	0.0	0.2	3.2	5.0	6.9	-3.4	-9.1	-9.8	-9.9	-8.9	-7.3
Wool	0.0	0.0	0.1	0.2	0.3	-0.2	-0.5	-3.4	-5.6	-6.3	-5.9	-4.9	-3.4

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Table A.4
% DIFFERENCES
Sheep and Beef Farm Sector

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Variable and Units	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990

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Export Value   (1977 $ 000)

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Meat	0.0	0.3	-0.4	0.1	2.5	7.4	8.8	-1.3	0.0	1.7	2.3	3.2	4.4
Wool	0.0	0.0	0.1	0.2	0.3	-0.2	-0.5	-3.4	-5.6	-6.3	-5.9	-4.9	-3.4

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Table A.5

Dairy Farm Sector

Variable and Units	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Livestock Numbers	(000 hd or 000 s.u.)												
Dairy Cows	0.0	-0.4	-0.1	0.1	1.5	3.0	2.5	1.2	0.4	0.0	0.0	0.0	0.0
Dairy Heifers	0.0	0.4	0.6	-0.6	1.1	3.4	2.4	0.8	-0.4	-0.3	-0.1	0.2	0.2
Total Dairy Cattle	0.0	-0.2	0.0	0.0	1.4	3.1	2.5	1.1	0.3	0.0	0.0	0.0	0.1
Total Dairy Stock Units	0.0	-0.3	-0.1	0.0	1.4	3.1	2.5	1.1	0.3	0.0	0.0	0.0	0.1
Farm Production	(000 tonnes milkfat)												
Milkfat	0.0	-0.2	-0.4	-0.3	-0.1	0.3	0.6	-0.4	-1.4	-1.6	-1.3	-1.0	-0.7
Factory Production	(tonnes p.w.)												
Butter	0.0	-0.2	-0.4	-0.3	-0.1	0.3	0.6	-0.5	-1.4	-1.6	-1.4	-1.0	-0.8
Cheese	0.0	-0.3	-0.4	-0.3	-0.1	0.3	0.6	-0.5	-1.5	-1.7	-1.5	-1.1	-0.9
Whole-milk Powder	0.0	-0.1	-0.2	-0.1	0.0	0.2	0.3	-0.1	-0.5	-0.6	-0.4	-0.2	-0.1
Skim-milk Powder	0.0	-0.4	-1.1	-1.2	-1.0	-0.1	1.2	-0.3	-3.5	-6.0	-7.3	-6.7	-5.8
Butter-milk Powder	0.0	-0.4	-0.6	-0.4	-0.2	0.5	0.9	-0.7	-2.2	-2.4	-2.0	-1.5	-1.1
Casein	0.0	-0.1	-0.2	-0.3	-0.2	0.0	0.3	0.0	-0.6	-1.2	-1.4	-1.3	-1.1

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Table A.6
% DIFFERENCES
Dairy Farm Sector

Variable and Units	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Income and Expenditure per Dairy Farm (1977s)													
Gross Income	0.0	-1.5	-1.0	-0.4	-2.1	0.3	0.4	-0.1	-0.3	-0.3	-0.2	-0.1	0.0
Fertiliser	0.0	-0.8	-0.9	-0.5	-1.8	-0.3	0.4	0.1	-0.2	-0.3	-0.3	-0.1	0.0
Repairs and Maintenance	0.0	-1.7	-1.4	-0.4	-2.8	0.2	0.7	0.1	-0.4	-0.6	-0.6	-0.5	-0.4
Interest	0.0	0.0	0.1	0.1	0.1	0.3	0.2	0.2	0.1	0.0	-0.2	-0.3	-0.4
Total Cash Expenditure	0.0	-1.0	-0.7	-0.3	-1.0	0.9	0.9	0.3	-0.1	-0.3	-0.2	-0.2	-0.2
Net Farm Income	0.0	-2.0	-1.5	-0.5	-4.1	-0.9	-0.7	-0.7	-0.6	-0.5	-0.2	0.2	0.6
Net Capital Investment													
Off-farm Investment	0.0	1.1	-0.3	-0.2	-0.1	0.0	0.1	0.3	0.4	0.6	0.7	0.9	1.0
Buildings	0.0	5.4	-5.5	-0.5	-0.6	-1.8	0.5	1.8	0.3	0.4	0.6	0.8	1.0
Plant, Machinery and Vehicle	0.0	-13.1	-2.4	-0.6	-8.2	-3.3	3.7	1.5	1.1	1.7	4.0	7.4	21.9
Land Development	0.0	-2.3	7.4	-1.0	-4.8	1.4	-6.6	-4.4	-3.8	-2.1	-1.5	-0.8	-0.3
Domestic Consumption (tonnes p.w.)													
Butter	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cheese	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Milk-Powder	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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Table A.7

- % DIFFERENCES -

Dairy Farm Sector

| Variable and Units	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Change in Dairy Stocks (tonnes p.w.)													
Butter	0.0	-3.8	-2.2	-4.9	4.3	-62.2	2.7	-28.5	-150.9	-5.3	-30.5	4.1	17.9
Cheese	0.0	1.0	-1.1	16.5	0.6	88.9	11.9	-10.7	110.0	-2.6	13.5	2.5	6.5
Whole-milk Powder	0.0	2.2	-0.6	0.2	-58.5	-1.3	-3.0	-5.7	-8.7	2.5	-2.1	-3.5	-2.3
Skim-milk Powder	0.0	1.1	2.2	-1.5	1.2	-2.1	-4.6	2.9	6.9	6.4	2.5	0.5	-1.5
Butter-milk Powder	0.0	-10.9	-1.4	2.8	1.7	9.4	2.6	-16.9	-22.0	-2.3	7.2	2.6	4.4
Casein	0.0	-0.3	-0.6	0.8	0.4	-13.8	2.9	-2.2	-5.7	-4.6	-2.5	0.3	1.9
Export Volume (tonnes p.w.)													
Butter	0.0	-0.1	-0.4	-0.4	-0.2	0.1	0.5	0.2	-1.0	-1.8	-1.8	-1.5	-1.1
Cheese	0.0	-0.2	-0.5	-0.5	-0.2	0.2	0.7	-0.1	-1.5	-2.2	-2.1	-1.7	-1.3
Whole-milk Powder	0.0	-0.1	-0.2	-0.2	-0.1	0.1	0.2	0.1	-0.3	-0.6	-0.6	-0.3	-0.1
Skim-milk Powder	0.0	-0.2	-0.8	-1.2	-1.1	-0.3	0.7	0.2	-2.1	-4.6	-6.1	-6.1	-5.5
Butter-milk Powder	0.0	-0.1	-0.6	-0.7	-0.4	-0.1	0.6	0.7	-1.0	-2.5	-2.6	-2.2	-1.6
Casein	0.0	0.0	-0.2	-0.3	-0.3	-0.2	0.1	0.2	-0.2	-0.9	-1.3	-1.4	-1.3
Export Value (1977 $ 000)													
Dairy Products	0.0	-0.1	-0.4	-0.5	-0.4	0.0	0.5	0.2	-1.1	-2.0	-2.3	-2.2	-1.8
All Pastoral Products	0.0	0.1	-0.2	-0.1	0.8	2.7	3.2	-1.5	-2.1	-2.0	-1.8	-1.1	-0.1

Figure A.1:   LIVESTOCK NUMBERS
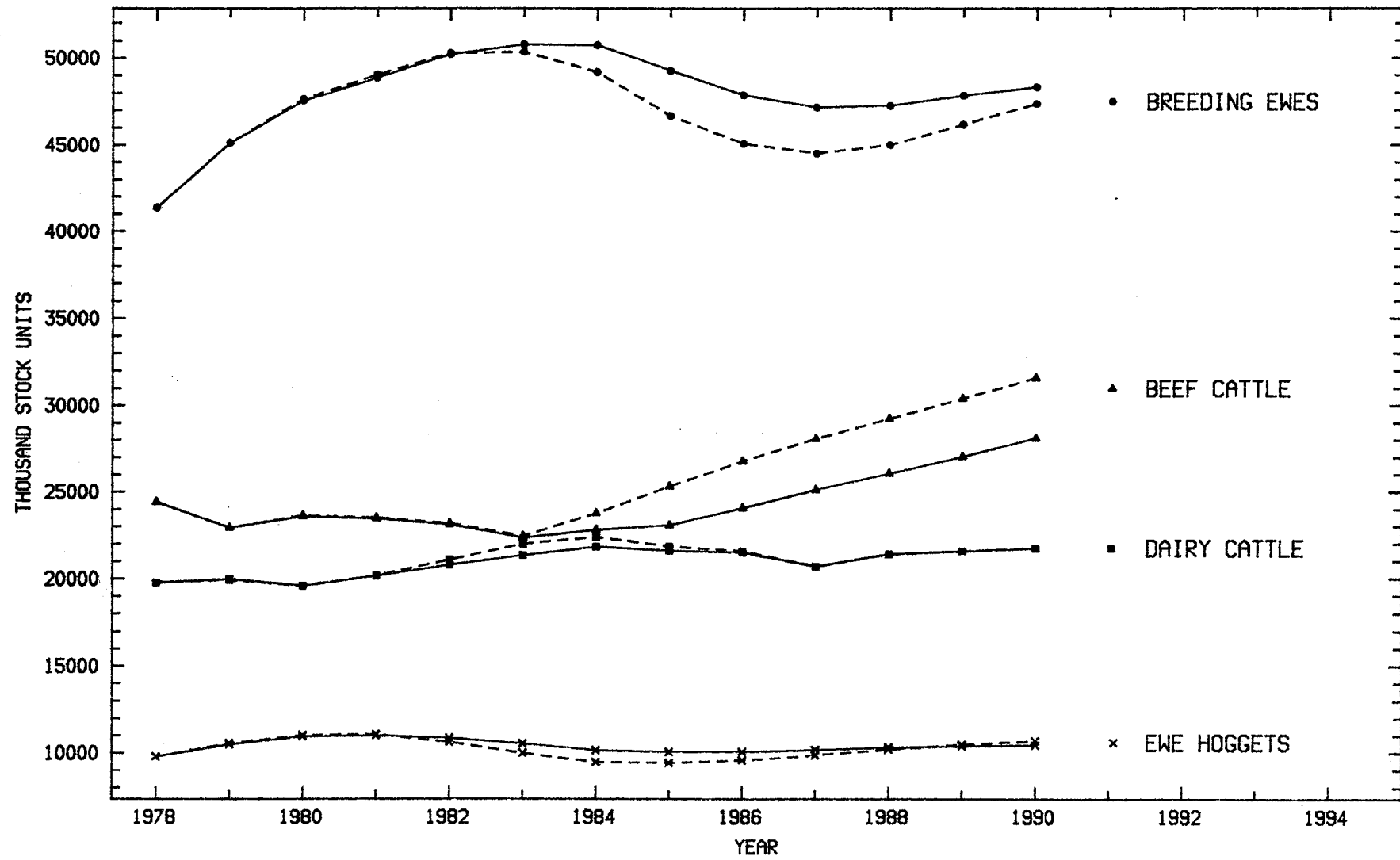
Figure A.2:   FARM PRODUCTION
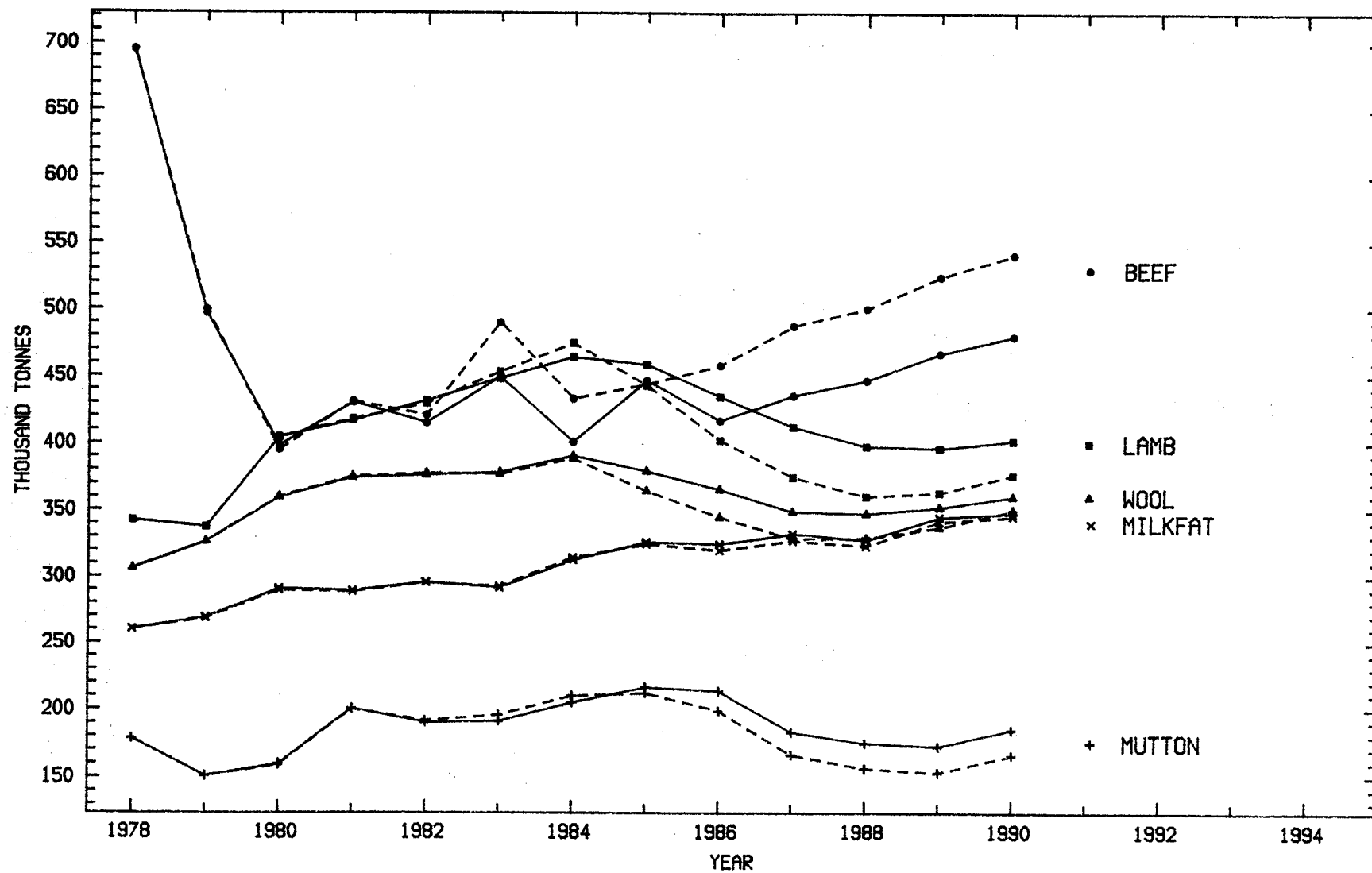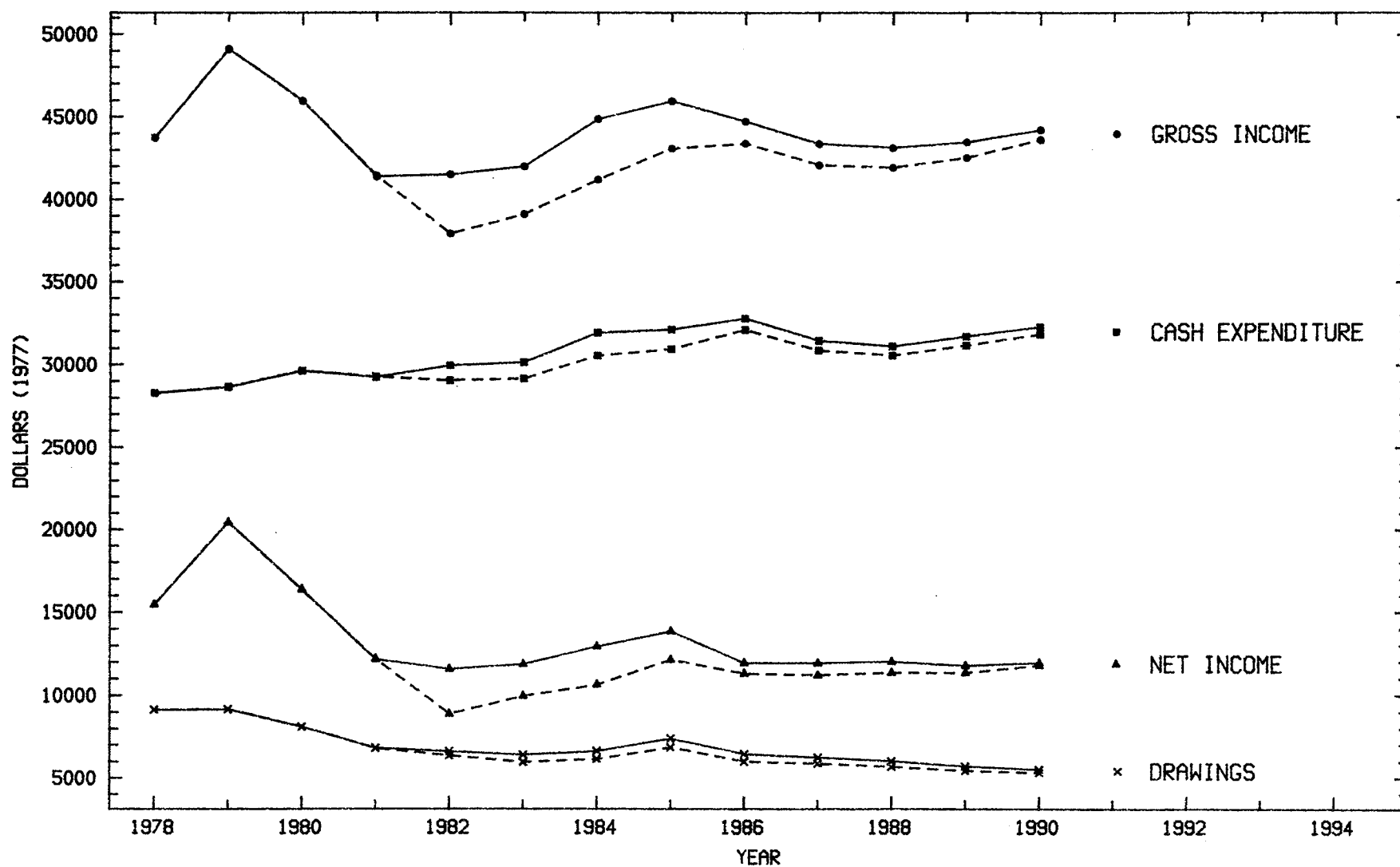
Figure A.3:   INCOME PER SHEEP AND BEEF FARM

Figure A.4:   GROSS CAPITAL INVESTMENT ON SHEEP AND BEEF FARMS

● PLANT & MACHINERY

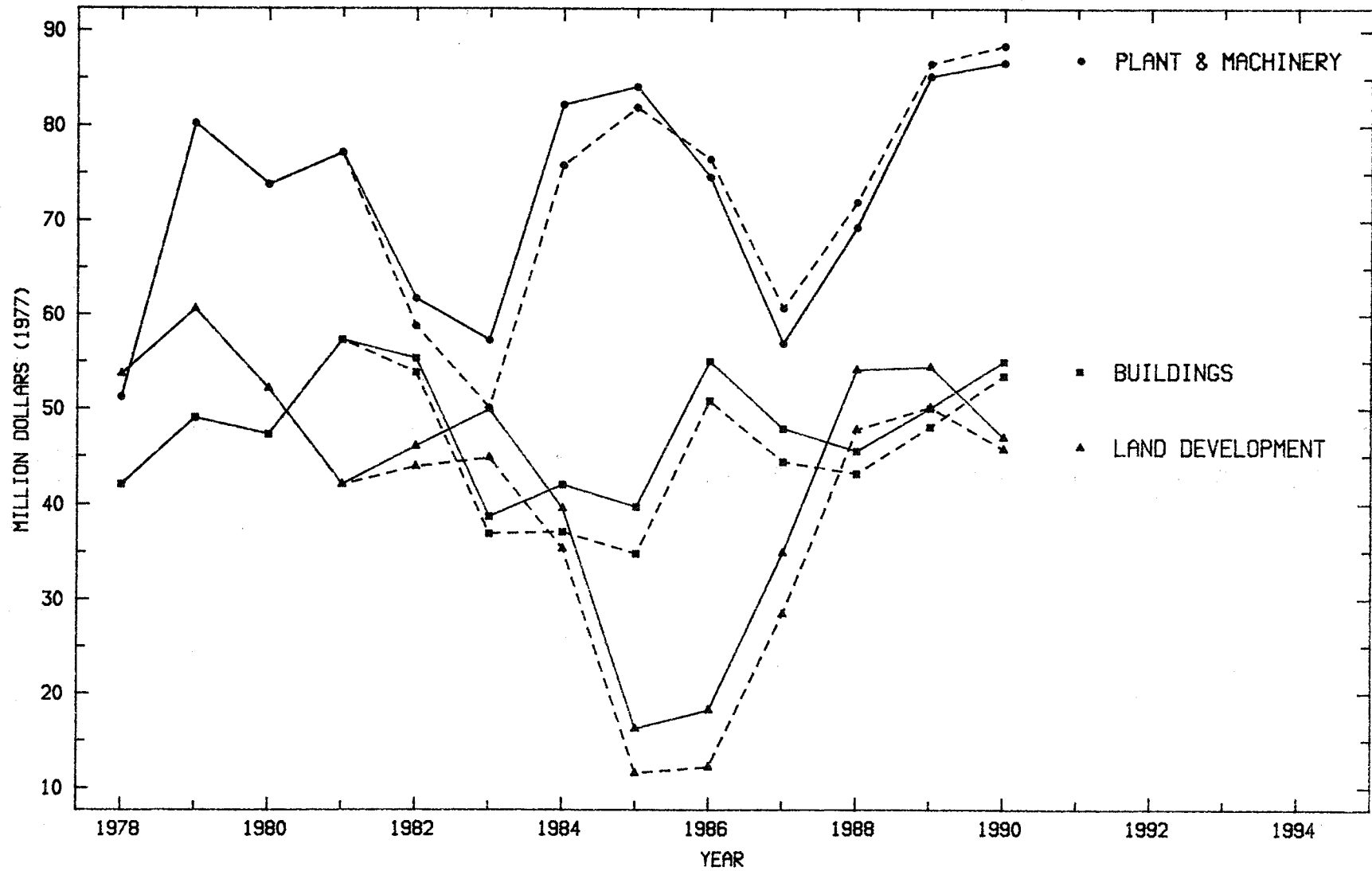■ BUILDINGS

▲ LAND DEVELOPMENT

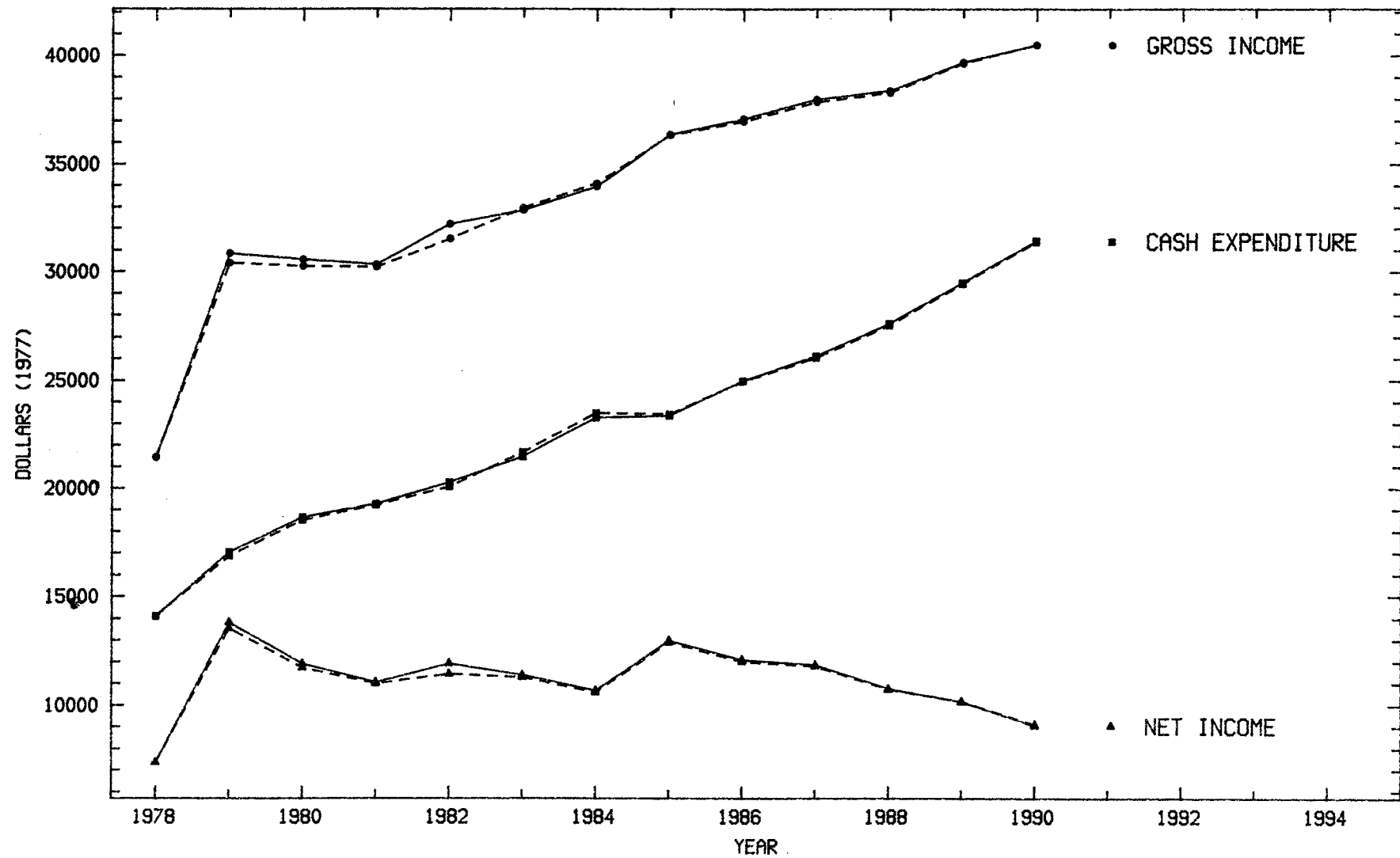Figure A.5: INCOME PER DAIRY FARM

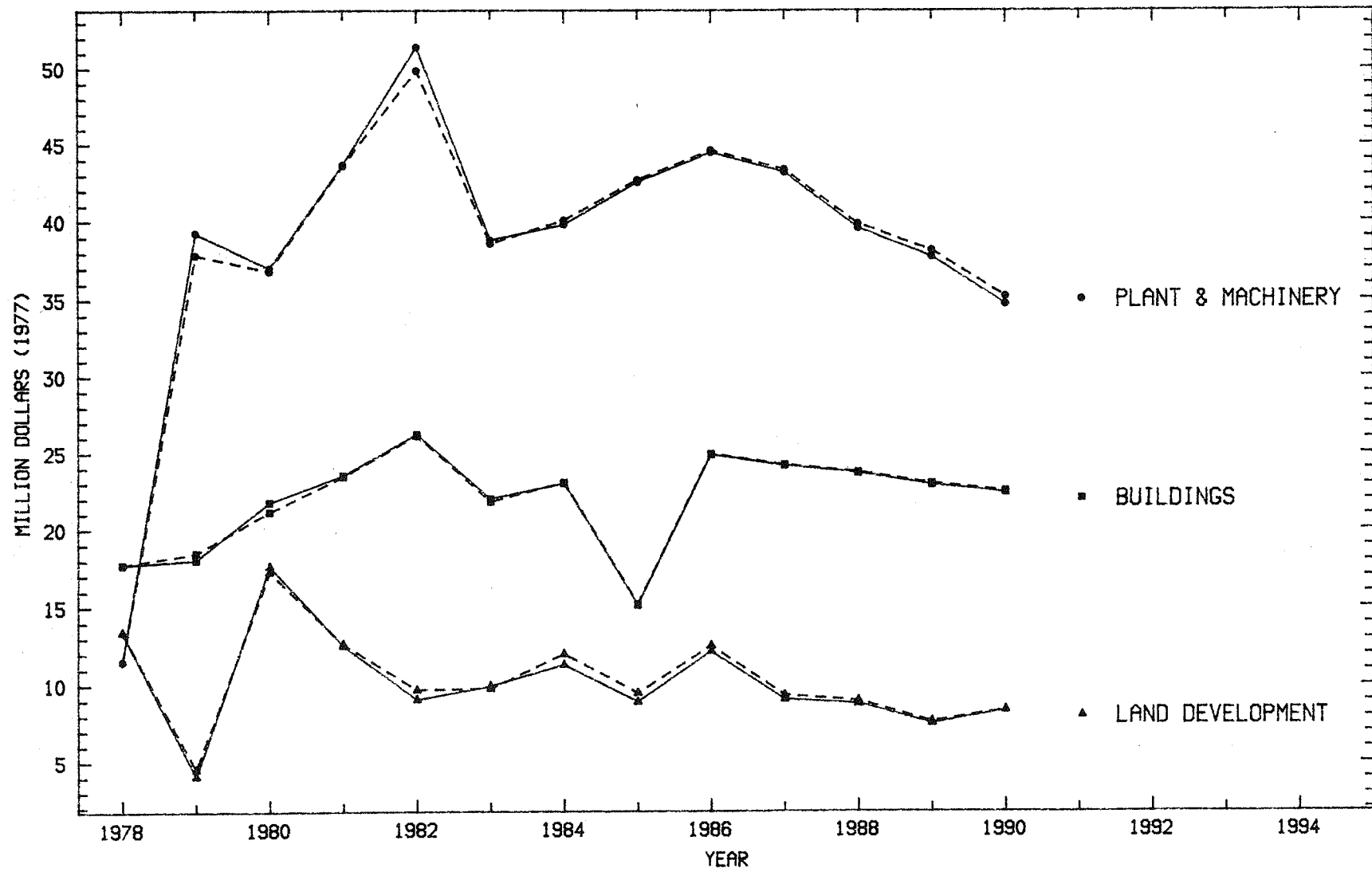Figure A.6:   GROSS CAPITAL INVESTMENT ON DAIRY FARMS
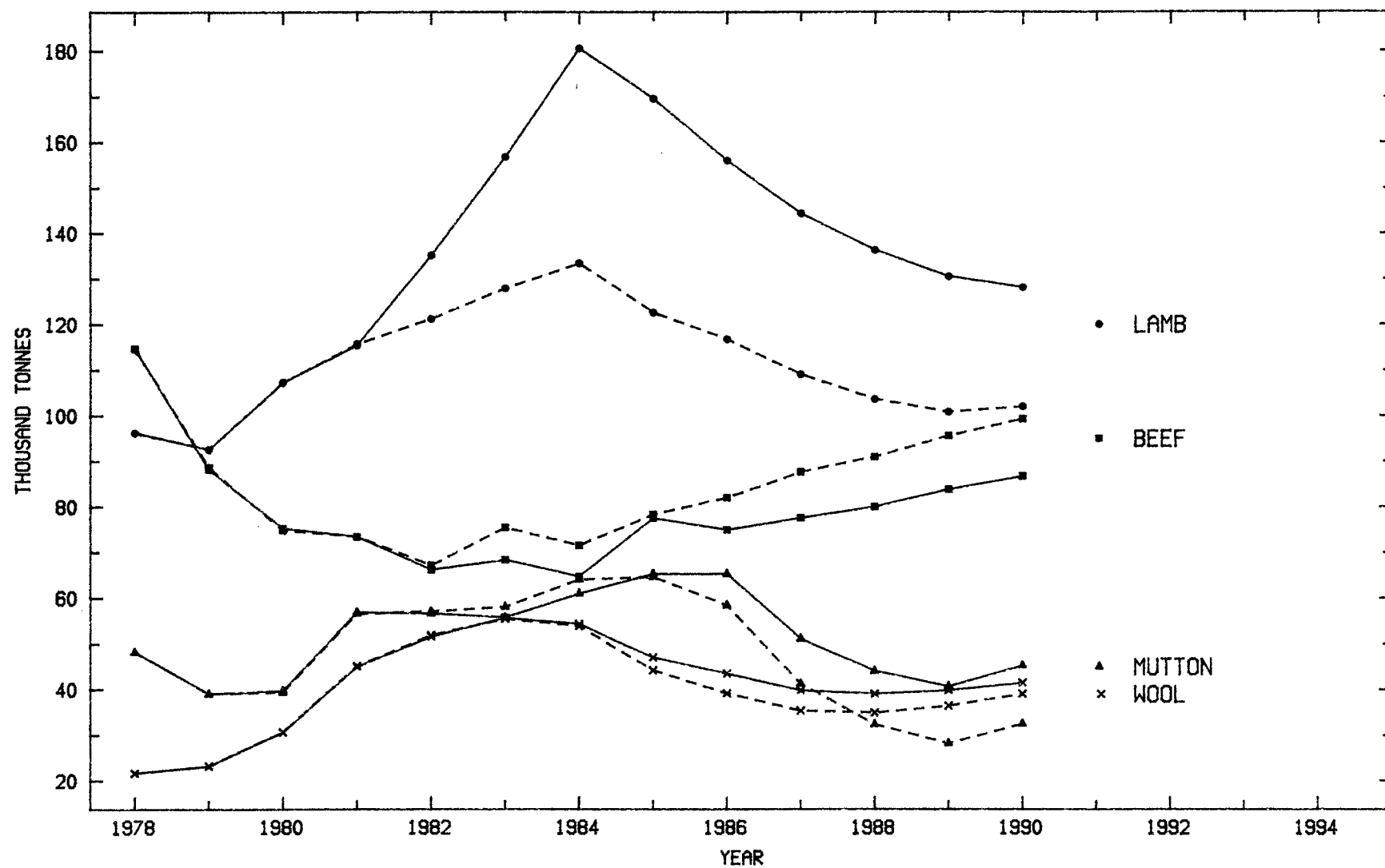
Figure A.7:   MEAT AND WOOL STOCKS
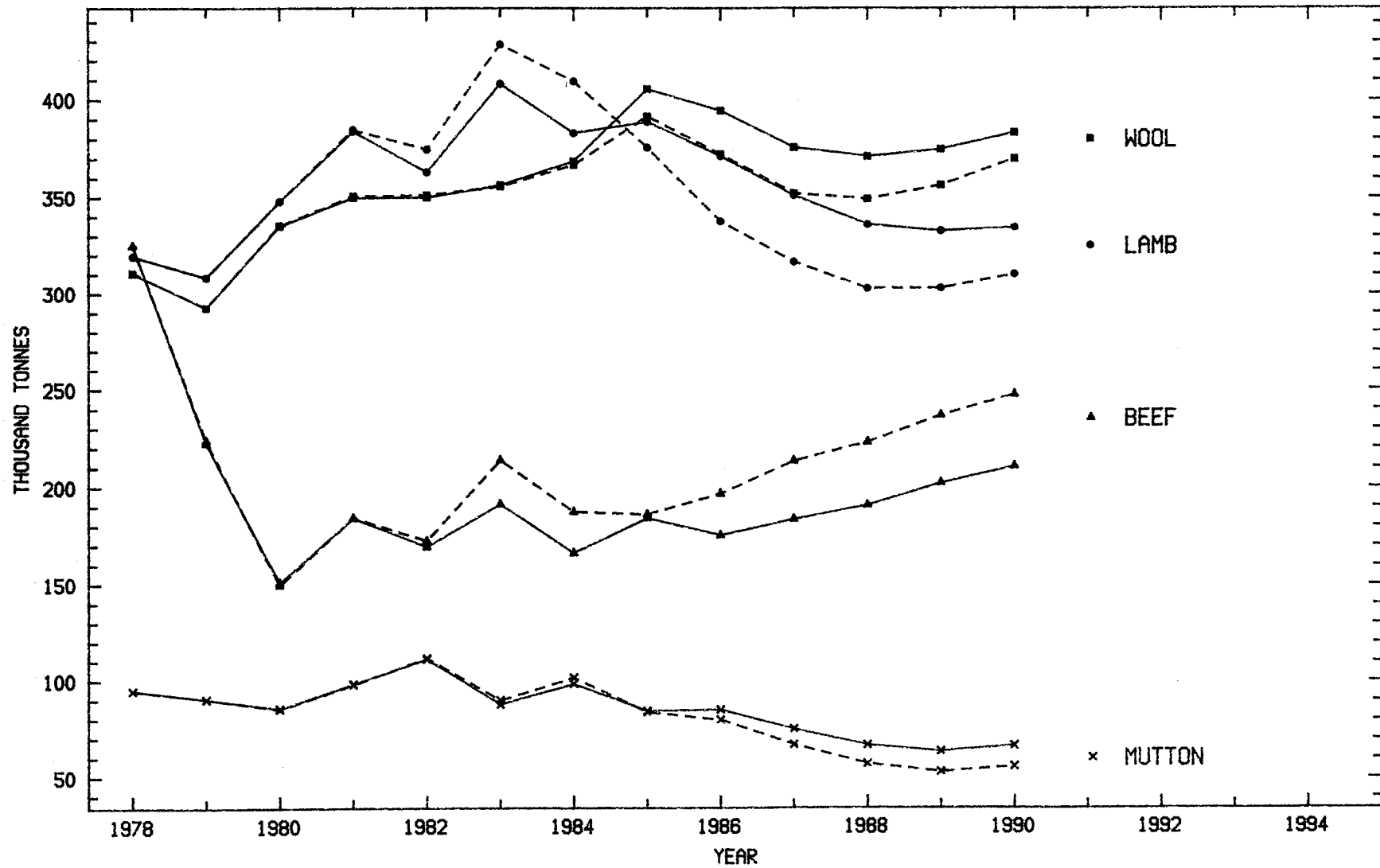
Figure A.8:   VOLUME OF MEAT AND WOOL EXPORTS
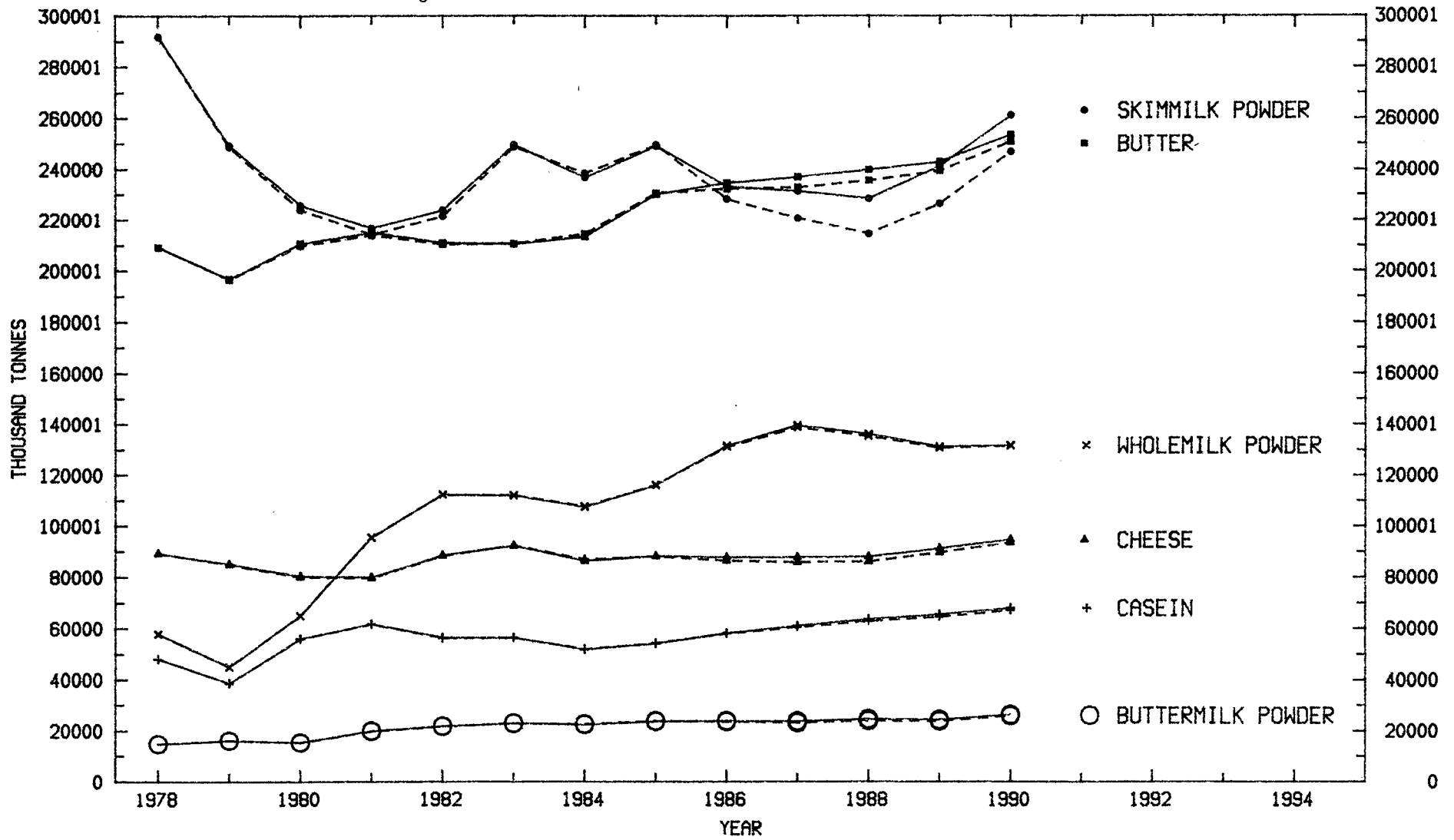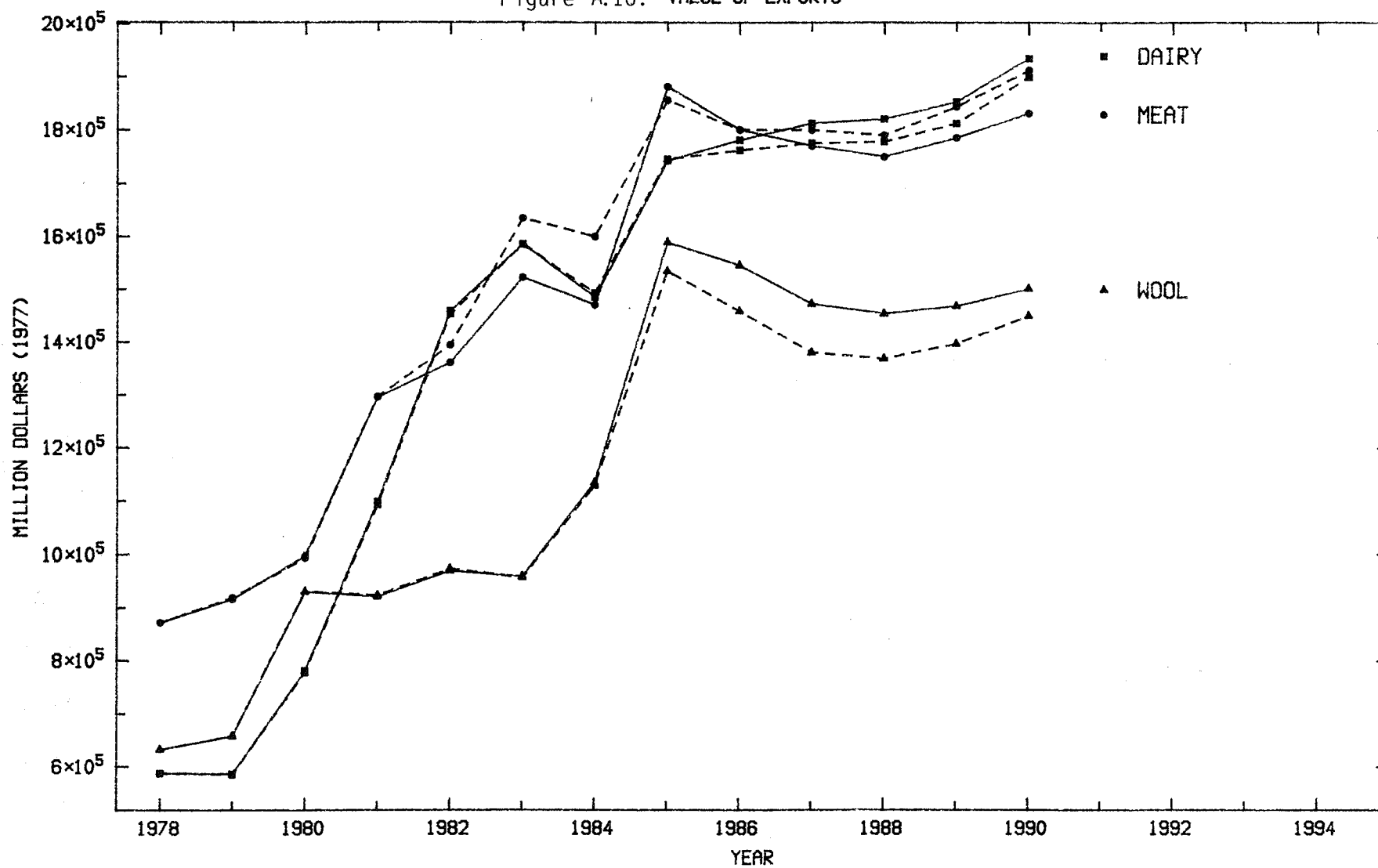
Figure A.9: VOLUME OF DAIRY PRODUCT EXPORTS

Figure A.10: VALUE OF EXPORTS

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