

PAPERS PRESENTED
AT THE
NEW ZEALAND BRANCH
AUSTRALIAN AGRICULTURAL ECONOMICS
SOCIETY CONFERENCE

Flock House, Bulls
(July 1989)

Volume I

Published on behalf of the
New Zealand Branch
Australian Agricultural Economics Society

by

Agribusiness and Economics Research Unit
Lincoln College
Canterbury

Discussion Paper No. 125

October 1989

ISSN 0113-4507

VOLUME I
TABLE OF CONTENTS

| | Page |
|--|------|
| Investing in Real Growth Murray Bolton | 1 |
| Meeting Peoples Needs Jock McKenzie | 11 |
| Change in the New Zealand Meat Processing Industry - A Union Perspective Roger Middlemass | 19 |
| The American Experience - Lesson for New Zealand Margaret Millard | 27 |
| Lessons to be Gained from Experiences with Farm Financial Stress in New Zealand and the USA Bill Dobson | 31 |
| Agricultural Policies in New Zealand and the US - Similarities, Differences and Lessons Ron A. Sandrey and Warren E. Johnston | 47 |
| Aspects of Farm Firm Growth in the Pongaroa Region A. Wright, J.R. Nicholls, D.I. Gray and P.A.G. Fraser | 59 |
| Adjustments to Dairy Farm Management Practices and Lifestyle Between 1985 and 1988 in Response to Changes in Government Policy and Milkfat Payouts in The Manawatu Region of New Zealand A.H. Hughes, H.D. Jose, W.J. Parker and F.M. Anderson | 65 |
| The Efficient Price of Energy Ralph Lattimore | 79 |
| Privatising Water: An Analysis of Initiatives to Sell Community Irrigation Schemes and to Create Water Markets Walter Moore and Murray Arthur-Worsop | 93 |
| The New Zealand Pastoral Sector Supply Responses: Preliminary Modelling Results S. SriRamaratnam and R.G. Reynolds | 111 |

VOLUME II
TABLE OF CONTENTS

| | Page |
|---|------|
| N.Z. in the Aftermath of GATT Larry Stenswick | 141 |
| New Zealand in the Post Mid-Term Review Stage of the GATT Uruguay Round D.J. Greenfield | 150 |
| A New Role for the Cairns Group John Pryde | 155 |
| Restructuring in the Kiwifruit Industry Philip Journeaux | 171 |
| Results of a Survey of Planning and Financial Management on Three Farm Types in New Zealand J.C. Lockhart | 185 |
| The Risk Environment of Farming R.W.M. Johnson | 195 |
| Agricultural Trade Liberalisation Initiatives Under GATT: Implications for New Zealand Doren Chadee | 205 |
| Measures of and Trends in Agricultural Competitiveness in New Zealand B.R. Robinson and R.G. Reynolds | 227 |

INVESTING IN REAL GROWTH

(Murray Bolton, Managing Director,
Rural Banking & Finance Corporation)

The Rural Bank is the leading financier to the New Zealand Primary Sector and as such our operations tend to mirror financial trends in the industry. Consequently, we are in probably the best position to gauge the environment in which our producers are operating.

We know that farming has gone through a difficult restructuring period and there are numbers still in severe difficulties who will not survive. This situation has tended to disguise the fact that the Primary Sector is still the engine room of the economy, earning two out of three of our overseas dollars.

With people like the Prime Minister saying that New Zealand cannot survive without the sector's valuable overseas earnings it is essential that we know the economic mechanisms which contribute to industry progress.

You, as agricultural economists are in the best positions to carry out this sort of analysis and come up with a prognosis about the "patient". The Bank, in turn, can draw on its experience and sector acumen to put into place financial products which can promote farmer's business success. By doing this we can all help resist adverse upheavals which drag the industry down.

Prudent, informed, financial management is a major control on farmer's sliding into difficulties and the more we understand about what is going on the better we will be able to help in this respect.

With this in mind the Bank recently undertook an analysis of data on farm trading and capital structures of sheep and dairy farmers before and after the 1984 restructuring of agriculture. This has allowed us to draw some interesting conclusions about how these sectors reacted to the change.

One significant factor was the change in productive value as measured by the capital turnover ratio between 1981 and

1987. This ratio measures gross income as a proportion of total capital employed and is shown below:

Performance Indicators
Dairying

| | 1981-82 | 1982-83 | 1985-86 |
|------------------------|---------|---------|---------|
| Capital Turnover | 13.7 | 16.1 | 18.6 |
| Debt: Total Assets | 18.8 | 20.7 | 28.65 |
| Debt Gross Income | 1.42 | 1.52 | 1.59 |
| Interest: Gross Income | 13.7 | 16.1 | 18.6 |

Performance Indicators
Sheep

| | 1981-82 | 1983-84 | 1986-87 |
|------------------------|---------|---------|---------|
| Capital Turnover | 11.5 | 12.2 | 19.5 |
| Debt: Total Assets | 16.6 | 19.6 | 27.5 |
| Debt Gross Income | 1.44 | 1.6 | 1.55 |
| Interest: Gross Income | 13.33 | 16.5 | 20.3 |

Dairying in 1981/82 had a ratio of 13.7% while in 1985/86 it was 18.6%. Sheep farming in 1981/82 was 11.5% and in 1986/87 19.5%. However, with renewed confidence in dairying, in particular, this trend has been arrested by farmers bidding up the price of farm and stock assets. Dairy land prices, for instance, have risen recently from around \$15 per kilogram of milk fat to around \$20 per kilogram.

In sheepfarming, while there have been only slight signs of income improvement, sheep farm prices are also showing a response.

As a banker I view with some concern the erosion of the productive value of the asset, particularly if lenders are tempted to lend against these asset values rather than the cash flow of the business. Farmers seems have a great propensity to trade away benefits from improving returns and

drive down the rate of return on assets to a level not accepted by other businesses.

Recent experience should tell them that there are serious consequences when this is done, especially when you consider the amount of debt required to service those assets. Up to 1985-86 we found debt relative to total assets increased, reflecting both declining asset value and a real increase in debt - but farmers are not reducing indebtedness and asset values are stabilising or improving.

From our business experience this year we know that 20 per cent of the Bank's total repayments have come from surplus cash rather than the sale of land. This suggests a strong desire to reduce debt before other spending.

From studying 1983-84 figures you find sheepfarmers' net term debt increased by \$142 million whereas in 1986-87 net farm debt increased by \$55 million. This trend is likely to continue. We know dairy debt reached a peak in 1984-85 and showed a subsequent decline but all indications are that it is now increasing again on the back of increased earnings and asset values. It appears that better times bring a willingness to spend across the board.

It is interesting to note, however, that even though there have been large fluctuations in asset values and farm profits, the average debt of both sheep and dairy farmers has maintained a relatively constant ratio of about 1.5 times gross income.

Interest payments have absorbed an increasingly proportion of farm income and is particularly a function of increasing interest rates and in the early years of this decade, increased indebtedness.

With that debt being cited as a major problem for farmers during the restructuring phase it is easy to lose sight of the fact that the average equity of sheep and dairy farmers is still more than 70 per cent of total assets. The debt problem is more particularly one of distribution of that farm debt. Both Rural Bank and other surveys show approximately 70 per cent of total farm debt is in the hands of 30 per cent of the farmers. For many of these farmers debt is an insurmountable problem.

One of the tests the Rural Bank applies in assessing future prospects of an over-indebted farmer is to determine the interest rate at which he could service his indebtedness. It is not common in many of the more difficult cases to find that the situation requires an interest rate of 5% or less to achieve viability.

Even with interest rates coming down we cannot foresee anything like 5 per cent. It therefore serves no purpose for either the Bank or the farmer to persevere and it is

these cases on which Bank is focussing to achieve a dignified and controlled exit from the industry.

An erroneous impression of a wholesale farm sell-up by the Bank has been given by those who have misinterpreted confidential bank business documents for their own ends. This has spawned a rash of emotive reactions; some of those published being:

- ** D Day is coming for farmers.
- ** There will be hundreds of foreclosures.
- ** 500 farmers are going to be kneecapped by the Bank which is lighting fires under them.
- ** Land values will crash as the market won't cope with the sales.
- ** The Bank is callous and has not taken enough care or attention in its selling up of farms.

Like any financial institution the Bank operates a policy of prudent management of its portfolio and will continue to do so. We have been functioning under the same policy regarding arrears for at least two or three years and the 500 figure quoted has also been around for a similar time.

Since March of last year our arrears management has meant dealing specifically with 280 severe arrears cases where the borrower has no prospects under any foreseeable income or interest rate scenario. These cases can be broken down into:

- 25 mortgagee sales;
- 46 voluntary sales assisted by our \$20,000 exit grant;
- 86 voluntary sales by clients and without the grant;
- 12 cases where the bank was a creditor but mortgagee sales were brought by other institutions;
- 28 cases where the client repaid the debt in full;
- 83 cases where contracts have been completed, or we are awaiting settlement or final accounting.

The degree of financial difficulty faced by the worst one percent of clients can be demonstrated by the fact they account for one-third of our dollars in arrears.

With the way we handle cases we definitely cannot be accused of taking precipitous action when you consider that 72 per cent of cases currently in hand have been under negotiation between the Bank and the borrower for three to six months - or more.

As prudent Bankers we are certainly working to improve our arrears situation but not in the calamitous D Day manner indicated by fearmongers who are only aggravating stress for some farmers. We expect the rate of exits, and also the circumspect way we handle them, to be maintained. And I'd like to see proof of any drop in land values because of our

action. We have had support from a number of quarters for what we are doing. The Christchurch Press, in an editorial reprinted by some North Island papers, said "a sound business does not send good money after bad. The Rural Bank like any other business must be expected to cry enough when its debtors fall months behind in mortgage repayments and there is scant chance of recovering the Bank's investment."

Hawke's Bay Federated Farmers' have said that the Rural Bank's action in handling insolvent clients makes a lot of sense and it has acted in a humane and professional way. Then we have Federated Farmers' National President Brian Chamberlin pointing out that it is no secret that a number of farmers have been in trouble for a long time and some people do not want to sell. In commenting on the Bank's exiting farmers, he said recently "the Rural Bank has a very real responsibility to deal with this in the fastest way possible."

So you can see that, far from realising the worst claims of some of our detractors, we have a programme which is recognised within the sector as being realistic but not untoward. Forget that 500 figure - future foreclosure numbers are hard to define.

A continually changing sector environment subject to many different influences, such as strong dairy prices or the East Coast drought, means we have a constantly changing farm debt picture and that the action we take will be related to reigning circumstances.

Whatever opinion you have formed of the Bank's position I can assure you our lending portfolio is very well collateralised with an estimated 67% of the portfolio secured by first mortgage over freehold or Government renewable lease land.

When the sector debt situation is taken into consideration many people conveniently over look the fact that there are many other financial institutions whose exposure is far more precarious than that of the Rural Bank.

Coming back to our analysis, we have found that farmers have significantly increased the proportion of their assets which are invested off-farm. In 1981-82, on-farm assets comprised 97% of the sheep farmer's total assets, but by 1987 this figure had dropped to 91%.

While farmers are now dealing with their farm management by running things as lean as possible they are also less willing to be tied into just one area of investment and are looking to spread their exposure.

The removal of tax deductibility for farm development has also had an effect and investment decisions are made free of the distortions of tax policy.

The Rural bank supports any strategy for farmers to create off-farm assets as it strengthens their resilience and their ability to cope with adversities such as droughts and market price fluctuations.

While interest absorbed a similar proportion of gross income on both dairy and sheep farms each sector adopted different strategies in dealing with the increasing interest bill. Dairy farmers maintained the proportion of gross income used to meet farm operating costs and tightened their own belts. Sheep farmers, on the other hand, reduced cash farm expenditure from 57% to 51% of gross income and diverted that income to meet interest.

In looking at the reorganisation of the Primary Sector and the reorganisation of the Rural Bank over the last 18 months I can see parallels. Both were in need of reorganisation - which was at some pain to both, too.

The sector had been cosseted by Government policies such as concessional lending while the Bank was still going along as a Government Corporation in spite of direction to change. Both have been subjected to influences from outside their control, forced to change and have readjusted.

Adjustment in the Primary Sector industry has impacted directly on the Bank. Where in the past we dictated the rural banking scene to some extent, we are now customer driven - as sector producers must be.

It is a commercial reality that our business is servicing customer needs. It seemed inappropriate to me when I joined the Bank that we had customers not knowing their rural banker and more importantly a rural banker not knowing his customers. Customers' needs reflect what has happened in the sector and where it is going and are now dictating how the Bank operated. Take farmers' financial management, for instance. As mentioned, they are looking at minimising interest rate charges, running lower cost operations and a minimum of maintenance. Tighter management practices are being implemented to ensure a reasonable living while servicing debt. This calls for carefully planned financial control.

The Bank, in turn, has to provide financial services which fit into this environment. It can now provide a variety of flexible financial packages which include interest only and residual value loans, a credit line facility including seasonal finance and variable repayment options.

In talking about getting messages out to the community I must say seasonal finance was a message directed at the Bank for sometime before it was heeded and made available. It is these messages from the sector that we have to - and will - heed. There has to be dialogue between the Bank and the sector if we are to be responsive to trends and concerns.

How well we all do in future in the new environment depends on our ability to recognise and respond to market forces.

Interest rates are a current concern. I can say the Rural Bank has done its bit, reducing our base rates from 18% in March 1988 to the current 15.75% (July, 1998).

When the Reserve Bank Governor says that in the last two years interest rates have dropped by 7 percent it appears that criticism of interest rates is not so much about them coming down but the speed at which they decrease.

You know better than I do interest rate determination involves consideration of a complex interaction of factors influenced by both Government, private sector, and international economic activity. We can't ignore the fact that Banks operate in a competitive environment and have a responsibility to show returns for their shareholders. We have to balance this fact of banking life against our customer needs. We have to differentiate our customers, to reflect their performances, financial status and ability in the interest rate charged.

In the past, primary sector producers were insulated against this risk-based assessment by sector subsidies.

There are good and bad farming areas, good and bad producers, good and bad products. For us, there is good and bad business. This dictates how we approach our lending and interest rate setting. It is no secret that interest rate policies must inevitably reward low risk clients. All banks operate on this basis.

The reorganising of the Rural Bank has taken this into consideration. There has been much restructuring and planning but not at the expense of the Bank relinquishing its place as the major financier of the Primary Sector. There have already been benefits from the reorganisation as our recently announced six monthly financial statements show.

Rural Bank - Half Yearly Financial Position

| | |
|---|------------|
| Audited Profit after Tax to Sept 30, 1988 (First commercial return for Bank in 15 Years) | \$51.087 m |
| Government Loans Repayment | \$ 200 m |
| Payment of dividends, interest and taxation to Government | \$ 228 m |

In addition, the Bank eliminated all taxpayer subsidies from Government

The restructuring of the Bank's balance sheet produced the first commercial return for the Bank in 15 years. In addition, we can point to eliminating any taxpayer subsidies to the Bank, repaying \$200 million in Government loans, and paying Government \$228 million by way of dividends, interest, and taxation during the last 12 months.

The Bank will maintain a strong business relationship with all Primary sector industries and we see ourselves as a successful business supporting successful business. Being a business success though, is not helped by public disclosure of confidential and sensitive business documents.

We have had the Opposition spokesman on agriculture, John Falloon, saying it is his "duty" to release commercially sensitive business information about the Bank. I am equally adamant that I have a duty to ensure the confidentiality of such information if the Bank is to operate successfully in a very competitive banking environment.

We are aware, even now, of potential clients being put off approaching the Bank through uncertainty caused by Bank sale process controversy. And I have support for the confidentiality of the Bank's business from the conservative NZ Herald. Commenting on the Leader of the Opposition indicating that he would want to "open the books" on the Rural Bank the Herald said: "If the Bank is to be sold, "he will have to keep the cover closed on commercially sensitive information."

Government has agreed the Bank is to be sold as a going concern and the sale process is underway now with Government and its advisors meeting prospective purchasers. There has been comment about the value of the Bank but the cold hard fact is that buyers will determine what it is really worth.

Farmers have signalled strong interest in the future of the Bank and just how they view the need for a bank geared to their sector is summed up by the Chairman of the Southland Rural Bank Mortgagors Association. He said: "Farmers would prefer to purchase the Bank themselves but, if they fail, can live with any commercially based entity subjected to the market economy and an organisation formed to protect their interests." Looking to the future I would draw your attention to where goes the Rural sector, so goes New Zealand. You can't differentiate between the two.

Cows earn more for the country than Fletchers and Brierleys combined - that's a fact. I make no excuse for stressing - even to you the converted - the importance of the Primary Sector and fully support recent calls for widespread positive promotion of the Primary Sector. Historically, rising commodity prices boost farm incomes and the resulting increased spending brings revival in overall business confidence.

We have evidence of this in the fact that regional economies currently are actually looking stronger than those of many cities. That's due to the agricultural upturn as result of the world commodity boom prices and the lower exchange rate.

We all have a mission to keep the sector moving forward and take advantage of any export opportunities. The sector is still going through change. Adjustments in meat and kiwifruit marketing, deregulation of the wheat industry, and waterfront reform are factors which will impact on our export potential.

The new markets opening up are also capturing the attention of other international sellers and we face challenges in being able to meet consumer needs with competitive quality, price and delivery standards.

Internally, we have to take into consideration energy pricing and also ensuring that there is an adequate labour force to cater for increased production demand.

We still have problem areas with production and maintenance figures being down and affecting our export capabilities in a way which cannot be compensated for by other industries.

The Bank is confident we can face up to these challenges and I am optimistic that the sector has the capacity to adjust and continue to lead the way in the country's economic recovery.

In summing up, I would say the Rural Bank is determined to maintain its proud record of service to rural business -and also listening to what it wants. It is essential that the Rural Bank asks customers what they think of it. We intend being a customer-driven organisation with the purpose of enhancing the success of Primary Sector business. We are concerned that the sector's real growth, which is vital to New Zealand's economic well being, is sustained and that people outside the industry recognise and appreciate this factor. The Rural Bank is now well positioned to fully participate as the leading financier in the Primary Sector and will be a major participant in the sector's contribution to the future prosperity of New Zealand.

MEETING PEOPLES NEEDS

Jock McKenzie
National Co-ordinator
NEW ZEALAND RURAL TRUST

Background Comment

Agricultural production incentives in the 1970s were accompanied by the development of confidence levels in the rural community, which resulted in a range of investment decisions, on and off-farm, which are now perceived to have been imprudent.

Many farming families stepped away from their normally conservative positions and mortgaged their high equity farms to buy more land for family or semi-retirement; others invested in urban enterprises; some of them went off-shore for funds; many, in their expectation of continued buoyancy, but caught short when seasonal finance was due, simply refinanced in the knowledge that the increasing value of their land easily covered their increasing hard-core debt.

The prevailing sense of security and indeed the clear opportunities for gain, resulted in an escalation of land values which went far beyond productive value, and which contained a component which recognised the expectation of capital gain.

Concurrent with this capital expansion on many established farms was the influx, at high cost, of farmers and orchardists, prepared to go into traditional or new ventures with minimal equity.

The Development of Needs in the Rural Community

The loss of tax breaks, increase in the cost of money, and fall in prices, created unprecedented problems. With the rapid fall in land values, equity fell and exposure of creditors increased significantly.

The Meat and Wool Board's Economic Service calculated that in June 1988, 35% of sheep and beef farms had an equity level of less than 50%. About this time, the Rural Bank said it had 15,000 clients whose level of debt to all creditors exceeded 50% of the value of their assets. An estimate widely publicised at this time was that up to 2,500 farmers were either

insolvent or had levels of debt, and constrained income which made their viability questionable.

Alarm and despondency created pressure on all sections of the community, and responsible groups began to mobilise activities which might be able to deal with a whole range of new problems confronting farming families. Naturally, the focus of much farmer comment was the Federated Farmers organisation, many senior local officers of which spent long hours in endeavouring to assist individuals with problems.

It became clear that there was not any structure available that did not stand in danger of being perceived as acting from a base of politics, commerce or seasonal interest, and therefore at risk of being damned for prejudice. Discussions between Government, Department of Social Welfare, Ministry of Agriculture and Fisheries, financiers and Federated Farmers determined that a public/private sector initiative be mounted, following the Government's statement that while it recognised the commercial realities and sensitivities, it did not intend to construct a package of assistance measures, and did not contemplate intervention of any sort.

Formation of the Trust

So, the New Zealand Rural Trust was born of the courage and enterprise of concerned individuals, with the desire to be independent, available at no cost, apolitical, compassionate and pragmatic.

\$1.5 million was raised from the public and private sectors, three Trustees including Sir Peter Elworthy as Chairman were chosen, and in the last week of September 1988, the Prime Minister launched the Trust, announcing the appointment of a national co-ordinator who was charged with putting together a network of personnel to carry out the Trustees' policies for the one year life of the Trust.

A search began for regional co-ordinators throughout New Zealand. These individuals were required to draw together and effectively deploy all local resources to facilitate the rehabilitation and restructuring of rural families faced with problems.

The Rural Trust made it clear that while its aims were to enable a co-ordinated approach to debt management, social and counselling services, it would not try to change the prevailing economic climate; would not make any funds available to solve on-farm problems; and would not coerce parties into acceptance of any particular option.

The finite life of the Trust required that the network of co-ordinators be found quickly, particularly as the approach of the summer holidays would restrict access to agencies significantly. Quick visits to all provinces were made to identify existing structures and try to assess these. Advertisements were run nationally, and short lists drawn up as soon as sufficient quality applicants were perceived to be available at each point.

In 7 weeks, after more than 200 applicants had been screened, and more than 70 interviewed and checked out, 18 co-ordinators had begun their work, with little more guidance than to make contact with all creditors, agencies and community groups in order to come to an understanding of the local problems; to identify individuals with problems; and to begin to build a case load.

Not in all areas, however, did Trust co-ordinators have to make such a cold start. In two of the 18 regions, for example, co-ordinators were appointed who were already involved through Federated Farmers, in almost identical work. They simply carried on, with a redirection of management control, and a more assured income. In other areas, the co-ordinators were able to pick up cases already being handled by local Federated Farmers leaders.

In the following 2 weeks, an induction/training course has been run in each Island, so that by the beginning of December, 18 co-ordinators had begun serious discussion and counselling with farming families reached from major towns from Kerikeri to Invercargill.

In mid-February, by which time all co-ordinators had some specific field experience, a national training course was held when role playing of interviewing and discussion of experiences played a big part in consolidating the confidence of the co-ordinators. Opportunity was also taken, at this time, to redirect those who needed it.

Trust Co-ordinators

The co-ordinators come from a range of backgrounds. Half were farmers. Although such a high proportion was not planned, or even desired, the successful applicants were those who seemed best suited to each position, taking into account their current support/counselling role in their regions. Other backgrounds include several senior local management people from agencies such as MAF, Rural Bank and farm management consultancy. Most co-ordinators are over 40 years of age, and all have had considerable experience in community affairs and/or interviewing experience in their work.

Field Work of the Trust

At the time the Trust was being created, MAFTech were putting together a package of measures to infuse into the more than 5,000 farmers severely affected by the drought in the East Coast of the South Island, and it seemed sensible to utilise the new independent structure which intended to become seriously involved with problems of individual farming families.

Four Trust co-ordinators in the South Island, and our kiwifruit specialist co-ordinator in Kerikeri, are involved in monitoring and approving facets of the Government's inputs. Other co-ordinators may later become involved, should further measures be introduced in the East Coast areas of the North Island.

Trust and MAFTech personnel have worked very closely to develop realistic guidelines for several of the drought measures, including Farm Appraisals, Farm Management Consultancy, Further Consultancy, New Start Grants and the new 80% rehabilitation loan guarantee scheme.

Seven Rural Trust co-ordinators work on a part-time basis - usually 2 days per week. Of the full-timers, clients number 20-odd, to more than 350 per person. Seventy-five per cent of the total 1,500 cases are handled by 5 co-ordinators, and about 80% of total cases of 11 full-time co-ordinators are handled by those same 5 co-ordinators. Four of these 5 are the co-ordinators employed in the South Island drought areas, where their efforts are greatly influenced by the drought effects, and the fifth is employed in the Bay of Plenty, where there has been a history of organised rural support, and where about two-thirds of his cases relate to kiwifruit farmers.

The factors influencing levels of problems discovered by Trust field staff include:

- (a) Involvement with Government measures applied for adverse climatic events recovery programmes.
- (b) Dominance of farming sectors in a region, e.g., kiwifruit, dairying, fine wool.
- (c) Regional characteristics:
 - (i) physical, e.g., relative assurance of dry matter production as in Waikato
 - (ii) conceptual, e.g., relative independence of farming families as in Hawkes Bay.

- (d) Historical reliance on corporate support structures, e.g., Southland, South Canterbury and more recently, as a result of regional consolidation after Cyclone Bola, Gisborne.

There may also be many problems not found by Trust co-ordinators, due to their own deficiencies, or to some lack of understanding or acceptance of the role of the Trust, or to some lack of communication in the regions, hard to define or overcome.

Finding clients in a situation in which the client is perceived to be the party who should make the approach is sometimes difficult. Most co-ordinators work with some sort of liaison group - usually one which had been active, or a modified or restructured version of local groups. These provide field intelligence and referrals. Also, co-ordinators have now gained access to, and in some cases, confidence of relevant agencies such as Government Departments (MAFTech, Department of Social Welfare, Inland Revenue Department); creditors (Stock Firms, Trading Banks, Rural Bank); churches; Federated Farmers and Women's Division of Federated Farmers; professional people (lawyers, accountants); and individuals whose work experience and inclinations make them useful contacts.

Many of these people, in their dealings with farming families with problems, suggest during discussion that an approach be made to the Rural Trust co-ordinator. Clearly, where the Trust co-ordinators are the clearing house for written applications for assistance, contact with clients is more direct.

Range of Duties

To achieve the objectives of the Trust, co-ordinators need to get into deep dialogue with clients then follow up by referring on to appropriate local resources, or by doing further research themselves. This may involve talking with creditors or legal advisers, or perhaps where the co-ordinator is experienced, in going over the books and doing cash flow budgets.

Either by their own efforts or with professional assistance, co-ordinators develop a range of options which they discuss with the farming family, in order for that family to make a decision on which alternative they wish to pursue. If and when this decision is made, the co-ordinator endeavours to assist and expedite the circumstances required to implement the decision.

Some of our co-ordinators have found considerable need for counselling and assisting families to acknowledge their need for some basic assistance, for example, for Special Needs Grants.

Some have found clients in extreme stages of mental stress, and have had to display great sensitivity and strength of character to work their way through problems with serious potential danger.

In one region, with a history of great corporate strength in the rural community, and currently exposed to severe economic pressures exacerbated by drought, the Trust co-ordinator has developed, in association with the powerful liaison group, a strong unit servicing 25% of all farms in the region, with the expectation of going to 50% in the next couple of years. There is a strong widely-representative group from the community, which controls and financially supports a team of rural guides, whose efforts are co-ordinated by a community worker paid for by the New Zealand Rural Trust, and reporting to the local Trust co-ordinator. Also employed by the Trust in this region, and reporting to the local Trust person, is a specialist restructuring person, who deals with the hands-on really significant physical and financial adjustments which are taking place in some situations. This person has gained the trust of creditors, and has achieved significant financial concessions for many of his clients. The development through the Trust of this type of experienced person, with a high degree of skill in communication and negotiation, acting from an independent position without charge, and making steady progress with farmers whose positions would otherwise be ever-deteriorating, is worthy of further consideration by Government and regional authorities.

Involvement with the drought package has been the most significant role of Trust co-ordinators, and in view of your inclusion in your programme of a paper by Alan Walker of MAFTech Policy Services on the drought package, it is suffice for me to say that the Trust's involvement is as a clearing house for several of the Government inputs. Trust activities for the New Start Grant include responding to preliminary approaches; receiving applications; giving conditional eligibility; receiving advice that required conditions have been met; and approving payment by MAF of the Grant. Farm Farm Appraisals, Trust co-ordinators approve eligibility and authorise approval to begin; ensure appropriate levels of competence of consultants; ensure needs of farmers are met; certify that quality standards of reports are met; encourage the use of the report in farm decision-making; and authorise payment by MAF to the consultant.

Other roles have come to Trust co-ordinators, by virtue of their unique status in their regions. For example, some funds which were made available to a small location which had sustained considerable damage in a freak storm, were put under control of the Trust co-ordinator in that region. Another example is that in which publicity has identified drought area co-ordinators as being involved with the Government inputs. Even though the Trust was not involved in the Adverse Events Family Income Support, paid for by MAF and administered through the Department of Social Welfare, except to hold application forms, the association

between the Trust and MAF resulted in up to 60 phone enquiries per day being handled by each Trust office relating to the Government measure.

Another role for the Trust has been that of providing field intelligence for the Trustees. There have been several innovative ideas of greater or lesser practicability, handed on from groups and individuals to Trust co-ordinators for their support.

While the Trustees have remained independent and apolitical, there have been efforts made to ensure that some of these ideas have not died without some chance for proper consideration.

Systems for Control

Because of the finite life, an immediate decision was to get a structure established as quickly as possible, with minimal administration and bureaucracy. Federated Farmers handle the payment of salaries and expenses from their Wellington office. Co-ordinators work in a relatively autonomous way, reporting by hand-written fax each week to the National Co-ordinator, who provides a supporting role by responding to specific pleas for assistance, and by providing relevant information from the Trustees and agencies, as it becomes available.

The National Co-ordinator reports to Trustees each month, and is in frequent contact with the Chairman regarding policy matters, and general progress. Close contact is maintained with the Prime Minister's Department, and Trustees report in person to the Prime Minister three times during the year.

Availability of Information

MAF and Lincoln College have separately approached the Trust to encourage the collection and possible use of the special information which is available to the Trust. The Trustees were unprepared to divulge information gathered on the basis that it would remain confidential to the Trust. The drought area co-ordinators were adamant that they were unable to disclose any part of the Farm Appraisals, as these had only been accepted by the farming community after specific undertakings had been given that no other person would see them.

For future reference, it should be part of any initial planning that de-personalised information of potential value should be captured and disseminated to relevant organisations.

Future of the Trust

Much criticism has been made of the finite life of the Trust on the basis that it has proved itself of value, and that problems in the rural community will not be over in the short term.

Because the funds allowed it, the Trustees have decided that the Rural Trust will continue beyond the end of September 1989, which was the original term, and will operate until 31 December 1989.

By definition, the Trust will then terminate. As the statements regarding ongoing rural problems are true, and as the withdrawal from the Government inputs monitoring role must create difficulties for MAF, some discussions as to possible initiatives for the future have been held. No decisions have been reached, and no efforts to retain staff or plan for funding have been mounted.

C H A N G E
IN THE N.Z. MEAT PROCESSING INDUSTRY

A UNION PERSPECTIVE.

**A Paper presented to the Australian Agricultural
Economics Society, N.Z. Branch, 30 June 1989.**

By:
Roger Middlemass
PRESIDENT,
N.Z. MEATWORKERS UNION

ATTITUDES TO CHANGE

People and institutions have a natural resistance to change. We are comfortable with the familiar, doubtful and wary of the untried or the unknown. The pace of change is always too fast, the timetable too compressed, the response " yes - but not yet."

This personal reluctance to change is not allowed to others, on whose behalf we are readily prepared to accept the necessity for change. Thus, motivators of change such as politicians, planners, researchers and even economists, tend to be well paid and comfortably insulated from the consequences of their proposals being enacted.

Unlike workers, who have learnt from bitter historical experience that change is seldom designed for their advantage, that any trickle-down of benefits will be purely coincidental, and that they will neither influence nor be involved in planning the changes.

However, it is indisputable that radical changes throughout the meat industry as a whole are necessary, overdue and inevitable. What is disputed is the method of implementation. Whether the changes should be planned, managed and participatory on an industry wide basis, or be left to the survival instincts of company directors buffeted by the swirl of market forces.

This paper favours the former. But before looking at specifics, we need to be aware of some broad trends during the next few decades which we cannot influence and which tend to be ignored in the flurry of the here and now. All have a bearing on the New Zealand meat industry.

SUPRA FACTORS

- * Change is not finite, in the meat industry or any other sector of society. It will be continual, accelerating and exponential.
- * The present population of the world will double. Arising from which it is probable -
- * The role of governments will continue to expand nationally and internationally.
- * European cultural influences will diminish.
- * National racial mixes will alter dramatically.

- * Political divisions may develop according to policies on environmental and ecological issues - Greens versus greenbacks.
- * The percentage of meat eaters will diminish, causing the entire international meat industry to be targeted at niche marketing for the comparatively wealthy.
- * Meat production may be judged a most inefficient method of converting sunlight into protein and protein as a most profligate substitute for carbohydrate.
- * Climatic changes may have a significant effect on the meat industry, in New Zealand and elsewhere.
- * The export of agricultural products is likely to remain the mainstay of New Zealand's economy.

HISTORICAL CHANGE

The Industry has a tradition of conservatism and therefore a resistance to change. This applies to all sectors - exporters, processors, farmers, workers and their unions.

For almost 100 years from its inception in 1882, it was the mainstay of a colonial economy dependent on a single guaranteed market in Great Britain. New Zealand supplied bulk, unprocessed agricultural commodities; meat, wool and butter. In return sole access was guaranteed to British manufacturers against foreign or local competition along with acceptance of British control over shipping, finance, insurance, marketing and foreign policy. The rules were made in London and obeyed in Wellington.

In 1973 the combined effects of Britain joining the European Economic Community and the dramatic rise in the price of oil, changed those rules forever. New and nearer markets needed to be developed, none of which would be guaranteed, and few desirous of bulk, commodity trading.

New Zealand became a seller in an internationally competitive buyers' market for food, with a change in emphasis from quantity to quality and from selling to marketing. However, the structure of the industry and the attitudes within it, have changed little.

Employment remains seasonal and insecure. The work boringly repetitive with a high division of labour and consequential deskilling. Industrial relations are confrontational in the extreme, the approach macho, and negotiating expertise rudimentary. Health and safety standards are low and job training perfunctory.

In essence the industry is failing to come to terms with its own metamorphosis from a bulk commodity trader to a high quality, high technology, sophisticated food processing and marketing organisation. The rest of this paper is a brief resumé of key aspects of the industry where change is urgently needed, and some suggestions regarding those changes.

OWNERSHIP

Since the first World War the meat industry has been controlled by a few big companies, operating large plants on a mainly regional basis, with some smaller operators on the fringes. The role of farmers has been to service that industry, not vice versa.

Right now, the industry is in a virtual state of paralysis as the current owners jockey for positions of individual advantage in the carve up of the carcass, with overseas interests hovering on the sidelines, Government leading from the rear, and meatworkers waiting to be declared redundant.

What is required is an agreed, planned and orderly rationalisation of ownership and of processing capacity. The industry does not need companies whose only commitment is to the annual dividend, nor small under-financed quick-buck operators. Large, regional, farmer owned co-operatives employing skilled management and marketing professionals and selling on a single desk basis is probably the best option, with some provision for already well established and stable exporters and small niche market specialists.

Any orderly transition of ownership and reduction in plant capacity should be on an industry wide basis and involve all participants - companies, farmers, Government and workers. Hard decisions have to be made with far reaching consequences. None of the participants should shirk their responsibilities.

The unions are prepared to accept that responsibility. But if restructuring is to be defined as workers merely doing what they are told, and reduction in capacity is to be on the brutal basis of the Whakatu closure, then the transition will be neither orderly nor peaceful.

MANAGEMENT

Management in the meat industry remains tied to "command and control" systems. Management structures tend to be hierarchic and stratified. Attitudes to industrial relations and to the workforce are either paternalistic or authoritarian and punitive, with workers treated either as school children or as military conscripts. The master/servant relationship is made obvious and the

"right of management" promoted as a self-evident truth. The ratio of supervisors to workers is high.

There is a perhaps understandable desire on the part of owners of property and possessors of status, power and authority, to hold what they have. In our view this is a mistaken belief. The changing nature of production, new control technologies, the demand for high and uniform quality and rapid changes in market requirements, make such attitudes obsolete.

The demand now is for a workforce which is flexible, adaptable and above all responsible. This presumes an intelligent workforce, no longer prepared to be treated as an extension of the machinery, nor to unquestioningly obey orders from on high.

WAGE AND BARGAINING STRUCTURES

The meat companies are in the forefront of those employers demanding labour market deregulation. The term itself is merely an example of the euphemistic business jargon currently popular as a substitute for the English language. Translated it means the removal of all barriers to the exploitation of workers. The main objectives are as follows:

- + The abolition of the national award. Thus removing any minimum standard of wages and conditions in the industry.
- + Replacing it with stand-alone plant contracts, subcontracting, or even individual contracts of service. These would be negotiated locally by the workers, but nationally by the employers.
- + Voluntary unionism and union contestibility to divide workers, fragment their organisations and diminish their resources.
- + Replacement of the Labour Court with Civil Courts to enable employers to sue unions and their members for damages.
- + Flexible ordinary time hours of work, followed by the abolition of penal rates for all overtime and the introduction of shift work on the same wages and conditions as day work.
- + The introduction of part time and casual work and the ability to dismiss and rehire whole sections of the workforce on a week by week basis.
- + The removal of workers' ability, or even right, to strike but not the employer's right to lock out or close plants.

- + Ultimately to dismantle all effective union organisation throughout the industry.

A yearning, backward glance to the industry of 60 years ago and recipe for anarchy and conflict.

Strong industries require strong democratic and responsible workers organisations able to speak authoritatively for the collective workforce and with the resources and knowledge to enable them to participate positively in the decision making processes at all levels.

The national award needs to be rewritten to more adequately reflect minimum standards for the industry. It should not be replaced with local agreements, but complemented by them to provide necessary flexibility for local conditions and changing market requirements. The two should operate in tandem, for the same term, with the same expiry date, and with the same constraints on industrial action. Most local agreements need to be rewritten as comprehensive, unambiguous documents replacing some of the scraps of paper and verbal understandings which at present only encourage industrial amnesia.

Similarly with wage structures. Wage rates are too numerous (half a dozen rates for the whole industry would suffice) and differentials are absurdly wide, with some workers earning three times as much as others. Piece rates remain the prevalent method of payment. A system geared solely to the high speed production of carcasses and therefore antagonistic to the uniformly high standards of quality and hygiene demanded by the markets. An elevated hourly rate of pay supplemented by a quantity/quality bonus system on a ratio of 80:20 would be much more in tune with modern requirements.

PRODUCTIVITY

Productivity no longer refers to a certain tonnage, churned out in a certain time, at a certain cost. It now means a unit cost and standard of quality acceptable to the market, with quality overtaking cost as the primary requisite. Red meat can never directly compete with white meats on a cost per kilo basis - let alone challenge rice or pasta.

Contrary to some ill-informed opinion, meat industry productivity is high and rising. For years now real wages have been falling, hygiene and quality standards rising, work speeds accelerating (dangerously so), staffing scales have been slashed, and technology introduced.

There has been little corresponding improvement in safety standards, working conditions, amenities, skills training, job security, career opportunities or industrial democracy. All of which have a bearing on productivity.

Arduous, boring and dangerous work methods coupled with financial insecurity, over-bearing supervision, dogmatic management and blank futures, encourage confrontation, not commitment. If workers are treated like machines, they will contribute like machines. If treated as dogs, they will bite. And the industry will bear the cost.

It need not be so. The Seafield works extended shift killing agreement with Fortex Group Ltd., is a pointer to the future. It has increased production immensely, simultaneously raised productivity, profitability and wages, slashed weekly working hours, substantially increased employment, improved job security and provided a significant degree of industrial democracy.

That is not to suggest that shift work is a panacea for all the industry's problems, nor that the agreement with Fortex can be transposed in its entirety to other plants.

In fact its main significance may not lie in the detail of the agreement but in how it was accomplished.

- + It was proposed and drafted by union negotiators
- + Negotiated by a nationally representative union team.
- + With a company prepared to consider and finally accept radical proposals while ignoring the shibboleths of the industry and the barrage of warnings and threats from their reactionary rivals and many farmers.
- + It was also preceded by industrial action taken by both parties - New Zealand and the world managed to survive the experience.

Roger Middlemass

THE AMERICAN EXPERIENCE - LESSON FOR NEW NEW ZEALAND

33,000 farmers lost their farms, broken marriages, dislocated families, countless suicides and bankers shot. How could this have happened?

The United States Government recognising its accumulating deficit in 1980 took steps to remedy the problem. Reducing expenditure to control the deficit became the Regan administrations policy. Agriculture felt the impact immediately.

Lending policies allowed 85% of the value of the land to be advanced on mortgage. As land values fell 30 - 50% banks lost their securities and proceeded to foreclose on mortgages. Some banks collapsed others were taken over and a number decided to get out of agriculture. Staff did not have the skills to analyse the viability of farming operations and were ill equipped to handle stressful situations. Hard-line policies were implemented with some degree of panic.

New Zealand's avoidance of a total collapse of agriculture should be credited to the foresight of the Cabinet of the day and Ray Chappell then General Manager of the Rural Bank who were aware that a similar pattern was developing in New Zealand implemented the Discounting Scheme. This provided forums where all creditors met with the farmer collectively sharing the responsibility of resolving the debt problems and allowing the farm to continue on a viable commercial basis. A finite time was given for decisions too which avoided months and years of additional debt and stress. New Zealand used commercial objectives whereas in the U.S. legal and administrative means to buy time or achieve settlements.

The United States Farm Credit Bill of 1987 has put into law set procedures to be administered before a foreclosure can take place. This has given considerable protection for the farming family.

U.S. farmers have traditionally expected and had financial support from the Federal Government, \$US 26 billion this year plus an additional \$US 5 billion for the drought. Agriculture and research has been production driven. Cost of production has never been a deterrent but rather a basis for lobbying congress. Extensive use of elaborate machinery, fertilisers and chemicals adds to the cost of production.

Farming organisations are very professional and effective in lobbying their case to Congress. There is a realisation now that Congress intends to reduce the farm bill funding.

The U.S. economy has the advantage of a broader base than New Zealand, it still has growth and they addressed their problems earlier. New Zealand by contrast has negative growth, a smaller economy and agriculture is the main exporter with 90-95% of its major commodities being marketed internationally.

There is no doubt subsidies distort production. U.S. farmers wait for the farm programmes before planning their season. Then as with any targeted programme they look to maximise returns from it e.g. the criteria of \$US 50,000 per family is soon bypassed as brothers and sisters families take shares in the farm enterprise. In New Zealand S.M.P's created distortions as the lamb kill increased by 43% between 1979 - 1985.

Surpluses of a number of products are the Federal Government's responsibility which then gets channelled into school, poverty or aid programmes. Aid to third world countries can depress their agricultural economy.

A lot is made of the "family farm", but I have yet to find an appropriate definition of the "family farm". They vary in size from 40 cows to 10,000 in the dairy situation yet the ownership is family but the management in the larger operation is on the corporate structure. Protecting the family farm is a common objective of many organisations and is a major lobbying strength.

The adjustments on U.S. farms since the downturn are positive.

Borrowing is now averaging 50% of the value of the land.

Cash flows are now a requirement for debt servicing. It was an uncommon practice previously as banks were more concerned with their security than the ability to service the loan.

Machinery sales are down.

A good university education is considered essential for all members of the family. Children are encouraged to graduate in a variety of disciplines even though they intend to join the family business.

Sustainable agriculture (LISA Low Input Sustainable Agriculture) is commonly talked about. With consumer resistance to chemical usage and residues in food as well as environmental concerns of pollution public opinion may force farmers to face the issue sooner rather than later. Mountain or spring water is sold in gallon jars in supermarkets such is the fear of contamination. High inputs have a high cost in dollar terms and lower inputs would not only be less harmful to the environment but could increase profitability.

Research and extension work has continued.

Bankrupted farms have been purchased by existing farmers. Corporate ownership is increasing. Some farmers have chosen to retire their land from production and use the property as a family retreat.

The 1988 drought was the worst in living memory yet farmers and their families coped extremely well.

Some individuals and farming organisations would prefer to be freed of Government regulation and programmes and promote free trade.

The lesson for New Zealand relates more to the off farm situation where costs have not yet been rationalised and opportunities maximised.

Banks have been a little slow in being flexible with their loans, terms and conditions. Farmers need to present themselves and their proposal well and acquire negotiating skills. Just recently one dairy farmer re-negotiated his loan saving \$8,000 per annum in charges.

Environmental concerns are real. Farmers have a responsibility to the nation not to pollute natural resources for future generations. Production increases in the U.S. have been at the expense of the environment. Whilst we do not have a serious problem it is important to be aware of and prevent pollution.

Nutritional value of food is important to the health conscious. Identification of vitamins, minerals, fibre, cholesterol, fat and calories appeals to the discerning purchaser. "Fresh and natural" will have an increasing market. While New Zealand does have a clean green image we do have a marketing edge.

Consumers preferences are paramount. New Zealand has been slow to develop products and packaging to a variety of cultures and tastes.

Americans look after their home market exceptionally well. While three million people may be small in world terms we are selling to tastes we understand, little transport is required and products should be fresh. Lamb for example could be sold in cuts suitable for quick cooking for career families and sophisticated entertaining. Currently the chances are tourists will only see lamb in the paddock not on a plate.

New Zealand no longer feeds the hungry but sells to those who can afford the luxury of choice. Our future is in the gourmet or niche markets. Americans really service their clients, promotions and incentives to retailers ensure prime shelf space. The retailing chains demand quality, quantity and a price advantage.

Farmers may have to seriously consider owning, processing and marketing their products from paddock to the table. An example of this is the Nonfort enterprise in Colorado still a "family farm" which fattens 300,000 head of cattle per annum on one feedlot alone, then processes through their own abattoirs and markets internationally.

The labour market has yet to be deregulated. The U.S. has 17% of its workforce unionised, work attitudes are notably different. An excellent example of this is Continental Airlines who faced bankruptcy some years ago - the staff were made aware of the situation - went non union - worked hard to bring the business back into profit and growth - they say "the only difference between us and our competition is service."

Use of capital and resources must be rationalised to achieve efficiency and cost effectiveness. New Zealand freezing workers work an average of seven and a half hours a day, 126 days per annum (Garway report) - each Island has an over capacity of 30% (Garway report July 1988). The Makarewa works in Southland could kill all the Southland catchment in eight months on a double shift.

Research needs to be coordinated and prioritised. The Land Grant Colleges have an effective extension service based in the rural communities, New Zealand would benefit from a similar network.

Our industry has to accept as given the tariffs and barriers that exist, simply stating it is not fair does not sell product, we are too insignificant in world trade to threaten. Political lobbying to reduce barriers must continue but we must ensure we are efficient and effective in New Zealand and in the marketplace. We still expect our sports people to compete at world level in spite of full funding and training support in the Communist block - agriculture is no different.

There is a future for New Zealand agriculture but it will not eventuate if we do not make it happen. Everyone from the farm Cadet to the researcher has a valuable role and it behoves us all to maximise our strengths and resources.

Margaret Millard
PRESIDENT
MANAWATU FEDERATED FARMERS

**LESSONS TO BE GAINED FROM EXPERIENCES WITH FARM
FINANCIAL STRESS IN NEW ZEALAND AND THE USA**

W.D. Dobson¹

Department of Agricultural Economics and Business
Massey University

Parallels exist between the farm financial stress that existed in the US during the mid-1980's and the farm financial problems that have emerged in New Zealand. Although some farm financial stress remains in the U.S., the worst there appears to be over. Painful and costly lessons learned by U.S. farmers, farm lenders and government officials about credit management during the mid-1980's may be worth noting by those concerned about farm financial adjustments in New Zealand. This paper describes (a) the origins and similarities of farm financial problems in New Zealand and the U.S., (b) the problems experienced by U.S. farm lenders -- especially the cooperatively-owned Farm Credit System (FCS), during the mid-1980's, and (c) mutually beneficial lessons that might be drawn from experiences of agricultural lenders in the two countries.

Similarities of Farm Credit Problems

Farming in New Zealand obviously differs from that of the U.S. in numerous ways including those relating to capital intensity of operations, degree of dependence on exports, nature of livestock enterprises, availability of off-farm employment, and the nature of government involvement in the sector.

1

Paper presented at the annual meeting of the New Zealand Branch of the Australian Agricultural Economics Society on 30 June 1989 at Flock House, Bulls, New Zealand. Helpful background information used for developing the paper was obtained from R.J. Townsley, University Professor, Massey University; and Mr John Lambert of Hunterville, New Zealand. While their help is acknowledged, they are in no way responsible for any errors or shortcomings in the paper.

Despite these differences, the recent financial problems of farmers in the two countries exhibit similar origins. In particular, some farmers in both countries borrowed too heavily against rising equity in farmland and failed to anticipate adequately the impact of changes in government policies. It is recognised, of course, that the impact of changes in government policies in both countries were difficult for farmers to predict and factor into management plans in an optimal fashion.

In New Zealand, the average nominal sale price of land increased by 240 per cent between 1976 and 1982 while incomes generated by the land inclusive of Supplementary Minimum Prices rose only 25 per cent (Pryde, p.6-10). Expectations regarding continued income support, double digit inflation during parts of the 1970s and early 1980s, negative real interest rates during 1971-72 to 1981-82 and rising land prices caused New Zealand farmers to borrow heavily against their rising equity. The removal of support structures, slower rates of de-regulation in parts of the nonfarm sector than in the farm sector, the rise in the New Zealand dollar relative to the currencies of some major overseas markets, the fall in farm incomes, and substantial increases in real interest rates have left some New Zealand farmers who had purchased land and other production items in the 1970s and 1980s with heavy and, in some cases, unmanageable debt burdens.

There is no evidence, of course, that the New Zealand farming sector as a whole is at risk. Moreover, the near boom times being experienced by dairy farmers will help them carry debt loads successfully. However, as MAF Corp analysts point out, various farm groups in New Zealand are at risk. For example, in 1983-84, only 6 per cent of sheep and beef farms had less than 50 per cent equity, but by 1985-86 this proportion had risen to 24 per cent with 5 per cent of all farms (1,100 farms) having zero or negative equity. On the 24 per cent of farms with less than 50 per cent equity, 41 per cent of gross income was going to debt servicing (MAF Corp., 1988, p.54). Farm debt servicing levels in excess of 25 per cent of gross

income are regarded by many lenders as indicating financial vulnerability.

Figures released in May 1989 in connection with the planned sale of the Rural Bank show that about 16 per cent of the Bank's loans were in arrears on 31 March 1989 (New Zealand Farmer). The comparable figure on loans in arrears during 1982-83 through 1984-85 was about 5 per cent (Rural Banking and Finance Corporation). On 31 March 1989, about 3800 farmers were in what was characterised as a "foreclosure situation" by the New Zealand Farmer, being over 90 days in arrears or paying more than 60 per cent of gross income in debt financing (New Zealand Farmer).

The percentage of farmers in arrears on Rural Bank loans in March 1989 exceeded the peak percentages recorded in a U.S. survey of Indiana farmers made during the depth of the U.S. farm recession in 1986. About 14 per cent and 9 per cent of Indiana farmers were in arrears on nonreal estate and real estate loans, respectively, during 1986 (Barnard, Dobson and Falck, p.4).

How much more will farm financial conditions in New Zealand deteriorate? For reasons discussed later, it will be important for agricultural lenders and others to have the best available information regarding this key question.

In the U.S., nominal average prices of farmland tripled from 1973-82, fueled by strong grain and soybean exports, negative real interest rates offered by commercial lenders during the late 1970s, subsidised credit offered to farmers by the lender of last resort -- the Farmers Home Administration (FmHA), larger than normal farm programme payments for dairy products and a few other commodities, and the belief that farmland represented an excellent inflation hedge. These were heady times for farmers in the U.S; the farm press carried many accounts of the new millionaires that had been created in farming communities by the land boom.

As in New Zealand, many U.S. farmers borrowed heavily against their farm equity during the late 1970s and early 1980s. Farmers' borrowing decisions were based partly on the

expectation that strong farm exports would continue and that officials of the U.S. Federal Reserve Bank would fail in their efforts to curb inflation in the U.S. They were proven wrong on both counts. U.S. farm exports fell 40 per cent in dollar terms from the 1981 peak to 1986. Moreover, the U.S. Federal Reserve's generally tight monetary policies -- which during 1981-82 gave the U.S. its most severe post-World War II recession -- brought inflation down from the double-digit rates of the late 1970s to 3 to 5 per cent during much of the 1983-88 period. Foreshadowing events that were to unfold later in New Zealand, the generally tight money policies that curbed inflation in the U.S. pushed real interest rates into the 4 to 8 percent range during the mid-1980s and pushed up the value of the U.S. dollar during 1981-85.

For some U.S. farmers, the higher real interest rates plus heavy, undercollateralised debt loads spelled financial trouble. Harrington employed the debt-asset ratios (and corresponding debt-equity ratios) shown below to classify U.S. farmers according to the amount of financial stress they faced.

| <u>Debt-Asset Ratio</u> | <u>Debt-Equity Ratio</u> | <u>Status of Farmer</u> |
|-------------------------|--------------------------|--------------------------------|
| Under 40% | 0 to .667 | No apparent financial problems |
| 40% - 70% | .667 to 2.33 | Serious financial problems |
| 70% - 100% | 2.33 to ∞ | Extreme financial problems |
| Over 100% | Minus values | Technically insolvent |

Using this categorisation scheme, he concluded that about one-third of U.S. farmers faced serious or extreme financial problems or technical insolvency in 1985 (Harrington). In this same year, about 10 per cent of the U.S. farmers were so highly leveraged that they had little chance of survival (Lee).

Programmed to rise when farm commodity prices fell, certain U.S. farm price support programme payments

increased during the mid-1980s, rising to a record \$26 billion in 1986. However, unlike conventional stabilisation payments, these payments were not targeted to help the needy. Instead, the payments simply went mainly to grain, soybean, cotton and dairy farmers in proportion to their sales. Hence, some large farmers who were in good financial condition received large price support payments (limits on payments per producer often can be legally circumvented in the U.S.). Moreover, since no price support programmes exist for U.S. producers of cattle, hogs and poultry, producers of these products received none of the payments. It is now widely acknowledged that raising price support payments represents an inefficient way to reduce farm financial stress; such blunderbuss approaches seem unworthy of emulation.

U.S. farmers made numerous adjustments to deal with their financial problems. Major adjustments, ranked in approximate order in terms of frequency of mention by many farmers, included the following:

- * Reducing debt (when repayment ability existed).
- * Increasing off-farm work.
- * Reducing farm machinery purchases.
- * Developing and using more complete financial and other farm business records.
- * Engaging in other general "belt tightening".

The "belt tightening" included reducing family living expenses, reducing rental payments for farmland, and reducing expenditures for fertiliser. Average yearly use of fertiliser by U.S. farmers was 13 per cent lower in 1985-88 than in 1979-84 (US Department of Agriculture, p. 10). This is smaller than the 35 per cent reduction in fertiliser use which was recorded in New Zealand during 1979-84 to 1985-88 (MAF Corp., 1989, p.82). The smaller reduction in use of fertiliser in the U.S. probably reflects many factors, including the large yield payoff associated with maintaining the amount of nitrogen used in maize production.

Farm machinery manufacturers and dealers suffered losses during the 1980s as a result of the U.S. farm recession. Sales of items such as tractors and combines dropped to a small fraction of 1979 levels by the mid-1980s in the U.S. Several machinery manufacturers -- e.g. International Harvester, Case and Allis Chalmers -- merged and/or diversified their product lines during the 1980s in an effort to regain profitability. To some extent, the decline in farm machinery sales during the 1980s was a world-wide phenomenon which was also apparent in New Zealand. For example, New Zealand tractor sales fell by 66 per cent from 3470 in 1985 to 1185 in 1988, forcing consolidation and reorganisation of dealerships (Hassall, p.1).

As a result of increased farm price support payments, government drought relief payments made to U.S. farmers in 1988-89, adjustments made by farmers, the restructuring of farm debt which is discussed later, partial recovery of U.S. farm exports, and other developments, the worst of the farm recession appears to be over in the U.S. According to Eric Thor, President and CEO of the Farm Credit System Assistance Board, only 8 to 11 per cent of U.S. farmers remain financially vulnerable (Thor, p.4). An Indiana survey showed that the percentage of Indiana farmers in arrears on farm real estate and nonreal estate loans had dropped to about 6 per cent in 1988 (Barnard, Dobson and Falck, p.4). Moreover, about half of Indiana farmers who had loans made principal payments in addition to scheduled payments in 1987.

Problems of U.S. Farm Lenders

Some of the most pervasive and dramatic impacts of the U.S. farm recession fell on farm credit suppliers. U.S. suppliers of farm credit include banks, insurance companies, the FmHA (government lender of last resort), the Commodity Credit Corporation (an arm of the U.S. farm price support system), individuals, and the FCS. The largest supplier of farm credit in the U.S. is the cooperatively-owned FCS. This organisation includes

Federal Land Banks which supply credit to farmers for land and capital purchases, Federal Intermediate Credit Banks which provide farmers with production credit -- e.g., for purchases of feed, seed and fertiliser -- and Banks for Cooperatives which provide seasonal and term loans for agricultural cooperatives. The FCS obtains funds for lending mainly through the sale of debentures in financial markets which are the joint obligation of all banks in the FCS, stock purchased by borrowers, surpluses and retained earnings. Although never owned by the U.S. government, the FCS received an infusion of capital from the government during the Great Depression of the 1930s. The FCS repaid these government loans during the next three decades and became a fully private organisation. In 1985-86 and 1987, the FCS again sought financial help from the U.S. government, which was provided mainly in the form of a \$4 billion line of assistance from the U.S. Treasury. Three FCS banks had received assistance as of March 1989 (Thor, p.6). It appears that less than \$4 billion of assistance will be required to help the ailing FCS units. The expectation is that the FCS will repay the government assistance funds during the next 15 years (perhaps sooner) and once again become a fully private lender.

The impression should not be left that the U.S. government has simply written big cheques to financially troubled banks in the FCS. Indeed, the Federal Land Bank of Jackson, Mississippi has been allowed to fail. Rather the assistance has been delivered parsimoniously to bank officials who have developed suitable long-term plans for putting their organisations in sound financial shape. To date, much of the assistance money has been used by the recipient banks to retire high cost debt issued during the 1980s to obtain funds to lend to farmers. Also, a secondary market for farm mortgages was created as part of the assistance package for the FCS. This measure will increase the number of suppliers of farm mortgage credit in the U.S. , provide increased competition for the FCS, and help to provide replacements for the FCS if it cannot survive with the assistance it has received.

How did the FCS get itself into the situation where it required government help? On 31 December 1987, the FCS had about \$49 billion in loans outstanding to U.S. farmers and agricultural cooperatives (Barnard and Dobson). About 65 per cent of this \$49 billion consisted of farmland mortgages. Reflecting problems connected with its farmland mortgages and numerous other problems, the FCS share of total agricultural credit supplied in the U.S. declined from about 33 per cent in 1984 to 27 per cent in 1989 (Farm Credit System Assistance Board, p.22). However, this 6 percentage point decline in market share understates the problems experienced by the FCS during the mid-1980s.

The FCS recorded losses of \$2.7 billion, \$1.9 billion and approximately zero for 1985, 1986 and 1987, respectively, and required government assistance in 1986-87 and 1988 in order to remain in operation (Farm Credit System Assistance Board, p.2). (The government assistance for 1986-87 was a less than fully effective attempt to make the profitable units of the FCS share reserves with unprofitable units. The \$4 billion line of assistance was provided in 1988). The reasons for the losses incurred by the FCS are many and, in view of the severity of the U.S. farm recession, perhaps the most careful planning and shrewd management decisions could not have prevented losses. But, equipped with hindsight, one can conclude that FCS losses were higher than necessary because financial signals were misinterpreted, plans for dealing with adversity were inadequate and questionable management decisions were made, as noted below:

- * The FCS commissioned a major study (released in mid-1984) which was carried out by business consultants, university professors, and FCS employees to assess the financial conditions which the System would face during 1985-1995. This Project 1995 Study, which served as a guide to FCS planners, substantially underestimated the severity of the economic conditions that faced the system. In particular, the study forecasted continued expansion in the amount of credit

that would be demanded by U.S. farmers during 1985-95 rather than the sharp contraction that began in 1985.

- * Loans made by the FCS during the first half of the 1980s carried interest rates based on the organisation's average cost of loan funds rather than the marginal cost of recently acquired loan funds. Funds acquired by the FCS from financial markets during the late 1970s for lending had a lower cost than those obtained in the early 1980s. Because the System based its interest rates on the average cost of loan funds, interest rates charged by the FCS on farm loans averaged about two percentage points lower than those of major competitors during 1980-85. The relatively low interest rates helped the FCS to increase its share of U.S. farm real estate mortgages by about eight percentage points during 1980-85. Higher rates reflecting the marginal cost of loan funds would have cost the FCS market share. But these higher rates also would have discouraged some FCS borrowers from obtaining loan funds which they later could not repay and could have produced reserves more adequate to deal with the harsh economic conditions encountered by the FCS in the mid-1980s.
- * Prior to the mid-1980's, many FCS loan officers had no exposure to operating under conditions of widespread farm financial stress. Indeed, some had received incentives to expand lending without adequate regard for the management skills of the borrower or the earning power of the assets being financed. Inflation, it was reasoned, would cover most damage that might result from extending too much credit to a farmer. Accordingly, some FCS lending officers were ill-equipped for the conditions they encountered in the mid-1980s.
- * FCS officials underestimated the sensitivity of farm borrowers to interest rate differentials among lenders. Eric Thor described the situation as follows: "Many financial institutions must survive on 50 to 75 basis point margins. Customers today will

switch institutions for 100 basis points or less. The Farm Credit System lost over \$35 billion in assets from 1984 to 1988 in large measure because many good farmers -- over 100,000 borrowers -- walked out. Price is important" (Thor, p.8). The problem described by Thor occurred partly because the System used average cost pricing for farm loans after the cost of loan funds to the FCS had become relatively high and because the FCS passed along to borrowers its relatively high operating costs.

- * The FCS was criticised during the mid-1980s for failing to communicate adequately with borrowers about the reasons for rising interest rates, the need for merger of local lending offices, the value of stock purchased by borrowers in the FCS and the viability of the System itself. Many creditworthy farm borrowers who took their business elsewhere apparently did so because of concerns about communications, stock values, and the previously noted interest rate differentials. Better communications undoubtedly would have reduced the desertions.

- * During the farm recession of the 1980s the FCS found it difficult to reduce operating costs. Indeed, total operating costs for the System remained appropriately constant from 1984 to 1987 although the volume of loans handled by the System declined by over \$20 billion during this period (Thor). As a result, operating costs as a percentage of gross loans outstanding rose from 0.8 per cent to 1.7 per cent during 1984 to 1987. This result is probably not surprising in view of the additional work involved in handling problem loans and the disruptive reorganisations of the System that occurred during this period.

While FCS officials made some mistakes, they did not select less creditworthy borrowers than other U.S. agricultural lenders. For example, in January 1985, 59 per cent of outstanding FCS loans were in the hands of farmers with debt-asset ratios exceeding 40 per cent

(Guebert). In this some month, an identical 59 per cent of the outstanding farm loans of all U.S. commercial banks consisted of debts of farmers with debt-asset ratios exceeding 40 per cent (Guebert). As noted earlier, farmers with debt-asset ratios above 40 per cent may have serious financial problems, severe financial problems, or be technically insolvent. Since the percentage of farm loans in the hands of farmers with debt-asset ratios exceeding 40 per cent was equal for both groups, the comparison suggests that, as a group, FCS borrowers were neither more nor less creditworthy than farmers who borrowed from commercial banks. However, the FCS apparently experienced more financial problems, because its loan portfolio was heavily devoted to farm loans while commercial banks typically had more diversified portfolios.

Lessons for Agricultural Lenders

Obviously one must be cautious about drawing inferences for New Zealand from the U.S. experience with farm debt since the farming sectors and agricultural lending organisations differ in the two countries. However, the situations appear to be sufficiently similar that the Rural Bank and other agricultural lenders in New Zealand might consider the following points:

- * As shown by the experience of the FCS, it is dangerous for a lender to underestimate the negative impact of farm financial stress on the ability of farmers to repay debt. Thus, New Zealand lenders might benefit from incorporating a sophisticated warning system which includes, in addition to information on debt-asset ratios (or debt-equity ratios), information on borrowers net cash incomes and the composition of debt. Maybe such a system is already in place. If so, good. Such an early warning system would have been valuable to U.S. lenders, both for spotting problem loans and for identifying borrowers whose financial condition was better than aggregated solvency indicators suggested. On the latter point,

U.S. experience suggests that some farmers who were technically insolvent had positive net cash farm incomes and retained some, albeit limited, capacity to service farm debt. Similarly, some skilled managers who carried a relatively small proportion of their debt in the form of land debt were in satisfactory financial condition despite having debt-asset ratios which suggested that they would have serious financial problems. Collateral recovery values for loans that will be foreclosed upon also need to be correctly assessed. Estimates quoted in connection with the planned sale of the Rural Bank suggest that the Bank has recovered about 65 per cent of its investment on foreclosed loans. In the U.S., a more common collateral recovery figure on similar loans is 50 per cent. Moreover average recovery might decline in New Zealand as the number of farm foreclosures increases.

- * It may be advantageous for New Zealand lenders to restructure loans by writing off part of the principal and/or lowering interest rates if this action would cost no more than foreclosing on a farm loan. This type of restructuring, which was adopted by many units of the FCS prior to receiving government aid and which was later incorporated as a condition for government aid, proved to be useful to the FCS from a public relations standpoint. New Zealand lenders who have written off parts of or reduced interest rates on troubled farm loans in the last few years only to witness a partial recovery of lenders' repayment ability and collateral values may be understandably reluctant to consider such a prescription. However, the financial prospects of some farm borrowers still may be sufficiently grim that restructuring which costs no more than foreclosing may be worth considering. In any event, lenders probably need to apply more uniform standards in deciding whose farm loans get partially written off rather than foreclosed upon. The perception is widespread that major inequities have occurred relating to this point.

- * Total operating costs of an agricultural lender may not decline in proportion to loan volume during times of farm financial stress. Partly this is because of the extra staff work entailed in working with problem loans.

- * Communicate, communicate, communicate! Experience of the FCS underscored how important it is for lenders to provide full information during times of financial stress. For obvious reasons, investors, borrowers, and the government will desire a greater than normal amount of information about the financial condition and strategies of an agricultural lender during times of farm financial stress.

The Rural Bank has diversified its loan portfolio to include more "off-farm" and "downstream" industries. For example, funding for the off-farm and downstream industry initiatives increased to \$32 million in 1986-87 (Rural Banking and Finance Corporation). While the \$32 million figure is not large, expanding these loans would limit the vulnerability of the Bank to damage from declines in farm income, if the profits of the off-farm and downstream businesses are not closely correlated to those of farms. This strategy would be worthy of emulation by the FCS. Except for the Banks for Cooperatives, none of the FCS units make loans to off-farm or downstream businesses. This specialisation could spell trouble for the FCS when another downturn in the farming economy occurs.

The discounting scheme used by New Zealand's Rural Bank in 1986-87 might be employed by the U.S. government to encourage the most creditworthy FmHA (lender of last resort) borrowers to "graduate" to unsubsidised credit. In 1985, the FmHA had \$29 billion in farm loans outstanding and accounted for about 14 per cent of the total value of farm loans in the U.S. (Barnard and Dobson). The Rural Bank's discounting scheme involved subtracting the present value of the concessional interest benefit from the farmers loan balance outstanding and, simultaneously, raising the interest rates on the adjusted loan to the market rate. While the scheme did

not improve the cash flow positions of the New Zealand farmers who qualified for the plan, it did make refinancing of their loans more attractive to additional lenders who had incentives to refinance these loans under conditions which could reduce farmers' loan payments. Since installing a discounting scheme might be interpreted as the first step toward eliminating the FmHA (or at least the beginnings of a more businesslike approach toward collecting principal and interest payments), many FmHA borrowers would likely resist such a change. However, pressures to reduce federal budget deficits in the U.S. might make such a plan attractive to policymakers.

Summary and Implications

During the mid-1980s, U.S. farmers and agricultural lenders experienced the most serious financial stress encountered since the Great Depression of the 1930s. Agricultural lenders in the U.S. -- especially the FCS -- were unprepared for the trauma. For lenders in New Zealand, the main lesson to be gleaned from the experience of the FCS is to avoid underestimating the effects of farm financial stress on farmers' abilities to repay loans. This rather obvious point is important since New Zealand's government seems inclined to manage failure of privately-owned financial organisations rather than bail out such firms, and New Zealand farmers have less access to off-farm income than in the U.S. Both factors have implications for an agricultural lender's ability to survive during times of farm financial stress. For the FCS in the U.S., the lesson is to diversify the organisation's loan portfolio to reduce dependence on farming. A variation of the Rural Bank's discounting scheme also might be used to advantage to reduce the number of recipients of subsidised FmHA credit in the U.S.

REFERENCES

Barnard, Freddie L and W D Dobson, "The Prospects for Successfully Restructuring the Farm Credit System, Chapter in forthcoming book entitled, Food, Policy and Politics : A Perspective in Agriculture and Development, Westview Press, 1989.

Barnard, Freddie L, W D Dobson and Jeurene Falck, "Results of the Indiana Farm Finance Survey for 1988," Purdue Ag Econ Report, October 1988.

Farm Credit System Assistance Board, Annual Report, 1988.

Guebert, Steven R., ed., "Agricultural and Credit Outlook '86," Farm Credit Administration, McLean, Virginia, January 1986.

Harrington, David H., A Summary Report on the Financial Condition of Family-Size Commercial Farms, ERS-USDA, Ag.Info.Bul. No.92, March 1985.

Hassall, Mark, "Norwood Gets Ford Franchise," Farm Equipment News, Issue 260, April 1989.

Lee, Warren F., "The Farm Recession Continues : Some Prospects for Recovery," Socio-Economic Information, Dept. Ag.Econ. & Rural Soc., Ohio State University, 1 March 1986.

MAFCorp, Situation and Outlook for New Zealand Agriculture,
Wellington, 1988 and 1989.

New Zealand Farmer, "Bank Report Triggers Call for Halt to
Sale," 24 May 1989.

Pryde, John, "Capital and Agriculture," Chapter 6 in Rural New
Zealand - What Next? Agribusiness & Economics Research
Unit, Lincoln College, Canterbury, New Zealand, 1987.

Rural Banking and Finance Corporation of New Zealand, 1987
Annual Report.

Thor, Eric P., "Overview of Agribusiness and Financial Trends
with Emphasis on Farm Credit", remarks made at seminar
presented for Department of Agricultural Economics, Purdue
University, Lafayette, Indiana, U.S.A. on 2 March 1989.

U.S. Department of Agriculture, Agricultural Resources --
Situation and Outlook, ERS, AR-13, February 1989.

Contributed Paper to New Zealand Branch of the
Australian Agricultural Economist's Conference,
Flock House, Bulls, 30 June - 1 July, 1989.

AGRICULTURAL POLICIES IN NEW ZEALAND AND THE US - SIMILARITIES, DIFFERENCES AND LESSONS

Ron A Sandrey¹ and Warren E Johnston²

The long slow dance of agricultural rationalisation and trade liberalisation will continue largely at its own pace. Like an army, it cannot advance too far beyond its support systems. Like a giant snake, it must rest and digest from time to time.
(John A Schnittker and A P Van Stolk)

¹ Senior Financial Analyst, Policy Services MAFCorp

² Professor of Agricultural Economics, University of California, and member of the Giannini Foundation of Agricultural Economics.

The authors acknowledge assistance from Dr Robert Reisel, ERS of USDA, for comments on an earlier draft. Errors and omissions remain, as always, the responsibility of the authors.

ABSTRACT

The agricultural sectors of New Zealand and the United States have experience Homeric decade-long wanderings with early states of euphoria (increased net incomes and asset values), followed quickly by deep depressions (poor economic returns, high levels of rural debt, and capital losses) in both countries. The speed and magnitude of requisite adjustments have been quite different, due in part to substantially different Government postures and/or policies. Are the two experiences similar enough to gain useful insights into the efficacy of widely different Government responses for assistance? This paper discusses similarities and contrasts between developments and Government responses since the 1970's. Policy environments, while on philosophically similar grounds, are substantially different when seen in real light, but are the differences likely to persist into the 1990's?

INTRODUCTION

Agriculture and agricultural policies in New Zealand and the US have shown some interesting parallels and differences, with many of the differences relating to the timing of policies, over the last 20 years. Paths during the 70's were similar, but started to diverge in the early 80's with a strong supportive policy environment in New Zealand while the US opened up to more market conditions. With the 1984 Labour Government and the 1985 US Farm Bill, the paths reversed with emphasis on support in the US and market forces in New Zealand. Currently the US is evaluating its support policies with a view to both GATT round positions and the next farm bill. This means there is some uncertainty about the next few years, and these few years are very important to New Zealand. Most studies indicate that we have a great deal to gain from unilateral liberalisation of agriculture, and like the small animals of the forest we are in danger of being trampled if the elephants of US, EC and Japan continue to dance to the tune of protectionism.

The specific objective of this paper is to develop an understanding of those similarities and differences with a view to seeing what implications and lessons for the US there may be in our recent economic liberalisation endeavours. With an increasing awareness of both the costs and benefits of agricultural trade liberalisation there is a great deal of international interest focusing on the recent New Zealand experience, firstly to find out what has happened to the sector and, secondly, to see what lessons can be gleaned from the experience. As Schnittker and Van Stolk's snake of rationalisation and liberalisation uncurls from its hibernation, policy makers are becoming increasingly aware that any movement in GATT must be linked to quite dramatic changes in domestic agricultural policies.

I feel it is in New Zealand's interest to move that snake as far possible as quickly as possible, and to help this we have embarked upon a joint research project with the USDA to study the response of the New Zealand agricultural sector to changes resulting from economic liberalisation. Our temperate climate agricultural sector is technically advanced, export orientated and crucially important to a stable, developed democracy. Assistance to agriculture was relatively high prior to deregulation, and our adjustment path is likely to provide some insights into potential adjustment in the US should progress be made on the GATT round. This paper does not report on our research per se, but rather sets the scene for a small but vital part of the research - that of the applicability of the New Zealand experience for the US. Time will preclude a detailed examination of many interesting and relevant issues.

2 THE 1970'S

The seventies were good to both groups. In the US, net farm incomes (in 1982 dollars) averaged some \$40.41 billion, an increase over the previous decades average of \$36.15 billion (Table 1). World food demand grew at very high rates and, in particular, world grain trade increased more than percent a year between 1970 and 1980 with US exports growing at about 10 percent a year. The US was uniquely placed, as the world's residual supplier, to take advantage of this, and the decade was unequalled success for US grain farmers, although some volatility did exist. Most other sectors also shared in the boom.

Table 1: US Farm Data

| Year | Net Farm Income (1982 US \$'s Bill) | Acreage Diverted (million) | Government Payments to Farmers (1967 US\$'s) | |
|------|---|----------------------------------|---|---------------------|
| | | | Aggregate Billion | Average per farm |
| 1970 | 34.2 | 57 | 3.2 | 1081 |
| 1971 | 33.8 | 37 | 2.6 | 893 |
| 1972 | 41.8 | 62 | 3.2 | 1105 |
| 1973 | 69.4 | 19 | 2.0 | 693 |
| 1974 | 50.5 | 3 | .4 | 128 |
| 1975 | 43.1 | 2 | .5 | 187 |
| 1976 | 32.0 | 2 | .4 | 157 |
| 1977 | 29.5 | 0 | 1.0 | 370 |
| 1978 | 34.9 | 16 | 1.6 | 580 |
| 1979 | 34.9 | 11 | .6 | 271 |
| 1980 | 18.8 | 0 | .5 | 218 |
| 1981 | 28.6 | 0 | .7 | 301 |
| 1982 | 23.5 | 11 | 1.2 | 516 |
| 1983 | 12.2 | 78 | 3.1 | 1331 |
| 1984 | 29.9 | 27 | 2.7 | 1164 |
| 1985 | 29.1 | 34 | 2.4 | 1050 |
| 1986 | 32.9 | 49 | 3.6 | 1400 |
| 1987 | 39.3 | 60 | 4.9 | 2340 |

Source: Incomes - USDA Remainder: Gardner 1989

Aggregate support to agriculture was reduced during the decade, reflecting the strong export demand. Government payments to agriculture averaged \$1.54 billion over the decade, or a per farm payment of \$546 (1967 dollars), compared to a \$2.34 billion aggregate and \$754 average for the previous decade (Gardner, 1989). During the years 1974 to 1976 aggregate government payments dropped to levels seen only in the halcyon days of the 1950's period, reflecting the impact of the Russian grain deal. These factors, and the continued expectations of even better times, combined to rapidly increase farm values over the decade - a phenomena accentuated by rapid inflation and relatively low (and at times negative) interest rates. This is shown in graph 1, which uses US cornbelt real land prices as representative of the US land values. Farm debt grew from \$52.8 US billion in 1970 to \$179 billion in 1980 as farmers expanded production and bid up land and other variable input prices.

Similarly, New Zealand farm incomes remained reasonably good during the decade, as measured by the Meat and Wool Board's Economic Service (MWBES) "All Farms Weighted Average" data. Instability existed, but only once (1974-75) did incomes really appear to be a problem. Total assistance was probably relatively low, although MAFCorp has not analysed assistance in that decade as rigorously as it has the 1980's. Retrospectively, we know that commodity prices continued a long-term downwards trend notwithstanding the 1972-73 commodity boom, a phenomena more apparent now than then. From the mid 1970's onwards agricultural assistance was raised considerably to buffer the effects of

the 1974-75 income drop and first oil shock, and to expand farm output in general (Lattimore et al, 1988). Although these measures may not have had the major impacts of the early 1980's, the important point was that measures were put in place which really started to "bite" later. Additionally, from 1976 Muldoon's "one sided" devaluation became important. These measures signalled to farmers that government of the day was prepared to underwrite the sector. Farmland prices rose during the period, in nominal terms by almost four times and in real terms by a third as shown in graph 1. Most of the increase, in real terms, took place between 1972 and 1974, and thereafter stabilised. These farmland values were undoubtedly held up by the negative real interest rates enjoyed by those taking up mortgages throughout the entire period.

As a generalisation the two sectors, New Zealand and US agriculture, enjoyed prosperity during the decade of the 1970's, although this was tempered by instability. Farmland values increased, especially in nominal terms in both countries. There were, however, some disquietening signs in New Zealand that all was not well at the end of the decade - assistance was increasing while incomes decreased from the decade's average, and product prices continued to trend downwards.

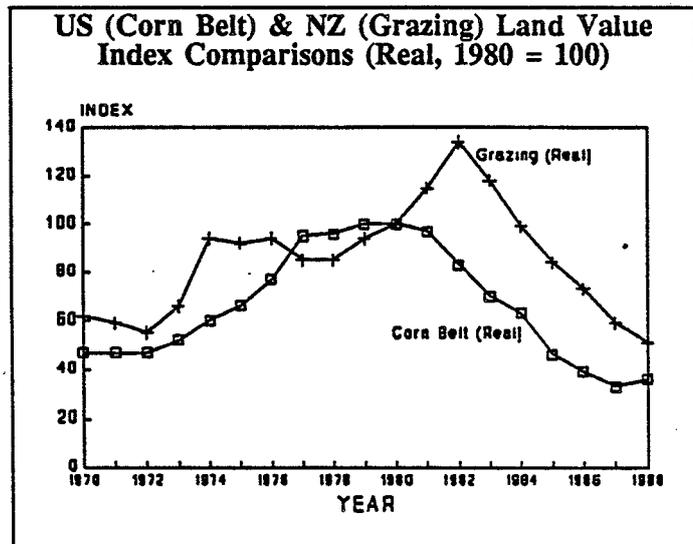


Table 2: New Zealand Data

| Year (March) | Real Net Farm ¹ Income Index (1980-81=1000) | Interest % Gross Farm Interest |
|--------------|--|-----------------------------------|
| 1970-71 | 887 | 8.9 |
| 1971-72 | 994 | 9.4 |
| 1972-73 | 2,471 | 5.9 |
| 1973-74 | 1,706 | 7.0 |
| 1974-75 | 569 | 10.9 |
| 1975-76 | 1,239 | 8.6 |
| 1976-77 | 1,596 | 7.3 |
| 1977-78 | 1,038 | 10.2 |
| 1978-79 | 1,217 | 9.2 |
| 1979-80 | 1,321 | 9.6 |
| 1980-81 | 1,000 | 10.8 |
| 1981-82 | 850 | 12.7 |
| 1982-83 | 822 | 14.0 |
| 1983-84 | 623 | 15.6 |
| 1984-85 | 1,031 | 13.4 |
| 1985-86 | 408 | 20.2 |
| 1986-87 | 589 | 19.3 |
| 1987-88 | 519(e) | 20.2(e) |
| 1988-89 | 561(p) | 18.2(p) |

1 Source: MWBES All Classes Average adjusted to 1980-81 March year.

3 THE EARLY 1980'S

The period 1979-80 was a major turning point for world and New Zealand agriculture as the terms trade fell as world food surpluses grew and nominal interest rates started to rise. During this period New Zealand farmers were largely isolated from these changes, as the exchange rate was fixed and interest rates were both heavily subsidised and artificially capped for many lenders and so commodity prices were heavily supported above world prices.

Assistance, measured as a percentage of output, increased dramatically during the period, with Lattimore et al (1988) showing an increase from 12 percent in the 1979-80 farming season to 20 percent in the 1982-83 farming season. Much of this assistance was concentrated on sheepmeats as the SMP and MISA schemes began to transfer large sums to farmers. Incomes of the MWBES Average Farm Index declined by 50 percent from the 1979-80 figure (and the 1970's average) to 500 in 1983-84 (table 2). These declines were in spite of the increasing assistance, and accentuated by increasing percentage of farm income being needed to meet interest costs.

However, the salient feature of the period must be the land price increases. Nominal index prices more than doubled from the 1979 to 1982 figures, and when inflation is taken account, the real index increased by about a third - this is demonstrated in graph 1, using the Grazing Land index. Loans outstanding to the sector doubled over the period, although MWBES data suggests much of these n

have gone to non-traditional agriculture. The important point is that agricultural debt was not considered a problem during the early 1980's, although real interest rates for mortgages finally become positive after a prolonged period of negative values. The New Zealand agricultural sector was in a dangerously vulnerable situation - prices continuing to decline, incomes falling in spite of assistance, debt increasing and interest rates, both real and nominal, increasing. Retrospectively, we know that farmers were reacting to the signals which they were receiving, but those signals were blurring market realities. This is highlighted by the graph showing land price increases over the 1979 to 1982 period. The 1972-74 property boom was in response to commodity prices, the second one was not.

In contrast, US farm incomes and asset values started to fall early in the decade in response to similar signals. The difference was that American farmers were exposed to these signals. The American turning points were defined by macroeconomic variables of higher real interest rates, a global commodity recession and, retrospectively, the beginnings of a dramatic cycle in the value of the American dollar. For the 1980 year real net farm incomes were one third lower than any year since World War II, and although they recovered somewhat for the next two seasons, real incomes fell again in 1983. As shown in graph 1, real land values started a downward decline as it became obvious that future expectations would not be fulfilled and farmers stopped bidding for land. Market interest rates soared (to 18 percent for the short-term), and this increase drove up the value of the dollar as foreign monies poured into the US. No acreage reductions were applied in 1980 or 81, and direct support to agriculture stayed low until the large Payment in Kind (PIK) programme of 1983.

The recession began to be felt on farms in 1982 as these effects started to bite and banks began to act on problem loans, highlighting the differences between the US and New Zealand. Adjustment took place via farm liquidations, with an estimated 3 to 4 percent of total farms above the normal one percent a year being liquidated in the early 1980's due to the conditions of the time (USDA, Bob Reinsel, pers com).

Three farm lenders were most affected: commercial banks lending to agriculture, the co-operative Farm Credit System (FCS) and the Government lender of last resort to agriculture, the Farmers Home Administration (FmHA). Agricultural commercial banks are generally local banks, with the proportion of farm loans to total loans greater than the average for all banks (e.g. 16.13 percent in 1988). Non-performing loans (overdue 90 days or more) increased from 2.5 to 7.7 percent of total loans at commercial banks from 1982 to 1986 with the 1986 figure being the highest since the 1930's depression. Profitability declined as a result. A number of banks failed (270 in 5 years), and although as a percentage the bank failures were not high their plight became a much publicised sign of the farm crisis.

The FCS is the United States' largest farm lender, holding some 40 percent of real estate and 15 percent of non-real estate debt. Its exposure was especially high, as it is a strictly agricultural lender. Delinquent loans increases from \$2.1 billion in 1984 to \$7.1 billion in 1986, some 14.4 percent of the loans outstanding in 1986. The crisis faced by FCS was alleviated by a rescue package of Government assistance and over the 1984-86 period \$3.2 billion in loans were written off. As lender

of last resort the FmHA experienced the sharpest deterioration in its loan portfolio. It faced a two-fold problem of an increase in its portfolio simultaneously with a deterioration of the quality. By 1988 \$8.3 billion of its \$26 billion portfolio was delinquent, and analysts consider that a third of the \$8 billion delinquent will need to be written off (at taxpayer expense).

4 THE LATE 1980'S

The United States Post-1985

Increased direct payments under the 1985 Act and tighter world markets have combined to increase farm incomes in the United States, and farmland values bottomed out in most states in 1986 and 1987 in response to these higher incomes. Both macroeconomic and farm policies combined to put agriculture on its recovery road. Lower interest rates, lower dollar values and the general strengthening of the world economy and tighter world markets stimulated the recovery, while the 1985 Farm Bill ensured a turnaround in the agricultural economic climate. The primary difference from the 1981 Act to the 1985 Act is the source of the income transfer. Support in the 1981 Act was to come through higher prices, thus transferring income from consumers, while the 1985 Act draws a large share of the support from the Treasury in the form of direct payments to farmers. Government payments to agriculture were, in 1987, the largest recorded in the previous 50 years - in both nominal and real terms (Gardner, 1989). Federal spending in the form of commodity programme outlays constituted nearly half of United States net cash farm income in 1986 and nearly 40 percent in 1987. Direct payments were about \$17 billion in 1987 and constituted roughly 10 percent of gross cash receipts. Additionally, the 1987 Agricultural Credit Act provided direct financial assistance to troubled FCS. Farm incomes have risen to record levels, land values have begun to increase, debt problems have receded and exports are rebounding. The rise in land values is probably not a favourable sign given the high level of support still coming from the Government, as New Zealand farmers have discovered to their chagrin.

The encouraging signs are that farmers are using this new-found income to repay debts as farm debt fell from \$206.5 billion in 1983 to under \$140 billion at 31 December 1988. This resulted from debt repayment (\$56 billion of the \$66 billion) and liquidations of perhaps 3 to 5 percent of the farms and consequential write-downs in asset portfolios of agricultural lenders (\$10 billion of the \$66 billion). Much of this write-down was borne by the United States taxpayer. However, the fundamental problem remains, with United States agriculture continuing to rely on subsidies. Recent surges in the value of the US dollar will accentuate those problems, although higher commodity prices will balance this to some extent.

New Zealand Post-1984

By 1984 it was becoming increasingly clear to most analysts that New Zealand's economic policies were not sustainable. A snap election held in July 1984 resulted in a change of Government, and the economic policies of this new Government were dominated by a strong Minister of Finance dedicated to a sweeping new market driven economy. Agricultural subsidies, put in place by the previous Government, were removed or their removal signalled. The New Zealand dollar was devalued some 20 percent, and six months later floated with the expectation this floated dollar would fall towards purchasing parity downwards. The 1985 farming season was a good one for agriculture as

short-term effects of devaluation, good climatic conditions and the lags associated with reducing subsidies raised farm incomes. In the following year, however, real net farm incomes dropped as the abrupt policy changes really started to bite. International commodity prices remained low, subsidies were largely removed and real exchange rates appreciated since the 1984 devaluation.

Since the 1985 farming year incomes have stayed low. Sheep farmers have been hit especially hard, as the previous assistance levels to sheepmeats were high. The continually declining land values have had an effect upon debt-equity ratios, a phenomena accentuated by increased interest rates and with the need to service the debt on both a lower income and asset base. Dairy farms have not fared as badly, with debt/equity ratios only slightly higher than the early 1980's and considerably lower than the early seventies. This reflects both increased commodity prices in the last season and a lower level of protection during the early 1980's.

As a result of these changes many observers consider that 10 or 15 percent of farms will have to be sold or restructured. To date the response has been slow, as few forced sales have taken place. There are a number of contributing factors which may explain this. These include a discounting scheme by the Rural Bank, the large (estimated 16) percentage of debt held by family loans, farmers' action groups and the resultant publicity, the desire by farmers (and lenders) to "hang in there" and hope, delaying the psychological factor of facing a new life. There are signs that lenders are taking a harder line and more liquidations are taking place. In the two years to March 1988 the Rural Bank realised on only 19 properties in total, and now, after these years of inactivity, it is faced with some 3,795 (6 percent of total loans) farmers in a "foreclosure situation" (NZ Farmer, 1989). Action has been taken in the previous 12 months, but a considerable degree of restructuring is yet to work its way through the system. Additionally, after its large corporate losses of the previous year, the Bank of New Zealand has discovered its rural exposure. The actual or *de facto* sale of both of these institutions is mean that both the Rural Bank and the Bank of New Zealand will continue (or even increase) the degree of commercialisation lately being adopted in their rural portfolio management.

Associated with the liberalisation programme of the late 1980's has been the resultant supply response. Sheep numbers have declined, and some product switching to increased emphasis on wool growing has taken place. Beef numbers are increasing due to the relative improvement in commodity prices following the removal of sheepmeat dominated price supports, although the recent drought is affecting this shift. An increased interest in dairying is becoming a feature of the pastoral sector and interest in deer (and to a lesser extent goats) continues to expand.

Overall, New Zealand agriculture is now in a similar situation to the American prior to the introduction of the 1985 Farm Bill, namely, a financially stressed sector burdened by excess debt and asset values losses. The adjustment which took place in the United States from 1982 to 1986 was due to somewhat different factors than will impact on New Zealand. This adjustment has largely yet to take place in New Zealand, but the signs are increasingly pointing to an adjustment occurring. Indications so far are that the private sector will be expected to bear a large percentage of this adjustment cost, although the debt has yet to work its way through the system. Adoption of an American type 1985 Farm Bill "solution" to the "problem" is precisely what took place in New Zealand with the assistance regime of the early 1980's. This caused the sector to come out of synchronisation with market realities, and would be a policy reversal from the present environment.

This time New Zealanders are facing market realities while their American counterparts continue to rely on Governmental assistance. The snake of Schnittker and Van Stolk had moved much faster than "a slow dance" in New Zealand since July 1984, although much of the structural adjustment has yet to take place. The next relevant question is what is likely to happen in the United States in the 1990's.

5.0 THE 1990'S

There is increasing awareness in the US that commodity programmes are not working for a variety of reasons. These include the distributional effects, whereby most of the monies go to an already well-off group of farmers, increasing doubts about the validity of "food security" as a legitimate policy objective, the schizophrenic nature of the American rhetoric on GATT and reality on agricultural policies, and general budgetary pressures (Gardner, 1989, Paarlberg, 1989, Pasour, 1988). These are forcing a re-evaluation of the objectives of farm policies and what actually has happened, and, as Sanderson and Mehra (1989), point out, "some, although not all, of the declared objectives are political smokescreens", while others are "mutually inconsistent". Income generally takes precedence over other objectives.

High support prices in US (and EC as well) represent a double-edged sword to New Zealand. Market access is restricted and consumer prices are increased by the original programs, reducing consumption. Marginal farmers remain in production, and surplus production is dumped onto the decreasing number of "free" markets, adding insult to the original injury. Although the magnitudes of benefits vary, an almost proliferation of trade models and subsequent analysis indicate that most countries would gain from liberalisation. These gains come about by the reduction or elimination of the dead-weight effects of current policies and reduced food prices leading to consumer gains substantially in excess of producer losses. Significant welfare gains for all countries would result if all liberalised simultaneously (Blanford, 1989). Almost embarrassingly, New Zealand is shown to be a big gainer in most of these multilateral trade liberalisation studies. This results because (a) dairy and red meats (and a change in grain prices) are big "winners" - our major export commodities; and (b) because our producer losses are negligible as we are liberalised. The point that American liberalisation is probably only likely to happen as part of multilateral trade liberalisation highlights how much we have to gain.

Is this likely to happen, and if so, what lessons can the US learn from us? Firstly, the signs of liberalisation are much more promising than they have been for a long time, and others will discuss the GATT situation in more detail later in this Conference. As Paarlberg (1989) points out, twice in this century the US has missed the opportunity to scale back farm programs - the first during World War II, the second during the relative prosperity of the 1970's when a scaling down almost took place prior to the 1985 Farm Bill. He considers that a series of events in place now have given the US a third chance, and hopes they will do better this time! Assisting in placing pressure on US reform is the Graham Rudman Hollings Act requiring Congress to be serious about reducing the budget deficit.

A major liberalisation of American agricultural policies is unlikely to have the same impact upon the sector as the New Zealand experience post 1984. This is for a variety of reasons, including:

- (a) the New Zealand experience was very much an economy wide liberalisation with changes in macroeconomics including the floating of the New Zealand dollar and a freeing of interest rate controls. Both have had major impacts in New Zealand and neither are applicable to the US.

situation. Additionally, many of the efficiency driven changes such as a movement to SOE's and privatisation of previous Government Departments which affected are New Zealand agriculture are not a factor in the US;

- (b) there are differences in the policy instruments and delivery mechanisms of American assistance compared to New Zealand's prior to 1984. This means the transfer efficiency or percentage of actual monies going to farmers would be less in the US than New Zealand. Blandford (1989) estimates the transfer efficiency of American programmes (when estimated in a multilateral liberalisation framework) to be about 40 percent, compared to Canada's 16 and Japan's 63 percent. Although we do not have estimates of New Zealand's transfer efficiency prior to 1984, using the same technique as Blandford it is most likely to be close to Japan's. This means that relatively less of an impact would be felt on American farms in the short run, but I acknowledge that this ignores the cost excess faced by New Zealand farmers in the medium to long term;
- (c) a major liberalisation of American agriculture is most likely only to occur with a multilateral liberalisation. This is linked to (b) above and highlighted in Blandford (1989), where he estimates from 1984 data that American producers would lose annual benefits of \$10.1 Billion US for multilateral liberalisation, as world prices would increase to compensate some of the transfer payments. In contrast, with a US unilateral liberalisation, the US producers would lose \$20.6 Billion but consumers would see prices decrease instead of the increase with multilateral liberalisation;
- (d) American liberalisation, even using the most radical scenario, is unlikely to either proceed as far or as fast as New Zealand's. For example, the Americans are unlikely to change R&D expenditures, adverse events policies or taxation structures as has occurred in New Zealand;
- (e) it is unlikely that the US would face major infrastructure changes in allied industries such as the meat processing sector. This reflects a more efficient processing sector;
- (f) both land prices and agricultural debt have already made major adjustments in the US, placing the American sector in a much stronger position to face liberalisation than New Zealand was in 1984/85. Graph 1 shows the relative changes in US cornbelt versus New Zealand grazing land prices. From 1982 they have paralleled each other downwards, with the major difference being the 1980-82 increase in New Zealand. As discussed in the text, the US debt has been squeezed by adjustments prior to liberalisation;
- (g) currently American farmers (especially grain farmers) are facing higher world prices. This is in contrast to New Zealand sheepmeat farmers, who entered an economic liberalisation phase when returns were being heavily supported, and more comparable to our dairy farmers.

Consequently, the American liberalisation debate is likely to focus more upon direct income measures than a whole raft of changes such as occurred in New Zealand. The supply response from price changes will continue to be an issue, and it is here that New Zealand can offer some lessons. SriRamaratnam and Reynolds, in another paper to this Conference, discuss the work which Policy Services MAFCorp is undertaking in addressing that question - is the supply response in New Zealand as we would have anticipated? This potentially may answer one of

the most useful questions for American policy makers.

The successor to the 1985 Farm Bill will signal to others the willingness or otherwise of the Americans to seriously participate in agricultural liberalisation as outlined in some yet-to-be defined GATT agreement. If progress is to be made in the Round, these two factors (the new Farm Bill and GATT) must have a large degree of commonality and compatibility. Gains from multilateral liberalisation are attractive, and especially so for us. However, it will require genuine commitment from the US to achieve both of these goals. As Webb and Dixit (1989) point out, less government intervention in agriculture is a sufficient condition for satisfying both the Graham-Rudman - Hollings and GATT, but reduced intervention is not a necessary condition for either. Budget constraints can be met by taking the intervention off-budget and transferring the costs to consumers, with the US dairy supports a good case in point. Similarly, GATT objectives can be met by using creative "non trade distorting" supports of agriculture, although most of these measures (decoupled, income support for example) require budgetary expenditure. Herein lies the problem, and our mutual potential gains in a genuine multilateral liberalisation.

Initially the economic reforms in New Zealand had the support of the agricultural sector. Farmers welcomed the exchange rate changes on the expectation that the NZ dollar would reflect our on-farm terms of trade and the withdrawal of assistance on the expectations that cost excesses would be removed and "the playing field would be level". Neither of these has happened, and Niverna has not been reached. Neither of these will be factors in a US liberalisation, although the US dollar would have some reaction to a liberalisation. Meanwhile the New Zealand agricultural sector is badly exposed awaiting further liberalisations at home and abroad.

REFERENCES

- Blanford, David, 1989. "The Costs of Agricultural Protection and the Difference Free Trade Would Make" Chapter IV in *Agricultural Protectionism in the Industrialised World*", ed by Fred Sanderson, Resources for the Future, Washington DC (draft form only).
- Drabenstott and Barkema, 1988. "US Agriculture's Odyssey of the Eighties" Paper presented to XX International Conference of Agricultural Economists, Buenos Aires, August 1988.
- Gardner, Bruce, 1989. "United States," Chapter 1, Part 1, in *"Agricultural Protectionism in the Industrialised World"*, ed by Fred Sanderson, Resources for the Future (in draft form only).
- Johnston, W E and R A Sandrey, 1989. "Land Markets and Farm Debt", MAFCorp Policy Services, unpublished manuscript.
- Lattimore, R G, B J Ross and R A Sandrey, 1988. "Agricultural Policy Reforms in New Zealand, 1984" Paper Presented to XX International Conference of Agricultural Economists, Buenos Aires, August 1988.
- Paarlberg Don, 1989. "The Farm Policy Agenda; It's Time to Change It", *Choices*, Second Quarter.
- Pasour, E C Jr, 1988. "The Farm Problem, Government Farm Programs, and Commercial Agriculture", *J Prod Agric*, Vol 1 no 1, p 64-70.
- Schnittker, J A and A P Van Stolk, 1989. "GATT Negotiations and Agricultural Policy Reform", *Choices*, Second Quarter 1989.
- Sri Ramaratnam, S and R G Reynolds, 1989 "Pastoral Sector Output: A modelling Approach". Contributed paper to New Zealand Branch of the Australian Agricultural Economists Conference, Flock House, Bulls, 30 June - 1 July, 1989.
- USDA, Oct 1988. "Economic Indicators of the Farm Sector: National Financial Summary, 1987". Agriculture and Rural Economy Division, ERS, USDA. ECIFS 7-1.
- Webb, A J and Dixit P, 1989. "GATT Compatibility of the 1990 Farm Bill". Paper to Workshop on Agricultural Policy, Trade and Development, PECC/KREI, 16-18 May 1989, Seoul Korea.

ASPECTS OF FARM FIRM GROWTH IN THE PONGAROA REGION

A Wright,¹ J R Nicholls,¹ D I Gray¹, P A G Fraser²

¹Department of Agricultural and Horticultural Systems Management,
Massey University

²MAFTech, Dannevirke

ABSTRACT

Farmers in the Pongaroa district were surveyed in 1989 as part of an investigation into adjustment strategies used by hill country farmers. Stocking rates for a group of progressive farmers had reached 10.3 su/ha in 1988, and 9.0 su/ha for 30 farmers replying to a postal survey. Diversification had made little contribution to gross farm incomes. Future increases in production would be based on fine tuning of existing systems and would be financed out of income. The majority of farmers were optimistic about the future economic viability of their farms.

Keywords: Farm survey, development, hill country, diversification

INTRODUCTION

As part of an investigation into adjustment strategies used by hill country farmers in response to changing economic conditions since 1984/85, a survey of the Pongaroa district was carried out in early 1989. The overall objective was to collect information which would be of assistance to individual farmers and to those responsible for formulating and implementing Government policy.

The Pongaroa district was chosen because of an information base extending back to 1949/50 when MAF carried out a comprehensive survey of the then Akitio County (Woods, 1951). The County was surveyed again in 1978/79 by MAF (Shepherd and Arthur-Worsop, 1980) and in 1985 was included in an extensive survey of Southern Hawkes Bay carried out by MAF and Federated Farmers. This latter survey (unpublished) was part of an exercise designed to alert farmers to problems likely to arise from deregulation of the economy and the removal of support structures for agriculture, and to advise them of measures that should be taken to deal with these problems.

The 1989 survey extends the information base for the Pongaroa region to 40 years. Analysis of the data is still in progress and full results will be published elsewhere. In this paper farm development since 1949 is briefly reviewed and some of the survey results relating to farm development are reported.

THE SURVEY

There were estimated to be about 125 sheep and beef farms in the region corresponding to the original Akitio County covered in the earlier surveys. Twenty-two farmers identified as "progressive" at the time of the 1985 MAF/Federated Farmers survey, were visited in early 1989. Information was obtained on 1987/88 levels of production and profitability, on management changes made since 1984/85, and on intended changes from 1988/89. Twenty-one farmers provided full physical and financial information for the period of interest. One farm was considered to be a special case because of its size and has not been included in the quantitative analyses.

Following the interview survey an abbreviated questionnaire was mailed to all other farmers in the region that could be identified, and 30 completed questionnaires were returned. In total, 51 farmers representing about 45% of farmers in the area participated in the survey. Basic details of the survey farms are shown in Table 1. Further details about the farms included in the interview survey have been published elsewhere (Nicholls *et al.*, 1990).

Table 1: Average data for survey farms

| | Interview survey | Postal survey |
|-----------------------------|------------------|---------------|
| Number of farms | 21 | 30 |
| Area (ha) | 563 | 547 |
| Stocking rate (su/ha, 1988) | 10.3 | 9.0 |
| Breeding ewes per farm | 3230 | 2591 |
| Breeding cows per farm | 81 | 99 |
| % dry cattle su | 63 | 51 |
| % dry sheep su | 28 | 31 |

DEVELOPMENT

The 1949/50 survey was carried out in order to gain information about "the problem of marginal land," and the results contributed substantially to the formulation of policy for the development of marginal lands in New Zealand. In 1949/50 the farmed area of 80270 hectares was carrying 365000 stock units (4.5 su/ha). With the development of every farm it was estimated the county could run about 586800 stock units (7.3 su/ha), an increase of 60%. However, it was considered that 92% of farms would need technical advice and financial assistance to develop, and 70% of the farms needing finance would be unable to offer security for loans (Woods, 1951).

Development did proceed during the 50's and 60's aided by relatively profitable conditions for farming. By the time of the 1978/79 survey total stock units had increased to 592400. The main features of development had been scrub clearance, pasture improvement through aerial topdressing and subdivision, and control of pests (rabbits, grass grub and porina). Most development had been financed out of income.

Although stock numbers had reached the potential as estimated in 1950, justification for the 1978/79 survey was "the apparent gap between what technologists indicate should be possible to produce from hill country sheep farms, and what farmers are actually achieving."

The objective of the 78/79 survey was to discover what was holding back further development and expansion of production. The farm labour situation (Arthur-Worsop *et al.*, 1981; Gillies, 1980) and the Pongaroa water scheme were also under investigation at the time. Development was seen to be primarily a case of bringing all farmers up to the level of production being achieved by the top farmers. This represented an increase in average stocking rates from 8 to a "readily attainable" 10 stock units per effective hectare. The potential under existing technology was seen to be around 12.5 stock units per hectare. The importance of having associated advisory inputs was noted. The survey indicated that over 70% of farmers intended to undertake further development. While there was a strong preference for development out of income, 35% intended to use Rural Bank development loans or the Land Development Encouragement Loans. Twenty-nine percent of farmers were under the Livestock Improvement Scheme or were considering applying.

The data in Table 1 show that in 1988 farms in the interview survey had achieved an average stocking rate of 10.3 su per effective hectare. Farms in the postal survey had achieved an average of 9.0 su per effective hectare. A number of farms in the region have thus achieved the readily attainable stocking rate identified in 1978. Only two farmers reported a stocking rate of 12.5 su per hectare or more in 1988, and one of these was a short term situation associated with buying additional land.

Nine farmers in the interview survey had made use of the LDEL scheme, ten had used the Livestock Incentive Scheme and three had taken out development loans. The increase in stock numbers on those farms involved in development averaged about 1250 su per farm. Most farmers felt the LDEL and LIS schemes had been useful to them, and these schemes, together with an effective extension service, had obviously been important in motivating and facilitating farmers to increase production¹.

There has probably been little if any overall increase in stock numbers since 1984/85. While farmers in the interview survey had achieved a slight increase up to 1987/88 (Nicholls *et al*, 1990), fifty percent of farmers in the postal survey indicated that they had made no change to stock numbers over the last five years. The remainder had either reduced overall numbers or changed policies, with emphasis on less breeding ewes and cows, and more dry stock. Seventy-three per cent of farmers in the postal survey were not planning any changes in stock numbers or policies over the next two years. Land development activities in the future will be focussed on improving existing pastures, particularly on flats, through renewal, fertiliser, subdivision and drainage, and will be financed out of income. Only one farmer in the interview survey was prepared to borrow to finance development.

DIVERSIFICATION

In a circular to farmers at the time of the 84/85 survey, MAF advised that opportunities for diversification were limited, costly, long term and therefore inappropriate to farmers hard hit by the current economic conditions. The value of this advice is borne out by farmer experience since 1984/85. Nineteen of the 51 farms surveyed had tried at least one form of diversification as indicated in Table 2. Establishment costs were less than \$30000 per farm except where deer facilities were involved. They were mainly financed out of income or through seasonal finance.

Table 2 Number of farmers trying new enterprises

| | Interview survey | Postal survey |
|-----------|------------------|---------------|
| Bull beef | 5 | 1 |
| Deer | 3 | 2 |
| Goats | 4 | 5 |
| Forestry | 1 | 1 |
| Fitches | 1 | - |
| Merinos | 1 | 1 |

With the exception of bull beef and merinos, which perhaps should be regarded as variations of existing enterprises, diversification had made little contribution to farm income up to 1987/88, and there was little confidence in future prospects. Three farmers received income from goats in 1987/88, averaging only \$4.83 per goat stock unit, or about \$1350 per farm. Deer contributed less than 5% of total farm income for the one farmer still running deer in 1987/88. Several farmers who had introduced goats commented that a major objective was weed control rather than an alternative source of income.

¹Farmers in the interview survey were not asked a specific question about advisory services, but many volunteered their views on the effectiveness of the local MAF extension service.

DEBT RESTRUCTURING

Thirteen farms in the interview survey had debt written off under the Rural Bank discounting scheme. The average amount was almost \$110,000 per farm and in terms of 1987 stock numbers, ranged from \$9.45 to \$77.30 per stock unit. Four farms also had from \$20000 to \$85000 of debt "parked" for two years as part of the restructuring package. Nine farms had annual charges reduced by \$2000 to \$8000 as a result of restructuring, while the remaining four farms had similar or slightly increased charges. All farmers who did not have debt discounted were ineligible to participate in the scheme, with six having no significant debt.

Six farms in the postal survey had debt written off, averaging \$119000 per farm for the four farms providing details.

While discounting reduced the debt loading of individual farms it did not increase income earning capacity as might be achieved for example, by increasing farm area. Farmers who participated in the discounting scheme were asked about their preference for reduced debt versus additional land if these had been alternatives². Features of the farms choosing each alternative are given in Table 3.

Table 3 Features of farms choosing extra land versus reduced debt

| | Extra land | Reduced debt |
|---------------------------|------------|--------------|
| Number of farms | 6 | 7 |
| Effective area (ha) | 276 | 622 |
| Total stock units (87/88) | 2978 | 6230 |
| Gross farm income (\$/su) | \$31.00 | \$29.04 |
| Interest payments (\$/su) | \$8.90 | \$5.97 |
| Farm surplus* | \$24440 | \$66000 |

*Gross farm income - farm working expenses - interest

Extra land is clearly the preferred option for smaller farms which are potentially at risk from falling production or prices. Further analysis of an expanded data set is needed to draw conclusions about adjustment strategies useful to small versus large farms.

FUTURE OUTLOOK

Farmers in the interview survey were asked to give their views on the future outlook for farming in the Pongaroa region, and on what changes in Government policy are needed to facilitate growth and survival of farms in the region. Over 90% of the farmers believed that the outlook for farming was good, providing that present Government policy was successful in reducing interest rates and inflation. The slow progress in reducing interest rates was of concern to all farmers. About a third of the farmers suggested that further deregulation (e.g. of the labour market) was necessary to help reduce off-farm costs, and 20% questioned the benefits of an uncontrolled exchange rate. A number of farmers felt that policies were needed to encourage young persons into farming. They believed that the farming population in the Pongaroa region was decreasing and aging, and that inadequate equity could create problems for farmers wanting to retire.

Farmers in the postal survey were asked for their opinions about improvements in income in the next two years, and about the future economic viability of their farms. Relative opinion was assessed on a scale from 1 (very pessimistic) to 5 (very optimistic), and the results are summarised in Table 4.

²This option was suggested by R J Townsley.

Table 4 Summary of farmer opinion on income prospects and farm viability

| | Pessimistic (1-2) | Neutral (3) | Optimistic (4-55) |
|---|------------------------------|------------------------|------------------------------|
| An improvement in next two years in gross wool income? | 4 | 18 | 8 |
| An improvement in next two years in gross sheep income? | 8 | 11 | 11 |
| An improvement in next two years in gross cattle income? | 4 | 9 | 17 |
| An improvement in next two years in "other" income? | 13 | 9 | 1 |
| Future economic viability of your farm? | 4 | 8 | 17 |

(Not all farmers gave an opinion for the last two questions)

The results indicate a degree of optimism about the economic viability of their farms that is a little surprising given current economic conditions, and the fact that the data were collected during the peak of the 1989 drought.

CONCLUSION

Since Akitio County was first studied as a typical example of marginal lands, there has been a thirty-five year period of land development and expansion of production up to the mid-1980's. This has been due to new technology such as aerial topdressing, to periods of farming prosperity in which incomes were sufficient to finance development, to Government policies such as LDEL which helped to change farmer attitudes towards borrowing, and schemes such as the Pongaroa rural water supply.

At the present time there are no new technological developments in sight but better use of existing technology could have a significant impact on production. There is much greater economic uncertainty following deregulation of the economy and the withdrawal of support for agriculture.

Unlike the previous surveys of 1949/50 and 1978/79, we cannot identify a potential for increased production. In the immediate future, farmers will be concentrating on fine tuning their farm systems to improve performance of existing enterprises, to seek greater flexibility to respond to market signals, and to achieve greater control over costs and debts. The next few years (from 1988) are likely to be ones of consolidation rather than growth, but the farmers at least, are confident about their future.

ACKNOWLEDGEMENTS

To the farmers who cooperated in the survey.

Financial support for this study was provided by the Rural Policy Unit of MAFTech, and the Massey University Research Fund.

REFERENCES

- Arthur-Worsop, M.; Shepherd, A.A.; Plunket, I.G. and Walker, V.J. (1981). The Akitio Study - Farm Labour. Research Paper 6/81, Economics Division, Ministry of Agriculture and Fisheries.
- Gillies, A. (1980). Farm productivity and rural society. Proceedings NZ Branch of Australian Agricultural Economics Society. R.W.M. Johnson and P.G. Bushnell (Eds). pp 63-71.
- Nicholls, J.R.; Gray, D.I.; Wright, A.; Fraser, P.A.G. (1990). Adjustment strategies used by hill country farmers in the Pongaroa district. Proceedings of NZ Grasslands Association. Vol. 51 (In preparation).
- Shepherd, A.A.; Arthur-Worsop, M. (1980). Factors affecting agricultural production from a group of hill country farmers comprising Akitio County. Proceedings N.Z. Branch of Australian Agricultural Economics Society. R.W.M. Johnson and P.G. Bushnell (Eds). pp 43-62.
- Woods, L.W. (1951). Developing Marginal Lands. Bulletin No. 339. N.Z. Department of Agriculture.

ADJUSTMENTS TO DAIRY FARM MANAGEMENT PRACTICES AND LIFESTYLES BETWEEN 1985 AND 1988 IN RESPONSE TO CHANGES IN GOVERNMENT POLICY AND MILKFAT PAYOUTS IN THE MANAWATU REGION OF NEW ZEALAND

A.H.Hughes¹), H.D.Jose²), W.J.Parker¹), F.M.Anderson¹).

1. Dept. Agricultural & Horticultural Systems Management, Massey University

2. Institute of Agricultural and Natural Resources, University of Nebraska

SUMMARY

A mail survey of dairy farmers supplying the Manawatu Cooperative Dairy Company was carried out in May 1988 with the aims of determining the adjustments dairy farmers made to their farm and financial management practices in response to changes in the economic climate from 1985 to 1988, and of identifying sources of information used by dairy farmers, and quantifying how their personal lifestyles had been affected during this period. Respondents adjusted by attempting to diversify, reducing costs, increasing off-farm work and herd size, and by taking greater care in managing their finances.

Key Words: Adjustment, Dairy, Management, Lifestyle.

INTRODUCTION

New Zealand dairy farmers, in the five years prior to 1989, confronted the greatest challenge to their livelihood since the Great Depression. The major factors responsible were changes in domestic government policies and world economic conditions, particularly declining agricultural commodity prices. The effects of these were compounded by high domestic interest rates and an increase in the value of the New Zealand dollar relative to the U.S. dollar. At the same time Government support to the agricultural sector was, with the possible exception of adverse events relief, sharply reduced (Douglas, 1984). The result was significantly lower and less certain farm incomes and greater risk of business failure for all types of farm firms. Reduced profitability precipitated a sharp drop in the value of farm assets, the magnitude of which was unprecedented in the past 50 years. While the number of farm foreclosures and forced sales has been limited, many farmers were placed in a precarious financial situation (Moffat, 1985; MAF, 1985).

To survive, farmers had to learn to cope effectively with the existing and the longer term implications of a dynamic and at times volatile production and market environment. They had to be able to assess a constantly changing situation, estimate the implications and impacts for their business and then take appropriate strategic action. For many, there was, and will continue to be a need to learn how best to restructure their farms financially, and how to design, implement and control both business and production systems in a more risky, uncertain and deregulated environment.

During the last five years, farmers' financial predicaments, together with their associated stress loads have been described and widely reported in the popular press, and at conferences (Tisdall,1986; Alexander,1986; Owen and Williamson,1987). Not so widely researched and documented are the management strategies farmers adopted; their sources of new or revised information; the learning styles they adopted and the barriers they had to overcome to remain solvent.

This paper summarises the main results of a May 1988 mail survey of dairy farmers supplying the Manawatu Cooperative Dairy Company (MCDC) in New Zealand. The survey had the primary aim of determining the adjustments dairy farmers had made to their farm and financial management practices in response to changes in Government policy and financial returns from 1985 to 1988. Secondary aims were to identify the sources of information used by dairy farmers in the MCDC supply region, in reaching decisions to effect change and to quantify how their personal lifestyles had been affected during this period.

SURVEY METHOD

A census survey approach was adopted because of the anticipated wide variability between farms and farmers. The most practical and economic way of obtaining responses from the 942 owners and sharemilkers supplying the MCDC was by mail questionnaire (O'Donnel, 1969). A 30 question, 13 page questionnaire was designed and pre-tested in April and mailed out in May 1988. The first section solicited details on farm and herd size, type of supply, ownership and management structure in 1985 and changes in these factors between 1985 and 1988. Subsequent sections asked for details of changes to management practices over the three year period; where farmers had sought information about changes made and the influence that information had on decisions to change; and changes that had occurred in respondent's lifestyle during the study period. Later sections sought information on respondent's beliefs about the likelihood of improved profitability of dairying in the forthcoming 1988/89 season and in three to five years time. Details were also sought on respondents' discussion group membership. Although not reported here, respondents were also asked for their image of the Faculty of Agricultural and Horticultural Sciences at Massey University as a source of information and learning opportunities, the learning strategies they had adopted, the obstacles to learning they encountered and the level of stress associated with their learning to cope with the changing agricultural environment.

Ordinal scaled questions (1-5 scale). were used to allow respondents to rank the relative importance or intensity of answers (Stevens,1946). No attempt was made to obtain details of either individual debt servicing or equity levels of respondents as, at the time of the survey, both issues were considered too sensitive for a survey of this type. Responses were coded numerically and analysed using the SPSSX (1983) statistical package.

RESULTS

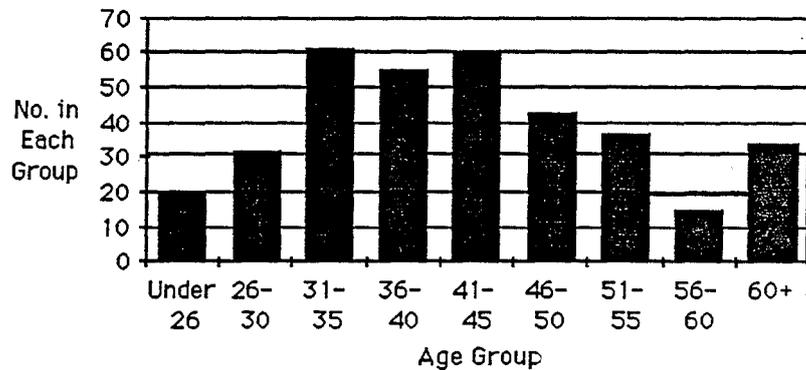
Response Rate

Over a period of six weeks completed questionnaires were returned by 372 (44%) of the suppliers. Survey respondents represented 350 farms (22 owners and sharemilkers submitted returns for the same property). These included 90 town milk and 260 seasonal supply farms. Of the 372 respondents, 216 (58%) described themselves as owners, 73 (21%) as sharemilkers and six (2%) as managers.

Age of Respondents

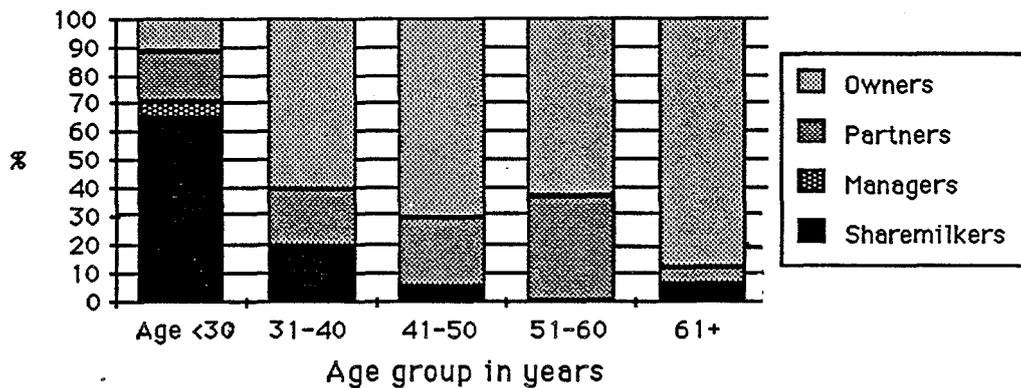
Sharemilkers averaged 32 years of age, and partners/owners averaged 45 years of age. Respondents ages ranged from 21 to 77 years (Figure 1). The mean age of seasonal and town milk suppliers was similar (41.5 vs 42.3 years). Less than 15% of all suppliers were under 30 years of age, some 65% were between 31 and 50, and the remaining 20% were 51 years and over. This age distribution is similar to that reported by Moran and Anderson (1988) for Northland dairy farmers.

Figure 1: Age Distribution of Survey Respondents.



The age distribution of 239 of the respondents summarised by their position on the farm is shown in Figure 2. This shows that most sharemilkers are less than 30 years of age and suggests that the common goal of farm ownership had been achieved for most, between 30 and 40 years of age.

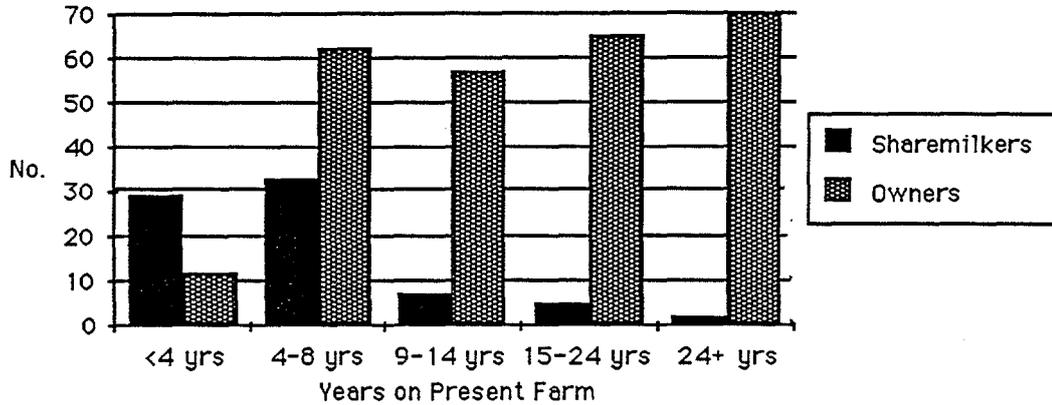
Figure 2: Percentages of Respondents Holding Different Positions on the Farm by Age Groups.



Years On Present Farm

The number of years that respondents reported being on their present farm averaged 16.1 years. Sharemilkers averaged 6.5 years on their present farms while partners and owner-operators averaged 17.6 and 19.3 years respectively. At the time of the survey, 12% of all suppliers had been on their present farm less than four years; 28% between four and eight years; 17% nine to fourteen years; 21% fifteen to twenty four years and 22% for more than twenty four years (Figure 3). These data suggest that movement between farms or entry into dairy farming has slowed down from 1984 to 1988, at least relative to the period 1980 - 1984.

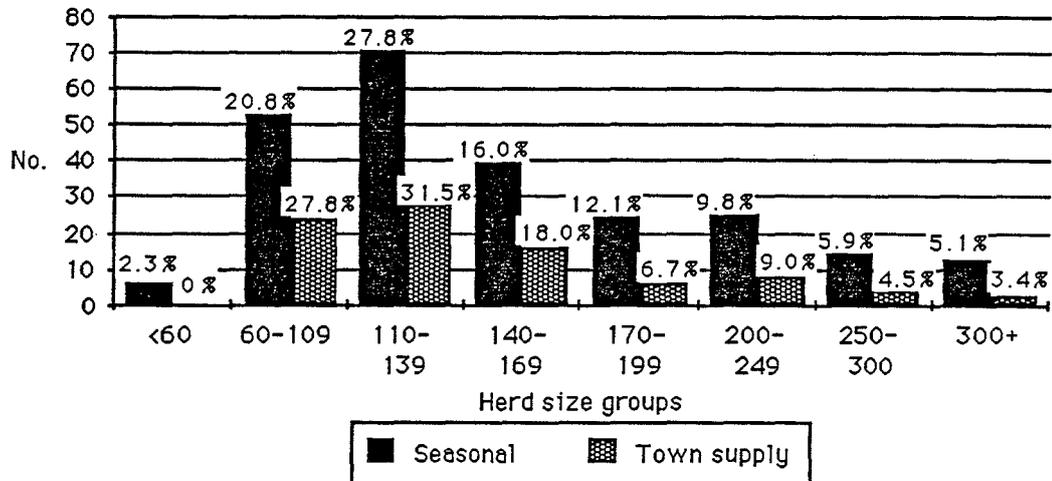
Figure 3: Number of Years Owners and Sharemilkers Had Been on Their Present Farms.



Herd Size

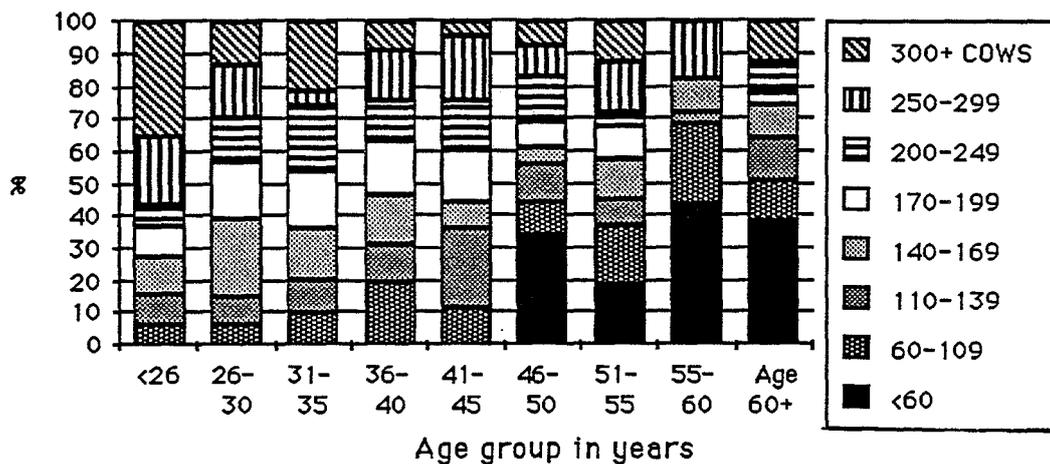
The average number of cows in milk on respondents' farms in 1985 and in 1987 was 154 and 156 respectively, with average dairy herd sizes for seasonal suppliers of 157 and 158 cows and for town suppliers of 146 and 149 cows respectively in the two years. Seasonal supply farms averaged 88.3ha in area, and town-supply farms 117.5ha. The distribution of herd sizes is presented in Figure 4.

Figure 4: Aggregate Distribution of Herd Sizes.



Younger suppliers tended to be associated with larger herds and, conversely, older suppliers (especially those over 50) tended to be associated with smaller herds, as is illustrated in Figure 5.

Figure 5: Age of Respondents by Dairy Herd Size.



Changes in Farming Practices

The extent and direction of changes in management practices between the 1985-86 and 1987-88 seasons reported by respondents are summarised in Table 1. Overall, respondents are shown to have reacted to reduced income by reducing discretionary expenditure, especially on repairs and maintenance, herd testing, amount of fertilizer applied and the amount of hired labour. Increased expenditure on supplements was probably due to increased feed requirements from increased stocking rates. The high profitability of bull beef during this period (MAF 1986) and their lower labour requirements encouraged dairy farmers to rear and retain more bull calves for beef production. There was a marked change in financial management, with 55.7% of respondents indicating that more time was spent monitoring cashflows and preparing budgets.

Table 1: Percentage of Respondents Changing Practices
Between 1985-1988.

| Farming Practice | Direction of Change | |
|--------------------------------------|---------------------|-------------------|
| | Decreased | Increased |
| Expenditure | | |
| Repairs and maintenance | 52.6 | 12.0 |
| Frequency of herd testing | 33.4 | 9.4 |
| Fertilizer application | 31.4 | 11.7 |
| Amount of hired labour | 28.6 | 9.1 |
| Annual pasture renewal | 18.9 | 24.3 |
| Proportion of herd artificially bred | 17.7 | 14.9 |
| Amount of supplements purchased | 12.9 | 24.0 |
| Stock Policy | | |
| Change in stocking rate | 15.7 | 34.6 |
| Number of heifer calves reared | 16.9 | 25.1 |
| Number of herd replacements | 17.7 | 14.9 |
| Number of heifers grazed off | 8.3 | 16.3 |
| Number of bull calves reared | 7.7 | 36.0 ^a |
| Financial Management | | |
| Budgeting including cashflows | 3.4 | 55.7 |
| Off-farm employment | | |
| Males | 4.3 | 15.1 |
| Females | 5.4 | 22.3 |

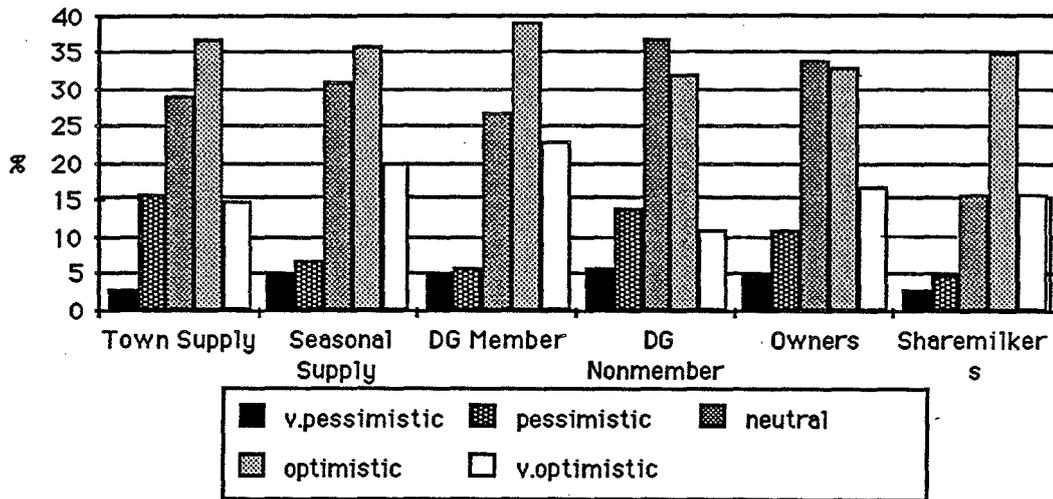
a) 17.9% of farmers kept more bulls over one year of age.

Optimism For Improved Profitability Of Dairying

Of the 366 suppliers who replied to the question on their optimism for improved profitability in the next season (1988/89), 27.1% reported that they were very pessimistic or pessimistic, while 37.7% reported they were optimistic or very optimistic. The remainder (35.2%) were neutral.

With respect to the situation in three to five years time, 14.2% reported they were either very pessimistic or pessimistic, while 55.0% reported they were either optimistic or very optimistic and 30.8% were neutral. The different optimism ratings by various groups of respondents is shown in Figure 6. Discussion group members were more optimistic ($p < 0.01$) than non-members about the longer term profitability of dairy farming. Differences between owners and sharemilkers, and between seasonal and town supply farmers were not significant.

Figure 6: Respondents' Long Term Optimism Ratings by Type of Supply, Discussion Group (DG) Membership and Position on the Farm.



The contrast between short term and long term optimism can be related to the May 1988 situation in the dairy industry. The \$2.25 per kg advance milkfat price for the 1986/87 season would still have been fresh in their memories, interest rates on borrowed money were still high (20-22%) and the European butter mountain was only just beginning to melt. A more optimistic response would have been anticipated if the same questions had been asked again in December 1988 by which time milkfat prices had increased.

No statistically significant relationship was found between the degree of optimism respondents reported for an improvement in the profitability of dairying three to five years ahead and the number or extent of changes they had made in their management practices between 1985/86 and 1987/88. Data on equity and debt servicing costs would have helped elaborate on this complex issue.

The number of suppliers reporting they were either very optimistic or optimistic about improvement in the longer term profitability tended to increase with increasing herd size (e.g. mean score for herds of less than 60 cows = 2.66; 140 to 170 cows = 3.69; 300+ cows = 3.88). This relationship could be due in part to the potential economies of size offered by large dairy herds (Wright et al. 1989). Optimism about improvement in the long term also tended to decrease with increasing age (e.g. mean score for farmers less than 26 years of age = 4.00; 41 to 45 years = 3.53; over 60 years = 3.23). Decreased optimism with increasing age may have been linked in the memories of older respondents to earlier milkfat price recessions and the relative stability of the industry in the 1960's and '70's. All of the herds of less than 60 cows and 38% of herds with 60 to 109 cows were owned by farmers over 45 years of age. These farms would have become increasingly uneconomic if the cost price squeeze had continued (Wright et al. 1989).

Changes In Lifestyle Since 1985

Increases in off-farm employment, listed earlier in Table 1, were reported by 56 (15.1%) of suppliers and by 83 (22.3%) of their spouses. Decreases in off-farm employment were reported by 16 (4.3%) of suppliers and by 20 (5.4%) of their spouses - most decreases were explained by the arrival of additional children in the family requiring the mother to give up off-farm work or the husband to give up off-farm work in order to perform farm work previously undertaken by the wife. Changes reported in personal drawings (probably associated with changes in lifestyle) between 1985 and 1987 are shown in the Table 3.

Table 3: Changes in Personal Drawings Between 1985 and 1987.

| Change in Personal Drawings | Number | % |
|---|------------|-----------|
| Increased spending by more than C.P.I. ^a | 34 | 9 |
| Increased spending equal to C.P.I. | 104 | 29 |
| Increased spending but by less than C.P.I. | 60 | 17 |
| No change in actual spending | 63 | 18 |
| Decreased actual amount spent | <u>101</u> | <u>27</u> |
| | 362 | 100 |

a) C.P.I. = Consumer Price Index

The 38% of respondents reporting increases in spending equal to, or more than, increases in the CPI suggests that not all dairy farmers had experienced hardship since 1985. Those with high equity and larger and more productive farms may have had the flexibility to adopt low cost strategies to counter the cost price squeeze and so preserve their lifestyle. Some of those reporting either increases or no change in their spending mentioned that off farm income had allowed them to maintain their lifestyle despite lower farm returns.

A total of 217 responses were received to the question regarding other changes in lifestyle between 1985 and 1987. Of these 217 responses, 30 suppliers reported no major changes except increased care in both personal and farm spending. A representative verbatim selection of the remaining 187 responses is presented below:

- "...no holidays for 4 years and no weekends off for 3 years..."
- "...no boarding school for kids..."
- "...less entertainment less eating out but more on kids education..."
- "...house improvements on hold..."
- "...cheaper holidays...with relatives and friends..."
- "...sold car, ute now only means of transport..."
- "...reduced spending but family holidays still first priority..."
- "...employed weekend milker to allow some leisure time..."
- "...diversified out of dairying..."
- "...no change thanks to other income..."

These verbatim responses were grouped into eight categories and are summarised in Table 4.

Table 4: Number and Percentage of Reported Lifestyle Changes.

| Lifestyle Change | Number | % |
|--------------------------------------|-----------|-------------|
| Reduced personal spending | 18 | 9.6 |
| Reduced eating out | 6 | 3.2 |
| Reduced recreation/entertainment | 36 | 19.1 |
| Reduced holidays/vacations | 84 | 44.7 |
| Reduced cost of childrens' education | 8 | 4.3 |
| Reduced home improvements | 8 | 4.3 |
| More careful planning | 4 | 2.1 |
| Increased on-farm workload | <u>23</u> | <u>12.7</u> |
| | 187 | 100 |

Reduction in recreation, entertainment and holidays was the most commonly reported change in lifestyle. These reductions may have prompted in part the pessimistic outlook of some respondents. Staying home on the farm, together with a reduction in recreational activity may have intensified introspection and worry over production, financial or lifestyle/family problems, and hence led to despondency for some respondents.

DISCUSSION

The survey reported here provided a data base on the managerial responses of dairy farmers to decreased product prices and removal of Government support. The analysis suggests that dairy farmers responded quickly to a changed economic environment in three main ways: by decreasing expenditure on discretionary farm inputs (repairs and maintenance, fertilizer, herd improvement); increasing stocking rate (both dairy and bull beef); earning additional income off the farm (mainly through wives seeking off-farm employment); and improving financial planning and control. A similar result was observed by Nicholls et al. (1990) in their study of hill country sheep and beef farmers.

Major sources of information for planning and implementing these changes were other farmers (e.g. discussion groups), non-paid advisors (e.g. Dairy Board Consulting Officers), paid consultants (e.g. private and MAFTech consultants) and farming magazines. The medium term outlook of younger dairy farmers in the survey was surprisingly optimistic, given the trauma of the recent past and their likelihood of having relatively high debt servicing commitments.

Discussion groups and opportunities for interaction with other farmers were reported to be most helpful in coping with the stress associated with changes in farm policy. Although a direct cause and effect relationship was not able to be established from the survey data, discussion group members were found to be significantly more optimistic about the future of dairying and achieved significantly higher average levels of milkfat production than non-members (not reported in this paper) over the study period (Hughes et al. 1989).

Dairy farmers in the survey population indicated a willingness to pay for advice from consultants. However, no differentiation was made in the questionnaire between types of consultant and it is likely that paid consultants included accountants, who may have been required to provide advice on the introduction of the Goods and Services Tax and other changes in tax legislation.

The increased level of off-farm employment and greater attention to financial management provide an indication of higher levels of stress experienced during the study period. These two factors are likely to have had a greater impact on the lifestyle of farm wives, more of whom had to find paid outside work. In many cases they also accepted greater responsibility for managing the farm's finances. The measurement of the stress associated with such changes in

farming practice and lifestyle is difficult (Rathge et al. 1988). However, the magnitude of the management changes and the low optimism scores of some farmers recorded in the current study indicate that many dairy farming families were placed under considerable stress. With respect to off-farm employment, Acock and Deseran (1986) in an American study suggest that this would not necessarily result in increased marital instability where couples had an experienced farming background. They were less certain that this applied to relatively new and inexperienced entrants to farming.

Many of the comments included with the returned questionnaires indicated the determination of dairy farmers to survive financially. This study has provided evidence that farmers and their families are willing to change farming practices and to make considerable personal sacrifices to achieve this goal.

REFERENCES

- Acock, A.C. and Deseran, F.A. 1986. Off-farm employment by women and marital instability. Rural Sociology 51 (3) : 314-327.
- Alexander, P. 1986. Strategies for financial survival - but looking ahead positively. Farm Management News (45): 43-47.
- Douglas, R.D. 1984. Budget Speech and Annex: Government Printer, Wellington.
- Hughes, A.H.; Parker, W.J.; Anderson, F.M. 1989. Report to the directors and executive officers of the Manawatu Cooperative Dairy Company on the May 1988 survey of MCDC suppliers. Department of Agricultural and Horticultural Systems Management, Massey University.
- MAF 1985. Farm Monitoring Report (Dairy). Ministry of Agriculture and Fisheries, Wellington.
- MAF 1986. Livestock and cropping gross margins 1985/86. Ministry of Agriculture and Fisheries, Palmerston North.
- Moffat, J. 1985. Thousands of farmers leave the industry ? New Zealand Journal of Agriculture 150 (5) : 4-6.
- Moran, N. and Anderson, A.G. 1988. Predicting enterprise choice : Exit from dairying in New Zealand. Journal of Rural Studies 4 (3) : 203-214.
- Nicholls, J.R.; Gray, D.I.; Wright, A.; Fraser, P.A. 1990. Adjustment strategies used by hill country farmers in the Pongaroa district. Proceedings of the New Zealand Grassland Conference (in preparation).

- O'Donnel, B.G. 1969. The mail survey in agricultural economics research : a New Zealand example. Occasional paper No. 1, Department of Agricultural Economics and Farm Management, Massey University.
- Owen, M. and Williamson, N. 1987. Coping with change. Proceedings 18th Large Herd Conference : 12 -17.
- Rathge, R.W.; Ekstrom, B.L., and Leistritz, F.L. 1988. The effects of economic strain on stress in farm families. North Dakota Farm Research 45 (4) : 19-22.
- Stevens, S.S. 1946. On the theory of scales and measurement. Science 103 : 677-680.
- Tisdall, M. 1986. Stress in the rural family. Farm Management News (42): 40-43.
- Wright, A., Holmes, C.W., Montgomerie, T.J. 1989. The future of the small scale dairy farm. Proceedings Massey University Dairy Farmers' Conference : (in press).

THE EFFICIENT PRICE OF ENERGY

Ralph Lattimore

Introduction

Energy is an important component in industrial, household and agricultural use in New Zealand. Accordingly, the price of the various energy products need to be efficient if these sectors are to exploit market opportunities to the fullest. In a neoclassical framework efficient product prices are the opportunity cost of the resources they embody at world or border prices in a small country environment.

Over the past fifteen years world energy prices have twice moved significantly upwards (1974 and 1979) and once downwards (1986). These market movements together with the continuing high degree of Government intervention makes the degree of pricing efficiency in the energy market less than fully transparent.

As is shown in Graph I, energy prices in New Zealand have shown some interesting trends over this period. In the graph, petrol and electricity prices are compared in equivalent energy units, megajoules, MJ (where 1 KWH = 3.6 MJ). In 1971, domestic petrol prices were more than double world or equivalent border prices while electricity was considerably more expensive per MJ than petrol. As international liquid fuel prices rose from 1973, domestic fuel prices rose but at a slower rate and were even lower than world prices for times in 1979, 1981 and 1984. Electricity prices were regulated till 1988 and fell below domestic petrol prices in 1974 and did not recover parity until 1988. After 1984, both domestic energy product prices moved in the opposite direction from world energy prices.

(1) Paper presented at the Annual meetings of the NZ Branch of the Australian Association of Agricultural Economists, Flock House, June 1989. The author is Reader In Agricultural Economics at Lincoln College, Canterbury.

make preliminary estimates of the efficiency price of one traded energy product, petrol, and a non-traded product, electricity.

The subject of this paper, in reality is a broad and complex issue that encompasses tax revenue and pollution considerations. These are ignored in the present analysis to focus directly on the efficiency pricing issue and energy asset sales.

To the extent that energy prices are found to be above their efficient levels, policies and institutions ought to be altered if the energy industry to maximise their contribution to job creation and economic growth.

Efficient Price of Petrol

The efficient price of petrol is defined here as the opportunity cost of imported fuel at the wholesale level. It is estimated as the potential import price of premium grade petrol in foreign currency converted to NZ dollars at the opportunity cost of foreign exchange (the equilibrium exchange rate).

The import price is derived from published world traded prices for petrol. The equilibrium exchange rate is derived from work carried out by Bascand and Carey (1985) which covered the period when the official exchange rate is thought to have been significantly overvalued (1974 to 1984). Since the currency was floated in 1985, the exchange rate is assumed to have been in equilibrium.

The efficient wholesale price is then estimated by adding the officially reported wholesale margin to the import price. These results are reported in Table 4 for the period 1971-88. The efficient price is given in the Table as the border equivalent wholesale price. The efficient price may be compared with the actual wholesale prices for the same period. The border equivalent wholesale price is also presented at the market exchange rate for comparison.

In 1971 the estimated efficient price of petrol was less than half the market price. As the world price rose throughout the 1970's the domestic price

tended towards the efficient price and they virtually coincided over the period 1979 to 1984. Since then the two prices have diverged again and in 1988 the gap was slightly wider than it was in 1971 before the oil shocks. The taxation of petrol was at least 25 percent of the domestic price throughout the period, Table 2. The domestic-border price gap closed over the 1979-84 period because the taxes were nullified by the effects of the exchange rate overvaluation.

In 1988 the efficient price of petrol is estimated to have been around 32 cents per litre at the wholesale level as compared to the actual market price of 76.6 cents per litre. This implies that the nominal rate of protection (or assistance) was 135 percent. This estimate is higher than the equivalent rate estimated by Syntec Economic Services for the petroleum refining industry for 1987/88 (7 percent), Treasury (1988). However, the Syntec estimate does not appear to include the effects of taxes and special trade arrangements on petroleum products (p 45). The Syntec measure appears to measure supply side distortions only and ignores the demand side.

The efficiency price estimate is probably biased in a number of ways. The import price is based on CIF quotations, Suva which is related to particular volume and unloading considerations. The import price is biased downwards to the extent these factors are not offsetting. The wholesale margin used is thought to be biased upwards as it was regulated over the period. On balance, the efficient price is likely to be a slight over-estimate.

The Efficient Price of Electricity

The efficiency price of electricity must be estimated in the market for an essentially non-traded product. The market is represented by Figure 1. The curve D represents the demand curve of electricity and S the supply curve. Demand is influenced by the degree of technical substitutability between alternative energy sources and their relative prices. Supply is influenced by the rising marginal cost of electricity generation. In equilibrium, supply must equal demand in NZ. Algebraically, the market can be represented in rate of change form by the following equations (1)-(3):

$$S = n_1 * P \quad (1)$$

$$D = -n_2 * P + n_3 * C \quad (2)$$

$$S = D \quad (3)$$

where: D, S and P represent the quantity demanded and supplied, and the price of electricity (rates of change).

The n_i are the behavioural parameters in elasticity form.

C represents the rate of change of the price of substitutes for electricity.

If the substitutes for electricity are traded goods, the efficient price of electricity will occur at the intersection of the competitive supply curve and the demand curve when the electricity substitute price is set at its opportunity cost. This can be shown algebraically by rearranging the above equations:

$$P = \left[\frac{n_3}{n_1 + n_2} \right] * C \quad (4)$$

From equation (4) P will represent the efficient electricity price when C is the opportunity cost of its substitutes.

I have been unable to find a complete set of longrun demand parameters for electricity in New Zealand but they are available for other countries. Chapman et al (1972) found that own price elasticities of demand for electricity use in the US ranged from -1.7 for industrial use to -1.3 for household use. They also estimated that the cross price elasticity of demand for electricity was 0.15 with respect to natural gas in various uses. Furthermore Taylor (1977) in an extensive survey of energy demand parameters, noted wide ranging economic substitution possibilities between electricity, gas, coal and liquid fuels in the longrun. For this reason, n_1 and n_3 are assumed initially to be -1.5 and 0.15, respectively where the substitute is taken to be petrol.

Bertram (1988) presents data on electric power output for all generating stations in NZ in ascending order of operating and management cost (Table 4). The costs of operating the hydro plants were in the range 0.09 to 2.71 cents per kilowatt/hour in 1983/84. The next cheapest plant cost 6.26 cents. The segment of the industry cost curve just prior to this plant, the first of the high cost units, was chosen to estimate the elasticity of the cost curve. That is, plants with costs between 1.31 and 2.71 cents/KWH. Lower cost plants generated 20.282 GWH. All plants with costs less than or equal to 2.71 cents/KWH generated 24.54 GWH of electricity. The elasticity of this segment is around 0.2. Beyond this segment the cost curve becomes considerably more inelastic of the order of 0.05. The second reason for choosing this segment is that the supply price in 1983/84 of Electricorp was 3 cents which is close to the end of this segment.

Using these initial parameter estimates in equation (4) and the 57.6 percent gap between the market and efficient price of petrol in 1988 (previous section) it is estimated that the electricity price in 1988 was above the efficiency price by 5.1 percent.

The gap between the actual electricity price, Table 5, and the efficiency price is sensitive to the parameters chosen. The more inelastic are n_1 and n_2 and the larger is n_3 , the greater the difference between the actual power price and its efficient price level and vice versa. For example, in a New Zealand study the own price elasticity of demand for electricity was found to be -0.3 even in the longrun, Treasury (1989). If the price elasticity of demand is actually this lower figure -0.3, and the other parameters are the same (0.2 and 0.15) then the efficient electricity price is 17.3 percent lower than the current price.

Summary and Conclusions

To the extent these preliminary estimates are correct the use of electricity in New Zealand is too high and the price being charge is too high. Accordingly industrial and primary sector output is too low as are the number of jobs generated given our resource base. Furthermore the market value of

assets owned by the energy sector are also higher than they would be at efficient energy price levels.

This situation could potentially create a dilemma for a Government attempting to simultaneously reduce inflation and providing for an efficient allocation of resources and growth in the energy using industries. The Government has chosen to reduce the fiscal deficit to reduce inflation, in part, through asset sales. The value of the energy project assets are higher, the higher are energy product prices, for electricity, natural gas, coal and liquid fuels. However, if energy product prices are significantly above their efficient levels, job and economic growth in the energy using industries will be lower than otherwise.

Graph I:

ENERGY PRICES

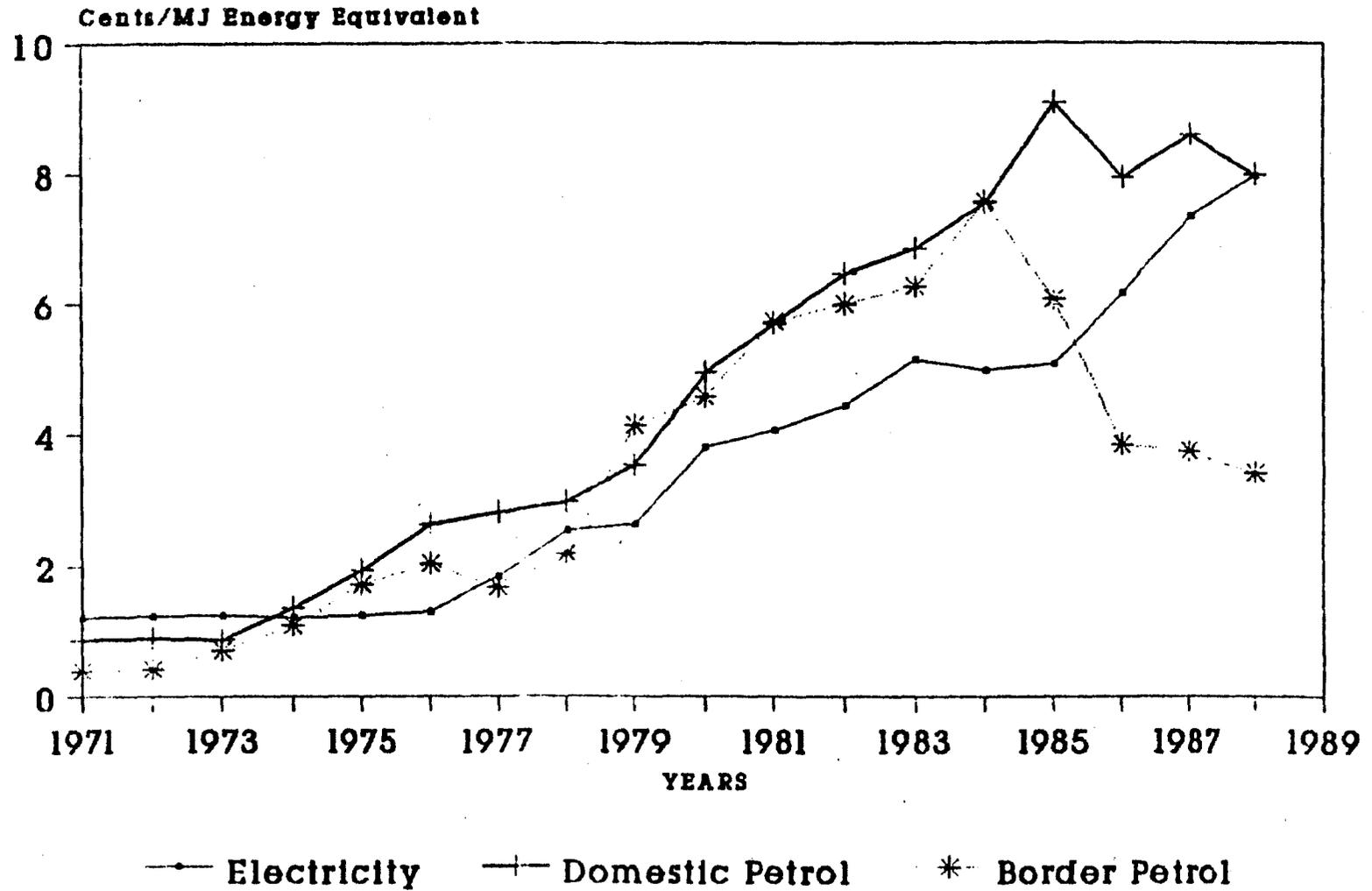


Figure 1: Efficient Price of Electricity

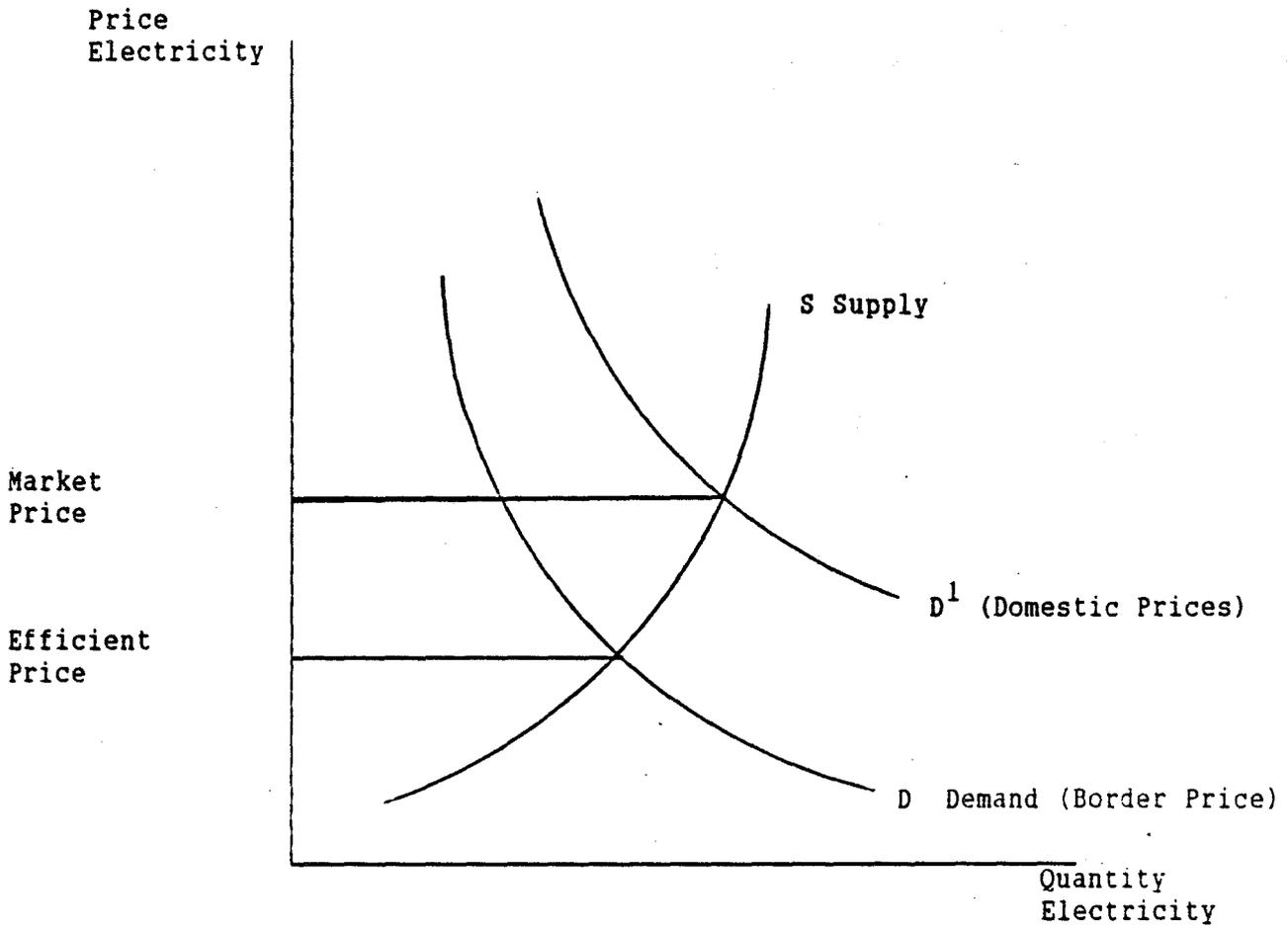


Table 1: International Prices of Petroleum Prices¹ (US\$/tonne)

| Year | Petrol | | Diesel | |
|------|-------------------------------|--------------------|---------------------------|-------------------------|
| | 91/92 Octane FOB Rotterdam | 95 Ron CIF Suva | 53 Index FOB Rotterdam | 48/52 Index CIF Suva |
| 1971 | 25.1 | | 30.5 | |
| 1972 | 30.4 | | 26.8 | |
| 1973 | 87.8 | | 83.6 | |
| 1974 | 131.1 | | 103.3 | |
| 1975 | 120.3 | | 100.0 | |
| 1976 | 137.9 | | 107.4 | |
| 1977 | 131.6 | | 117.8 | |
| 1978 | 160.0 | | 128.6 | |
| 1979 | 335.0 | | 310.9 | |
| 1980 | 358.0 | | 307.1 | |
| 1981 | 354.1 | | 298.7 | |
| 1982 | 323.6 | | 289.7 | |
| 1983 | 283.2 | | 248.2 | |
| 1984 | 257.4 | | 238.3 | |
| 1985 | 255.2 | 326.02 | 239.8 | 244.66 |
| 1986 | 146.0 | 178.39 | 142.3 | 98.83 |
| 1987 | | 222.35 | | 182.67 |
| 1988 | | 187.49 | | 148.41 |

Source: IBRD (1988) Commodity Trade and Price Trends, The John Hopkins University Press, Baltimore and IBRD, pers comm.

1/ 1 tonne petrol and diesel of this specification is equivalent to 1340 and 1160 litres respectively.

Table 2: New Zealand Petroleum Prices and Margins (cents/litre)

| Year | NZ Import Price Petrol 96 Octane | Wholesale Margin Petrol (96) | Total Petrol Taxes | Wholesale Price Petrol (96) | Retail Price Petrol (96) |
|-------|--|------------------------------------|--------------------------|-----------------------------------|--------------------------------|
| | (1) | (2) | (3) | (4) | (5) |
| 1971 | | 1.791 | 4.0 | | 10.57 |
| 1972 | | 1.791 | 4.0 | | 10.79 |
| 1973 | | 1.791 | 4.0 | | 10.57 |
| 1974 | 7.027 | 1.788 | 4.66 | 13.09 | 15.19 |
| 1975 | 10.468 | 2.595 | 7.53 | 18.56 | 22.00 |
| 1976 | 13.005 | 2.953 | 9.36 | 25.22 | 27.00 |
| 1977 | 13.991 | 3.000 | 10.11 | 26.94 | 29.60 |
| 1978 | 13.515 | 3.712 | 12.13 | 28.50 | 31.60 |
| 1979 | 17.646 | 4.321 | 13.46 | 33.77 | 40.70 |
| 1980 | 28.986 | 5.631 | 13.46 | 47.34 | 54.00 |
| 1981 | 36.664 | 6.598 | 13.72 | 54.52 | 61.00 |
| 1982 | 40.198 | 7.510 | 16.41 | 61.88 | 71.00 |
| 1983 | 39.847 | 7.565 | 19.69 | 65.59 | 71.00 |
| 1984 | 40.249 | 8.209 | 22.62 | 72.41 | 89.20 |
| 1985 | 44.054 | 8.964 | 30.51 | 87.10 | 90.00 |
| 1986 | 35.107 | 10.827 | 33.22 ⁽⁶⁾ | 76.18 | 83.60 |
| 1987E | 27.746 | 10.844 | 43.70 | 82.37 | 92.00 |
| 1988E | - | - | 44.70 | 76.60 | 88.20 |

Footnotes: (1)-(4): Ministry of Energy, Wellington Rex Young, pers comm.
(5): Consumer Price Index, Department of Statistics, Christchurch, for November.
(6): For 1986 includes GST of 1.945 c/litre, 1987, 7.585 c/litre.

Table 3: Exchange Rates

| Year | Market Exchange Rate (US\$/NZ\$) | Exchange Rate Overvaluation (percent) | Equilibrium Exchange Rate (US\$/NZ\$) |
|------|--|---|---|
| | (1) | (2) | (3) |
| 1968 | 1.1121 | 0 | 1.11 |
| 1969 | 1.1198 | 0 | 1.12 |
| 1970 | 1.1161 | +1 | 1.10 |
| 1971 | 1.1952 | +10 | 1.08 |
| 1972 | 1.1952 | -1 | 1.21 |
| 1973 | 1.4284 | -11 | 1.59 |
| 1974 | 1.3155 | -5 | 1.38 |
| 1975 | 1.0437 | +23 | 0.80 |
| 1976 | 0.95 | +19 | 0.77 |
| 1977 | 1.0197 | +9 | 0.93 |
| 1978 | 1.0666 | +19 | 0.86 |
| 1979 | 0.9862 | +11 | 0.88 |
| 1980 | 0.9623 | +10 | 0.87 |
| 1981 | 0.8244 | +18 | 0.68 |
| 1982 | 0.7325 | +18 | 0.60 |
| 1983 | 0.6546 | +23 | 0.50 |
| 1984 | 0.4776 | +22 | 0.37 |
| 1985 | 0.4985 | +4 | 0.48 |
| 1986 | 0.5235 | 0 | 0.52 |
| 1987 | 0.6575 | 0 | 0.66 |
| 1988 | 0.6423 | 0 | 0.64 |

Source: (1) International Financial Statistics, IMF, Washington DC various issues.

(2) From Lattimore (1987), Table 3.

(3) Column (1) * (1 - Column (2)/100).

Table 4: Nominal Rate of Protection for Petrol

| Year | Domestic Wholesale Price | Border Equivalent ⁽⁴⁾ | | | Nominal Rate Protection | |
|------|-----------------------------|----------------------------------|---------------------|--------------------|----------------------------|-------------------------|
| | | Import Price | Wholesale Margin | Wholesale Price | Market Exchange | Equilibrium Exchange |
| | cents/litre (1) | centres/litre (2) | | | percent (3) | |
| 1971 | 8.47 | 1.94 | 1.79 | 3.73 | 127 | 115 |
| 1972 | 8.69 | 2.36 | 1.79 | 4.15 | 110 | 111 |
| 1973 | 8.47 | 5.69 | 1.79 | 7.48 | 13 | 23 |
| 1974 | 13.09 | 9.23 | 1.79 | 11.02 | 19 | 24 |
| 1975 | 18.56 | 10.67 | 2.60 | 13.27 | 40 | 12 |
| 1976 | 25.22 | 13.44 | 2.95 | 16.39 | 54 | 29 |
| 1977 | 26.94 | 11.95 | 3.00 | 14.95 | 80 | 67 |
| 1978 | 28.50 | 13.89 | 3.71 | 17.60 | 62 | 36 |
| 1979 | 33.77 | 31.45 | 4.32 | 35.77 | -6 | -15 |
| 1980 | 47.34 | 34.45 | 5.63 | 40.08 | 18 | 8 |
| 1981 | 54.52 | 39.77 | 6.60 | 46.37 | 18 | -1 |
| 1982 | 61.88 | 40.91 | 7.51 | 48.42 | 28 | 8 |
| 1983 | 65.59 | 40.06 | 7.57 | 47.62 | 38 | 9 |
| 1984 | 72.41 | 49.90 | 8.21 | 58.11 | 25 | 0 |
| 1985 | 87.10 | 47.40 | 8.96 | 56.37 | 55 | 50 |
| 1986 | 76.18 | 25.82 | 10.83 | 36.65 | 108 | 107 |
| 1987 | 82.37 | 25.05 | 10.84 | 35.89 | 129 | 130 |
| 1988 | 76.60 | 21.62 | 10.84 | 32.47 | 136 | 135 |

- Source: (1) The wholesale price of 96 Octane petrol extrapolated from 1973 to 1971 using the retail margin for 1974, Table 2.
- (2) From Table 1 and 3, the international price of petrol f.o.b. Rotterdam converted to NZ dollars, raised 25 percent for ocean freight and unloading charges and raised 2.7 percent to equalise the energy rating of 96 Octane (34.5 MJ/litre) with 92 Octane (33.6 MJ/litre), Energy Data and Conversion Data, NZERDC, Report No 100, University of Auckland.
- (3) Column (1)-(2)/(2).
- (4) At the market exchange rate.

Table 5: Retail Electricity Prices (cents/KWH)

| Year | Large Users | Government Departments | Power Boards | Territorial Authorities | Weighted Average |
|------|-------------|------------------------|--------------|-------------------------|------------------|
| 1970 | 0.674 | 1.604 | 1.228 | 1.606 | 1.176 |
| 1971 | 0.653 | 1.459 | 1.221 | 1.573 | 1.154 |
| 1972 | | 1.617 | 1.248 | 1.572 | 1.306 |
| 1973 | | 1.446 | 1.253 | 1.570 | 1.306 |
| 1974 | | 1.488 | 1.222 | 1.582 | 1.278 |
| 1975 | | 1.535 | 1.252 | 1.626 | 1.308 |
| 1976 | | 1.621 | 1.309 | 1.748 | 1.375 |
| 1977 | | 2.218 | 1.844 | 2.413 | 1.928 |
| 1978 | 0.673 | 3.354 | 2.547 | 3.384 | 1.658 |
| 1979 | 1.001 | 3.463 | 2.635 | 3.530 | 1.877 |
| 1980 | 1.382 | 4.860 | 3.799 | 4.871 | 2.655 |
| 1981 | 1.549 | 5.452 | 4.062 | 5.292 | 2.917 |
| 1982 | 1.698 | 6.164 | 4.438 | 5.774 | 3.200 |
| 1983 | 1.957 | 6.880 | 5.132 | 6.544 | 3.640 |
| 1984 | 2.099 | 6.983 | 4.971 | 6.561 | 3.538 |
| 1985 | 2.261 | 6.518 | 5.066 | 6.371 | 3.665 |
| 1986 | 2.602 | 8.324 | 6.161 | 7.580 | 4.459 |
| 1987 | 3.072 | 8.252 | 7.374 | 7.893 | 4.929 |
| 1988 | 3.072 | 9.101 | 7.983 | 8.441 | 5.171 |

Source: Mr D O'Neill, Ministry of Energy, Wellington pers comm.

References

- Bascand, A, and D Carey (1985), "Exchange Controls and Real Exchange Rate Adjustment", AERU Discussion Paper No 97, Lincoln College, Canterbury.
- Bertram, Geoff (1988), "Rents in the New Zealand Energy Sector", Discussion Paper No 52, Department of Economics, Victoria University of Wellington.
- Chapman, D, T Tyrell and T Mount (1972), "Electricity Demand Growth and the Energy Crisis", Science, Vol 178, p 705, Nov 17.
- Lattimore, R G (1987), "Economic Adjustment in New Zealand", in Economic Adjustment: Policies and Problems, ed Sir Frank Holmes, IMF, Washington DC.
- Taylor, Lester D (1977), "The Demand for Energy: A Survey of Price and Income Elasticities", in William D Nordhaus ed. International Studies of the Demand for Energy, North-Holland, Amsterdam.
- Treasury (1988), Industry Assistance Reform in New Zealand, The Treasury, Wellington.
- Treasury (1989), "Draft Report of the Electricity Task Force", Dr Sid Durbin, Treasury, Wellington, pers comm.

Paper Presented to the Annual Conference
of the New Zealand Branch of the Australian Agricultural
Economics Society; Flock House, Bulls, June 1989

**PRIVATISING WATER: AN ANALYSIS OF INITIATIVES
TO SELL COMMUNITY IRRIGATION SCHEMES
AND TO CREATE WATER MARKETS**

Walter Moore & Murray Arthur-Worsop*
Policy Services, MAFCorp
PO Box 2526, Wellington

ABSTRACT

As part of its asset sales programme, the Government is transferring Crown interests in irrigation schemes to the irrigators. These sales are predicated, in part, on the grounds that economic efficiency will be enhanced by granting irrigators financial and management independence from Government. Although at an early stage, number of efficiency and equity concerns have been raised by the transfer process. These include asset valuation, the effects of the transfer on resource allocation and exclusion of non agricultural buyers. This paper discusses the mechanisms of the irrigation sales and the general economic implications of the transfer process. A recent sale of the lower Waitaki irrigation scheme is used to highlight the sales process.

A separate but related issue is the possible use of transferable permits to allocate water resources in New Zealand. This policy change, proposed by the Resource Management Law Reform, would give regional governments the right to create and govern water markets within their jurisdiction. The relevant economic and institutional issues of creating water markets are reviewed and several recommendations are offered.

* The views expressed in this paper are those of the authors and not necessarily those of the Ministry of Agriculture and Fisheries, The Treasury, or the Ministry for the Environment.

1.0 INTRODUCTION

In 1988 the Government announced its intention to sell its shares of 52¹ community irrigation schemes. This directive was a marked departure from previous high levels of Government involvement in both the funding of scheme development and the management (conduct) of the schemes on behalf of agricultural users. Principal reasons for the asset sales were to recapture a proportion of past expenditure and to allow more efficient pricing of irrigation services and water resources to occur. While the asset sales programme is only partly completed, several precedents have been set which may affect the overall efficiency of the resource transfer.

Concurrently, the ongoing Resource Management Law Reform (RMLR) is attempting to legislate better definitions of water rights and to rationalise regional systems of water allocation. This allocation process is a relatively inflexible one, existing of semi-permanent "rights" issued by regional water boards. The RMLR has indicated its approval for regional systems of transferrable water permits to be introduced. This would give better definition of property rights, account for changing water demands and account for third party effects. This system of tradeable rights and appropriate regulations, if implemented correctly, could add an important mechanism to promote efficient water use in New Zealand.

The purposes of this paper are:

- (a) to review past irrigation and water rights policies;
- (b) to outline prospective changes in policy; and
- (c) to discuss the efficiency and distributive implications of the asset sales and RMLR proposals, both separately and in relation to one another.

¹ For five of these schemes it appeared the Crown had no interest and therefore they dropped out of the sale process.

2.0 PREVIOUS POLICY AND REGULATORY ENVIRONMENT

Government has extensively controlled both the delivery and allocation of water. This has been done by owning much of the means by which water is abstracted (irrigation, municipal supplies, electricity) and by controlling the allocation of water resource/rights. Historically this is broadly consistent with water policies in other countries such as the USA or Australia, where water has generally been considered a "special" or public good, despite its obvious economic values (Watson et al, 1987; OECD, 1987; Gardner and Huffaker, 1988).

Given the relative abundance of water resources through most of this century, water management has concentrated solely on supply issues rather than on the demand side. This system has sufficed given relatively little conflict of water use and allocation. However, the allocative wrangle over the Rakaia River in the early 1980's indicated that the old system had difficulty coping with new demand and increasing opportunity costs of water use. In areas where water is fully allocated pressure exists for water to be transferred to other consumptive and also in-stream uses, but the current regulatory system lacks the means to do so.

2.1 Irrigation Policy

Government has been the principal agent in developing all community irrigation schemes. To date it has assisted in the development of 49² community irrigation schemes to water over 160,000 hectares on roughly 2,500 properties, about 3% of current farm holdings and about 60% of total the irrigated area in New Zealand. The 40 South Island schemes supply water mainly for pasture and crops while the 9 North Island Schemes are solely for horticulture. The first scheme was completed in 1916, with the majority of present schemes developed since the 1960's. Several schemes still have off-farm works that are incomplete. Current capital replacement costs for Crown backed Schemes are valued at over \$500 million (Audit Office, 1987).

Government has funded the majority of costs required to develop schemes, including investigation costs, costs of headworks, distribution systems and in some case even on-farm delivery systems (Audit Office, 1987; Lewthwaite and Martin, 1987). While the share of Crown funding of these schemes has varied over time, the majority of community schemes were built with over 50% of off-farm capital costs borne by the taxpayer (table 1). In addition, on-farm irrigation expenditure was eligible for concessional Rural Bank development loans with capital and interest repayments commencing after 3 years under the policy of the early 1980's. For example, the Amuri Plains Irrigation Scheme had an estimated private rate of return to irrigators in 1978 of 33% with all available subsidies and 14% without the on-farm subsidies (Greer, 1984). Once completed, the former Ministry of Works and Development (MWD) would manage the schemes and enforce water charges. The MWD

² The number recorded in the Report of the Audit Office (1987); three schemes were excluded from their total.

has effectively subsidised delivery costs and water charges to irrigators, as most schemes have operated at a loss. As a manager, the MWD was unable or unwilling to recapture the majority of the unpaid irrigators share of construction costs with the consequence that \$60-\$80 million worth of irrigator debts are still outstanding³.

Table 1: Government Share of Irrigation Scheme Capital Costs
(indicative years only)

| | 1960/61 | 1973/74 | 1978/79 % | 1984/85 | 1988/89 |
|--|---------|---------|--------------|---------|---------|
| Headworks | 100 | 100 | 100 | 35 | 0 |
| Distribution Works | 100 | 50 | 50 | 35 | 0 |
| On-farm Works | 0 | 33 | 50 | 0 | 0 |
| On-going Capital and Maintenance Expenditure (\$million) | NA | 6.7 | 5.5 | 20.9 | 12.6 |

Source: Audit Office (1987), Estimates of Expenditure.

2.2 Water Allocation Policy

Traditionally the right to abstract water has been administered through the Water and Soil Conservation Act and allocated through a system of water rights⁴ issued by regional water boards. Rights are granted under a beneficial use criteria (RMLR, 1988) and established through administrative and sometimes legal decisions. Water allocation policy follows the riparian doctrine that considers water a public resource, held in trust by the Crown (Verdich, 1987). Property owners, say with an irrigation permit, do not have ownership rights to water resources but only a right to withdraw water by virtue of its attachment to a property. Use permits under this system are granted to provide security to existing permit holders (Checchio and Colby, 1988), and to prevent gross misuse from occurring.

³ With the dissolution of Ministry of Works and Development in 1988, the Ministry of Agriculture and Fisheries (MAF) has undertaken the interim management of schemes. With the exception of several schemes in Central Otago, schemes that have completed their development period are now meeting full operating and maintenance costs.

⁴ The consents to withdraw water have been called "rights" in the past, but in fact rights are held by the Crown. Thus the term is somewhat misleading as it implies legal ownership. The new legislation will use the term permit rather than right to more accurately reflect the status of the right.

2.3 Effectiveness of Past Policies

While never having an explicit irrigation policy, outside of general guidelines in various Public Works Act, it can be concluded that a de facto policy existed whereby irrigation was subsidised as part of a general assistance framework for agriculture. It appears that special targeting for irrigation development occurred as assistance rates were considerably higher than for other agricultural projects (The Treasury, 1984). This has meant a sizeable resource transfer to the agricultural sector. Without the high subsidy rates it is doubtful that a large number of pastoral irrigation schemes would ever have been developed on private grounds (Audit Office, 1987)⁵ although Greer (1984) found that private benefits in some cases were significant.

While the large transfer of taxpayer monies to irrigators does not result in major net welfare losses in itself, the subsidies and regulatory environment can cause resource misallocation and misuse of water resources to occur. This happened as national resources were locked into investments which in some instances had low or negative returns. Hence the rising demand for scarce capital and water resources has exposed the need to account for the opportunity costs of these resources and the inherent flexibility of this system.

This system also inhibits short-term volume transfers, as in the case of drought, causing further efficiency losses. Tenure was often granted for periods of 40 years. The only transfer of rights that could occur was between successive owners of land or if the Crown revoked and reissued a permit. Market forces were effectively ignored under the administrative ("supply management") allocation scheme.

The resultant efficiency problem is that the water delivered to irrigators in community irrigation schemes has been undervalued. While water charges, to recover operating, maintenance and some financial costs have been in place since the 1960's, actual revenues have not always met average delivery costs, let alone any opportunity costs of the water. This promotes inefficiency in water consumption, with subsidy benefits captured only by initial landowners (The Treasury 1984). Resources were not allowed to move to areas of highest return, lowering national returns from water use programmes. Taxpayers have, in general, got very poor returns on their investments. These policies are no longer deemed affordable or justifiable given the move to treat sectors more neutrally within the economy and the increasing demand for water resources.

⁵ For major investments involving Government Subsidy, an economic report is normally required to show that the investment meets certain economic criteria set by Government. However, the experience of MAF has been that even when these criteria were not met, decisions were sometimes made on political considerations. Also in predicting investment returns, Government has tended to be over-optimistic.

3.0 THE NEW POLICY EMPHASIS

3.1 Rationale for Sale of Irrigation Schemes

The combination of management inefficiencies (as discussed in Section 2.0), and scheme cost overruns has imposed high costs on the taxpayer and caused concern and frustrations for Government and irrigators. This concern led to a series of policy announcements over the past two years in which the Government stated its intention to:

- (a) seek to place all community irrigation schemes on a fully commercial basis including full operating cost recovery;
- (b) remove Government from ownership and management of community irrigation schemes and to eliminate all Government funding.

Transferring the ownership and control to a party with strong incentives to improve the management and efficiency of the schemes was seen as the best answer to the deficiencies of past scheme operation and development. Therefore, new institutional arrangements are needed to provide incentives for the greatest commercial benefits from the schemes.

3.2 The Sale Process

Government recently agreed to the sale of the first scheme (the Lower Waitaki Scheme). This followed the completion of negotiations and the preparation of a Sale and Purchase Agreement. Agreement in principle has been reached with a further 11 of the remaining 46 schemes.

Several options were considered for future scheme ownership, including the irrigators, a State Owned Enterprise (SOE) to be created from the commercial arm of the Ministry of Works and Development, and territorial local authorities. Although the first two options were considered to meet the objectives of least cost commercialisation, it was felt that irrigator ownership would provide greater incentive for efficient operation and maintenance of the schemes through direct involvement and therefore greater accountability. Schemes owned and operated by the SOE or a territorial local authority would be in a position of monopoly supply with rent-seeking potentials.

A further consideration was one of fairness or equity. Community irrigation schemes have been a joint undertaking between the Crown and irrigators, and it was considered fair to offer irrigators the first right of refusal for the Crown share. The Government therefore decided to offer existing users ("the irrigators") the first opportunity to purchase the Government's interest.

3.2.1 Benefits to Irrigators

The transfer of ownership to irrigators is expected to benefit irrigators by removing central government from the operation of the scheme. This should lead to more efficient operation, greater flexibility, more security and long term investment incentives. Additionally irrigators would have direct representation before and in negotiation with regional water boards.

Water should now be priced at its marginal delivery costs, with a greater emphasis on conservation and generally improved operational efficiency. There are many examples of privately owned irrigation schemes operating successfully in New Zealand. There is ample precedent that schemes can be privately owned and managed. (Touche Ross, 1988).

3.2.2 Benefits to Central Government

As already noted, the primary objective of transferring community irrigation schemes is to improve the efficiency of irrigation management in New Zealand. Such a transfer of ownership provides a clear opportunity to restructure the existing debt as recorded in the Government's accounts for each scheme. Additional, benefits to Government include a reduction or elimination of the current operating deficit, revenue from the sale of the Crown's interest, and the transfer of responsibilities, and liabilities for refurbishment and development of schemes to the new owners.

3.3 Transferable Water Permits: Rationale

A system of well defined and tradable property rights would have a number of advantages over the current water allocation scheme. These include greater flexibility and security, better information on resource values, minimal transactions costs and the ability to accommodate new resource values (Checchio and Colby, 1988; Hide, 1987). Flexibility comes from being able to allocate water in accord with demand and changing use values. Security is to be gained by actual ownership of the right, as opposed to Crown ownership. The allocation process has the potential to be more transparent as resource values will emerge through bidding amongst alternative users. Given a well defined statutory and regulatory environment, information regarding transfer arrangements and possibilities are also available, limiting uncertainty and ultimately transactions costs. As Coase has theorised, tradable resource rights will lead to an efficient allocation of resources, regardless of the initial distribution of these rights. This conclusion is based on the key assumptions that transactions costs and wealth effects are minimal (Coase, 1960). It should be noted that the transaction costs under the current system would be almost infinite.

The Resource Management Law Reform (RMLR) is a fundamental review of New Zealand's natural resource laws with an objective of bringing various Act's up to date to reflect current

management needs and issues (including the Treaty of Waitangi). and to make the laws governing resource use more equitable and consistent. In the view of the Land, Water and Minerals Core Group of the RMLR, the current system of water management has several major deficiencies relating to the definition and allocation of water use rights. Their findings conclude that:

- (a) uses such as recreation, conservation and spiritual values (in stream uses) are often provided for only implicitly in the granting of water rights;
- (b) some water use rights do not specify clearly what the right holder is entitled to, or place inadequate restrictions on the right holder to protect the interests of other water uses;
- (c) the present system of allocating water may not be the most cost-efficient way of enabling water to be used where it is valued most highly (RMLR Core Group, 1988).

The first criticism indicates that the growing in-stream uses have not been explicitly valued while the second highlights the problems of an inflexible and publicly administered allocation system. Alternative uses and third party effects are effectively ignored in granting rights and the current system does not explicitly allow for liability of users as there is little the water users can be liable for. The existing system is felt to be inequitable to "new" users, and the lack of defined use rights can lead to problems with administering quality standards. The third criticism applies when there are competing interests in water use as the existing system does not allow for valuing of alternative water uses. Third parties and competing users can easily overstate the value of water resources to them as they do not face actual costs, while existing users have no incentive to forego some or all of their rights as they would not be compensated. This creates very high transaction costs in water allocation policy.

3.4 Proposed Changes

The move to creating a system of transferable water permits (TWP's), will occur at two levels. A national Act will approve the legality of TWP's and set down basic requirements for their implementation. The bulk of the responsibility will then fall upon the regional councils to design regional resource management plans in order to establish the new water allocation framework and the rules of water rights and transfer. The establishment of the regional plan's will be consultative in nature and will dictate the constraints and opportunities for TWP's. The councils would need to determine:

- the amount of water reserved for in-stream uses
- management (allocative) approaches for periods of low water flow

- the regulatory agency to register all permits and transfers, as well as handling the notification, hearing and appeal process (for transfer)
- that adequate information (including decision criteria) for participants in a TWP scheme is available so the parties can decide whether a proposed transfer can occur
- the conditions and liabilities of the permit. This would include the exclusiveness, transferability, volume, possible external effects, and enforceability of the right.

The terms and conditions attached to the permit will ultimately influence their value. The greater the certainty and information available for TWP's, the more likely this scheme is to be successful in creating trade and efficient pricing of water resources. While this may appear a major undertaking for regional bodies, it is felt that they possess the expertise to implement the TWP scheme. Much of the process is to make the existing water allocation process more explicit and transparent. The principal tasks for regional government will be to establish the legal and regulatory framework, and to establish the allocative framework for granting in-stream rights.

Experience from South Australia indicates that with resource scarcity and effective regulations, water markets can achieve better water allocation. On the other hand, uncertainty over the tenure of water rights in Victoria and New South Wales meant that markets were slow to develop (Verdich, 1986). A cautious approach in implementation needs to be taken so as not to create significant uncertainties amongst current resource users. The Australian experience does show that participants have warmed to the process as the potential for the TWP scheme is realised and incorporated into their investment strategies.

3.5 TWP's and Agriculture

The TWP scheme, if successfully implemented, has considerable benefits and some potential costs to the agricultural community. Active markets in water rights can create opportunities to respond to changing economic and climatic conditions. Water transfers can augment water supplies to municipal and industrial uses, precluding the need to invest in new dams and diversion systems. Money flowing into the agricultural sector through the sale or lease of water rights can be reinvested to improve irrigation efficiencies or other applications and flow on to rural communities.

Water transfers within the agricultural sector can also offer significant benefits as the potential exists to move water to its highest value use. This is especially important during periods of water shortage and would help to promote short-term adjustment (Verdich, 1986).

The principal adverse consequence of intra-sectoral water transfer is in the area of 3rd party effects. Withdrawals reduce in-stream flows, leading to constraints on aquatic values

and water available to other users. To alleviate these problems the regulatory framework governing TWP's must include provisions which will protect 3rd parties from damage due to water transfers. Whether a compensation criteria can be added in the approval process to satisfy 3rd part effects is yet to be seen. A common but myopic criticism of TWP's is that future local income may be reduced through capital disinvestments. This is purely a distributional issue though as national benefits can be improved through market transfer resulting in a net welfare gain.

A possible initial constraint on developing water permits markets is the ownership of the irrigation schemes mentioned above. It is likely that the scheme itself would hold a single right over the water supplied to all properties. Irrigators merely purchase water and delivery services from the company and would have no rights to transfer water per se. If irrigators are unable to transfer their "share" of the water right, a major impediment to water transfer within agriculture may develop. This could be overcome if irrigators are allowed to "bid" for water supplies from a company, who creates a market within the limits of its permit. However, potential irrigators outside the physical supply network of the scheme may be precluded from gaining rights as they would have to bid for the entire permit, rather than marginal quantities. This is akin to the wealth effect discussed by Coase in his property rights theorem. This could only be resolved if the "outside" irrigator could bid for a portion of the scheme's right, eg a volume transfer.

4.0 **TRANSITION PROCESS - CASE STUDY OF A SALE**

4.1 Sale and Negotiation Process

It is proposed to go into only brief details of the process involved in the transfer of schemes as details are provided in the Appendix.

To assist the irrigators possible ownership structures for each scheme were investigated by consultants (Touche Ross, 1988). Following this, a fair market value is to be set by negotiation between the Crown and the irrigators, with differences between assets and liabilities being settled by a cash payment.

One of the key issues in the whole process is the extent of Crown ownership in irrigation schemes. For five of the original 52 schemes it appeared the Crown had no interest and therefore they dropped out of the sale process. For the remaining 47 schemes it was concluded that the legal ownership position is clearly that the Crown has 100 percent ownership, as in the case of a mortgage. However, it was agreed that in any settlement it would be fair and reasonable to recognise the capital contributions made by the irrigators.

Government also agreed to a final offer arbitration procedure, to facilitate a quick settlement to negotiations. While the Crown would be obligated to sell at the arbitrated price the irrigators would be under no obligation to buy. In order to avoid a monopoly buyer situation, it was considered desirable for irrigators to be aware the Government is not prepared to sell "at any price", and that if irrigators do not exercise their option to purchase at the arbitrated price other parties would be invited to purchase at that price.

Determining a fair market value provides a basis for the parties to agree on the terms of transfer and a means to ensure that the interests of both parties are given full consideration. The first step of the valuation is to calculate the value of the water to irrigators based on its realisable value productivity. This value represents the potential revenue from the sale of water to irrigators. The valuation model (developed jointly by MAF and The Treasury) then takes these revenues together with any other revenues and the expected operating and maintenance costs to produce pre-tax and post-tax cash flows. The post-tax cashflow is discounted at the required post-tax discount rate to produce an economic value for the scheme. Further details are provided in the next Section and the Appendix.

4.2 Lower Waitaki Example

As noted in Section 3.2 the Lower Waitaki Scheme was the first scheme the Government agreed to sell. Details of the sale and purchase agreement, including the sale price, remain confidential at this stage. However, the sale of this scheme still provides a good case study. The scheme assets include the physical assets (land, buildings, water races, plant and machinery, etc), water supply agreements and water rights.

The valuation of the scheme was derived using production data provided by MAF, discount rates of 11% real pre-tax and 7.5% real post-tax⁶, and estimated operating and management costs. The discount rates and cost estimates were agreed with the irrigators. This information was then used to estimate the gross margins for each of the current land uses in the scheme and produce a value which would represent the "economic" or productive value of the scheme to the irrigators.

This figure was then adjusted (downwards) to recognise that as a normal commercial product, water can be used as an input for a wide range of products on-farm. Therefore it cannot be sold to individuals at different prices reflecting land uses in narrowly defined areas. Because in the Lower Waitaki Scheme the predominant land use is sheep farming (approx 60 % of irrigated area), the valuation was recalculated assuming that the gross margins for sheep applied to the full scheme area. Other land uses include dairying, which has a higher marginal value, and therefore obtains some economic rent. The adjustment to the methodology therefore produces a significantly lower scheme value, but one which is considered to be representative of a "realistic" economic or market value. This is really the marginal value to the sheep farmer and not an average value per se.

4.3 Irrigator Equity

Although the Crown's legal position on the ownership of the Schemes is clear, the Scheme's value derives from past investment both by the Crown, in the form of construction costs, grants, subsidies and accumulated scheme debts, and by the irrigators in the form of on-farm development costs. This was dealt with by recognising that the two sets of investments are equivalent to shares in a partnership, with one partner now having the opportunity to buy out the other. In the case of the Lower Waitaki Scheme this results in about 60 percent/40 percent irrigators/Crown split.

4.4 Commercial Value

The next step was to derive a commercial value for the scheme, based on expected after tax cashflows derived from a capital structure with a debt/equity ratio that is considered "normal". To value an irrigation scheme on this basis it was necessary to determine the cashflows. This was done using the expenditures agreed with the irrigators plus realistic revenue assumptions for water charges and other sources of revenue (sales of water to users other than irrigators). The average water charge to irrigators was derived taking into account the irrigation gross margin for sheep farming, farmers ability to pay, and charges

⁶ The required scheme post-tax rate is the rate of return that would be required by an investor in the irrigation company. It is based on Treasury's analysis of longterm rates of return on equity investment in New Zealand and current rates of return on rural investment.

from other schemes. Water is also supplied to Waitaki International and Oamaru Borough, and revenue from these sales was derived using current (cheap) prices.

The offer that was finally accepted from the irrigators was below Treasurys' estimate of the commercial value of the scheme. The price offered by the irrigators was constrained by their method of financing (no equity and therefore 100% debt financing).

The irrigators intend to operate the scheme on a co-operative basis with the objective of delivering the water at least cost to each farm rather than operating it as a business with the objective of maximising net returns to the (irrigator) shareholders through profits and dividends.

Acceptance was recommended because:

- (a) irrigators were unlikely to improve their offer for the above reason; any higher price would need to be obtained from an alternative purchaser with the attendant delays, and opposition from the farming community.
- (b) the offer removed the Crown from any ongoing liabilities for the schemes. As noted in section 5.1 below, this is now the main objective of the exercise rather than maximising sale price; and
- (c) agreement to this sale would serve as a useful signal to the remaining schemes about the Crown's determination to dispose of these schemes.

5.0 SOME OBSERVATIONS AND IMPLICATIONS FOR THE FUTURE

5.1 Outcome of the Transfer Process

Very few schemes are expected to realise a significant sale price, and where liabilities exceed assets, as with some schemes, they may be a net payment to irrigators.

Some of the reasons for not realising a significant sale price are highlighted in the Lower Waitaki case study in Section 4.0. Most important is the divergence between the economic or market value of a scheme and its commercial value based on irrigator's ability (and therefore willingness in the absence of alternative bidders) to pay for water. Government is therefore placing a high value on removing the Crown's ongoing liability to fund schemes, rather than to achieving a large sale price. Issues of equity and irrigators' ability to pay are likely to override any immediate economic efficiency gains. Nevertheless, it is expected that some efficiency gains will be made in the longer term for reasons indicated earlier. However, to achieve efficient pricing, the opportunity cost of water should be included. This will only occur with the establishment of tradeable property rights for water.

5.2 The Need for a New Regulatory Framework

It is apparent that the current system of water rights allocation is not flexible enough to handle the growing demands upon water resources. A new regulatory framework is needed to bring water resource management into the era of resource scarcity and to ensure maximum efficiency. While it is likely that water allocation and resource use efficiency would benefit from a tradeable rights scheme, there needs to be enough confidence and transparency in the process for it to succeed. The biggest impediment to this scheme is the establishment of an appropriate legal and regulatory framework. This must be done in a way that maximises transparency of the allocative process. The Regional Councils must disseminate information about the scheme and transfer process to minimise uncertainty and transactions costs among parties. These aspects are critical to the success of TWP's and lessons from Australia and the United States can be incorporated to ensure the scheme works in areas where competing water demands exist.

The other principal area of concern regards transfer options. Current wordings of the RMLR proposal do not include the option of short-term or volume transfers. As found in Australia this is an important aspect in creating resource use efficiencies and in establishing the credibility of a market for water rights (Verdich, 1986). It would be preferable to include the option of water rights leasing in the National Act rather than leave it to regional discretion.

Finally, the possible wealth inequities of permits held by irrigation schemes may have to be addressed. The rights of individual irrigators vis a vis the scheme itself will need to be spelled out. It would be preferable if individual irrigators

could transfer their share of scheme water, even if only on a lease basis. Otherwise the irrigation permit becomes an all or nothing asset, with few distinguishing features from the current water rights tenure.

5.3 Concluding Comment

Clearly the Lower Waitaki scheme has been undervalued in economic terms, while both the market value and a commercial value were established, the agreed price is less than even the commercial value. This results in an effective subsidy to non marginal users. However, this was inevitable given the strong equity considerations (the price was considered to be all that the irrigators could pay) and the absence of competing bidders. Both these constraints have been imposed by Government to a greater or lesser extent. The sale process has been largely governed therefore by political considerations.

Nonetheless, it is still expected that most of the within scheme benefits will be obtained through privatising. However, the opportunity for major efficiency gains rests with the introduction of the TWP scheme. This will allow better economic values, particularly opportunity costs, to be placed on water resources. This will force water users to consider the full value of the irrigation and water resources with a consequent improvement in allocation as values are equated with benefits.

REFERENCES

- Audit Office, 1987. Ministry of Works and Development: Irrigation Schemes. Office of the Controller and Auditor General, Wellington.
- Checchio, E and B Colby (1988). Refining the Water Transfer Process: Innovations for Western States In : Water Marketing 1988: The Move to Innovation, S Shupe editor. University of Denver.
- Coase, R (1960). The problem of Social Cost. Journal of Law and Economics 3: 1-44.
- Gardner, B and Huffaker, R (1988). Cutting the Loss from Federal Irrigation Water Subsidies. Choices: 4: 24-26.
- Hide, R (1987). Property Rights and National Resource Policy. Studies in Resource Management No 3, Centre for Resource Management, Lincoln College, Canterbury.
- Lethwaite, W and Martin, G (1987). Review of Existing Community Irrigation Schemes in New Zealand with a View to the Future. Report for the Minister of Works and Development.
- Greer, G (1984). The Economics of Irrigation Development of Amuri Plains Irrigation Scheme, Research Report No 159. Agricultural Economics Research Unit, Lincoln College, Canterbury.
- Moore, W (1989). Impacts of Changes in Government Services to Agriculture. Discussion Paper 4/89, Policy Services MAFCorp, MAF, Wellington.
- OECD (1987). Pricing of Water Services. OECD Environment Committee, Paris.
- Resource Management Law Reform Core Group (1988). The Rights to Use Land, Water, and Minerals. Working Paper No 5. Ministry for the Environment.
- The Treasury (1984). Economics Management: Land Use Issues. Government Print, Wellington.
- Touche Ross (1988). Corporate Structure for Private Ownership of Community Irrigation Schemes in New Zealand. Report to Irrigation Committees commissioned by the Ministry of Agriculture and Fisheries and the Treasury.
- Verdich, P (1986). Transferable Water Rights. Contributed Paper, Australian Agricultural Economics Society Seminar (?).
- Watson, W. Reynolds, R. Collins, D and R Hunter (1983). Agricultural Water Demand and issues. Water 2000: Consultants Report No 5, Department of Resources Energy, Canberra.

APPENDIX: ASSET VALUATION ISSUES

1 Assets/Liabilities

1.1 Crown Assets

The Crown assets generally comprise:

- (a) The future net earning capacity of the physical assets and associated rights either at market prices or as specified in existing legal agreements (alternatively the break up value).
- (b) The present value of the supply agreements and minimum payment requirements gazetted as part of the scheme.
- (c) The debts owed by the individuals within the scheme on account of both capital and maintenance costs.

1.2 Crown Liabilities

The Crown liabilities generally comprise:

- (a) Implicit scheme insurance (contingent liabilities).
- (b) commitments to supply water.
- (c) operation and maintenance costs.

2 Crown Ownership

Several issues arose in relation to the determination of Crown ownership:

- (a) Schemes built since 1975 have required irrigators to pay contributions (of varying amounts) to the capital cost of schemes. Some irrigators argue that this contribution vests them with a proportional share of the scheme's equity.
- (b) Some irrigators argue the Crown contribution to capital costs of the scheme is an unencumbered grant, so that once the irrigators have paid the specified portion of capital (sometimes as low as 30 percent of total costs) they own 100 percent of the scheme's equity.
- (c) The provisions of the Public Works Act, the Crown's liability to pay compensation, the insurance risks and the basis of setting charges all strongly support total Crown ownership.

3 Valuation Methods

The valuation model was developed jointly by MAF and Treasury, and set up initially using data provided by MAF.

Factors which have the most significant impact on the valuation include:

- * the assumed long term gross margins from various types of land use;
- * the assumed future changes in land use;
- * the post-tax discount rate;
- * the availability and security of water supplies;
- * future operation, maintenance and refurbishment costs;
- * risks and liabilities associated with the scheme;
- * the costs of surveying and registering easements.

The approach adopted was to construct a combined economic and financial model of each scheme.

Irrigation schemes have value for several reason:

- (a) they allow production increases in both quality and quantity;
- (b) they enable some land uses that would not otherwise be feasible (for example; dairying in Canterbury and North Otago, horticulture);
- (c) they provide an insurance against disastrous or debilitating losses from drought.

Paper to be presented to the Annual Conference of
the New Zealand branch of the Australian Agricultural Economics
Society, Flock House, Bulls. June 1989

**THE NEW ZEALAND PASTORAL SECTOR
SUPPLY RESPONSES:
PRELIMINARY MODELLING RESULTS**

S SriRamaratnam and R G Reynolds
Policy Services MAFCorp, Wellington

This paper reports early results of an on-going study into supply and investment response in the New Zealand pastoral sector.

The views expressed in this paper are those of the authors and do not necessarily reflect the official view of the Ministry of Agriculture and Fisheries. The helpful suggestions and comments of Al Shepherd, Ken Armstrong and Richard Wallace are acknowledged. Typing assistance of Nicole Southon is very much appreciated. Errors and Omissions remain the responsibility of the authors.

New Zealand Pastoral Sector Supply Responses:
Preliminary Modelling Results

CONTENTS

Abstract

I Introduction

- 1.1 Rationale for the Study
- 1.2 Framework of the Modelling Exercise
- 1.3 Outline of the Paper

II Background to the Pastoral Livestock Industries

- 2.1 Historical perspective
- 2.2 Recent Developments of New Industries
- 2.3 Factors Influencing Supply Response or Adjustments

III Pastoral Supply Response Model

- 3.1 The Conceptual Model Specification
- 3.2 Disaggregation, Dynamics and Data
 - 3.2.1 Sheep Sector
 - 3.2.2 Cattle Sector
- 3.3 Theoretical Concepts of Supply Response

IV Model Estimation - Results and Discussions

- 4.1 Behavioural Equations: Sheep Sector
- 4.2 Behavioural Equations: Cattle Sector
 - 4.2.1 Dairy Sector
 - 4.2.2 Beef Sector

V Summary and Conclusions

- 5.1 Progress thus far?
 - 5.1.1 Conceptual Model
 - 5.1.2 Data
 - 5.1.3 Estimated Equations
- 5.2 Directions for further work
 - 5.2.1 Model Simulation and Sensitivity Analysis
 - 5.2.2 Farm Investment and Input Responses

Appendix

- A Data Sources
- B List of Variables
- C Estimated Behavioural Equations

NEW ZEALAND PASTORAL SECTOR SUPPLY RESPONSES: PRELIMINARY MODELLING RESULTS

ABSTRACT

The objectives of developing the model are two-fold. Firstly, MAFCorp wishes to extend its in-house forecasting capabilities and secondly, to answer some questions with respect to the effects of the economic liberalisation programme upon the agricultural sector. This paper will focus upon the former objective. The hypothesis that the supply response was consistent during the slow growth period from 1960 to 1978, during the assistance build up of 1979 to 1984, and the post liberalisation period since 1984 is also proposed to be tested. The model will provide the framework in the future to analyse the impact of exogenous shocks (such as drought), and market developments, such as the expansion in the live exports of sheep and lambs.

A pastoral sector livestock supply model is developed on a micro-computer using data from 1960 in the case of sheep and from 1972 for the cattle sector. The model is conceptually similar to the model developed by Laing and Zwart at Lincoln College on the main frame, but a richer data source updated to 1988 and re-specified equations are used. The model specification differs from Laing and Zwart in that behavioural equations for all natural increase and turn-off activities are estimated, while changes in inventory is then derived by identity to ensure consistency. This approach is consistent with that adopted in the Australian livestock models developed at ABARE. All prices are treated exogenously, as is farm investment. Total livestock units will be constrained, and the new livestock (deer and goats) along with live exports of sheep and lamb introduced exogenously. The TSP software is used to estimate and subsequently be used to simulate the model on a micro.

The natural increase and turn-off behavioural equations introduced provide a good fit. The responses to exogenous price variation, in particular to wool relative to lamb and beef relative to milk fat prices, was shown to be important in the enterprise mix decisions. Mutton prices were not relevant and confirm the postulate that it is a salvage value. Dairy calf retentions for bull beef production was found to be important. Ewes retained for breeding and lambs marked were driving forces in the sheep flock dynamics whereas on the cattle side it is the changes to cow and heifer inventory which lead to overall numbers and slaughter responses. Supply response was consistent throughout the entire period and the farmers responded to actual farm gate returns and cost factors which adequately captured the effects of the growth in assistance to outputs during 1979-84.

NEW ZEALAND PASTORAL SECTOR SUPPLY RESPONSES: PRELIMINARY MODELLING RESULTS

I INTRODUCTION

1.1 Rationale for the study

The pastoral sector is of critical importance to the New Zealand economy as it accounts for a significant part of both agricultural production and total exports. Past attempts at modelling the pastoral sector (Laing and Zwart, 1983; Shaw, 1986) and their updates (Grundy, Lattimore and Zwart, 1988) have provided valuable insights into the factors determining the nature of supply response and its dynamics. This work provided the impetus for the modelling exercise at Policy Services MAFCorp reported in this paper. We intend to use this model in the analysis of policy impacts, including the economic liberalisation programme, and as an in-house forecasting and monitoring device of production, productivity and changes in the inventory of various classes of livestock.

1.2 Framework of the Modelling Exercise

The pastoral sector livestock supply model is developed on a micro-computer using data from 1960 in the case of the sheep sector and from 1972 for the cattle (beef and dairy) sector. The model is conceptually similar to the model developed by Laing and Zwart (L&Z) at Lincoln College on the main frame but a richer data source updated to 1988 and re-specified equations are used. Behavioural equations for all natural increases and turn-off activities are estimated, unlike in the L&Z model, while changes in inventory are then derived by identity to ensure consistency.

The approach taken in this study is consistent with that adopted in the Australian Livestock models (Reynolds and Gardiner, 1980; Reynolds et al, 1981), including the EMABA model (Dewbre et al, 1985) at ABARE (BAE). But, importantly the need to derive more than one series of data as residuals in the inventory equations has been avoided by limiting the disaggregation of male and female as well as the different age classes of livestock, to the extent data is available. All prices and farm investment are treated as exogenous, while total livestock units are constrained by the available pasture base. The influence of new livestock industries such as deer and goats along with live exports of sheep and lamb are introduced exogenously. The TSP software is used to estimate and will be used subsequently to simulate the model on a micro.

1.3 Outline of the Paper

The paper is organised as follows:

Some background information on policy measures and market developments affecting the pastoral sector and historical trends in the New Zealand sheep, beef and dairy numbers are outlined in section 2. A description of the conceptual model and the econometric specification arising from it, including the dynamic features of the model, and the data sources utilised are summarised in section 3. In section 4, the results of estimation of the behavioural equations of the model relative to inventory adjustments or natural increases, turn-off (slaughter), and per unit production are reported and discussed.

The final section summarises the main focus of the study, the major findings of the estimated model and the important policy simulation experiments which are possible using the model.

II NEW ZEALAND PASTORAL LIVESTOCK INDUSTRIES

2.1 Historical Perspective

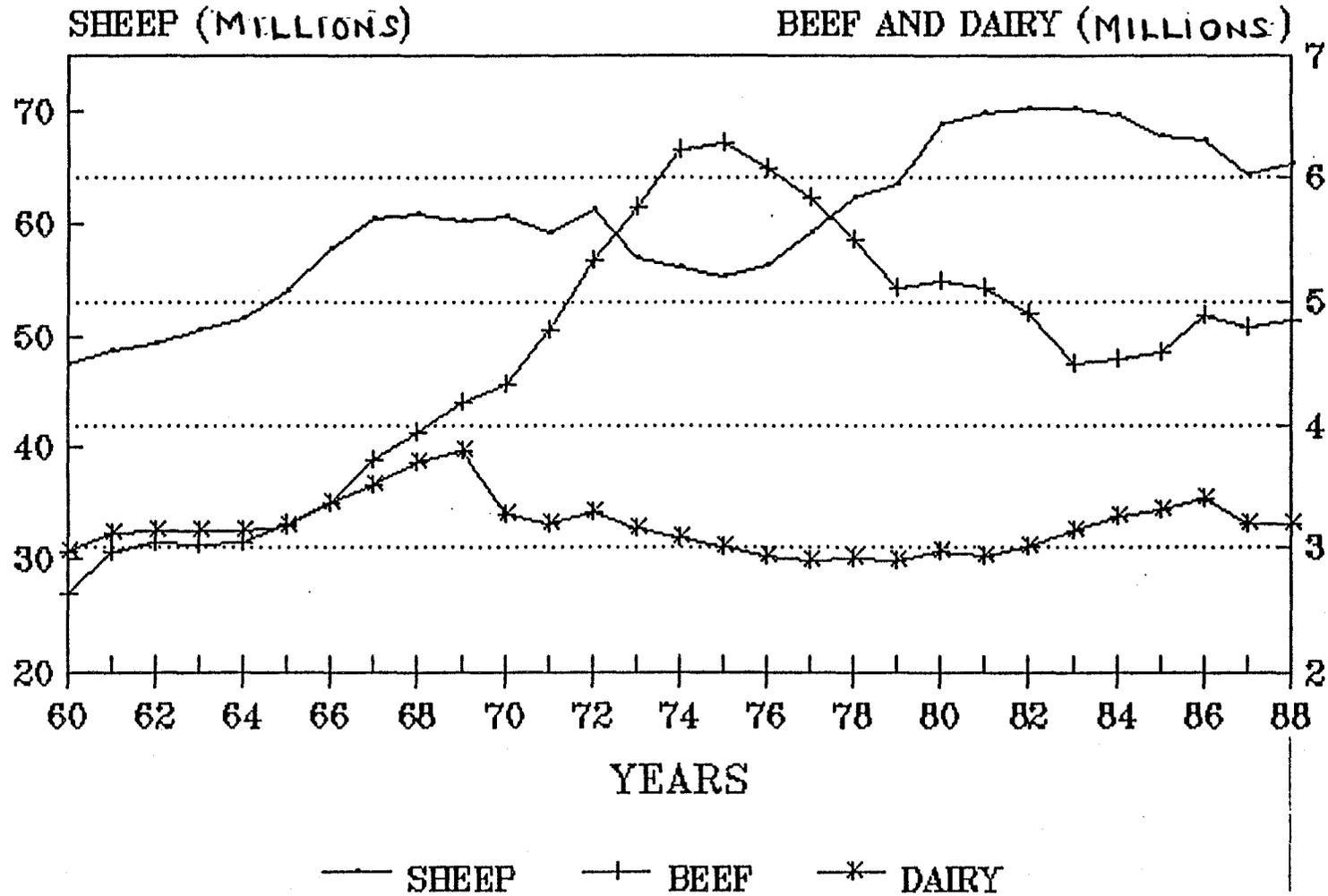
Traditionally, the pastoral sector of New Zealand has consisted mainly of the sheep industry, producing lamb, mutton and wool, the beef industry responsible for both prime and manufacturing beef production, and with the dairy industry outputs being primarily milk fat and transfers of cattle for use in production of beef. This latter area is significant in New Zealand and has risen in importance in recent years. Other new livestock industries (goats and deer) in the pastoral sector, in spite of their tremendous growth, still account for only a small portion of the total output.

While sheep and beef farming has been the mainstay of New Zealand agriculture for a long time, changing fortunes for beef and sheep production has been equally characteristic over the last 30 years. Both activities saw a steady growth throughout the 1960s when beef numbers rose by about 50 percent from under 3 million and sheep numbers by about 25 percent from about 48 million in 1960. During the early 1970s, beef numbers continued to rise to over 6 million while sheep numbers fell back by about 6-8 million. Beef numbers fell since 1975 to below 5 million at a steady rate, (except for a brief period of stability in 1979 and 1980) and then since 1983 there has been a mild recovery taking the beef numbers back up to almost 5 million in 1986 (figure 1). During the period since the mid 70s, sheep numbers rose consistently and were over 70 million in 1982 and 1983. They then fell back in the post 1984 period to below 65 million in 1987.

Dairy numbers, on the other hand, rose from about 3 million in 1960 to almost 4 million in 1969, but then fell below the 3 million mark during the mid 70s. The dairy numbers recovered

Figure 1

TOTAL SHEEP BEEF AND DAIRY NUMBERS



somewhat in the mid 80s to be almost 3.5 million in 1986. In 1987 sheep, beef and dairy numbers all fell but have recovered slightly during 1988 (figure 1).

This period of almost three decades has seen some major changes in the domestic assistance levels, developments in the international markets and the effects of adverse climatic conditions on seasonal pasture availability. Among the overseas market developments, the accession of UK into the European Community (EC) in the early 1970s and the expansion of the US, Middle East, and third world markets have had major impact on the pastoral sector production levels and livestock numbers.

In the domestic scene, the period of growing assistance to the rural sector in mid 1970's culminated in the supplementary minimum prices (SMP) scheme for all three main pastoral activities during 1979-84. Their subsequent elimination along with major changes in the macro economic environment in New Zealand since 1984 are likely to have had still greater impacts on the pastoral livestock industries. Besides the market related and policy oriented impacts on the pastoral sector, weather induced effects arising from soil moisture deficits were pronounced during the drought years of 1964, 1973, 1978, 1983 and, most significantly for the sheep sector in 1988 and 1989.

2.2 Recent Developments of New Industries

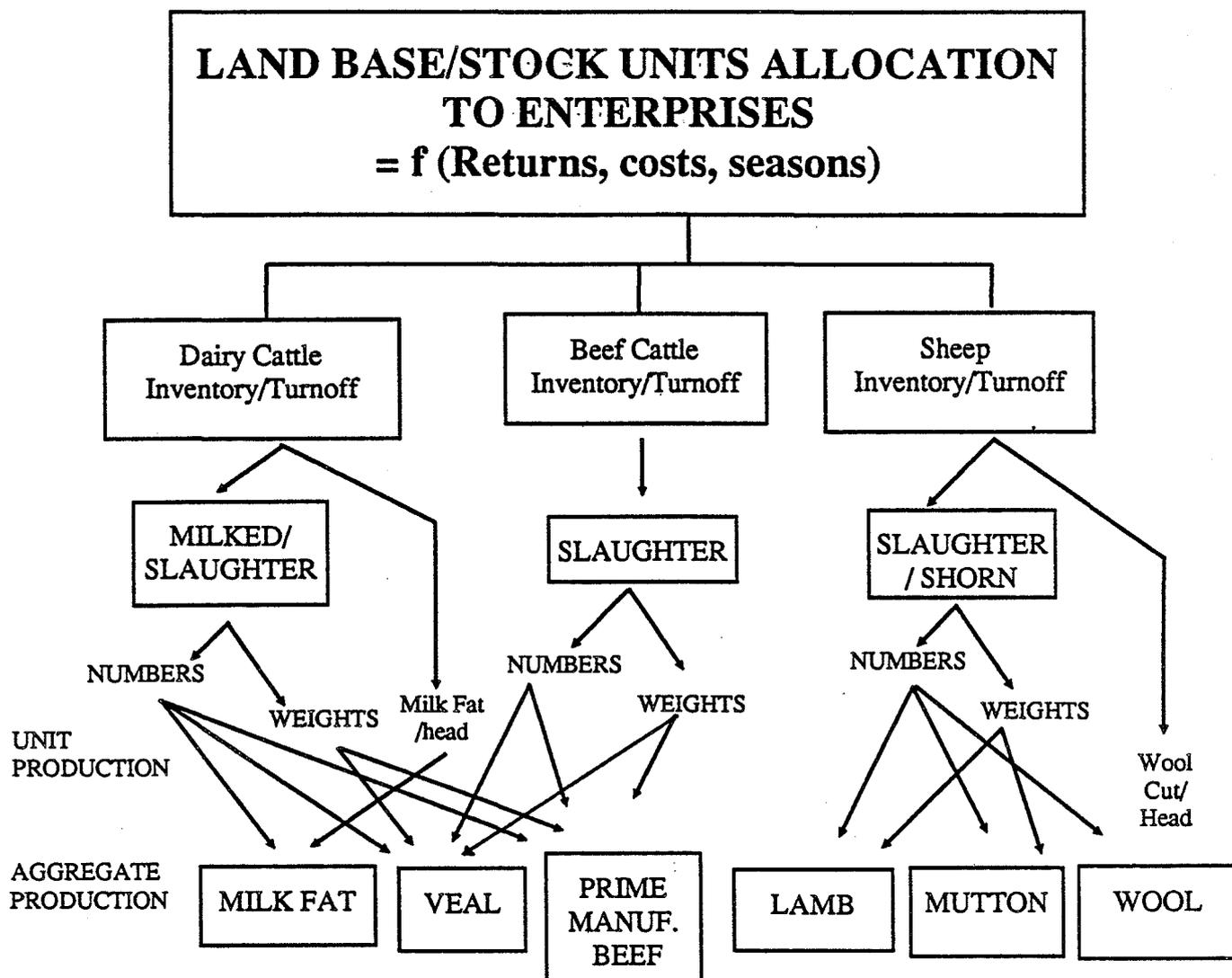
Among the newer pastoral industries of New Zealand, both deer and goat numbers have seen tremendous growth during the last 4-5 years. Total deer numbers estimated to be around 600,000 at present are expected to reach the million mark by 1991. Goat numbers, estimated at around 1.3 million in 1988, will approach the 2 million level by 1991 with strong demand prospects for velvet, venison and goat fibres in general (SONZA, 1989). These dramatic increases reflect the emphasis on herd build up and velvet and goat fibre production, while the levels of venison and goat meat production have not been as spectacular.

III PASTORAL SUPPLY RESPONSE MODEL

3.1 The Conceptual Model Specification

The main focus of this model is to capture the changes in the inventories and the level of aggregate production of the major outputs from the traditional pastoral livestock industries. These changes are modelled as responses to the incentive environment (price and cost) arising from the domestic policy measures, both direct and indirect, the international market developments and also weather and their exogenous influences. In this respect, this model is analogous to the livestock numbers and production sub-model developed by Laing and Zwart (1983). A flow diagram of the conceptual model is provided in figure 2.

**Figure 2: Conceptual Model of
Livestock Supply**



3.2 Disaggregation, Dynamics and Data

The producers' decisions at the aggregate sectoral level are modelled first with respect to the enterprise mix vis a vis sheep, beef and dairy activities, and then the supply response further disaggregated by outputs. These are prime and manufacturing beef from the beef and/or dairy sectors veal and milk fat from the dairy sector, and the joint products of lamb, mutton and wool from the sheep sector. The inventory of breeding stock (ie, ewes, beef and dairy cows) are the determining factors of next period's birth of lambs and calves, both beef and dairy, which in turn determine lamb and veal production in the same period and beef, mutton, wool and milk fat production in the subsequent period. Here the time periods are years ending 30 June.

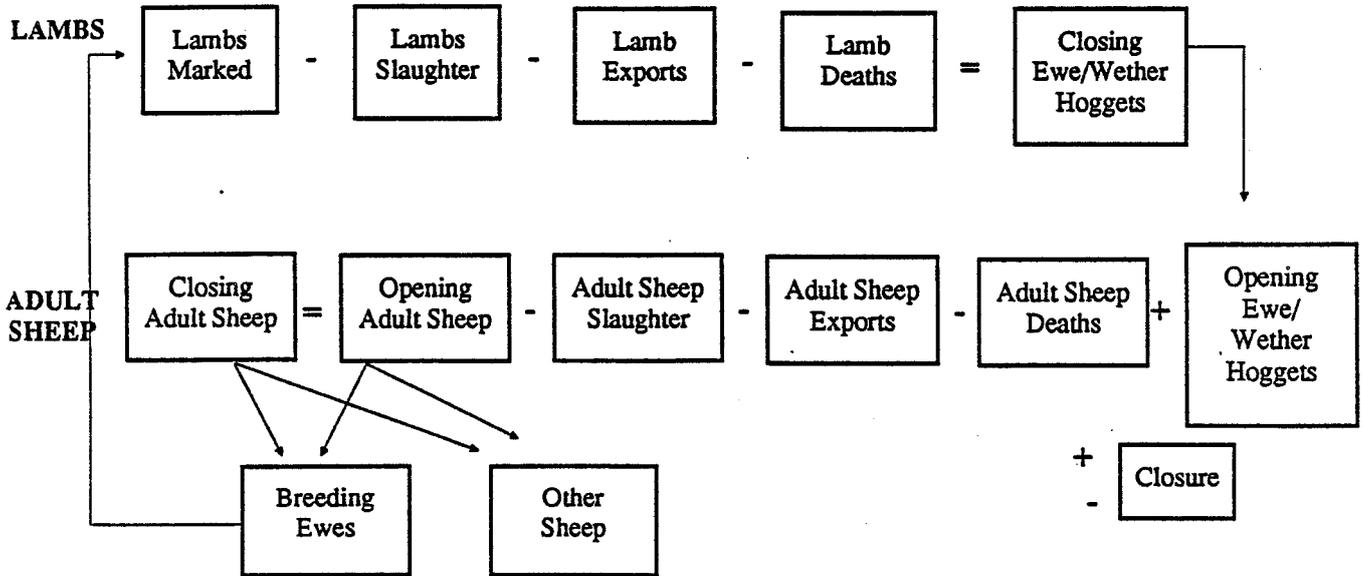
3.2.1 Sheep Sector

New Zealand sheep flock as counted at census time consists of the adult sheep flock and the ewe and wether hoggets being promoted. The lamb crop of this season contributes towards a build up of the adult flock next season through promotions as hoggets. Alternatively, the flock is rundown through deaths and slaughter of lambs and/or adult sheep respectively (figure 3). Breeding ewes are an important component of the adult flock and the breeding decisions of sheep farmers this season determine the lambs marked in the subsequent season. Here the weather and price factors determine the number of ewes bred and also the lambs marked. As shown in figure 3, the sheep component of the model is closed by a closure factor in the adult sheep inventory relationship.

Prices of the joint products from the sheep sector (lamb, mutton and wool) along with the price of beef determine the breeding decisions, which lead to stock build up next period. It also determines the slaughter decisions of both lambs and adult sheep, which result in stock decline. Weather determines seasonal pasture availability and becomes important not only in the breeding and slaughter decisions of farmers but also determines the loss of lambs and adult sheep on farms through deaths. In this analysis, weather conditions for sheep farming in New Zealand is defined as the number of soil moisture stress days. It is measured by the meteorological service and recorded for the different sheep growing regions and weighted according to the sheep numbers.

Output of the joint products from the sheep sector are measured through changes in the slaughter numbers in the case of lamb and mutton (adult sheep) and the corresponding average slaughter weights, while wool production is determined from sheep wintered and average fleece weights (figure 2). These weights are again determined by weather, both current and previous season in the case of wool, along with prices of the respective products and a trend variable representing the changes in the technology (management) of on-farm production and/or market preferences for heavier or lighter animals.

Figure 3: Sheep Inventory Turn/off Relationships



The price variables are generally defined in real terms, where they are measured as ratios of nominal prices to the prices paid indexes of the respective farming activity in the different years. The inventory and slaughter numbers are measured on a June year ending basis and the study period for the sheep sector is 1960-1988. But the estimated sheep sector equations reported in Section 4 cover 27 years of data from 1962-1988, due to the nature of changes in inventory reconciliation and the lagged effects of weather and sometimes prices on the endogenous variables represented by the behavioural equations.

3.2.2 Cattle Sector

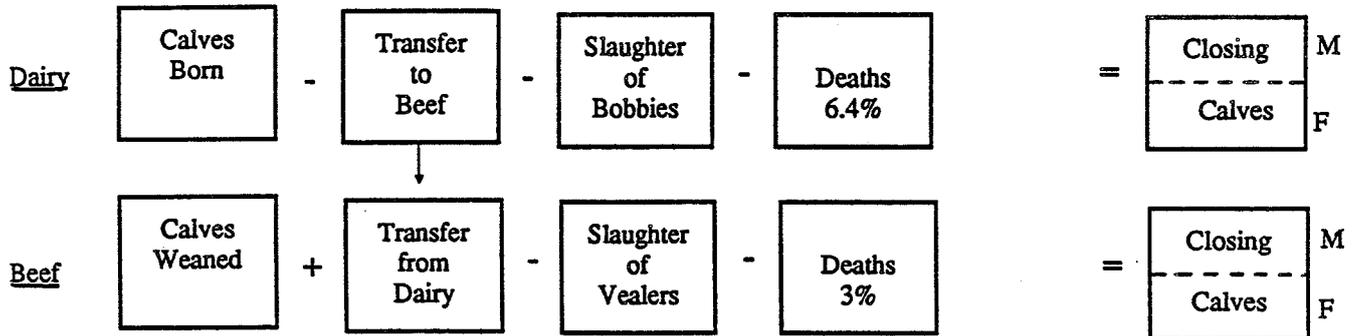
The cattle sector is differentiated into dairy and beef enterprises with separate representation of the male and female stock (figure 4). The younger (1-2 years), and older (over 2 years) animals are also modelled separately in each case, accounting for promotions within the dairy and beef herds and transfers from the dairy to the beef herds of (young) surplus and/or (older) culled stock for beef production. The data period for the cattle sector in this model is 1972-1988 with census data reported on a June year ending basis.

The calves born on dairy farms account for young dairy heifer and bull calves promoted next season to the 1-2 year age category. They also account for bobby calves slaughtered for bobby veal production, and a proportionate (6.4% of births) number of calves dying on farms (NZDB) while the remaining animals are retained for dairy beef production on beef or dairy farms. These dairy beef animals along with the calves weaned on beef farms account for young beef heifer and bull/steer calves promoted next season to the 1-2 year age category (figure 4), along with the veaner or yearling cattle slaughter this season and death of calves on beef farms reported to be around 3% (NZMWBES).

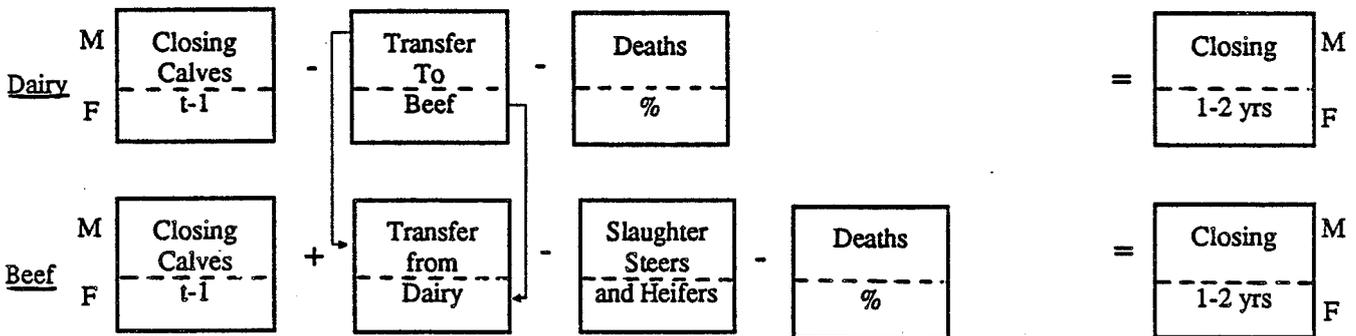
The dairy calves retained for beef production is the residual in the dairy calves born relationship and feeds into the beef calves weaned relationship. The total number of young beef heifer and bull/steer calves remaining are modelled as the residual in the latter inventory relationship. These are then apportioned according to the actual ratios of male to female, under 1 year Beef stock, reported in the beef census statistics for each year of the study period. It has been recognised by others who have modelled the New Zealand cattle sector (Laing and Zwart, 1983) that census data on young, especially female, stock tend to under report the number of animals in the below 1 year age class relative to the 1-2 year age group. This suggests fewer younger stock from which the older stock are derived and is particularly a serious problem in the case of young female stock in the dairy census data. This problem has been corrected to some extent by recent changes in 1988 to the census questions dealing with this aspect. This problem in the data (1972-87) was overcome by increasing and then offsetting the respective numbers of under one year and 1-2 year dairy heifers to establish a more realistic ratio between these two inventories. This was carried out to be consistent with earlier periods when the census data was more sensible in this respect. A similar correction was made in the case of beef sector young male and female inventory as well.

Figure 4: Cattle Inventory Turn/off Relationships

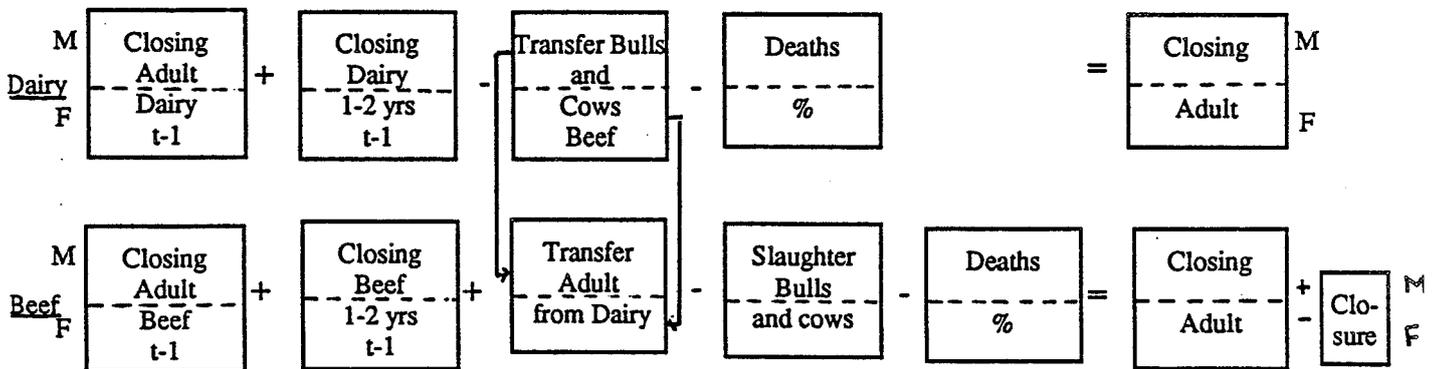
Calves < 1 yr



Young Cattle 1-2 yrs



Adult Cattle > 2 yrs



M = Male
F = Female

The young cattle in the 1-2 year age category representing the dairy and the beef sector were also modelled separately (figure 4). The previous period's male and female closing calf inventories described before are the promotions, while transfers from dairy to the beef sector are the residuals. Deaths of young dairy heifers (3%) and bulls (2.5%) based on the New Zealand Dairy Board (NZDB) estimates are treated as fixed ratios. The slaughter of heifers and steers are represented on the beef side with the slaughter component from the dairy industry being part of the transfers of young female and male cattle referred to above (table 1). These slaughter figures are derived as the residuals in the 1-2 year beef inventory relationships from calf promotions and again by using death rates of 3% for heifers and 2.5% for young steers and bulls, based on NZMWBES estimates. The slaughter figures from MAF for heifers and steers, based on inspected kill records at the meat works, do not strictly correspond to the 1-2 year age category modelled. Therefore, the differences are adjusted in the cows and mature steers and bulls slaughter figures respectively, while modelling the adult cattle over 2 years of age.

Promotions of 1-2 year young heifers, bulls and steers into respective adult dairy and beef cattle (over 2 years), both male (bulls) and female (cows), are also modelled. Here again the transfer of both adult bulls and cows from dairy to the beef sector are derived as the residuals in the dairy inventory relationships. Here a 2.5% death rate is assumed for the mature dairy bulls and a variable death rate ranging from about 5-8% is used for cows, based on NZDB wastage statistics on tested herds. The transfers of adult (over 2 years) bulls and cows from the dairy to the beef sector represent the culled animals contributing to the total slaughter of bulls and cows in the beef inventory relationships (table 1).

The promotions of young beef bulls/steers and heifers in the 1-2 year category are from previous year's closing inventory and with the opening inventory of mature (over 2 year) bulls/steers and beef cows account for the slaughter of total bulls and steers and cows, in addition to fixed death rates of bulls (2.5%) and beef cows (3%). The balance should represent the closing inventory of mature bulls/steers and cows, when the transfers from the dairy herd are accounted for (figure 4). This requirement for the closure of the model is not met exactly due to the reporting errors in the census data, both intentional and inadvertent. It is not met also because of the noise arising from the assumption of fixed death rates owing to a lack of information on deaths for the different classes of both dairy and beef cattle, with the exception of dairy cows where a variable death rate from NZDB was used.

One of the most noteworthy items arising from the above analysis is that, a detailed breakdown (by age and sex) is now available for transfers from the dairy to the beef herd for meat production. Summary figures are presented in table 1, along with the best previously available estimates from the Dairy Board.

Table 1: Transfers of Dairy Cattle to Beef Production
(‘000’ head)

| Year | Dairy Board Estimates of Dairy Beef Calves | Calves <1 yr | Heifers and Bulls (1-2 yrs) | Cows and Bulls (>2 yrs) | Total Dairy Cattle Transfers |
|---------|--|-----------------|-----------------------------------|-------------------------------|------------------------------------|
| 1972/73 | 405 | 312.8 | 72.3 | 397.9 | 783.1 |
| 1973/74 | 235 | 358.8 | 85.9 | 356.0 | 800.8 |
| 1974/75 | 150 | 133.8 | 96.1 | 289.5 | 519.4 |
| 1975/76 | 210 | 87.0 | 73.3 | 309.6 | 469.9 |
| 1976/77 | 200 | 162.6 | 59.9 | 313.7 | 536.2 |
| 1977/78 | 220 | 129.1 | 62.1 | 265.2 | 456.4 |
| 1978/79 | 310 | 208.0 | 57.4 | 297.5 | 562.9 |
| 1979/80 | 366 | 231.2 | 43.2 | 272.3 | 546.7 |
| 1980/81 | 300 | 414.7 | 73.6 | 319.3 | 807.6 |
| 1981/82 | 251 | 356.8 | 45.5 | 245.7 | 657.0 |
| 1982/83 | 409 | 426.1 | 51.3 | 209.5 | 686.9 |
| 1983/84 | 530 | 520.5 | 35.9 | 281.6 | 838.0 |
| 1984/85 | 640 | 658.0 | 71.0 | 290.7 | 1019.6 |
| 1985/86 | 596 | 674.0 | 65.2 | 270.1 | 1009.3 |
| 1986/87 | 648 | 616.8 | 103.5 | 464.9 | 1185.2 |
| 1987/88 | 650 | 606.2 | 46.1 | 362.6 | 1014.9 |

These estimates show the significance of the dairy industry as the source of animals used for beef production. It needs to be noted that the analysis only provide information on animals transferred, and do not mean that slaughter occurred in that year. Moreover, it is impossible to say what proportion of stock were sold off dairy farms, because a number of these animals could be retained and fattened on dairy farms. Additionally, some dairy calves were slaughtered as bobbies, although numbers here have diminished considerably in recent years. It is also likely that transfers would diminish in years when dairy returns improve.

3.3 Theoretical Concepts of Supply Response

A multi-output characteristic is exhibited by both the sheep and dairy sectors in New Zealand and a multi-period sequential decision making is involved in all the three sectors modelled. This requires a block recursive structure and a dynamic simulation framework to capture the inter-relationships between the time periods and also the sectoral outputs. In the application of

the theory of capital and investment to livestock supply studies (Jarvis, 1974), the livestock are viewed as capital goods and the producers as portfolio managers. Output in future periods can be increased only by increasing the size of the breeding flock or herd and/or withholding stock from slaughter in the current period.

When output prices rise, the optimum slaughter age increases as it pays to keep the animals longer which leads to a negative short run supply or slaughter response. Another consequence of rising output prices is the rise in opportunity cost of pasture land which varies for different classes of animals depending on their discounting horizons (Reynolds and Gardiner, 1980). This results in a greater decline of the slaughter of breeding ewes, cows, lambs and young steer relative to other adult sheep and cattle.

Some other a-priori hypothesis suggest a positive short-term supply response to increasing wool and milk fat prices and a negative response in the case of beef, mutton and lamb supply to own price rises in the short run. The longer term response will be positive in all cases, but the time required to realise it is indeterminate as it depends on the process of farming expectations and the relative returns from the alternative enterprises. The response to increases in returns from competing products can also be either positive or negative depending on the time period of adjustment. In the very long run however, this cross price supply response will be negative.

Producers try to adjust production to meet the desired end of year or closing inventory levels for each stock category within a framework of stochastic prices and climatic conditions and a discrete production decision environment imposed by biological constraints (Reynolds and Gardiner, 1980). The coincidence of this desired inventory level (known as the equilibrium) and the actual outcome can only happen by chance as producers continue to respond in a discrete decision framework to stochastic prices and seasonal factors. A brief description of the data sources and some of the data limitations are summarised in Appendix A.

IV RESULTS OF MODEL ESTIMATION

The list of endogenous variables modelled and the exogenous factors used as explanatory variables in the behavioural equations are provided in Appendix B. Estimated Inventory adjustments, turnoff/slaughter and unit production behavioural equations are reported in Appendix C as tables C1 (Sheep), C2 (Dairy) and C3 (Beef).

4.1 Behavioural Equations - Sheep Sector (1962-1988)

The breeding decisions of sheep farmers are represented through the equations on closing inventory of breeding ewes (KE) and the lambs marked (LM). These are determined by the size of the available sheep flock (KS), seasonal weather factors in the sheep growing districts, both current (WS) and lagged (WSL), real prices of lamb (RPLPP), wool (RPWPP), and competing product such as (prime) beef (RPPBPP). In the breeding ewe equation, the opening

inventory of the total sheep flock (KSL) is an important variable along with current weather, real prices of lamb, prime beef and wool.

A higher total sheep flock can support a larger breeding stock and greater the number of moisture stress days, fewer the number of ewes in condition to be bred (table C1; equation I). Higher real lamb prices lead to more ewes being mated, while higher wool and prime beef prices result in fewer ewes put to the ram. This is due to the substitution of wool for lamb within the sheep enterprise and beef for sheep in the sheep/beef farming system respectively. Overall, this equation exhibits a high degree of explanatory power with an R^2 of 0.949 and F statistic of 99.3. The individual co-efficients are also significant at least at the 10 percent level, except for weather and real wool prices.

Lambs marked depend on both ewes bred and the weather in the previous season along with the real prices of lamb and (prime) beef (table C1: equation II). Here again the direction of impact of the variables is similar to the breeding ewes equation and the coefficients were significant at least at the 5 percent level, except for real lamb prices. Lambs slaughter in turn depends on lambs marked, weather, real prices of lamb and mutton (table C1: equation III). More lambs marked can produce a higher lamb slaughter particularly under unfavourable seasonal weather conditions (destocking), and/or higher real lamb prices (greater returns). But a higher real mutton price on the other hand, reduces lamb slaughter (substitution). The lamb slaughter equation also has a high degree of explanatory power with an R^2 of 0.939 and an F value of 102.1. Lamb deaths (table C1: equation IV) are mostly determined by the number of lambs marked (LM) and the weather in the previous period (WSL), which influences the condition of the ewes and also the lambs which are born.

Adult sheep slaughter (table C1; equation V) depends on the opening inventory of the adult sheep flock (KASL), current weather (WS), real price of wool (RPWPP) and the ratio of real lamb to mutton prices (RPLMPP). A larger adult flock can support a bigger slaughter number, which is in turn further increased under unfavourable weather conditions for seasonal pasture availability, due to destocking. The co-efficient for current weather (WS) is larger in the adult sheep slaughter (SLAS) equation than the lamb slaughter (SLL) equation and is positive in both cases. This reflects the common practice on farms of destocking more adult sheep than lambs under adverse climatic conditions. Adult sheep deaths (table C1: equation VI) are also influenced by the size of the adult flock (KASL), current and the previous season's (WSL) weather, and real mutton prices (RPMPP).

Sheep wintered (SHW) for wool production (table A1: equation VII) is also determined mainly by the adult sheep flock (KASL), lagged weather (WSL) and lagged real wool prices (RPWPPL). A larger adult flock leads to more sheep being wintered, subject to the weather in the previous season which reduces this number and favourable wool prices in the last season which leads to greater number of sheep kept for wool production.

Per unit production of lamb, mutton and wool are estimated as slaughter weights and fleece weight and are reported in appendix table A1, as equations VIII IX and X. Slaughter weight of lambs (SWL) is determined by weather (WS), real price of lamb (RPLPP) and a trend factor (T62) capturing the technology and/or market preferences. This factor is defined as 62 in year 1962 and as 88 in year 1988, with years in between defined accordingly. Current unfavourable weather reduces slaughter weights; so does higher lamb prices, probably due to their earlier slaughter. A small but significant negative trend is also observed in lamb slaughter weights.

Adult sheep slaughter weight (SWAS) is influenced again by current weather (WS), real wool prices (RPWPP) and the trend (T62) variable. As for lambs, adverse weather has a negative impact on slaughter weights of adult sheep, but to a somewhat greater degree, and higher wool prices lead to heavier slaughter weights as they tend to be kept longer for wool production. The trend variable was negative in the case of adult sheep slaughter weights also and larger than for lambs. Fleece weight of wool (FWL) is also determined by current (WS) and lagged (WSL) weather as they come off the sheep wintered (June - August), while the census period is year ending June. Real price of wool (RPWPP) and mutton (RPMPP) and also the trend variable (T62) appear to have an impact on fleece weights. Both current and lagged unfavourable weather have a negative effect on fleece weights and so does higher real mutton prices probably due to earlier slaughter, while higher real wool prices increase fleece weights as one would anticipate. A very small, but not a significant, negative trend was observed in the case of fleece weights as well.

4.2 Behavioural Equations - Cattle Sector (1973-1988)

The cattle sector equations cover the dairy and the beef sector and are reported in Appendix tables C2 and C3 respectively. They cover inventory adjustments, turn off/slaughter and per unit production of milk fat beef and veal. Total milk fat, beef and veal production are then derived from per unit production and cows and heifers in milk and total cattle slaughter numbers respectively.

4.2.1 Dairy Sector

Inventory adjustments here are related to cows and heifers in calf and/or milk (KCHMD), dairy calves born (CVBD) and the closing numbers of young dairy heifers (KYHD) and bulls (KYBD) under the age of one year remaining at the end. The dairy breeding stock closing numbers (KCHMD) are determined by the total cows and heifers in the dairy herd (KCHTDL) at the beginning of the year as well as dairy milk fat prices (PD), manufacturing beef prices (PMB) and the dairy prices paid index (PPID). While higher milk fat prices increase the size of the dairy breeding stock, higher beef prices and input prices paid in dairy production reduce the size of the breeding stock. This equation has a high degree of explanatory power with an R^2 of 0.932 and an F statistics of 52.7 and all the estimated co-efficients significant.

Dairy calves born (CVBD) equation also exhibits a high degree explanatory power and is influenced by the opening inventory of the breeding stock as well as dairy, beef prices and prices paid index. Closing numbers of young dairy heifers (KYHD) in turn are determined by the calves born, weather and the real price of prime beef, while young dairy bull (KYBD) numbers are mainly a constant, but also influenced by dairy, and (manufacturing) beef prices and prices paid.

Bobby calf slaughter is determined by the dairy calves born as well as weather and prime beef prices. Adverse weather conditions increase bobby calf slaughter while higher prime beef prices reduces the bobby slaughter. Slaughter weights of bobby calves are determined by lagged weather which influences the condition of the cows in calf. The average weight of bobby calves have also declined since the early 1980's, due to the extraction of heavier friesian crosses for dairy beef production. This is represented by a dummy variable (D80) which is 0 from 1972-1979 and 1 from 1980-1988 and has a negative sign as anticipated. There was also an overall negative trend in the bobby calf weights observed in the trend variable T72.

Milk fat produced per cow is influenced by current weather (WD), price of milk fat (PD), the prices paid index (PPID) and the trend factor (T72). Adverse weather and higher prices paid reduces milk fat production while higher milk fat prices appear to increase production. There was also a significant declining trend observed in milk fat production per cow.

4.2.2 Beef Sector

Inventory adjustments in the case of the beef sector are related to cows and heifers bred, beef calves weaned, and the closing numbers of young beef heifers and bulls/steers under the age of one year remaining at the end. Here again the closing breeding stock (KCHPB) number is determined primarily by the total cows and heifers in the beef herd (KCHBL) at the beginning of the year, weather (WB) in the beef farming regions, prices paid index in beef production (PPIB) and a trend factor capturing a general decline in the breeding stock over the sample period. Adverse weather in the current period reduces the number of animals bred, while higher prices paid tends to increase the number of animals bred to offset the higher cost. A statistically significant and large negative trend was also observed, while prices did not appear to be important.

Beef calves weaned (CVWB) are determined naturally by the number of female animals bred (KCHPBL) in the previous season, lagged weather (WBL) which determines the condition of the breeding animals in the beginning of the census year and the real price of (prime) beef (RPPBPP). Adverse weather reduces the number of beef calves weaned, while higher beef prices increase them probably due to better care after birth. There was also a significant negative trend in calves weaned.

Young beef heifer (KYHB) closing numbers are determined by the number of calves weaned, price of prime beef (PPB) and the prices paid index for beef (PPIB). Young beef steers and bulls (KYSB) closing numbers on the other hand, are determined by the number of dairy calves retained for beef production (BCVRD) which are mostly males, along with beef prices (PPB) and input prices (PPIB). While higher prime beef prices increase the number of young beef heifers for breeding purposes and future beef production, they reduce the young steer numbers probably due to their slaughter in the current period. Higher prices paid for inputs also appear to reduce the young male stock but increase the young beef heifer numbers. This is an important result capturing the beef herd dynamics in response to changes in output and input prices which are modelled separately.

Slaughter weight of vealers or yearling cattle is determined by lagged weather (WBL), the total number of vealers reared and slaughtered (SLV), prices paid for inputs (PPIB) and the trend variable (T72). Adverse weather and higher input costs appear to reduce vealer weights along with the number of vealers slaughtered. But there was a significant positive trend in vealer weights during the ample period.

Slaughter weights of adult cattle (>1 year) modelled represents a combined average weight of both younger (1-2 year steers and heifers) and mature (over 2 year bulls and cows) cattle and will vary according to their proportion in the total slaughter of adult cattle, in addition to this total itself. As in other livestock categories, adult cattle slaughter weights also depend on weather which determines seasonal pasture availability, and prices of both prime and manufacturing beef in relation to the price of other outputs from competing enterprises such as wool and dairy.

Higher prime beef prices will lead to more younger animals being slaughtered while better manufacturing beef prices will result in more mature bulls and cows being killed. This in turn will be reflected in the slaughter weights of adult cattle, where higher prime beef prices reduce the average weights while higher manufacturing beef prices increase them. When the proportion of young steers to mature bulls slaughter (SLSBT) increase, the average slaughter weights decline. When milkfat prices increase the dairy cows are kept longer leading to heavier animals being slaughtered. Higher wool prices will reduce slaughter weights of adult cattle due to the substitution between the sheep and beef enterprises. There was no trend observed in adult cattle slaughter weights.

In addition to average slaughter weights of adult cattle, the slaughter numbers of adult (>1 year) cattle was also modelled for the first time by age (1-2 years and over 2 years) and sex (heifers/cows and steers/bulls) categories. For each of the category of slaughter, a corresponding slaughter pool variable was defined based on the inventory equations (figure 4) for the adult (>1 year) beef cattle. Heifer slaughter (SLHT) is determined by the slaughter pool of heifers (SLPH), made up of young beef heifers (KYHB) and the transfer of heifers from dairy to beef (THDB), as well as the real price of manufacturing beef (RPMBPP) and price of

milk fat (PD). An increase in all these variables increases heifer slaughter. Higher beef prices produce an own price response and higher dairy prices suggest a substitution and destocking of the beef breeding herd.

Young (1-2 year) steer slaughter (SLST) is again influenced by the slaughter pool of steers (SLPS), which is made up of young steers/bull calves (KYSB) and the transfer of immature (culled or surplus) dairy bulls to beef (TIBDB), along with the price of prime beef (PPB) and the price of lamb (PL). The responses here are similar to the heifer slaughter, but to a different own and competing enterprise output prices.

Cow slaughter (SLCT) also depends on the slaughter pool of cows (SLPC), made up of the beef heifers being promoted from previous period ((KHBL), transfer of culled dairy cows for beef (TCDB), and the opening inventory of beef cows over 2 years (KCBL). In addition, higher prices for manufacturing beef (PMB) and milk fat (PD) have a negative impact on cow slaughter due to the perverse own short-run beef supply response and because of fewer dairy cows culled, respectively. Higher prices for lamb (PL) however, will lead to increased cow slaughter due to the destocking of the beef breeding herd as a preference for lamb production. Adverse weather also appear to increase cow slaughter again as a result of destocking. There was also a significant positive trend in the number of cows slaughtered.

Slaughter of bulls (SLBT) over 2 years is determined by the slaughter pool of bulls (SLPB), made up of immature bulls and steers being promoted from the previous period (KISBL), transfer of culled dairy bulls for beef (TBDB) and the opening inventory of beef bulls and steers over 2 years (KSBL). In addition, the real price of manufacturing beef, weather and prices paid have a positive effect on bulls slaughter. Vealer/yearling slaughter on the other hand, is reduced by higher prime beef prices and prices paid and increased by adverse weather conditions.

V SUMMARY AND CONCLUSIONS

5.1 Progress thus far?

5.1.1 Conceptual Model

In this paper we have developed a framework within which it is possible to analyse and project aggregate livestock producer responses to changes in prices, costs and seasons. First, we presented a theoretical and conceptual model which captured changes in livestock inventories and linked these to changes in producer decisions concerning livestock build-up or turn-off as well as to opening inventories. The key theme of this approach is that closing inventories are being jointly determined with the decisions to build-up, withhold or turn-off stock. Consequently, livestock response is characterised by being the outcome of dynamic

(multi-period) sequential decision making. The livestock need to be viewed as capital goods and the producers as portfolio managers.

Producers adjust production decisions to meet the desired end of year inventory levels for each stock category within a framework of known biological constraints and of highly stochastic prices and climatic conditions. It is from this recognition that the need for disaggregation of livestock types (by age and sex) and the need for dynamics is derived. However, the whole pastoral livestock system is constrained by the available pasture base. Thus the competitive nature of dairy, beef and sheep enterprises needs to be accounted for. As well, there are complementary and competitive within enterprise interactions such as between wool or lamb and the use of dairy animals for meat production (ie, the joint products scenario).

5.1.2 Data

By applying the conceptual model to the available data sources, a significantly richer data base than used in earlier New Zealand livestock models has been derived. In particular, slaughter data for each major age and sex category of each of sheep, dairy and beef livestock are elicited. By correcting the available statistics for the implied breakdown, greatly improved fits on the turn-off behavioural equations are promised.

A major advance has been the delineating and constraining of separate measures of flows and transfers within the flock and herds of New Zealand. First, the residual of the lamb drop which is promoted to the adult flock in year $t+1$ is derived directly. The proxy for this used to date have been ewes and male hoggets on hand at 30 June, and these have shown significant differences. Secondly, the transfers from the dairy herd to beef production are derived directly for each category and found to be greater than earlier estimates. Finally, within the cattle herds the demographic variables for cattle aged between 1 and 2 and over 2 years are differentiated for the first time. This advance will enable analysis of the break down of slaughter by type and give basis to understanding trends in the mix and level of output. Further analysis which involves a split of total beef to manufacturing and prime beef production is made possible.

The price variables used in the model have been updated and refined to better reflect actual farmgate returns. In order to do this improved MAF estimates of the impacts of assistance on output have been utilised. Moreover, disaggregated indices of farm costs (by type of enterprise and of seasonal conditions) are presented.

5.1.3 Estimated Equations

On the basis of the conceptual model and the data available or derived, equations were estimated to explain inventory, turn-off, build-up, transfers, and per unit production trends. The results presented represent work in progress but are a potential advancement of earlier work on livestock numbers and production by Laing and Zwart (1983) and of Shaw (1986). We regard

the results as preliminary. Further work is continuing to check the sensitivity of the model to changes in specification or improving the specification in some areas. The model will also be validated via simulation experiments and tested for dynamic stability. As it is applied it will succeed in meeting the objective of improving our understanding of basic response parameters and relationships in the pastoral industries.

5.2 Directions for Further Work

5.2.1 Model Simulation and Sensitivity Analysis

The livestock response model is being developed not only to improve our understanding, but principally as a tool enabling medium- term forecasting and quantitative analysis of the impact of alternative policies and exogenous shocks. In particular, it will be used to answer some questions with respect to the effects of the economic liberalisation programme upon the agricultural sector. Impacts of exogenous shocks such as drought and of market developments such as the expansion of the live exports of sheep and lambs will be analysed. Immediate and subsequent years effects will be determined within the context of given scenarios for prices, costs and seasons. Overseas demand shifts as typified by the possible reduction in EEC tariff levels can also be analysed.

In this respect, the dynamic aspects of the model are particularly important in the application to both forecasting and analysis of policy. Snapshot forecasts of the future are of little use without an indication of paths which variables take in arriving at forecast future levels.

5.2.2 Farm Investment and Input Responses

MAFCorp Policy Services has determined that the model(s) developed will be structural models with development proceeding in a series of steps or modules. The probable next step is to update the understanding of farm investment and input response. Significant early work by Laing and Zwart (1983) should provide a good basis for further development. Later steps could involve endogenising the price determination by inclusion of export and domestic demand models, and of linking with the established models of livestock response at ABARE, Australia.

It is intended that application of the models will go hand-in-hand with model development. In this way, feed back from application of the model can become an important element in future development.

REFERENCES

- J Dewbre, I Shaw, G Corra and D Harris (1985), "EMABA-Econometric Model of the Australian Broad Acre Agriculture", BAE Report and Technical Documentation, Canberra.
- T P Grundy, R G Lattimore and A C Zwart (1988), "New Zealand Livestock Sector Model", Version 4 AERU Research Report No 192, Lincoln College, March.
- L L Jarvis (1974), "Cattle as Capital Goods and Ranchers as Portfolio Managers: An Application to the Argentine Cattle Sector", *Journal of Political Economy* 82(3), 489-520.
- M T Laing and A C Zwart (1983), "Investment and Supply Response in the New Zealand Pastoral Sector: An Econometric Model", Version 3, AERU Research Report No 137, Lincoln College, May.
- R G Reynolds and B Gardiner (1980), "Supply Response in the Australian Sheep Industry: A Case for Disaggregation and Dynamics", *Australian Journal of Agricultural Economics* 24(3), 196-209 December.
- R G Reynolds, D Weissel and G Corra (1981), "Responses to differing circumstances for the Australian Sheep Industry", paper presented at the 25th annual conference of the Australian Economics Society, Christchurch, New Zealand, February.
- I Shaw (1986), "Modelling New Zealand Wool and Sheep Meat Supply: An Alternative Approach", paper presented at the 30th annual conference of the Australian Agricultural Economics Society, ANU, Canberra, February.
- SONZA (1989), "Situation and Outlook for New Zealand Agriculture", Policy Services MAFCorp, Ministry of Agriculture and Fisheries, April.

APPENDIX A: DATA SOURCES AND LIMITATIONS

I Inventory of Livestock

The main source of data for the inventory of sheep and cattle breeding stock and the various age groups of male and female livestock numbers was the New Zealand Agricultural statistics. The issues used cover the period 1960-1988 and report the results of Agricultural Census surveys carried out by the Department of statistics. While the data on sheep numbers have been collected on a June year ending basis by the census throughout, the dairy and beef numbers were collected on a June year basis only from 1972. This and the dairy calf births data availability from 1972 and the beef calf weaning rates from 1969 lead to the use of data from 1972-1988 for the cattle sector.

II Births, Deaths and Slaughter

Birth rates such as lambing percentages and beef weaning rates were obtained from farm surveys conducted by the New Zealand Meat and Wool Board's Economic Service (NZMWBES), which was also the source of the variable death rates of lambs and adult sheep as well as the fixed death rates for the various classes of beef cattle. The Dairy Board was the source of death rates in the Dairy Sector. The source of slaughter figures on lambs, adult sheep (including hoggets), calves, vealers, heifers, steers, bulls and cows was the Ministry of Agriculture and Fisheries, which receives and compiles the data on inspected kill at Meat Works throughout New Zealand.

III Aggregate Output, Per Unit Production and Live Exports

The department of statistics Information Network For Official Statistics (INFOS) was the main source of information on aggregate production of lamb, mutton, beef and veal while the Dairy Board and the Wool Board were the source of aggregate milk fat and wool production respectively. Live export of sheep and cattle data is also from INFOS, reported separately as breeding and not for breeding categories and in recent years into Dairy and Beef animals.

Per unit production or slaughter weights of lamb, mutton (adult sheep), bobby calves, vealers/yearlings and beef were derived from total production and slaughter numbers of respective livestock categories. At this stage of the modelling exercise, beef production is not differentiated into prime and manufacturing beef. The grand total of heifer, steer, cow and bull slaughter numbers are used to derive an average adult cattle slaughter weight. The production of milkfat per cow is also derived from total milk fat production and cows and heifers in milk. In a similar manner, wool cut per head is derived from total greasy equivalent of shorn wool production and the number of sheep wintered statistics from the New Zealand Wool Board (NZWB) Statistical Hand books.

IV Prices, Costs and Weather

Farm gate prices of lamb, mutton, prime and manufacturing beef were obtained from the New Zealand Meat Producers Board (NZMPB) Annual Reports and/or NZMWBES Annual Reviews of the Sheep and Beef Industry. Wool and milk fat prices at the farm gate were obtained from the New Zealand Wool Board Annual Reports and statements of accounts and the New Zealand Dairy Board Annual Reports respectively. Bobby calf prices were obtained from "farm costs and prices" published by MAF Economics Division until 1987.

Farm costs are modelled using prices paid indices computed for sheep, beef and dairy farms separately, with a base period of 1981. These indices are computed using the NZMWBES series on prices paid index for the different expenditure items on sheep and beef farms and are weighted according to their importance.

The corresponding indices for dairy farms are from the New Zealand Department of Statistics Monthly Abstracts. The weather indices for sheep, beef and dairy farms were also obtained from the NZMWBES. They were initially computed by the New Zealand meteorological service as the number of soil moisture stress days for sheep, beef and dairy farms around New Zealand, weighted by the population of the respective classes of livestock in the various climatic districts.

APPENDIX TABLE B: LIST OF VARIABLES IN THE PASTORAL SUPPLY RESPONSE MODEL

| | <u>SHEEP SECTOR</u> | | <u>BEEF SECTOR</u> | | <u>DAIRY SECTOR</u> |
|------------|---|-----|--|-----|---|
| I | <u>ENDOGENOUS</u> (From Behavioural Equations) | | | | |
| (a) | KE - Breeding Ewes ('000's) | (a) | KCHPB - Cows and Heifers put to the Bull ('000's) | (a) | KCHMD - Cows and Heifers in Calf and/or Milk ('000's) |
| (b) | LM - Lambs Marked ('000's) | (b) | CVWB - Beef Calves Weaned ('000's) | (b) | CVBD - Dairy Calves Born ('000's) |
| (c) | SLL - Lamb Slaughter ('000's) | (c) | KYHB - Young Beef Heifers <1 year ('000's) | (c) | KYHD - Young Dairy Heifers <1 year ('000's) |
| (d) | DL - Lamb Deaths ('000's) | (d) | KYSB - Young Steers and Bulls < 1 year ('000's) | (d) | KYBD - Young Dairy Bulls <1 year ('000's) |
| (e) | SLAS - Adult Sheep Slaughter ('000's) | (e) | SLV - Vealer/yearling slaughter ('000's) | (e) | SLCV - Bobby Calf Slaughter ('000's) |
| (f) | DS - Adult Sheep Deaths ('000's) | (f) | SWV - Slaughter wt of Vealers (kg) | (f) | SWCV - Slaughter wt of Bobby Calf (kg) |
| (g) | SHW - Sheep Wintered (Millions) | (g) | SWAC - Slaughter wt of Adult Cattle (kg) | (g) | MPCOW - Milkfat per cow (kg) |
| (h) | SWL - Slaughter Weight of Lambs (kg) | (h) | SLHT - Heifers (1-2 yrs) Slaughter ('000's) | (h) | TCDB - Transfer of Cows (>2 yrs) from Dairy to Beef |
| (i) | SWAS - Slaughter Weight of Adult Sheep (kg) | (i) | SLST - Steers (1-2 yrs) Slaughter ('000's) | (i) | TBDB - Transfer of Bulls (>2 yrs) from Dairy to Beef |
| (j) | FWL - Fleecce Weight of Wool (kg) | (j) | SLCT - Cows (>2yrs) Slaughter ('000's) | (j) | THDB - Transfer of Heifers (1-2 yrs) |
| | | (k) | SLBT - Bulls and Steers (>2 yrs) Slaughter ('000's) | (k) | TIBDB - Transfer of I.Bulls (1-2 yrs) |
| II | <u>ENDOGENOUS</u> (From Identities) | | | | |
| (a) | KS - Total Sheep ('000's) = KAS + KEWH | (a) | KCB - Beef Cows >2yrs ('000's) | (a) | KCD - Dairy Cows >2yrs ('000's) |
| (b) | KAS - Adult Sheep ('000's) | (b) | KHB - Beef Heifers 1-2 yrs ('000's) | (b) | KHD - Dairy Heifers 1-2 yrs ('000's) |
| (c) | KOS - Other Sheep ('000's) = KAS - KE | (c) | KSB - Beef Bulls & Steers >2yrs ('000's) | (c) | KBD - Dairy Bulls >2yrs ('000's) |
| (d) | KEWH - Ewe & Wether Hoggets ('000's) | (d) | KISB - Beef Immature Bulls & Steers 1-2 yrs ('000's) | (d) | KIBD - Dairy I. Bulls 1-2 yrs ('000's) |
| III | <u>EXOGENOUS</u> | | | | |
| (a) | LES - Live Exports of Sheep ('000's) | (a) | DCB - Death of Beef Cows ('000's) | (a) | DCD - Death of Dairy Cows ('000's) |
| (b) | LEL - Live Exports of Lambs ('000's) | (b) | DHB - Death of Beef Heifers ('000's) | (b) | DHD - Death of Dairy Heifers ('000's) |
| (c) | WS - Weather Index for Sheep (No of days of moisture stress/year) | (c) | DSB - Deaths of Beef Bulls & Steers ('000's) | (c) | DBD - Death of Dairy Bulls ('000's) |
| (d) | PPIS - Prices paid Index Sheep (1981=100) | (d) | DISB - Deaths of Immature B&S ('000's) | (d) | DIBD - Death of I. Dairy Bulls ('000's) |
| (e) | PL - Farm gate price of Lamb (cts/kg) | (e) | DCVB - Death of Beef Calves ('000's) | (e) | DCVD - Death of Dairy Calves ('000's) |
| (f) | PM - Farm gate price of Mutton (cts/kg) | (f) | LEB - Live Exports of Beef Cattle ('000's) | (f) | BCVRD - Dairy Calf Retentions for Beef ('000's) |
| (g) | PW - Farm gate price of wool (cts/kg) | (g) | WB - Weather Index for Beef (No. of days) | (g) | LED - Live Exports of Dairy Cattle ('000's) |
| | | (h) | PPIB - Prices Paid Index Beef (1981=100) | (h) | WD - Weather Index for Dairy (No of days) |
| | | (i) | PPB - Farm gate price of Prime Beef (cts/kg) | (i) | PPID - Price Paid Index Dairy (1981=100) |
| | | (j) | PMB - Farm gate price of Manufacturing beef (cts/kg) | (j) | PD - Farm gate price of milk fat (cts/kg) |
| | | | | (k) | PBCV - Average Pool price of Bobby Calves (\$/hd) |

APPENDIX TABLE C1: SHEEP SECTOR BEHAVIOURAL EQUATIONS (1962-1988)

| | | | | | | | | | <u>R²</u> | <u>F</u> | <u>DW</u> | | |
|------|--------------------------------------|----------------------|---|---------------------------|---|---------------------------|---|---|----------------------|---|-----------|----------|------|
| (A) | <u>INVENTORY ADJUSTMENTS</u> | | | | | | | | | | | | |
| I | BREEDING EWES | | | | | | | | | | | | |
| | KE = | -4667.2 (-1.43) | + | 0.8313 KSL (18.75***) | - | 29.603 WS (-1.269) | + | 2155.5 RPLPP (1.715') | - | 2378.3 RPPBPP (-2.359**) 153.1 RPWPP (-0.32) | 0.949 | 99.3*** | 1.79 |
| II | LAMBS MARKED | | | | | | | | | | | | |
| | LM = | 3312.8 (1.73') | + | 0.9868 KEL (27.1***) | - | 83.103 WSL (-5.238***) | + | 709.43 RPLPP (0.914) | - | 1682.6 RPPBPP (-2.428***) | 0.975 | 252.7*** | 2.16 |
| (B) | <u>TURN OFF/SLAUGHTER</u> | | | | | | | | | | | | |
| III | LAMB SLAUGHTER | | | | | | | | | | | | |
| | SLL = | -9662.3 (-3.08**) | + | 0.8554 LM (16.2**) | + | 29.21 WS (1.25) | + | 1389.9 RPLPP (0.937) | - | 2449.7 RPMPP (-1.495') | 0.939 | 102.1*** | 1.53 |
| IV | LAMB DEATHS | | | | | | | | | | | | |
| | DL = | -33.7 (-0.199) | + | 0.0359 LM (9.488***) | + | 0.665 WSL (0.362) | | | | | 0.774 | 45.4*** | 2.50 |
| V | ADULT SHEEP SLAUGHTER | | | | | | | | | | | | |
| | SLAS = | 5196.4 (2.57**) | + | 0.0919 KASL (3.085***) | + | 43.739 WS (3.005***) | - | 463.63 RPWPP (-1.792') | - | 684.2 RPLMPP (-2.867***) | 0.617 | 11.5*** | 1.31 |
| VI | DEATH OF SHEEP | | | | | | | | | | | | |
| | DS = | -74.9 (-0.27) | + | 0.0563 KASL (9.985***) | + | 9.325 WS (3.068***) | + | 3.815 WSL (1.366') | - | 142.84 RPMPP (1.295) | 0.853 | 38.7*** | 1.25 |
| VII | SHEEP WINTERED | | | | | | | | | | | | |
| | SHW = | 3.57 (1.21) | + | 0.0015 KASL (24.2***) | - | 0.0118 WSL (-0.545) | + | 0.620 RPWPLL (1.57') | | | 0.968 | 265.3*** | 2.05 |
| (C) | <u>PER UNIT PRODUCTION</u> | | | | | | | | | | | | |
| VIII | SLAUGHTER WEIGHT OF LAMBS | | | | | | | | | | | | |
| | SWL = | 16.4 (18.5**) | - | 0.0164 WS (-2.762***) | - | 0.252 RPLPP (-1.192) | - | 0.027 T62 (-2.816***) | | | 0.423 | 7.4*** | 2.20 |
| XI | SLAUGHTER WEIGHT OF SHEEP | | | | | | | | | | | | |
| | SWAS = | 37.2 (15.9**) | - | 0.0569 WS (3.031***) | + | 0.4009 RPWPP (1.368') | - | 0.183 T62 (-6.793***) | | | 0.751 | 27.1*** | 1.32 |
| X | FLEECE WEIGHT OF WOOL | | | | | | | | | | | | |
| | FWL = | 5.48 (20.8**) | - | 0.0073 WS (-3.346***) | - | 0.0093 WSL (-4.476***) | + | 0.084 RPWPP - 0.304 RPMPP - 0.004 T62 (2.03**) | | | 0.665 | 11.3*** | 2.57 |
| (D) | <u>CLOSURE REQUIREMENT FOR SHEEP</u> | | | | | | | | | | | | |
| | CRS = | 534.4 (1.78) | + | 4.823 SLPF (2.32) | + | 1550.3 SD86 (1.89) | - | 3516.7 SDLIS (-4.28) | 0.498 | 9.6 | 2.09 | | |

Values in parentheses are t-statistics, with the asterisks (*) representing the level of significance at the 10% (*), 5% (**) and 1% (***) level. The same applies to the F statistics.

APPENDIX TABLE C2: DAIRY SECTOR BEHAVIOURAL EQUATIONS (1973-1988)

| <u>A INVENTORY ADJUSTMENTS</u> | | | | | | | | | | | | <u>R²</u> | <u>F</u> | <u>DW</u> | | | | |
|--------------------------------|---|---------------------------------|---|-----------------------------------|----------|----------------------------------|-------|------------------------------------|--------|-----------------------------------|------|----------------------|---------------------|-----------|--|--|--|--|
| I | COWS AND HEIFERS IN CALF AND/OR MILK | | | | | | | | | | | | | | | | | |
| | KCHMD = | 384.4 (2.0 ^{***}) | + | 0.7409 (9.797 ^{***}) | KCHTDL + | 1.309 (3.303 ^{***}) | PD - | 0.687 (-1.587 [*]) | PMB - | 1.696 (-2.411 ^{***}) | PPID | 0.932 | 52.7 ^{***} | 2.25 | | | | |
| II | DAIRY CALVES BORN | | | | | | | | | | | | | | | | | |
| | CVBD = | 427.4 (1.9 ^{***}) | + | 0.5784 (6.229 ^{***}) | KCHMDL + | 1.687 (3.962 ^{***}) | PD - | 0.753 (-1.629 [*]) | PMB - | 1.544 (-2.016 ^{***}) | PPID | 0.927 | 48.9 ^{***} | 2.37 | | | | |
| III | YOUNG DAIRY HEIFERS | | | | | | | | | | | | | | | | | |
| | KYHD = | -187.5 (-2.4 ^{**}) | + | 0.2989 (8.289 ^{***}) | CVBD - | 0.400 (-1.17) | WD + | 44.284 (3.915 ^{***}) | RPPBPP | | | 0.827 | 24.8 ^{***} | 2.53 | | | | |
| IV | YOUNG DAIRY BULLS | | | | | | | | | | | | | | | | | |
| | KYBD = | 38.5 (57.8 ^{***}) | + | 0.0249 (2.144 ^{**}) | PD + | 0.0196 (1.516 [*]) | PMB - | 0.0559 (-2.897 ^{***}) | PPID | | | 0.609 | 8.8 ^{***} | 0.97 | | | | |
| <u>B TURN OFF/SLAUGHTER</u> | | | | | | | | | | | | | | | | | | |
| V | BOBBY CALF SLAUGHTER | | | | | | | | | | | | | | | | | |
| | SLCV = | 3128.4 (6.8 ^{***}) | - | 0.9766 (4.691 ^{***}) | CVBD + | 2.367 (1.216) | WD - | 188.0 (-2.497 ^{**}) | RPMBPP | | | 0.602 | 8.6 ^{***} | 1.63 | | | | |
| <u>C PER UNIT PRODUCTION</u> | | | | | | | | | | | | | | | | | | |
| VI | SLAUGHTER WT OF BOBBY CALF | | | | | | | | | | | | | | | | | |
| | SWCV = | 31.9 (3.4 ^{***}) | + | 0.0378 (1.416 [*]) | WDL - | 3.095 (-2.558 ^{**}) | D80 - | 0.172 (-1.375 [*]) | T72 | | | 0.821 | 23.9 ^{***} | 2.75 | | | | |
| VII | MILK FAT PER COW | | | | | | | | | | | | | | | | | |
| | MPCOW = | -253.3 (-2.1 ^{**}) | - | 0.2028 (-1.856 ^{**}) | WD + | 0.0621 (1.398 [*]) | PD - | 0.4535 (-2.665 ^{**}) | PPID + | 5.187 (3.049 ^{***}) | T72 | 0.822 | 18.3 ^{***} | 2.14 | | | | |

DAIRY SECTOR PRODUCTION IDENTITIES

| | | | | |
|----------------------------------|---|---|---|------------------------------------|
| TOTAL MILK FAT PRODUCTION QML | = | COWS AND HEIFERS IN CALF AND/OR MILK KCHMD | * | MILK FAT PER COW MPCOW |
| BOBBY VEAL PRODUCTION QBV | = | BOBBY CALF SLAUGHTER SLCV | * | SLAUGHTER WT OF BOBBY CALF SWCV |

Values in parentheses are t-statistics, with the astreisks (*) representing the level of significance at the 10% (*), 5% (**) and 1% (***) level. The same applies to the F statistics.

APPENDIX TABLE C3: CONT'D

| | | | | | | | | | | | | | | |
|-----|-------|----------|---|-------------|------|---|--------|----------|--------|----|--|-------|--------|------|
| (D) | BULLS | | | | | | | | | | | | | |
| | SLBT | -740.8 | + | 1.009 | SLPB | + | 84.6 | RPMBPP + | 2.824 | WB | | 0.631 | 9.5*** | 1.72 |
| | | (-2.6**) | | (5.345****) | | | (1.02) | | (1.19) | | | | | |

BEEF OUTPUT/PRODUCTION IDENTITIES

| | | | | |
|--------------------------|---|---------------------------|---|-------------------------------|
| YEARLING VEAL PRODUCTION | = | VEALER/YEARLING SLAUGHTER | * | SLAUGHTER WT OF VEALERS |
| QYV | | SLV | | SWV |
| TOTAL VEAL PRODUCTION | = | BOBBY VEAL PRODUCTION | + | YEARLING VEAL PRODUCTION |
| QTV | | QBV | | QYV |
| TOTAL BEEF PRODUCTION | = | SLAUGHTER OF ADULT CATTLE | * | SLAUGHTER WTS OF ADULT CATTLE |
| QB | | SLAC | | SWAC |

Values in parentheses are t-statistics, with the astreisks (*) representing the level of significance at the 10% (*), 5% (**) and 1% (***) level. The same applies to the F statistics.