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(b) No papers were produced for the following theme addresses:

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RURAL FINANCE IN NEW ZEALAND

Some Statistics for Session on Rural Finance

at Conference of New Zealand Branch

of Australian Agricultural Economics Society, Blenheim

(11 - 12.30 p.m. **Saturday 11 July 1987**)

John Pryde
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LINCOLN COLLEGE

Table 1: **Loans Outstanding to the Agricultural Sector as at 31 March**
($ million)

	1980	1981	1982	1983	1984	1985	1986
Stock and Station Agents	353	403	431	414	506	549	568
Trading Banks	348	467	658	674	806	827	966
Trustee Savings Banks	48	67	111	142	141	151	149
Private Savings Banks	35	37	40	25	16	12	8
Finance Companies	82[e]	113[e]	156[e]	161[e]	223	236	250
Development Finance Corp.	6[e]	6[e]	19[e]	40[e]	55	71[e]	133[e]
Building Societies	49	54	61	69	82	104[e]	110[e]
Insurance Companies	210	256	303	354	397	447	449
Dept. of Maori Affairs	38	47	58	73	85	93[e]	111
Dept. of Lands & Survey	108	126	158	190	214	231	252
Marginal Land Board	30	32	33	-	-	-	-
Rural Bank	1,043	1,242	1,510	1,820	2,074	2,262	2,440
Sub Total:	2,350	2,850	3,538	3,962	4,599	4,983	5,436
Solicitors Trust Funds	194	247	318	389	462	530	570
Family Loans	490	569	675	880	1,050	1,200	1,300
Private Sectors	187	250	337	309	330	300	300
Trust Companies	124	135	148	164	165	190	150
Local Body Loans	29	38	50	42	46	40	41
Dairy Companies	33	39	47	26	33	46	64
Other	46	68	103	61	66	80	60
TOTAL	3,453	4,196	5,216	5,833	6,751	7,369	7,921

[e] estimate

Sources: Pryde (1978), Pryde and McCartin 1982-86, Pryde and Bain.

Table 2: Average Size, Interest Rate and Term of Farm Loans by Selected Lender, 1986

		Average loan	Average Rate of Interest	Term (% of average loan) Long	Medium	Short
1.	Local Body	$11,400	9.1	77	20	3
2.	Private Savings Bank	$20,000	18.0	100	-	-
3.	Building Society	$28,700	20.0	82	18	-
4.	Trading Bank	$29,600	20.3	7	30	63
5.	Stock & Station Agent	$34,400	22.1	5	8	87
6.	Finance Company	$37,900	21.4	6	22	72
7.	Dairy Company	$41,200	19.6	15	49	36
8.	Trustee Savings Bank	$47,900	19.7	65	22	13
9.	Solicitors Trust Fund	$56,800	19.5	8	29	63
10.	Govt Agency - Other than Rural Bank	$58,800	12.0	82	15	3
11.	`Other'	$60,700	14.3	47	32	21
12.	Trust Company	$62,400	18.1	32	24	44
13.	Insurance Co.	$66,500	17.9	69	21	10
14.	Family Loan	$70,900	10.4	61	27	12
15.	Rural Bank	$82,150	12.1	79	19	2
16.	The Last Owner (The Vendor)	$89,000	14.2	21	48	31
17.	Offshore Lender	$255,900	10.7	8	83	8

Note: Long-term (longer than 10 years)
Medium-term (3 - 10 years)
Short-term (up to 3 years)

Source: Pryde, J.G. and McCartin, P.J. (1986), "New Zealand Farmer Intentions and Opinions Surveys", A.E.R.U., Lincoln College.

Table 3: **Distribution of Liabilities of New Zealand Farmers**
(By Farm Type)

Production Year	No Loans	- $50,000	$50,001- $100,000	$100,001 $250,000	$250,001 $500,000	OVER $500,000	
ALL TYPES							
1982	9	32	24	29	6	1	100
1983	14	25	21	29	8	2	100
1984	15	25	19	29	9	2	100
1985	18	22	19	28	10	2	100
1986	19	22	17	29	11	2	100
MAINLY DAIRY							
1982	8	34	28	27	3	0	100
1983	11	27	27	29	6	1	100
1984	12	28	21	32	7	1	100
1985	12	21	20	35	10	2	100
1986	15	24	19	30	10	1	100
MAINLY SHEEP-BEEF							
1982	10	30	22	29	8	1	100
1983	16	25	17	31	9	3	100
1984	18	22	19	27	11	3	100
1985	20	22	18	27	10	2	100
1986	22	20	16	29	12	2	100
MAINLY CROPPING							
1982	6	18	12	53	0	12	100
1983	4	22	26	28	20	0	100
1984	4	18	20	31	16	11	100
1985	27	21	6	24	19	2	100
1986	19	19	6	23	23	9	100

Source: Pryde and McCartin, "Farmer Opinion Surveys", 1982-86., A.E.R.U., Lincoln College, Canterbury.

Table 4: **Liabilities of New Zealand Farmers (as at Mid-October)**

	Average Loans (by main Farm type)				
	1982	**1983**	**1984**	**1985**	**1986**
Dairy	80409	101786	98856	121365	112770
Sheep-Beef	99755	114604	119277	118638	118342
Cropping	158788	139532	196654	142712	188744
National Average	94334	112198	112903	117635	117380

Source: J.G. Pryde and P.J. McCartin, Survey of New Zealand Farmer Intentions and Opinions 1982-86, Agirbusiness and Economics Research Unit, Lincoln College.

Table 5: **Average Liabilities of New Zealand Farmers - by Provincial Land District**

	1982	1983	1984	1985	1986
Northland	68,000	91,100	79,700	83,400	79,100
Central Auckland	78,400	60,600	97,100	105,600	95,000
South Auckland	97,000	116,400	113,800	120,800	116,800
East Coast	127,200	112,900	117,900	94,500	147,300
Hawkes Bay	96,700	148,700	138,800	145,200	132,000
Taranaki	72,600	78,800	76,200	100,700	96,000
Wellington	96,500	106,100	91,300	123,700	140,000
Marlborough	102,600	115,700	116,900	101,400	94,300
Nelson	64,000	88,500	69,500	84,200	64,400
Westland	75,900	128,700	91,800	69,400	77,400
Canterbury	99,800	115,500	139,300	134,800	134,900
Otago	126,600	148,800	147,600	151,500	129,600
Southland	96,500	100,800	119,600	126,800	126,100
New Zealand	94,400	111,900	112,600	117,700	117,300

Source: J.G. Pryde and P.J. McCartin, Surveys of New Zealand Farmer Intentions and Opinions 1982-86. Agribusiness and Economics Research Unit, Lincoln College

ANALYSIS OF ASPECTS OF THE UNITED KINGDOM IMPORT APPLE MARKET IN THE POST-EEC MEMBERSHIP PERIOD

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SUMMARY

The paper begins by outlining CAP mechanisms that influence the EEC's import trade in apples, and by describing recent developments in the United Kingdom's apple imports. Emphasis is given to voluntary export restraints and the factors that encourage their implementation. Having made a case for more detailed analyses of policy impacts within the EC apple market, some problems in horticultural market trade analyses are outlined. An explanatory analysis of the United Kingdom market is then presented, in an effort to measure the impact of variations in the supply of imported apples, and domestic supplies, on prices.

Key words: EEC, apples, VER's, price flexibilities.

IMPORTANCE OF THE UNITED KINGDOM MARKET

The United Kingdom is the world's third largest importer of fresh apples, after the Federal Republic of Germany and the USSR. Imports during 1985 totalled 428,600 MT, compared with 462,400 MT to the USSR and 637,400 MT to West Germany.[1] Global imports during that year amounted to 3,302,000 MT. Not surprisingly then, the European Community constitutes a major market for apples produced elsewhere in the world, and accounted for 52% of all imports (EC-9) in 1985.

By far the most important segment in international trade in apples is that conducted amongst European nations, where France, Italy, the Netherlands and Hungary are major exporters. However, Northern Hemisphere markets, especially the EEC, are also major destinations for Southern Hemisphere exporters. Averaged over 1984 and 1985, apple exports from the Southern Hemisphere (South Africa, Argentina, Chile, New Zealand and Australia) consigned to the EEC constituted 26% of EEC apple imports.[2]

In the case of New Zealand, 88% of apples exported during

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[1] F.A.O., Trade Yearbook

[2] Commonwealth Secretariat, Fruit and Tropical Products, June 1986.

1986 were destined for the EEC.[3] The United Kingdom alone was the major destination, and accounted for 20% of exported volume. Corresponding percentages for the preceding year were 61% and 15%.

TRADE POLICY DEVELOPMENTS

Prior to the United Kingdom's accession to the EEC in 1973, apples from the Commonwealth were imported free of duty whilst those from other countries (e.g. Continental Europe, South America) were restricted by quota arrangements. On accession to the EEC, Britain had to abandon this arrangement and phase in, over a five year period, the foreign trade regulations of the EEC. During this period of adjustment, accession compensatory amounts were introduced in the UK as some protection against EEC competition. These amounts were charges on imports into the United Kingdom, but were not applied over the period April-July when Southern Hemisphere fruit is imported. They were gradually phased out, and the EEC system phased in over the period 1974 to 1977. As from 1st January 1978, EEC apple import regulations applied in full to the United Kingdom.

The EEC regulates its apple trade with third countries by tariffs, a reference price system, a safeguard clause, quality norms and export subsidies. By themselves, the common customs tariff and the reference price system do not constitute significant trade barriers. The tariff rate is 6% over the months of April to July (when the bulk of Southern Hemisphere apples are imported) but reaches a maximum of 14% during the remainder of the year. The reference price system determines minimum entry prices for imports from third countries. According to specific rules, the importer must pay the difference between the reference price and the import price (a countervailing levy), should the import price fall below the reference level. Only rarely have countervailing levies been paid on Southern Hemisphere apple imports.

Apple imports are also restricted to those meeting EEC quality norms. Neither has this regulation posed a serious trade barrier, since competition ensures that exporters place only high-quality fruit on the market.

Of greater concern to Southern Hemisphere exporters is the Safeguard Clause. Article XIX of the GATT sets out procedures whereby a contracting party may suspend its trade obligations, in whole or in part, when "any product is being imported into the territory of that contracting party in such increased quantities and such conditions as to cause or threaten serious injury to domestic producers in that

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3 New Zealand Apple and Pear Marketing Board, Annual Report.

territory of like or directly competitive products." This provides the opportunity for the EEC to impose quotas, additional levies, or to ban third country imports completely. The approach taken by the EEC has been to reach agreement with Southern Hemisphere suppliers over voluntary export restraints (VER's), which specify tonnages which individual suppliers have agreed not to surpass. Producer groups within the Community continue to press for a greater level of protection through the raising of reference prices and greater use of the Safeguard Clause.

RESULTANT CHANGES IN MARKET SHARES

The preferential access to the United Kingdom market enjoyed by South Africa, Australia and New Zealand prior to 1973 was lost following the United Kingdom's entry to the European Community. Those countries had to compete on an equal basis with South American suppliers, and also with the unleashed supplies of duty-free apples from EEC exporters, especially France.[4]

As expected, given the transport cost advantage enjoyed by Continental European suppliers, major changes in market shares resulted. Annual United Kingdom imports, as well as quantities imported each year during the "traditional" Southern Hemisphere season (March to July) and the remainder of the year, increased steadily from 1961 to 1985 (see Table 1). However, the proportion imported during the traditional Southern Hemisphere season declined from 70% on average over 1961-72, to an average share of 55% during the 1978-85 period. While imports from continental EEC[5] showed strong growth over 1961-85 for both periods of the year (by a factor of six over March-July, and threefold during the remaining period of the year), that increase was partly offset during the traditional Southern Hemisphere season by a particularly marked reduction in supplies from Australia.

4
Atkin and Blandford (1982) have analysed import market share changes in the United Kingdom apple market, but used annual rather than seasonal data.

5
Around two-thirds of these exports originate in France.

TABLE 1 Average Annual Imports ('000 tonnes)

	March-to-July season	Remainder of year	TOTAL
1961-72	180.9	80.6	261.5
1973-77	207.3	134.8	342.1
1978-85	215.4	177.3	392.7

Source Commonwealth Secretariat, Fruit Intelligence and Fruit and Tropical Products.

Table 2 and Figure 1 show trends in market shares during the March to July period. Prior to the United Kingdom's entry to the EEC in 1973, the market shares of South Africa, New Zealand and the EEC were generally increasing, while that of Australia was trending steadily downwards. From 1961 to 1972, the shares of these four countries averaged 33%, 15%, 9% and 38% respectively. During the five-year phase-in period (1973-77), the market shares of all Southern Hemisphere suppliers fell while that of EEC exporters increased sharply. Since 1977, the EEC's share of the United Kingdom import market during March-July has averaged 50%, that of South Africa, New Zealand and "others" (mainly Chile) have indicated a resumption in growth, while Australia's share has continued to decline.

TABLE 2 Average Imports ('000 tonnes): March-July Season

From	Australia	New Zealand	South Africa	EEC	Other	TOTAL
1961-72	68.1	26.3	59.0	17.0	10.5	180.9
1973-77	30.0	19.4	56.3	96.0	5.7	207.3
1978-85	6.7	14.6	67.9	108.3	18.1	215.4

Source Commonwealth Secretariat, Fruit Intelligence and Fruit and Tropical Products.

In summary, the United Kingdom's accession to the EEC and adoption of the EEC's trade policies has meant that continental EEC exporters have evolved from seasonal suppliers during the traditional Northern Hemisphere season, to the dominant source of imports the year round. Thus the earlier "tradition" in the seasonal pattern of supplies no longer holds.

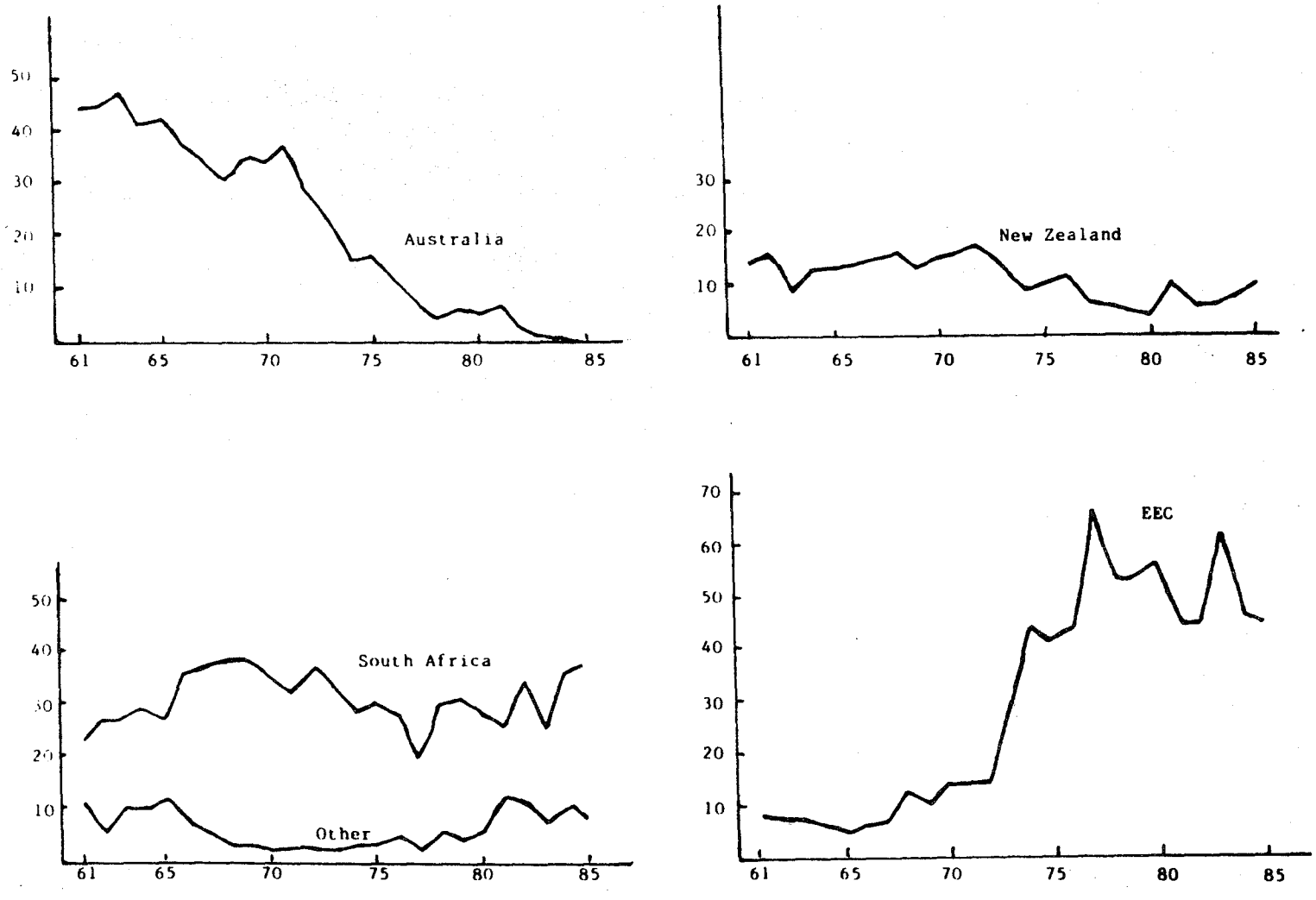

Figure 1 UK Import Apple Market Shares (%) : March-July Season

VER'S : PAST INCIDENCE AND CAUSATIVE FACTORS

Section 2 outlined the EEC's apple trade regulations as they apply to third countries. While mention was made of the Safeguard Clause, it was pointed out that the approach taken by the EEC in the past has been to enter into "voluntary export restraints" with Southern Hemisphere suppliers. However, should exporters choose not to cooperate with respect to voluntary restraints, they face the threat of the EEC enacting the conditions of the Safeguard Clause.

VER agreements have been reached in 1976, 1979 and 1983. In each case, negotiations commenced sometime during the January-March period. In 1976, the EEC wished to limit imports from the Southern Hemisphere to the corresponding level in 1974. The final agreement placed a limit on April-to-June shipments, but not to those over the entire Southern Hemisphere season. In the event, Chilean exporters exceeded their "quota" by a factor of three.[6] In 1979 and 1983, negotiated import quantities applied to total shipments from the Southern Hemisphere, in contrast to the April-to-June restriction of 1976. In the first of these two years, the VER was for 310,000 tonnes[7] compared with the 1973-75 average of 330,000 tonnes. Imports from Chile were suspended for a period when that country exceeded its national "quota". And in 1983, Agra Europe reported a VER quantity of 332,700 tonnes over the period 15 March to 15 August, or about 10% below the average imports of the previous three years.[8] The EEC farmers' organisation COPA had earlier pressed for a VER of 240,000 tonnes because of the record 1982/83 EEC apple crop. This move was countered by pressure from the EEC union of fruit and vegetable wholesalers who argued that that EEC crop, while a record, was of poor quality.[9] Apparently the EC had asked Southern Hemisphere exporters to agree to VER's so as to avoid using legal instruments of the Safeguard Clause, which had led to a GATT dispute with Chile, and a series of cases bought by exporting firms in the European Court of Justice in 1979.[10]

6
Agra Europe, March 30, 1979.

7
Agra Europe, March 30, 1979.

8
Agra Europe, March 25, 1983.

9
Agra Europe, February 11, 1983.

10
Agra Europe, February 25, 1983

While no VER agreement was reached in 1985, Agra Europe reported that the EEC had negotiated a maximum import quantity of 355,000 tonnes, and that all countries but Australia had agreed to their national "quotas".[11] One year later, however, the same journal reports actual 1985 Southern Hemisphere shipments to the EEC of 405,000 tonnes, which exceeded the earlier forecast level of 390,000 tonnes.[12]

The year 1986/87 saw the fifth-largest increase in EEC apple production since 1974/75, record apple crops in Argentine, Chile, South Africa and New Zealand, heavy March-April stocks in most EEC member states and low prices for domestic (EEC) fruit.[13] While the EEC again raised the possibility of a VER agreement, this did not eventuate.

The market events that are likely to generate pressure from within the EEC for VER's are clearly observable in Table 3. All variables are measured in terms of changes from the previous year. The three VER years of 1976, 1979 and 1983 exhibit the three largest annual increments in the size of the EEC dessert apple crop, and the three largest increments in privately-held EEC apple stocks. EEC intervention purchases were also high during each of these years. As regards prices of EEC-produced fruit on the UK market during January (when VER negotiations might begin) the years 1976, 1979 and 1983 recorded the three largest declines in the real price of United Kingdom Cox's Orange. The two largest declines in the real price of French Golden Delicious in the United Kingdom occurred in 1979 and 1976, while the decline recorded in 1983 was only slightly exceeded by that in 1981.

11
Agra Europe, March 22, 1985

12
Agra Europe, February 28, 1986,

13
Agra Europe, May 15, 1987.

Table 3 Indicators of EEC Apple Market Conditions[a]

Year[b]	EEC Dessert Apple Production	EEC Private Stocks	EEC Intervention Purchases	UK Prices[c] January	
				UK Cox	French Golden Delicious
	'000 MT	'000 MT	'000 MT	p/kg	
1974/75	- 256	- 231	- 361	+5.8	+3.3
1975/76*	+1647	+ 372	+ 784	-3.3	-6.1
1976/77	-1069	- 148	- 660	+2.4	+1.6
1977/78	-1345	- 56[d]	- 165	+5.5	+3.6
1978/79*	+1693[d]	+ 224	+ 377	-9.5	-7.1
1979/80	+ 484	- 100	+ 170	-0.8	-0.1
1980/81	- 125	+ 90	- 31[d]	+0.5	-2.2
1981/82	-2168	- 227	- 464	+6.1	+2.6
1982/83*	+3545	+ 172	+1093	-6.1	-2.0
1983/84	-2375	- 17[e]	-1022	+3.1	+1.9
1984/85	+1145	+ 24	+ 536	-1.9	-0.5
1985/86	-1084	NA	- 509(P)	+2.1	+0.2
1986/87	+ 950(P)	NA	NA	NA	NA

Notes: a. All variables are measured in changes from the preceding year.
b. The year 1974/75, for example, includes the EEC crop produced in late 1974, but also covers the period in 1975 when Southern Hemisphere fruit would be imported. An * indicates a VER was agreed.
c. Deflated to a January 1974 base.
d. Following data refers to EUR-10 rather than EUR-9.
e. Following data refers to EUR-12.
P Provisional
NA Not available.

Sources

European Commission, Agricultural Situation in the Community (various).
UK Ministry of Agriculture, Fisheries and Food, Agricultural Statistics : England and Wales (various).

In the absence of rapid consumption growth in the EEC (which seems unlikely), the above suggests that Southern Hemisphere exporters will continue to face the prospect of VER's, or more severe quantitative restraints on trade, whenever domestic EEC prices are depressed due to heavy EEC crops which appear to occur every few years. It should be noted that the EEC has recently introduced a regulation requiring member states to monitor imports of dessert apples by providing twice-weekly information on quantities and values of imports from third countries.[14] Opposing

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14
Agra Europe, March 27, 1987.

this set of forces, however, are the current resolve of many governments, including those of EEC member states, to reduce agricultural protectionism and hence the barriers to agricultural trade, the Standstill and Rollback agreement negotiated during the GATT meeting in Punta del Este, and the continuing discussions associated with the current GATT round. In such an environment, apple exporting nations may exhibit a stronger resolve to resist EEC requests for trade restraint than perhaps they have shown in the past.

A DIGRESION ON SOME PROBLEMS IN HORTICULTURAL TRADE ANALYSIS

The problems

Compared with commodities such as grains or beef, relatively few analyses related to international trade in horticultural products have appeared in the literature. This is partly due to data problems which themselves can be traced to at least two characteristics that are particularly relevant to trade in horticultural products.

The first is seasonality of supplies. Generally, the harvesting season for fresh crops is relatively short, following which supplies should proceed rapidly through the marketing channel if profitability is not to be eroded through quality deterioration. In addition, because of climatic (and other) variations both within and between countries and hemispheres, the origin of supply is likely to change several times during the course of a year for any given commodity and market. Thus supplies from any particular country may be on offer for only a matter of weeks, making annual data inadequate for the analysis of many horticultural trade issues. Biannual, "seasonal", monthly, or even weekly data on trade flows and prices may be required.[15]

The second problem associated with horticultural commodity analyses derives from the often large number of cultivars (varieties), grades and countries of origin that may exist for a particular commodity. That is, each sub-category of the commodity may be differentiated on the basis of colour, size, shape, flavour, quality and reputation of the supplier. The question that arises is whether each commodity variant needs to be treated as a separate commodity in trade models, or whether a degree of aggregation is permissable. If the latter, then how should aggregation be attempted?

15
As in, for example, M.D. Bale (1986)

In this paper, the first problem was overcome by making use of monthly price and quantity data, and by employing the assumption in the empirical demand analyses that quantities imported into the United Kingdom in any given month would clear at least the wholesale stage of the marketing channel in the same month. The adopted approach to the aggregation problem is described in the next section.

Aggregation of data over cultivar and country of origin

Hicks' composite commodity theorem asserts that if a group of prices move in parallel (i.e., constant relative prices) then the corresponding group of commodities can be treated as a single good. The price of any of the individual commodities can be used in the demand analysis, and the quantity variable should be defined by weighting the individual quantities using base-period prices (Deaton and Muellbauer, pp.120-121). The data requirement is for both prices and quantities for each commodity variant.

Monke and Petzel provide an application of this theorem to international trade in cotton. Theysuggest that the extent to which prices of each pair of commodity variants move in parallel can be tested empirically by estimating the relationship:

$$P_A = \alpha + \beta P_B \qquad (1)$$

If β is not significantly different from zero, then the price series are independent. Otherwise, the following possibilities exist:

a.	$\alpha = 0$,	$\beta = 1$:	identical prices
b.	$\alpha = 0$,	$\beta > 0, \beta \neq 1$:	pure percentage differential
c.	$\alpha \neq 0$,	$\beta = 1$:	fixed price differential
d.	$\alpha \neq 0$,	$\beta > 0, \beta \neq 1$:	fixed and percentage differentials

The composite commodity theorem is strictly applicable only in cases a and b. It may be applied under the final two cases, however, if α/P_B is small relative to β.[16] Apple prices[17] were collected for a range of cultivars and

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[16] From (1), write $\frac{P_A}{P_B} = \frac{\alpha}{P_B} + \beta$

If α/P_B is "small" relative to β, then the price ratio P_A/P_B is "nearly" constant.

[17] Price data were obtained from Ministry of Agriculture, Fisheries and Food, Agricultural Statistics : England and Wales, and by personal communication with MAFF. Monthly prices are estimated as the averages of the means of the ranges of the most usual prices at 9 centres in England and Wales, with New Covent Garden prices receiving a weight of 4 relative to the other markets.

countries of origin for the months March to July inclusive, covering the period 1968 to 1983. These series contained several gaps since prices were not recorded when "insufficient quotations" were obtained, and also because of the natural sequencing of availability of the various cultivars during the season.

TABLE 4 Chosen Cultivars and Origins for Aggregation Test

Country of Origin	South Africa	Australia	New Zealand	Northern Hemisphere
March	Dunn's Seedling Golden Delicious Jonathon	-	-	Golden Delicious (France)
April	Golden Delicious Red Delicious Granny Smith	-	Cox's Orange	Golden Delicious (France)
May	Golden Delicious Granny Smith	Cox's Orange Golden Delicious	Cox's Orange Golden Delicious	Golden Delicious (France)
June	Golden Delicious Granny Smith	Granny Smith Sturmer	Golden Delicious Granny Smith Sturmer	Golden Delicious (France)
July	Golden Delicious Granny Smith	Granny Smith Sturmer	Granny Smith Sturmer	Golden Delicious (France)

From this data bank a set of price series was chosen, covering the major supplying countries and cultivars (see Table 4). All price data were deflated by the appropriate monthly CPI to reduce the danger of spurious correlations. For each possible price pairing, equation(1) was estimated and results were classified according to significance tests on α and β. In all cases, the hypothesis that $\beta = 0$ was rejected at the 1% significance level in favour of the alternative hypothesis $\beta>0$.

There was strong evidence that prices of Southern Hemisphere varieties do move in parallel.

In 40 of the 54 price pairings examined, prices were statistically identical, while for a further 5 cases relative prices were constant. All of the 8 price pairs that did not fall into one or other of the above categories involved the Cox's Orange variety.

The evidence in support of including EEC-sourced supplies with the Southern Hemisphere varieties in a single aggregate commodity is somewhat weaker. Of the 27 equations linking Southern Hemisphere cultivar prices to those of French Golden Delicious (the predominant European variety), 16 supported aggregation while 11 did not.

Whilst the above analysis suggests an appropriate approach to aggregation, data availability may limit the degree of aggregation that is feasible. In the current study, United Kingdom monthly import quantity data are published by country of origin but not by cultivar. Therefore a separate analysis of the Cox's Orange cultivar was not possible. Lack of such data also ruled out the construction of price-weighted aggregate quantity variables. The approach taken was to form two quantity aggregates, covering imports sourced from the Southern, and the Northern Hemisphere. This is equivalent to assuming, in each case, that the prices for all cultivars and countries of origin are identical. For the Southern Hemisphere aggregate this is not unreasonable as was explained above. It is also a reasonable approach for the Northern Hemisphere variable, given the predominance of a single variety from France in imports from that region of the world.

THE IMPACT OF IMPORTS ON UNITED KINDGOM PRICES

Estimation of Price Equations

The case for the imposition of voluntary export restraints in the EEC apple market must rest on the supposition that a reduction in imports from the Southern Hemisphere would impact favourably on prices of domestically-produced apples. The magnitude of this impact will depend upon buyers' perceptions of the closeness of Southern Hemisphere and EEC-grown apples as substitutes. Given the freshness of fruit from the former source relative to that from the EEC (which may have spent at least six months in cool storage), it is not clear that the substitution relationship would be strong. The present author is unaware of any previous research that examined this issue, although a South African commentator has been reported by Agra Europe as saying "nor ..does the Commission appear to have taken into account strong evidence from the past that imports from the Southern Hemisphere have no detrimental effect on European apple prices".[18]

18
Agra Europe, 25 February, 1983.

Price equations were estimated to explore the sensitivity of wholesale apple prices, during March to July in the United Kingdom, to variations in quantities supplied. These equations were:

$$P_{1jt} = \alpha_{oj} + \alpha_{1j} Q_{1jt} + \alpha_{2j} Q_{2jt} + \alpha_3 Y_t + e_{jt} \quad (2)$$

$$P_{2jt} = \beta_{oj} + \beta_{1j} Q_{1jt} + \beta_{2j} Q_{2jt} + \beta_3 Y_t + u_{jt} \quad (3)$$

where

j = March, ..., July;

P_{1j}, P_{2j} = deflated wholesale price per kg in month j of apples imported from Northern and Southern Hemisphere origins, respectively;

Q_{1j}, Q_{2j} = quantity of apples imported (and by assumption, sold) in month j from Northern and Southern Hemisphere origins, respectively, expressed on a per capita basis;[19]

Y = real disposable income per capita, second quarter of each year.

Recall that for each of the quantity aggregates Q_{1j} and Q_{2j}, the price of any of the commodity variants included in the aggregate can be chosen for the variables P_{1j} and P_{2j}. French Golden Delicious prices were used to construct the first of these price variables. For imports from the Southern Hemisphere, no single cultivar from any exporting country was recorded as imported throughout the March to July period each year. On the basis of data availability, March prices were measured by those of South African Dunn's Favourite, the price variables for April to June were represented by South African Granny Smith prices, and Australian Granny Smith prices were used during July.

Both sets of equations were fitted to data commencing in 1973, marking the commencement of the United Kingdom's membership of the European Community. Data up to and including 1985 was used for estimation of equations (2), but available price data for equations (3) covered the shorter period 1973 to 1981.

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The minor quantities of UK-produced apples that might be sold during the March-to-July period have been ignored.

The monthly equations of (2), and of (3), were estimated jointly through specification of appropriate dummy variables. These were subsequently removed where little variation in coefficients over months was observed. Both equations were estimated using the Cochrane-Orcutt procedure, as the ordinary least squares estimates indicated the presence of autocorrelated errors.

TABLE 5 The Estimated Price Equations

Dependent variable	Month	Q_2	Q_1	Y	constant	
P_{1j}	March				57.96	
					(6.0)	
	April	0.68	-8.99		56.46	$\bar{R}^2$ =0.82
		(0.3)	(2.2)		(5.9)	DW =1.68
	May			-0.21	56.65	
				(4.3)	(5.9)	
	June	-6.07			59.20	
		(1.4)			(6.2)	
	July	-23.00	-46.51		71.47	
		(3.7)	(5.9)		(7.7)	
P_{2j}	March				78.98	
					(5.0)	
	April	0.18			79.78	$\bar{R}^2$ =0.80
		(0.1)	1.01		(5.1)	DW =1.87
			(0.2)		78.26	
	May			-0.32	(5.0)	
		-12.47		(3.8)	84.27	
	June	(2.2)			(5.5)	
		-34.06	-46.07		97.29	
	July	(4.5)			(6.4)	

Note: Figures in parentheses are t-ratios.
Approximate critical t-values : 1% significance : 2.7
5% significance : 2.0
10% significance : 1.7

Price responsiveness to imports

Monthly wholesale prices of French Golden Delicious apples in the United Kingdom are related inversely to the quantity of apples imported from continental EEC. This inverse relationship exists in all months of the March-to-July season, with the July coefficient about five times as great as the coefficients estimated for the four previous months.

Variations in quantities imported from the Southern Hemisphere have no significant impact on French Golden Delicious prices during the first three months of the Southern Hemisphere season. Only towards the end of that season does an inverse relationship exist between this pair of variables. A similar set of relationships was found to exist between monthly imports from the Southern Hemisphere and wholesale prices of Southern Hemisphere apples.

Variations in quantities of apples imported from continental EEC had no significant impact on prices of Southern Hemisphere supplies between March and June, although a significant inverse relationship was estimated for the month of July.

Using the estimated coefficients of Table 5, along with the mean values of the monthly price and quantity variables, price flexibilities were calculated (see Table 6). These estimate the percentage price change that would result from a 1% change in monthly imports. All coefficients of Table 5 with a t-ratio less than 1.4 have been assumed to equal zero. Thus a VER that reduced Southern Hemisphere imports by 10% each month from their mean values would, according to the estimated coefficients, have no impact on French Golden Delicious prices on the United Kingdom market from March through May, but would exert upward pressure on prices in June and July by 1.6% and 3.1% respectively. Such VER action would produce much the same impact on prices of Southern Hemisphere cultivars, increasing them in June and July by 2.1% and 3.5% respectively.

Table 6 Price Flexibilities

Price Variable	Month	Imports from: Southern Hemisphere	Imports from: EEC
French Golden Delicious (P_{1j})	March	0	-0.33(0.15)
	April	0	-0.32(0.15)
	May	0	-0.27(0.13)
	June	-0.16(0.12)	-0.19(0.09)
	July	-0.31(0.08)	-0.63(0.11)
Southern Hemisphere (P_{2j})	March-May	0	0
	June	-0.21(0.09)	0
	July	-0.35(0.08)	-0.40(0.10)

Notes: 1. Figures in parentheses are standard deviations of the estimates.

2. Flexibilities have been calculated as:

$(\partial P_{1j}/\partial Q_{ij})/(\bar{Q}_{ij}/\bar{P}_{1j})$ and $(\partial P_{2j}/\partial Q_{ij})/(\bar{Q}_{ij}/\bar{P}_{2j})$

While a 10% reduction in United Kingdom apple imports from continental EEC each month during the Southern Hemisphere season would increase prices received by the EEC exporters, the monthly price responses were estimated to vary from only 3% to 6%. Thus total revenue received by EEC exporters during this period would be reduced by such action.

Revenue implications

The estimated price flexibilities indicate that a VER covering the March-to-May period only would have no impact on prices of European-sourced apples, and would therefore do nothing to improve incomes of domestic apple producers. Their prices received and incomes would increase, though, should the VER cover the entire Southern Hemisphere import season. Predictions of French Golden Delicious prices (P_{1j}) were obtained for 1985 by substituting the actual 1985 values of the independent variables into equations (1). A further set of price predictions was obtained by reducing all monthly values of Southern Hemisphere supplies (Q_{2j}) during 1985 by 10%. In other words, the impact of a VER that reduced imports by 10% each month was simulated. From the resultant predictions, such a VER would increase revenues from the sale of EEC-sourced imports, at the wholesale level, by just 1.6%.

Such a reduction in imports from the Southern Hemisphere would also produce revenue implications for these suppliers. While the results suggest prices received would not change between March and May, prices received during June and July would increase in response to the lower volume of imports. Using the estimated equations (2), price predictions were made for the 1985 year, with and without the 10% reduction in monthly exports to the United Kingdom. The results suggested that the VER would reduce revenues of Southern Hemisphere exporters by 8%.

Obviously, the negative revenue impact on Southern Hemisphere suppliers can be reduced if any reductions in exports to the United Kingdom can be concentrated into the months of June and July, when at least a positive price response will result in a partial compensation for the volume reduction.

CONCLUDING REMARKS

While the United Kingdom is a major EEC importer of apples from the Southern Hemisphere, so also are countries such as West Germany, Belgium and the Netherlands. Since pressures for protection against imports have tended to arise from continental producers' organisations, it would be useful to determine whether or not the results obtained from the above analysis also apply in the major continental-EEC markets.

The political pressure for greater use of VER's, or the safeguards clause, could also reflect a concern of domestic producers that increased imports of Southern Hemisphere apples impact negatively on prices received for a range of EEC summer fruit crops, such as stone fruit or summer pears, in addition to their domestic apple supplies. The strength of such substitution relationships could also be explored.

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THE PHASING OF TRADE LIBERALIZATION POLICY
THE NEW ZEALAND EXPERIENCE

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INTRODUCTION

The material in this paper is drawn from a major report on the New Zealand experience of the Timing and Sequencing of Trade Liberalization (Rayner and Lattimore, 1987). This project forms part of a World Bank study looking at the experiences of 19 countries (Argentina, Brazil, Chile, Colombia, Greece, Indonesia, Israel, Korea, New Zealand, Pakistan, Peru, Philippines, Portugal, Singapore, Spain, Sri Lanka, Turkey, Uruguay and Yugoslavia). The study attempts to draw general inferences about the most appropriate way of phasing a trade liberalization policy. The other countries taking part in the project commenced the period being underdeveloped, even though some of them ended by being relatively wealthy. New Zealand might thus seem inappropriately grouped with the other memebers of the study.

Despite this country's initial wealth, the economy displayed many of the characteristics of an LDC, being largely resourse based with a small and highly protected manufacturing sector. The history of the attempts at trade liberalization in New Zealand therefore started from as restricted a situation as that of many of the other countries in the World Bank study.

It is probable that the relative wealth of New Zealand at the commencement of its attempts to liberalize trade had a negative influence on the viability of the policies. The economic losses that resulted from protection were of apparently small significance when the country was enjoying a high standard of living. It is therefore no coincidence that the early movements towards trade liberalization did not contain that one essential ingredient for success, which is the intention to improve efficiency in resource use by allowing domestic import competing industries to be damaged by cheaper imports.

As the years passed, and the New Zealand economy stagnated relative to the rest of the world, it slowly became realized that a major policy initiative was required to reverse this trend. Although there have been many changes over the past three years, there still seems to be a lack of firm commitment to radical restructuring of the import competing industries.

There can be no doubt that the aim of protecting the New Zealand economy from the world was an expensive policy failure. Its legacy is an import competing industry which is, in some cases, grossly inefficient by world standards. Real incomes will continue to be depressed until these inefficiencies are removed.

A HISTORY OF TRADE LIBERALIZATION IN NEW ZEALAND

The period of this study starts in 1950 with imports subject to tight quantitative controls through import licensing. In addition there were high tariff levels and very restrictive exchange controls. This situation is depicted on our ordinal measure of liberalization as a level of 5 out of 20. (Figure 1)

From this illiberal base the country had its first flirtation with trade liberalization. The fortunate coincidence of a recently devalued currency together with a world commodity price boom, in part engendered by the Korean War, led to a balance of payments surplus. The government reacted to this by starting to remove import licensing from 1949 onwards. (Table 1)

The intention of this liberalization appears, however, to have been merely a method of permitting increased import consumption, much as the removal of war time rationing allowed general increases in the consumption of goods. Indeed safeguards were built into the relaxation of import licensing so as to allow its reimposition where domestic industry was able to demonstrate damage resulting from the imports. Clearly, then, the policy did not have the intention of reaping the economic gains from the removal of protection that result from the rationalization of domestic import competing industries.

During the early 1950's the causes of the trade surplus disappeared and the newly freed imports increased the resulting movement to deficit. Inevitably import licensing was reintroduced as a rationing device, since its reduction had had no deeper economic justification. The percentage of imports requiring licenses, which had fallen from 100% in 1948 to 40% in 1957, was returned to 100% again in 1958. The first episode of apparent trade liberalization had concluded.

The second episode was much more complex than the first, and at the same time contained a greater degree of economic rationalisation for the policies involved. For ease of exposition

the episode has been divided into three phases, although the divisions chosen do not mark changes in the full spectrum of trade policies. Rather they represent significant new initiatives in some aspects of the policy.

The first phase, and also therefore the entire second episode, started around 1962, quite soon after the conclusion of the first episode. This phase can be characterized as an attempt to move closer to neutrality in trade intervention by providing compensation to exporters for the effects of import protection. The forms of compensation varied widely, from direct export subsidies, to subsidization of inputs and various tax concessions. The policy commenced slowly, with the interventions few in number and size. However, as the years passed it built up an accelerating momentum aided by a chronically overvalued exchange rate.

The oil shocks of the middle and late 1970's increased the country's trade problems and reinforced the perceived need to artificially boost exports. From this period, until 1983/4, export promotion policies rapidly grew to levels that became unsustainable. Overseas reaction to the export subsidies began to build up, but more significantly, the fiscal cost of the policy grew to a level where it was having a major impact on the economy.

Before considering the consequences of this increasingly unstable trade policy it is necessary to return to the late 1970's. Around this time, politicians and other leaders in the economy, were becoming more and more aware of the real economic costs of protecting the import competing industries. As a result two new policy initiatives were introduced. The first of these identified those industries which were considered to be the least able to face international competition. Each of the industries was investigated in turn and a unique Industry Plan developed. The intention of these plans was to make deliberate progress towards increasing international competitiveness and increased international competition. The initial steps to designing the

first of these plans began at the end of the 1970's and the full set was completed by 1985. (Figure 2)

The second trade policy initiative was perhaps of even greater significance. Again it stemmed from a recognition of the costs of protection. Its intention was to phase out the entire import licensing system for the non-industry plan industries. Instead continued protection, if it was seen as being necessary, was to be through tariffs alone. The method of removing licensing was through tendering ever increasing amounts until the license premia fell close enough to zero that the system could be abolished. Tendering commenced in 1981. (Table 2)

Both these trade policy initiatives had a real intention of forcing domestic industry to face greater international competition. It is also clear that there was an expectation that some rationalization would result. Thus, for the first time, a liberalization policy was put in place with a motivation of obtaining some of the real gains that result from adjustment. 1981 can therefore be seen as a watershed in the second liberalization episode and so can be characterised as the beginning of its second phase.

Coincident with this reduction of protection, there was ever increasing growth in export subsidization and some new major public investments in import competing industries. As was suggested above, this aspect of policy became unsustainable. The costs of the so called "Think Big" investment projects and the relatively large scale subsidies for agriculture helped to lead the country into an economic crisis. Attempts to deal with this by imposing tight central controls on prices were unable to remove its root cause, which was the high internal deficit. The crisis led to a collapse of confidence in the government and the election of the opposition Labour Party with a substantial majority, in July 1984. There then followed a policy reversal that was unprecedented in New Zealand. The third phase of the second trade liberalization episode had commenced.

In point of fact the impact on trade liberalization was less dramatic than on general economic policies. While the main thrust of policy was an emphasis on less government intervention in the economy and a greater reliance on market forces, the reduction of protection proceeded along the lines already determined in the early 1980's. There may have been some acceleration in the phasing out of licensing and the implementation of the Industry Plans, but these changes were not dramatic. There were tariff reductions for the first time in the post-war period, but the initiative for this policy had also been planned before the 1984 election.

This third phase, then, has seen a continuation and perhaps acceleration of the reduction in protection. The changes in the other aspects of policy which influence trade have, in contrast, been more dramatic. There was an initial devaluation of 20% which was then followed by a floating of the currency six months later. Exchange controls were removed over a short period of time. Interest rate controls were removed and the following rise in rates had a major influence on the exchange rate. Almost the entire policy of export promotion and subsidization was removed. The cumulative effect of these changes on the export industries was very considerable, particularly since the exchange rate did not move to levels which led to even the approximate balancing of trade through export stimulation.

New Zealand in 1987 has a trade regime that is certainly more liberal than at any time over the past fifty years. Yet this is perhaps less of an achievement than it might seem. The pace of trade liberalization over the past three years has been slow when compared to the liberalization of the domestic economy. If anything, the liberalization of trade shows signs of faltering as rent seeking pressures groups become more influential and adjustment costs are perceived to be appearing. There is therefore a real possibility that New Zealand's second liberalization episode may be drawing to a close. Yet one of the successes of the recent policies is the way that attitudes to change have altered. It appears to be much more widely accepted

that structural change is necessary and therefore that any attempt to return to the old aim of simply preserving the status quo is no longer acceptable. For this reason the impetus to trade liberalization may continue, albeit only at a slow pace.

One of the tentative conclusions from the World Bank study (Papageorgiou et al., 1986) is of some consolation to New Zealand in its present circumstances. It has been a common experience of a number of countries that later liberalization episodes prove to be more robust than earlier ones. The reason for this is presumably is that each proves to be a learning experience. The long term benefits become clearer as time passes, while the net adjustment costs are seen to be much lower than originally expected.

INFERENCES TO BE DRAWN FROM THE NEW ZEALAND EXPERIENCE

The World Bank was particularly interested in the inferences to be drawn from each country's experiences regarding the right and wrong ways to go about trade liberalization. It was taken as a proven fact that there could be no doubt about the desirability of the removal of protection. The aim, therefore, was to design a policy so that it managed to avoid being aborted. Thus the perceived costs to the economy should never be such as to outweigh the perceived benefits.

The following are a list of topics that were either selected by the World Bank for consideration, or else seemed to arise from the New Zealand experience.

The Benefits and Costs of Trade Liberalization

The benefits of trade liberalization are demonstrated in the New Zealand case in a negative way rather than in a positive one. The relatively recent history of true trade liberalism and its slow implementation combine to make it impossible to clearly observe the economic benefits that should result. On the other hand the long practice of import restrictions has very clearly led to a manufacturing industry that is, at least in part, very inefficient. The resulting higher costs and lowered living standards are very real. The potential benefits of freer trade can therefore be seen in the costs to the country of its addiction to protection.

The costs of liberalization are also difficult to measure, given the limited restructuring that has taken place to date. If these costs exist, they are likely to be seen in increases in unemployment in the industries where some relaxation of importing has taken place. There is certainly a public presumption that such gross unemployment costs are occurring, although there has been little in the way of research to investigate whether they are in reality, nor whether the net unemployment costs are significantly lower due to new enterprises being set up.

In order to estimate the full gross value of increased unemployment it would be necessary to look in detail at each sub-sector of manufacturing industry and attempt to determine the extent that import liberalization had caused unemployment. The total effect could then be computed. This task would both be onerous in terms of the detailed analysis required and also problematic in the attribution of the cause of employment changes.

An alternative approach is to attempt to draw tentative conclusions from the more aggregate figures. For example, the number of registered unemployed increased from 49,000 in February 1981, the year the first tendering of import quotas occurred, to 58,000 in 1985. In some sense 9,000 represents an upper limit on the net increase in registered unemployment caused during this period by the liberalization. (This represents 0.6% of the 1986 estimated work force in the non-primary sector.) On top of this there would also have been an increase in non-registered unemployed, to give an absolute maximum value for net increased unemployment of perhaps 14,000, or 1% of the non-primary work force.

Of course, this "upper bound" estimate depends on a number of strong assumptions concerning the neutrality of: the effects of government macro-policies, the cyclical state of the internal economy and the influences of the rest of the world. None of the assumptions can be confirmed, so the figure must remain speculative.

Another method of estimating the effect of trade liberalization is to examine the trends in employment data. Concentrating on industries where import liberalization was suspected to have some effect we find a drop in employment from 1980-1985 of 3,500 in Transport Equipment, of 3,800 in Textiles and Clothing and of 1,300 in Footwear, Tyres and Radio and Television Manufacture combined. These three figures total 8,700 and turn out to be quite consistent with the "upper bound" estimate discussed above. The estimate assumes that there would

have been zero change in employment in the absence of import competition. Once more, therefore, the accuracy of the cost estimate depends on assumptions about the neutrality of other factors.

In one sense, 8,700 can be considered a lower bound estimate of the true effect of imports on employment, since it was obtained from only a limited number of sectors. Imports would have had a depressing influence, although of a smaller size, in some other industries.

What can be concluded from this discussion? It would appear that somewhere in the range 5,000 to 10,000 would be a very approximate confidence interval for the gross effect of the import liberalization policy to February 1985.

In contrast, the tariff compensation policies of the period to 1984 presumably led to an increase in employment, or at least prevented a decrease, in the export industries. This would be very difficult to measure in practice, and indeed in principle it is not clear that such measurement would be appropriate if the subsidies were seen as simply neutralizing other aspects of trade policy.

Once the impacts of the manifold policy changes that occurred from 1984 onwards are taken into account, the attribution of further employment changes to specific aspects of these policies becomes an almost impossible task. With so many changes occurring essentially simultaneously, the resulting example of a classic identification problem prevents the separation of the individual policy effects. Aggregate unemployment started to rise from mid 1986, but it is doubtful whether this was the result of trade liberalization per se., rather than being more of a cyclical nature. In so far as trade matters were involved, the rising value of the real exchange rate was probably of greater significance for unemployment than the gradual reduction in protection.

The most that can be gleaned from the New Zealand experience is that perhaps around 0.7% of the work force was made unemployed by the import liberalization up to 1985. This is an estimate of the gross effect, since no attempt was made to measure the effects of other aspects of trade policy during this period.

It is quite clear that a considerable degree of structural adjustment will be required when some parts of the New Zealand economy finally face world prices. Hence there will be significant gross unemployment effects in due course. However there is sufficient evidence of factor mobility and entrepreneurial skills that the net unemployment effects are likely to be small, at least assuming that the real exchange rate is not prevented from falling to appropriate levels by other aspects of economic policy.

The Importance of a Clear Liberalization Plan

New Zealand has given evidence of the desirability for trade liberalization to follow a clear pre-announced plan. The first episode had no such stated liberalization intent, so that there was no incentive for firms to make adjustments to production processes. In contrast the tendering system for the removal of import quotas, which commenced in 1981, was clearly stated and well understood. For this reason there has been little attempt by interested parties to reverse the policy. Even within the Industry Plan industries this scheduled liberalization has proceeded without interruption, even if at a slow pace.

On the other hand, the question of the tariff levels that will replace the quotas was not determined in advance. The industry plans allow for this determination to take place at a pre-determined future date. For other industries the tariff reform package contained a first reduction of 5% in 1986, followed by another of 10% in 1987 and thereafter by a major review. This imprecision has resulted in pressure being exerted by rent seekers. Their aim is to replace quotas with higher tariff levels than are currently in force, or, at the very least, to resist any further reductions in tariff levels.

As a result of these pressures, there are indications from some of the statements and actions of politicians that they will be sympathetic to calls for protection, where the industry concerned can show evidence of actual, or even potential, damage from imports. If this approach were to really be adopted as the policy of the government it would, of course, spell the end of the whole liberalization episode.

At times the politicians appear almost schizophrenic on the issue of protectionism. They quite correctly belittle the EC, Japan and the US for their protection of domestic agriculture, pointing out the costs to the local consumers of these policies and to job creation accross the economies generally. Yet the same politicians will talk of the problems facing domestic industry from cheaper imports, forgetting to mention the potential gains to be made by New Zealand consumers and the rest of the tradable sector.

Without a firmly designed policy for tariff reduction in place, there is little for the Ministers to fall back on when they are being pressured to protect particular industries. As a result, promises of help become that much easier to make. In addition, the rent seekers, knowing that there is no tariff reform policy set in concrete, have the greater incentive to devote resources to influencing the policy in directions that would suit themselves. As a result, even though New Zealand has now been experiencing the removal of quotas for six years, and tariff reductions for two years, there is a very real uncertainty amongst producers as to even the direction of change of tariffs after 1987. There is definitely no clear idea at all as to the likely long term aim of the tariff reform policy with respect to final levels to be achieved. In these circumstances it is very difficult indeed for the import competing industries to make any sensible plans for restructuring, so as to optimally react to the further liberalization of tariffs that may take place. This lack of a definitive plan therefore not only makes full liberalization the less probable, but also makes it the more difficult to minimize the costs of the structural adjustment which is so clearly required by the economy.

The Speed of Reform

Implementing a liberalization programme in a democratic system of government poses some particular problems. When the electoral cycle is of only three years duration and the political parties are evenly balanced and oppose each other on most issues, these problems are considerably exacerbated. In particular any major policy change has to be believed to be leading to clear benefits, which outweigh any costs, within a short space of time. If this is not the case, the party pursuing liberalization is likely to be voted out of office.

In New Zealand, the period from 1981 saw a gradual liberalization of trade which then became overshadowed by a rapid liberalization of the domestic economy after 1984. It is not possible to make any inferences concerning the relative actual adjustment costs of these two phases, due to the brevity of both the periods involved and the confounding influence of the domestic liberalization in the latter period. On the other hand, as suggested above, it is the perceptions of costs and benefits that are important in an electoral system. These may not be the same as the actual economic outcomes, particularly given the time it takes for these to emerge relative to the length of the electoral cycle.

Even given the reforming zeal of the incoming Labour government in 1984, it still took some months before their new policies began to be implemented on a large scale and longer still for some aspects to be put into operation. This meant that there has been only a short period for the net benefits to become apparent in advance of the 1987 election. As a result, the efficacy of both liberalization policies inevitably is being treated even more as a matter of electoral speculation, than would have been the case if there had been time for concrete outcomes to have emerged.

An additional political problem with trade liberalization is that the gains for the voter are in any case not dramatic, particularly in the short run. On the other hand, the rent

protecting pressure groups, whose losses are potentially substantial, are publicly very vocal and privately very effective in lobbying for their own interests. Given these problems, it is difficult to sustain a public will to support liberalization for a long enough time for it to be effective. If there are any costs in terms of increased gross unemployment that can rightly or wrongly be attributed to trade liberalization by its opponents, then the chances of a liberalization episode being aborted become greater.

None of the foregoing necessarily predicates that the speed of reform should, for electoral purposes, be fast or slow. The more rapid the reform, the greater the chance of benefits emerging within the three year electoral cycle, but the greater also the likelihood of there being significant adjustment costs. On the other hand, the slower the reform, the more opportunity there may be for the pressure groups to mount an effective campaign against it at the time of the next election.

In some ways the main inference to be drawn from the New Zealand case concerns the length of the electoral cycle rather than the speed of liberalization. Of its nature trade liberalization is likely to be less electorally popular in the short run than in the long run. In consequence an electoral cycle which is short in length increases the probability of trade liberalization being aborted before its benefits are realized.

The Place of Export Promotion

New Zealand used a policy of tariff compensation for the export sector as the central part of the first phase of its second liberalization episode. In retrospect this appears to have been an undesirable policy for a number of reasons.

Firstly, the second-best nature of tariff compensation tends to have been overlooked. A more competitive manufacturing sector was essential for the economy to achieve the growth observed in other OECD countries. Yet the protection afforded the import competing sector enabled the continuation of efficiency

levels which were extremely low by world standards. If government had peeled away this protection, while avoiding over-valuation of the exchange rate, a more effective import competing sector would have been forced to develop. Exporters would then not have required the tariff compensation.

A problem associated with a mixture of protection and tariff compensation is that there are more policy instruments which the government may make mistakes over. Thus, for efficiency, both the protection and the compensations need to be uniform across the entire sectors involved. In point of fact the chances are that these interventions will be made in response to lobbying pressures, and so are likely to be very selective and extremely variable in degree. This was indeed the case in New Zealand, so that much greater inefficiencies resulted than would have been the case with uniform protection and optimal tariff compensation. The chronic inability of the economy to develop an efficient, import competing, manufacturing sector, or to recover after the oil shocks, was almost certainly the result of an over-long allegiance to the infant industry argument and to multitudinous, non-uniform, attempts to compensate the rest of the economy for the costs of the infants.

The second problem with tariff compensation is the fiscal cost involved. This must result in either extra taxation, extra borrowing, or the reduction of other governmental expenditures. The first leads to efficiency loss, the second to a channeling of savings away from productive investment and the third to a weakening of other government objectives. In addition there is the danger that, as occurred in this country, the total fiscal cost of compensation may get out of hand, with very serious effects on the budget deficit.

The final problem raised by a tariff compensation policy is the difficulty involved in shifting from such a policy to one of true trade liberalization. New Zealand rapidly reduced compensation in 1984, while at the same time only slowly continuing to reduce protection. For a period of time, therefore,

the overall balance of intervention moved against the export industries. Their costs remained high due to the direct and indirect effects of tariffs, but the compensation that they had received for these extra costs was largely removed. As a result these industries were disadvantaged and, if anything, tended to contract rather than expand as should have occurred with liberalization. Once import restrictions are finally removed this timing problem will have gone, but in the meantime there are real resource costs involved with the temporary contraction of the export industries.

Appropriate Circumstances for the Introduction of a Liberalization Policy

The first liberalization episode in New Zealand is a clear example of inappropriate circumstances in which to introduce such a policy. The combination of the temporary nature of the boost in export earnings, the fixed exchange rate and the lack of commitment to reform all made it inevitable that the episode would not be long lasting.

The third phase of the second episode, in contrast, is an example of more auspicious circumstances. The economic stagnation of the economy over a long period made it possible to develop the political will for major reform. The financial problems caused by the tariff compensation policy meant that some kind of reform was inevitable. The preceding period of pervasive economic controls caused the movement away from interventions to be seen as a better alternative.

Thus the circumstances appeared to favour the introduction of liberalization. The main problem that it faced, on the other hand, was the degree of distortion in the economy, resulting from decades of ever increasing interventions. The size of the policy objective was dauntingly large.

The Value of an External Trade Agreement

Throughout almost the entire length of the second episode, New Zealand and Australia were moving closer to forming a free

trade zone. Starting under NAFTA in 1965 and then accelerating with the implementation of CER in 1983 these trade agreements succeeded in making free trade with Australia appear inevitable, even though there was continued disagreement on the extent of tariff reduction with the rest of the world.

The lack of pressure group activity aimed at preventing the Australasian common market being implemented can be interpreted in part as a measure of the limited advantages to be made from it. In some ways the two economies are too similar for the potential trading gains to be very large. As a result, New Zealand producers were not so worried by the prospect of the removal of protection. At the same time, however, exporters had success in penetrating the Australian market, as evidenced by the very considerable growth in trade between the two countries and the fact that the trade balance became much less biased in favour of Australia. Export led growth of manufacturing occurred to a limited extent, as the barriers to trade with Australia were removed.

It is doubtful whether these industries would have expanded in a free trade environment with the rest of the world. To this extent it can be argued that CER may not be in the long term interest of the country if trade liberalization is eventually fully implemented. Nevertheless one of the greatest gains that have been made from the agreements with Australia is the realization that it has not spelt the end for New Zealand's manufacturing industry and that it has in fact been advatageous to it. With this lesson learnt, the resistance to a broader liberalization has probably been somewhat reduced.

Exchange Rate Regimes

New Zealand has used a number of different exchange rate regimes during the post-war period. Although each had its own particular problems, the real exchange rate remained chronically over-valued throughout. Under the fixed and crawling peg systems, very considerable restrictions on foreign exchange transactions were in place. In addition, governments pursued inflationary

macro-economic policies. The net result was that, although the nominal value of the dollar fell due to the successive devaluations initially and to the monthly adjustments latterly, the real exchange rate did not move enough to overcome the continuing balance of payments deficits. In addition, the devaluations themselves were typically accompanied by speculation against the currency, which proved costly, particularly in 1984.

In contrast, the float of 1985 overcame these acute speculations. On the other hand the short term variations in the nominal value of the currency then experienced caused difficulties for exporters. Moreover, the continuing inflationary macro-policies of the government, together with the overseas approval of the domestic liberalization, caused the real exchange rate to remain at levels which made import competing and export production less and less profitable, as domestic costs continued to rise relative to those of the country's trading partners.

The high values of the real exchange rate reduced the prospects for continued trade liberalization in both episodes. Yet these values occurred under both the main exchange rate regimes. In principal a floating system should allow an easier adjustment to a level that will allow export led growth. However, for this to occur in the short run, other policy measures need to be made compatible, as discussed below.

Sustainability of the Liberalization Policy under other Policy Measures

The fiscal deficit was reduced in two years from 9.2% of G.N.P. in 1984 to around 4% in 1986. At the same time the deficit is now being fully funded by internal borrowing from a recently decontrolled financial sector, thus maintaining a tight monetary policy in an attempt to reduce the level of inflation. This attempt is indeed showing some success, but the cost is high nominal and real rates of interest.

These high rates of interest, combined with the now free foreign exchange markets and the good international press has

attracted very considerable capital inflows from overseas. As a result, the free nominal exchange rate appreciated and the real exchange rate has risen even further. Their values appear to be considerably above any long term equilibrium level. Overseas lenders appear to require a 2-4 percent risk premium in New Zealand (relative to major financial markets) and thus have driven real interest rates in this country to nearly twice those being experienced in other deficit countries, like the United States.

There is no doubt that the traditional pastoral export sector, which is still by far the most important source of New Zealand's exports, has had very serious economic difficulties. It was faced with the overshoot of the exchange rate, the fall in world agricultural prices and the faster reduction in tariff compensation than in import protection. The non-traditional export sector has faced similar, but not quite so intense, problems. The import competing industries too have felt the pressure from the over-valued real exchange rate. As a result their fears of the implications of further trade liberalization have been intensified.

The import restrictions on petroleum products are an especially important problem. The New Zealand economy has not been able to benefit from the recent fall in energy prices to the same extent as other developed countries.

There is a growing realization amongst all parties, of the importance of the size of the fiscal deficit on the economic health of the tradable sector. In the 1987 budget we have seen the deficit reduced yet further, although there is some confusion as to its appropriate measure. In addition there are the complicating influences on the deficit of the carry over of costs associated with the "Think Big" projects and revenues from the sale of government assets. Both of these are temporary in their effects, yet they will continue the pressure on interest rates in the meantime.

As a consequence, it is very difficult to judge the continuing viability of the current liberalization episode. This viability is becoming increasingly fragile as adjustment costs appear in domestic manufacturing, partly caused by the value of the exchange rate.The latter also prevents these costs being compensated for by a growth in exports. Were the trade policy to have another three years in which to demonstrate success, its future might be more secure. However, the increasing pressure group activity being felt by both main political parties as the next election approaches makes the continuing movement towards full trade liberalization under the incoming government by no means a certainty.

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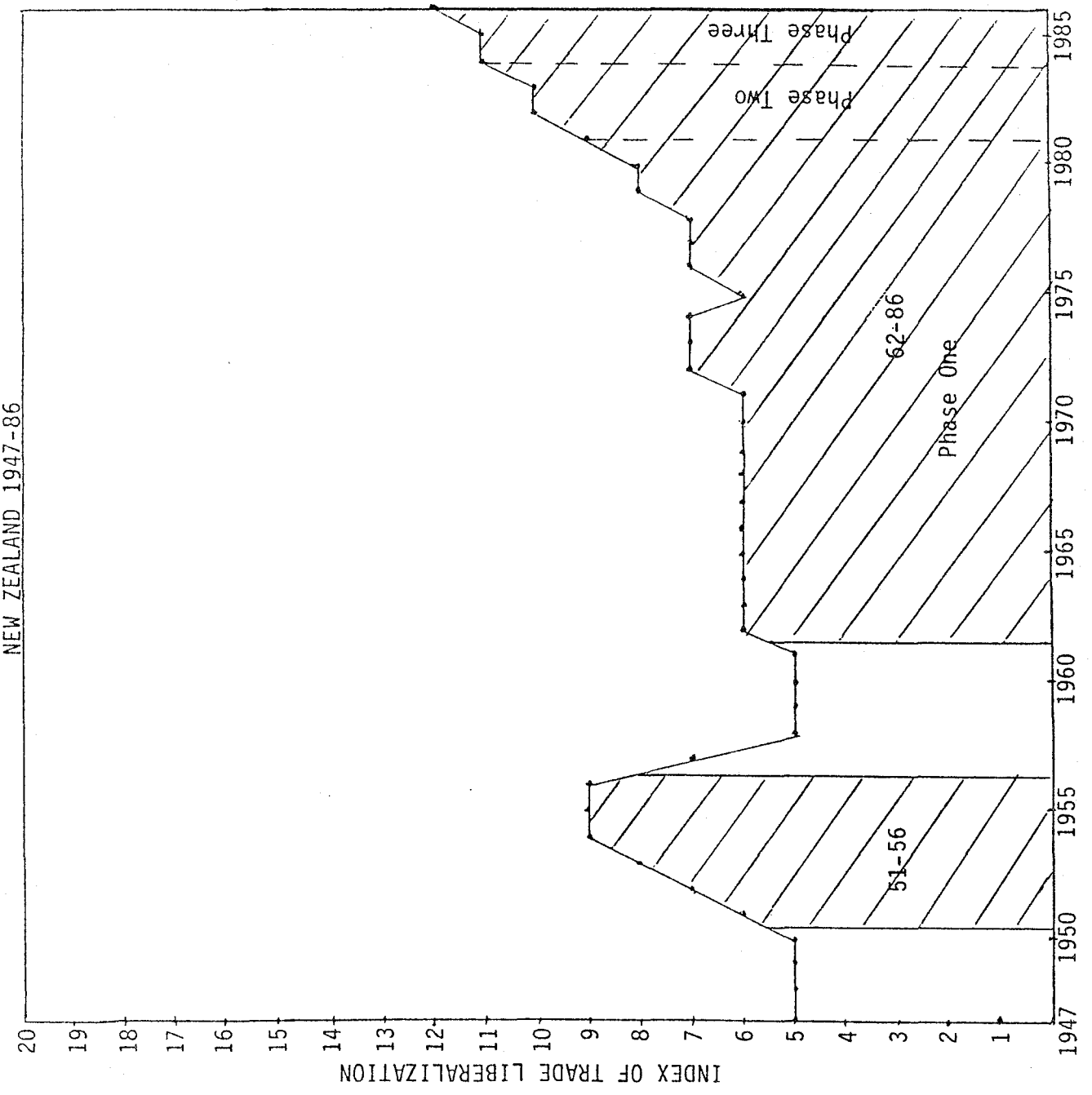
NEW ZEALAND 1947-86
INDEX OF TRADE LIBERALIZATION
20
19
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1947
1950
1955
1960
1965
1970
1975
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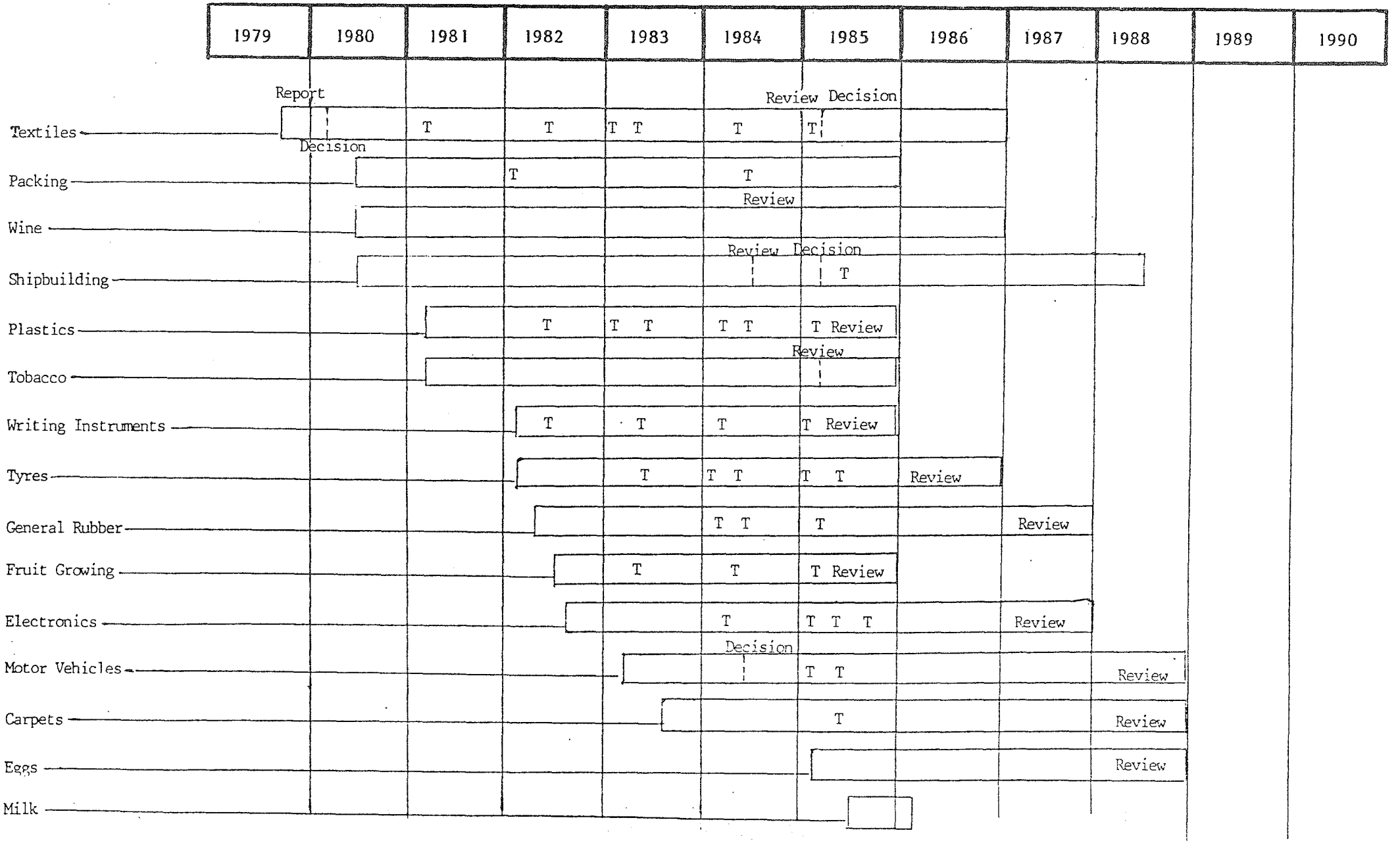
51-56
62-86
Phase One
Phase Two
Phase Three

Figure 1

Figure 2

I.D.C. - INDUSTRY STUDY PROGRAMME



Legend: T: Import Licensing Tender Round

Table 1

Quantitative Restrictions on Imports

Year	Percentage Imports Requiring Licences (1)
1938	100
1939	(100)
1940	(100)
1941	(100)
1942	(100)
1943	(100)
1944	(100)
1945	(100)
1946	(100)
1947	(100)
1948	100
1949	(92)
1950	(84)
1951	(76)
1952	(69)
1953	(62)
1954	(55)
1955	(48)
1956	40
1957	40
1958	100
1959	(95)
1960	(90)
1961	(85)
1962	(80)
1963	75
1964	74
1965	72
1966	57
1967	55
1968	52
1969	44
1970	42
1971	34
1972	31
1973	30
1974	30
1975	38
1976	25
1977	24
1978	24
1979	24
1980	21
1981	18
1982	22
1983	22
1984	24
1985	20
1986	18

Source: Hawke, G; The Making of New Zealand, Oxford University Press, Oxford (1985).
Galt, D., Department of Trade and Industry, pers. comm.

Table 2

Import Licensing Premiums (Exclusive of Tariffs)
1981-1985

Round	Date	Licence Allocation $ millions	Successful Premium $m	Average Premium Rate (%)	Type Round
1	Mar 1981	10.7	1.75	16	
2	Mar 1981	5.9	1.08	18	
	1981	16.6		17	
3	May 1982	13.2	4.61	35	General
3a	Aug 1982	18.8	3.09	16	Plastic, Glassware
4	Nov 1982	8.4	1.60	19	
	1982	40.4		23	
5a	Jan 1983	14.3	1.36	10	
5b	Mar 1983	0.2	0.01	5	
6	May 1983	138.0	2.20	2	
7	May 1983	18.8	1.20	6	
8	June 1983	24.2	4.86	20	General, Plastic Glass
9	July 1983	3.5	1.16	33	Tyres
10	Aug 1983	1.5	1.25	83	
11	Nov 1983	4.6	1.00	22	Tyres
	1983	205.1		6	
12	Mar 1984	15.5	1.08	7	Plastics
13	May 1984	122.2	1.44	1	
14	May 1984	18.3	7.31	40	
15	May 1984	40.4	2.40	6	Tyres
16	Aug 1984	18.4	1.40	8	Plastics, Glass
17	Oct 1984	19.4	0.40	2	CER
18	Oct 1984	13.4	6.86	51	Tyres
19	Dec 1984	453.7	15.00	3	General, Plastic
	1984	701.3		5	
20	Feb 1985	56.7	14.49	26	General, cars
21	Mar 1985	10.4	0.57	5	
22	Apr 1985	21.7	10.06	46	General, Tyres
23	May 1985	183.4	0.92	1	CER
24	May 1985	24.5	7.63	31	General
25	June 1985	49.0	2.46	5	
26	July 1985	49.2	11.48	23	General, cars
27	Aug 1985	6.2	0.25	4	
28	Oct 1985	47.2	4.35	9	Ceramics, Glass
29	Oct 1985	69.6	0.75	1	
30	Nov 1985	720.3	10.92	2	General
31	Nov 1985	92.8	2.96	3	Plastics
	1985	1331.0		8	
Weighted Average 1981-85				7 percent	

Source: Department of Trade and Industry, Wellington.

An Econometric Model of New Zealand Milk Production, and Utilisation.

J.C. Robertson, G.R. Griffith and R.G. Lattimore

Preface

In Robertson, Griffith and Lattimore(1986), an econometric model of the New Zealand dairy industry was described and estimated. However, re-examination of that model revealed a number of problems arising from mispecification of some of the variables. In this paper a second version of the econometric model is described incorporating a number of revisions and extensions. The majority of the background discussion and description presented in Robertson et.al(1986) is retained and updated in this paper. The major differences between the original and current models are listed in Appendix 1, while the actual alterations are described in detail in the body of the text.

This report is intended to provide a complement to the papers: "An International Comparison of Dairy Support Programmes" (Robertson and Griffith,1987), " An Econometric Model of the Australian Dairy Industry" (Griffith,1987) and " Regionally Linked Models of NZ, A, EC, US and Canadian Milk Production and Utilisation" (Robertson and Griffith and Lattimore,1987).

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Section 1 Overview and Objectives

Currently, the international market for manufactured dairy products is in a precarious position. While the demand for milk and milk products remains low in most areas of the world, the continued growth in world production, particularly in the main exporting regions, has resulted in the stock-piling of large amounts of milk products. The mere presence of these stocks has had a depressing influence on prices in international markets. For export dependent countries such as New Zealand and Australia, shocks to the world market of this sort have far reaching consequences.

For the United States (US), the European Community (EC), production-stimulating support policies has caused significant reallocation of resources and income transfers. Also, the cost of funding dairy-farmer support policies rises substantially as world market prices are depressed. In Canada, which operates a milk quota system, the profitability of small producers is limited by the imposition of large over-quota levies. While consumers face high prices, the larger quota holders enjoy relatively high guaranteed returns. (See for example, Robertson and Griffith(1987) for an international comparison of dairy industry assistance).

Recent trends in world milk production is provided in Table 1.1, and highlights the magnitude of the current over-production problem. The EC provides more than 26% of total world milk supplies, although growth in total production has slowed over the last three years. In comparison Australia, Canada and New Zealand combine to produce only around 5% of the world's milk supply. Undisposed stocks continue to grow annually in the EC, and as a proportion of total stocks the EC currently accounts for 77 percent. New Zealand stocks also appear high relative to production. However they are typically trading stocks and are a low, stable percentage of total world stocks.

Table 1.1:

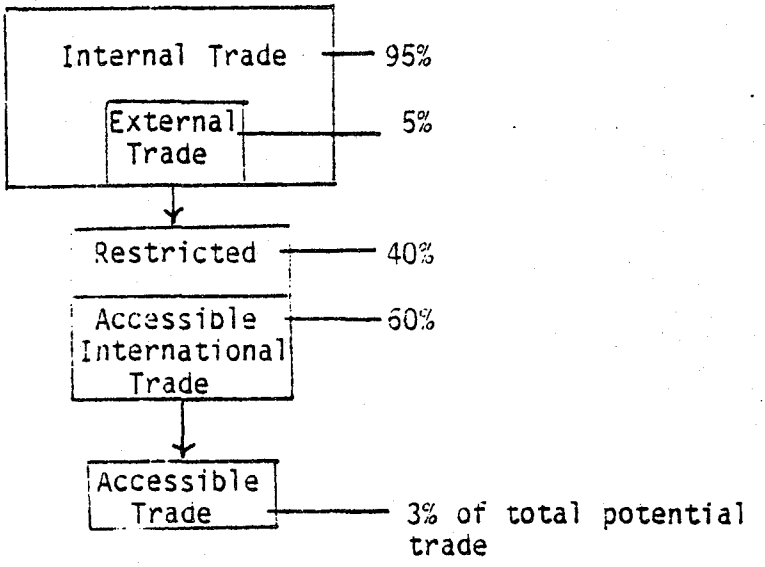
	Cows Milk Production (Calender Years)				December Stocks of Milk Products (Butter and Cheese in milk equivalents -3.6% milkfat base)			
	1978-82 ave	1985	1986	1987(F)	1978-82 ave	1985	1986	1987(F)
	million tonnes							
EC(12)	110.6	114.6	115.4	113.9	16.0	37.5	44.3	45.9
(%Total)	(28.4)	(27.4)	(26.6)	(26.9)	(52.5)	(66.3)	(70.9)	(77.0)
US	58.2	65.2	65.8	64.3	6.9	6.8	5.5	2.7
(%Total)	(15.0)	(15.6)	(5.2)	(15.2)	(22.6)	(12.0)	(8.8)	(4.5)
Canada	7.8	7.9	7.9	7.9	1.1	1.1	1.0	1.0
(%Total)	(2.0)	(1.9)	(1.8)	(1.8)	(3.6)	(1.9)	(1.6)	(1.7)
A	5.6	6.3	6.2	6.2	0.8	1.5	1.3	1.1
(%Total)	(1.4)	(1.5)	(1.4)	(1.4)	(2.6)	(2.7)	(2.1)	(1.9)
NZ	6.6	7.8	8.2	8.0	1.9	3.5	4.3	3.3
(%Total)	(1.7)	(1.9)	(1.9)	(1.9)	(6.2)	(6.2)	(6.9)	(5.5)

Source: USDA(1986).

US production has expanded since the early 1980's but has been accompanied by some growth in domestic demand. This fact is reflected in the recent decline in stock levels below the 1978-82 average. The use of quotas has restricted Canadian production to largely balance supply and demand, and like Australia, stock levels generally represent normal trading stocks.

In terms of international trade only a very small proportion of production is sold on world markets. Moreover, the extensive use of trade barriers means that access to the world dairy market is highly restricted. As depicted in Figure 1.1, the result is that a small proportionate increase in net milk supplies potentially causes a substantially larger proportionate rise in the volume of milk products available for trade. When competition in a restricted market expands, prices invariably fall.

Figure 1.1: International Dairy Trade



Source: New Zealand Dairy Board(1984).

The combined effect of domestic over-production and restricted trade is the likelihood of further disruptions to international dairy trade in the short to medium term. However, there appears to be considerable debate amongst policy makers and advisors as to whether this situation may be prevented in the future under a regime of international co-operation to liberalise trade and to reduce production stimulating policy intervention.

Consequently, developing an understanding of the policy environments that currently exist in the major dairy producing regions and their effects on their domestic industry and the world market as a whole, would seem to an important priority for research.

Under this general framework a joint USDA-AERU research project was initiated in 1986 with the the overall goal of constructing a compact model of world trade and prices for dairy products which has the potential to serve as input into the continuing bilateral and multilateral policy dialogue, and to aid medium term forecasting of dairy trade patterns.

As part of this project, an econometric examination of the New Zealand dairy industry was under-taken to compliment earlier studies by Clough and Isermeyer (1985), Johnston (1985), and the monitoring work conducted by the New Zealand Dairy Board. To assist the analysis, an econometric model of the New Zealand dairy products industry over the period 1967 to 1986 was constructed. This model details the economic aspects of production, manufacture, domestic consumption, international trade, and the mechanisms and influence of New Zealands dairy policies are described, modeled and analysed. Although Laing and Zwart(1983) partially incorporate the dairy industry into their model of the New Zealand pastoral sector, no detailed model of the New Zealand dairy industry appears to currently exist elsewhere.

Section 2 The New Zealand Dairy Industry

2.1 New Zealand's Role in the International Dairy Market

New Zealand is somewhat unique within the international dairy sector because of its over-riding dependence on dairy export receipts. In turn the industry's and dairy-farm incomes are determined almost entirely on the basis of export realisations. Table 2.1 highlights the ordering of countries in terms of recent trends in volumes of milk product exports. New Zealand is by far the most trade dependent of the regions but is dominated by the EC in terms of actual volume. Australia is also heavily reliant on dairy exports. Notice that the percentage net trade figures are slightly biased since they represent exports as a proportion of current milk production and therefore ignores import and stock availability.

From Tables 1.1 and 2.1 it should become clear also that most of the worlds milk production is utilised domestically, (principally in fluid milk). In the US and EC the international market for milk products is seen mainly as at outlet for excess milk production. However, in New Zealand, and to a slightly lesser extent Australia, the international market is viewed as a key foreign exchange earner.

Table 2.1:

	Exports of Milk Products (Butter and Cheese in milk equivalents - 3.6% milkfat base).				Exports as a percentage of current domestic production			
	1978-82 (Ave)	1985	1986	1987(F)	1978-82 (Ave)	1985	1986	1987(F)
EC(12) (excluding intra EC trade)	11.9	11.0	10.3	11.4	10.8	9.6	8.7	10.0
US	0.7	1.3	0.8	1.7	1.2	2.0	1.2	2.6
Canada	0.0	0.1	0.1	0.1	0.0	1.3	1.3	1.3
A	1.1	1.8	1.8	1.7	19.6	28.6	29.0	27.4
NZ	5.1	6.1	6.1	7.5	77.3	78.2	74.3	93.8

Source: USDA(1986)

2.2 Dairy Policy in New Zealand

As with all industries, the New Zealand dairy sector is heavily influenced by the policy decisions of government relating both to agriculture and the general economy. In addition, within the industry there is a different, but related, set of policies directed specifically at dairying. These policy decisions are generally made by a single producer controlled institution, the New Zealand Dairy Board (NZDB)(1). Historical and institutional descriptions of the New Zealand Dairy Board are provided in NZDB(1984) and Martin(1986).

The NZDB is run jointly by producer-directed processing co-operatives. The Board's main functions are to purchase and market the export production of the co-operative companies, co-ordinate domestic sales, and return the net proceeds to the industry.

No attempt is made here to provide an historical approach to the development of dairy policies and institutions in New Zealand, only to say that its development has been strongly influenced by three features - co-operative ownership of processing, centralised marketing, and the operation of a buffer-fund to stabilise producer incomes.(2)

2.2.1 The Mechanisms of New Zealand Dairy Policy

During the period 1965 to 1986 the main mechanisms of dairy policy in New Zealand have consisted of:

a) Income stabilisation via a scheme administered by the NZDB, which operates through a price stabilisation mechanism. The farmer receives payment for milk in two stages with the value of the payout depending on the efficiency of the dairy company in processing milk at low cost and the export realisations of the Dairy Board. The aim of the stabilisation scheme is to reflect international prices while "smoothing" fluctuations.

In principle the Board establishes offer-to-purchase prices at the begining of the dairying season in July for all manufactured milk products. These prices are set in consultation with government officials, Dairy Board, and factory representatives - remembering that the factories are co-operatively owned by dairy farmers. These offer-to-purchase prices tend to reflect attitudes toward the industry's stability and ability to pay, market prospects, and movements in processing costs. Before 1976 these prices were set solely on a milkfat in milk basis, however, prices now reflect the important role of skimmilk and high protein products. In turn this has altered the compostion of the national dairy herd away from high milkfat producing Jersey breeds toward the lower fat but higher milk-producing Friesian.

---

(1) 10% of milk production is as fluid townmilk, and at the time of writing this was handled by a separate statutory authority, the New Zealand Milk Board (NZMB). Dairy Board producers could not sell for town supply, however, excess townmilk production was able to be channeled into processing. Except in this context, this study will concentrate on the activities of the NZDB only. From September 1 1987 production in the town milk industry is to be deregulated. However, the impacts of this on the processing industry is likely to be only minor. (See NZMB 1987).

Once these prices are determined they are converted into the farmgate price for milk which will be paid to all factory supply farmers - with small regional variations. Until 1986 these prices were managed to some extent in that they may not increase by more than 10 percent, or decrease by more than 5 percent, on the previous seasons values, and in general, prices set at the start of the season usually held all year.

At the end of the dairying season export trading surpluses or deficits are recorded in the Dairy Produce Account (DPA). Up to 50 percent of a surplus may be distributed to companies as an end of season distribution, which is passed on to farmers as an end of year payout. As indicated in Table 3.9, this end of year payout represents only a small proportion of the dairy farmers pay cheque. However, the role of remaining surpluses from the DPA is significant to the Boards policy operations.

b) Concessional loans from the government to the Board to assist its cash flow during the year.

Up until 1986 any surpluses after deductions for end of season distributions were held in a Reserve Account with the New Zealand Reserve Bank at a 1 percent interest rate. Deficits in this account also drew 1 percent interest, and thus provided a cheap source of funds. This facility allowed the Board to operate a buffer-fund for producers in order to stabilise incomes while not ignoring international market prices.

c) A supplementary minimum price (SMP) scheme administered by the government, effective only in 1979.

This additional income support scheme had wide use in most pastoral industries from 1978 to 1984. However, because the Board was able to maintain good returns to the industry during this period, activation of this scheme was only required in one year.

d) Government legislation in areas of quality control, storage, distribution of milk and milk products, and general agricultural and input subsidies.

These included such activities as extension services, income tax relief, fertiliser subsidies, and research. Johnston(1985) estimates the total effect of these types of subsidies on milk production in New Zealand for the period 1978 to 1981 as being $NZ 58 million, or around $NZ 0.03 per litre of milk.

In summary, besides the SMP scheme, the New Zealand dairy industry has received only minimal direct government assistance. In fact, Gibson and Nickel [5], suggest effective rates of assistance to the factory milk supply industry in the order of 5 to 15 percent during the early 1980's, and when adjusted for movements in the underlying cost structure within the economy as a whole, Lattimore [6] provides estimates of the true effective rates of assistance one third that for wool and more than a tenth of that for the New Zealand sheepmeats industry for 1983/84.

Since the election of the current Labour government in 1984, the New Zealand dairy industry has faced some dramatic changes in its operating environment. The adoption of a market orientated philosophy by the government for economic policy has caused major restructuring within the economy. For the dairy industry two factors have been particularly important:

(1) the removal of any assistance via the concessional loan arrangement with the Reserve Bank. Therefore, all pricing decisions must now also be based on the Boards ability to cover deficits at market interest rates;

(2) the floating of the exchange rate has meant that the Board must now make crucial decisions about the timing of export transactions and the movements of foreign exchange;

During the 1985/86 season it became clear that actual world prices would not be sufficient to cover the guaranteed farm-gate milk price. Consequently, all dairy industry reserves that had been accumulated over the preceding seasons were exhausted (see Table 3.7a). In the absence of the Reserve Bank loan arrangement, high domestic interest rates, and low but revaluing exchange rates, there has been a large reduction in the New Zealand advance farm-gate milkfat price for the current 1986/87 season and an expectation that the final price will not match the guaranteed price in the previous year.

Although this study describes the dairy industry over the period 1967 to 1986, it is in the post 1984 environment that much current interest exists. However, the principles of the Dairy Boards price guarantee scheme have remained largely unaltered. This may indicate that the structural re-direction in the economy has affected the dairy industry somewhat less severely than other agricultural industries which had experienced a substantially higher degree of insulation from ruling export-market conditions in the past.

Section 3 The Econometric Model of the New Zealand Dairy Industry

3.1 Introduction

The research reported in the remainder of this paper relates to the re-estimation of a simple annual model of the New Zealand dairy-products industry. Economic modelling research in this area has been largely neglected to date. Laing and Zwart(1983) and Grundy(1987) examined dairying as a component of a larger aggregate pastoral based investment model, but little attention was paid to the determination of the policy-directed pricing mechanism within the industry. These models do however make important contributions to the understanding of the underlying investment decisions that must be made within the pastoral sector.

The dairy model in its current form is a relatively simple specification compared with Agriculture Canada's FARM and the USDA's FAPSIM models. Nonetheless, in line with the overall objectives of providing an international set of regional specifications which may be easily linked to examine international trade in dairy products, it is felt the New Zealand model is sufficiently fully specified to capture most of the major features of the industry. Also, the present specification provides a natural module-base for developing the other smaller regional models.

Before the analysis however, it is important to recognise that models are just models - approximations of what are regarded as the main characteristics of the economy or sector being examined. There are numerous political, social and even economic factors that have been excluded from the model's specification which may also be considered important. As such it is to be hoped that this will encourage further work in developing extensions to the current research.

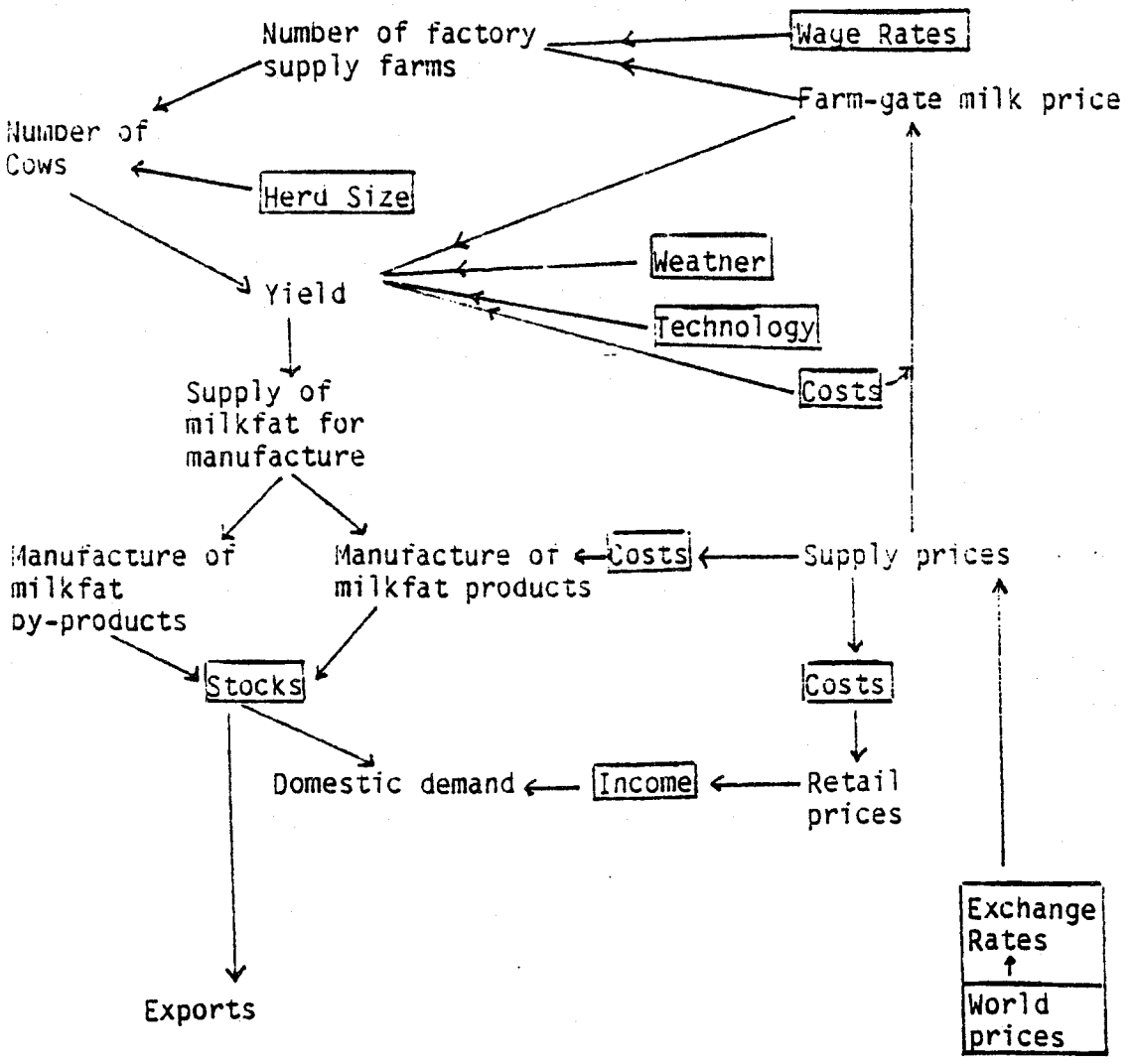
In its present form no attempt has been made to link the world prices endogenously into the model through any market-clearing mechanism. Clearly, this is an important factor for the final complete international trade model. Further, the model does not explain the domestic fluid milk market in New Zealand or on-farm utilisation of milk. Since they represent such a relatively small proportion of total milk utilisation (around 8 percent), and the New Zealand town-milk industry operates largely independently of the manufacturing milk sector this was deemed unnecessary. Of course, the domestic fluid market cannot be treated exogenously in the other regions were fluid consumption is a far more important factor.

In New Zealand export stocks cause little problem in terms of holding capacity, (except for perishable products such as cheese and wholemilk powder). Therefore, exports may be treated as being derived from a simple supply disposition identity. This may belie the true situation to some extent since exports are commonly a function of a more complex set of politico-economic considerations than the current specification would suggest.

Finally, given the requirement for simplicity and practicality, most pricing decisions are based on naive expectational assumptions regarding the reliance on previous years activities as being the dominant factor in influencing the current period's decisions. However, the data does not appear to reject this notion in the present case.

In summary, the model contains 18 linear equations and identities explaining the numbers of producing dairy cattle, milk production intended for manufacturing, the manufacturing process, domestic per capita consumption of dairy products, export of dairy products, the basic producer milk price and the prices set for the manufactured products, both domestically and for export. The July/June year data base is for the period 1966 to 1986, and the basic specification for the model is outlined in Figures 3.1 and 3.2; where Figure 3.1 is a stylised representation of the various linkages, and Figure 3.2 is a more detailed specification of the particular model used in this study. Data definitions and sources are presented in Appendix 2. In general, quantities are expressed on a wholemilk equivalent basis. Unlike the original specification non-fat products are not expressed on their milkfat content but rather as their milk equivalent. The yield conversion factors used are also presented and explained in Appendix 2.

Figure 3.1: Overview of the Structural Model of the New Zealand Dairy Products Industry



= endogenous variables
= exogenous variables

Figure 3.2: Summary Model Specification

Block	Dependent Variable	Explanatory Variables
Farm Supply of Manufacturing Milk		
	YIELD	= f(T,(MMKPNZ(-1)/CPINZ(-1)),RAINNZ, YIELDNZ(-1)) ;
	NHNZ	= f(MMKPNZ(-1)/CPINZ(-1), (WAGNZ(-1)/CPINZ(-1)),NHNZ(-1)) ;
	COWNZ	= HSNZ*NHNZ ;
	QSMMNZ	= (COWNZ*YIELD) - FARMUS - FLUIDMK ;
Milk-Product Processing Block		
	QSBTFNZ	f ((PSBTNZC*1.19)+(1.78*PSSMPMNZ)/CPINZ), ((PSCHNZ*MKFCHNZ)/CPINZ),QSMMNZ*MMKFNZ, IBTNZ ;
	QSOTFNZ	= QSMMNZ*MMKFNZ - QSBTFNZ ;
	QSSNFNZ	f ((1.78*PSSMPNZ)/CPINZ,QSSNF(-1), QSBTNZ) ;
Domestic Milk-Product Retail Demand		
	PCDBTNZ	f (T) ;
	PCDCHNZ	f ((PDCNZ/CPINZ),(PCYNZ/CPINZ), PCDCNZ(-1));
Exports		
	XBTNZ	= (QSBTFNZ/1.19)-(PCDBTNZ*POPNZ)-DSBTNZ;
	XOTFNZ	= QSOTFNZ-((PCDCNZ*POPNZ)*MKFCHNZ) -QDWMFNZ-DSOTFNZ;
	XSNFNZ	= QSSNFNZ-DSSNFNZ ;
Guaranteed Ex-Factory Product Prices		
	PSBTNZ	f ((PWBT(-1)/XRNZ(-1))) ;
	PSCHNZ	f ((PWCH(-1)/XRNZ(-1))) ;
	PSSMPNZ	f ((PWSMP(-1)/XRNZ(-1))) ;
Weighted Factory Wholemilk price		
	WTMMPNZ	= (((PSBTNZ/23.4) + (PSSMPNZ/11.0))*100 *(MMKFNZ/0.035)
Retail Cheese Price		
	PDCHNZ	f (PSCHNZ,(WAGENZ(-1)/CPINZ(-1)) ;
Wholemilk Guaranteed Farm-gate Price		
	MMKPNZ	f (WTMMPNZ,DUM72) ;

Notes:
1) constant terms and dummy variables are omitted for simplicity
2) Variables are defined in Appendix 2.

3.2 Milk Production

3.2.1 Introduction

The New Zealand dairy industry is almost totally pasture based with a temperate maritime climate suited to continuous pasture growth over much of the year. In addition, the climate allows cattle to be kept outside all year round. The main factory-supply dairying areas are located in the North Island where topography and climate are most favourable (currently 92% of dairy cattle). Herds are mated so that calving will coincide with the period of best pasture growth in September and October, and this pastoral reliance in turn results in seasonal variation, with more than 50% of production achieved in the spring and summer.

Ten percent of dairy farms produce milk for the fluid market and recieve a price premium to reflect the additional costs and lower yields associated with producing during the winter. In this paper milk no endogenous explanations of the fluid milk sector is provided. Clough and Isermeyer(1985) provide a useful description of the characteristics and structure of both forms of milk production in New Zealand.

3.2.2 Dairy Cow Numbers

Over the last 20 years there has been an increased realisation that per-hectare production is most important to a pasture based industry such as dairying, because this is the appropriate measure of how efficiently a given amount of pasture is converted into milk. Per animal yield is less important. In turn, increasing production per hectare means obtaining an optimum stocking rate. As a consequence, over the sample period there has been a rapid increase in average herd sizes on factory-supply farms to capture these perceived economies of scale. Similarly, there has been an offsetting reduction in the number of herds, and hence, herd managers, with farm sizes varying but stabilising. Although these factors have reflected the degree of amalgamation that has taken place in dairying in New Zealand over the last twenty years, the net result has been only slight alterations to the total number of milking cows in any one year.

Any attempt to econometrically model the small variations in the size of the national factory-supply dairy herd would appear difficult. However, an alternative to estimating the total supply function exists, and may be applied in this case. By examining the factor supply functions, and assuming perfectly competitive markets for these, the total supply function can be easily derived. (See for example Henderson and Quandt(1980, Pp154-157)). In the case of dairying the most limiting factor is the supply of labour, or more specifically, the supply of dairy herd managers.

The number of herd managers should be closely approximated by the number of factory-supply herds. As indicated by NZDB(1984) and supported by NZDS statistics on farm ownership, the typical dairy farm has traditionally been owner-operated. The supply of these farm units would in turn be determined by the profitability of dairying relative to other farming activities - principally beef, and the opportunity cost of farming in general - nonfarm wage income. Probably the best measure of the relative profitability of dairy farming would be relative land prices. However, using land prices would require an

endogenous examination of total farm income, investment and profitability and is beyond the scope of the current research (See for example, Laing and Zwart(1983) for such an analysis of the New Zealand pastoral sector). The farm-gate milkfat price relative to costs would give an approximation to this underlying profitability.

A relative index of non-farm wages is used to provide a measure of the opportunity cost associated with dairy farming. Of course, decisions regarding the viability of dairying are not instantaneous decisions, but are based on a reflection of previous and anticipated conditions. A representation of the movement in stock of dairy farms, and hence managers, would thus include a sufficient lag to capture the main dynamics of these decisions. Pretesting indicted a lag of one year was adequate for explaining a large proportion of dairy labour supply.

A summary of the Least Square estimation results for the supply of factory-supply dairy farms is presented in Table 3.2. The negative sign and magnitude on the lagged wage variable are consistent with a priori considerations of substitutability. Similarly the estimated coefficient on own-price indicates theoretically consistent behaviour, although the calculated response elasticity is quite low (0.038). The magnitude of coefficient on lagged herd sizes (0.84) suggests a slow adjustment process taking place in actual herd sizes and consequently the desired supply of dairy farm labour. Based on this estimate 90% of the desired adjustment is accomplished in 13.0 seasons. All the coefficients are statistically significant at 0.05 level based on the critical t values in Appendix 3. except the real farm-gate milk price. Overall, the results suggest a high proportion of the variation in farm numbers is explained by the current specification. However, since the decline in the number of factory supply farms has shown strong trending behaviour, such a result is not surprising. The ability to explain the determinants of milk production is a crucial factor to the overall ability of the model to reflect subsequent decisions based on milk production.

Table 3.2: Summary of Factory-Supply Farm Numbers Estimation

Dependent Variable:	NHNZ
Explanatory Variables:	
CONSTANT	4.02
	(2.55)
WAGENZ(-1) / CPINZ(-1)	-0.02
	(-1.96)
MMKPNZ(-1) / CPINZ(-1)	3.18
	(1.03)
NHNZ(-1)	0.84
	(25.12)
DW	1.40
R^2	0.99

3.2.3 Herd Size and Total Cow Numbers

The supply of farm labour does not by itself describe the total supply of cows, and hence the the total supply of milkfat available for processing. Average herd size is the scaling factor required to produce total cow numbers from the following identity:

COWNZ = NFNZ*HSNZ

The rapid increase in average factory-supply herd sizes is largely in response to changes in technology that have taken place during that time. These include investment in milking sheds, management programmes etc. This nearly linear increase may be adequately represented simply as a function of a linear trend variable as used in Robertson et.al(1986). However, for current purposes very little is lost by its absence from the model. Moreover, technology changes can still be examined via exogenous shifts in the time paths of the herd size or yield variables. It should be noted that due to data collection problems the data on the number of cows in milk refers to cows producing to both the processing and fluid milk markets. The number of herds however, refers only to factory supply farms. Consequently, average herd size estimates used in the model may be potentially biased. Of course this will cause little concern if a similar dynamic restructuring process is occuring in the town milk industry also.

3.2.4 Milk Yield

In addition to the patterns in monthly variation of milk output during the year, annual average milk yield per cow is highly variable. Yield is closely related to the amount and quality of concentrates (grain) fed, and in New Zealand, production per cow is relatively low compared with the United States and Canada, since it is pasture based. In this situation, variations in year-to-year milk yield is typically a function of pasture development, climatic conditions, sunshine, feed reserves, size of calve and heifer herds. The long term growth trend in average milk yield over the last thirty years largely reflects the level of participation in herd improvement - artificial breeding programmes, and investment and improvements in management techniques.

La France and deGorter(1985) represent milk yield in the US as a strictly technical quadratic function of concentrate and roughage feed intake, and the level of herd testing. However in New Zealand such an excercise is unlikely to provide a good base for forecasting because of the dominant influence of climatic conditions.

Preliminary estimation of a partial adjustment price response function for per cow yield in New Zealand provided an adequate and theoretically consistent overall fit to the data, but severely under and over estimated yield in drought and flush years respectively. The result then provided inaccurate milk production estimates for those years. When the equation was supplemented with a measure of distributionally-weighted soil moisture deficit the poor results were only marginally improved. This is probably due to the carry-over effect of high variations in climatic conditions to the subsequent year's milk production.

The impact price elasticity was calculated at 0.091. The mean adjustment lag was 0.858 periods and 90% of desired adjustment was estimated to take place by 2.9 seasons. That is, although the immediate price response is very low, it appears to encourage investment which produces desired adjustments in yield within the normal breeding-to-production cycle. The effect of prices on long term capital investment in yield improving activities in dairying have also been examined in the Laing & Zwart (1983) study, and subsequent work by Grundy (1987). Their results also suggest low impact price responsiveness but a rapid adjustment process.

It was concluded that although yield was dominated by exogenous factors it would be incorporated into the model because of the apparent price adjustment process and the inclusion of endogenous price response functions in the overall model. Following simulation of the complete model it was found that the yield equation introduced little additional bias to the simulation. Clearly, this provides scope for more research on this important area. (Details of the comparison of the with and without simulation is avaliable on request from the authors). The results of estimation are provided in Table 3.3.

Table 3.3: Summary of Yield equation Estimation

	Dependent Variable: YIELD
Explanatory Variables	
CONSTANT	-0.33 (-0.92)
MMKPNZ(-1) --------- CPINZ(-1)	1.08 (1.57)
RAINNZ	-0.01 (-6.41)
T	0.02 (5.11)
YIELD(-1)	0.46 (4.45)
DW	1.65
R^2	0.94

3.2.5 Total Supply of Milk for Processing

Based on the previously described stocking relationship and yield equation, plus information on on-farm utilisation, and fluid(town) milk production, the total supply of milk for manufacture in any period can be represented by the following identity:

QSMMNZ = (COWNZ*YIELD) - FARMUS - FLUIDMK

3.3 Processing Sector

As in milk production, the New Zealand processing sector is in a continuous state of restructuring - particularly since the early 1960's. In 1960 there were 106 factories producing butter; 151 producing cheese, and 11 producing skimmilk powder. By 1982 there were 28 factories producing butter; 27 producing cheese; and 32 producing skimmilk powder. There has been extensive amalgamation of co-operative firms and rationalisation has seen the closure of numerous factories. The trend toward larger multi-product firms has resulted in a high level of technical efficiency within the sector. Clough and Isermeyer(1985) note however that although scale economies in manufacture are important, there remains marked regional concentrations and specialisations within the processing sector itself.

3.3.1 Processing Options

The products manufactured from milk can be divided into 3 general groups:

(i) those consisting almost entirely of fat (eg. butter, Anhydrous milkfat,(AMF))

(ii) those consisting almost entirely of solids non-fat (eg. Skimmilk powder,(SMP) and casein); and

(iii) other products which are fat based such as cheese and wholemilk powder.

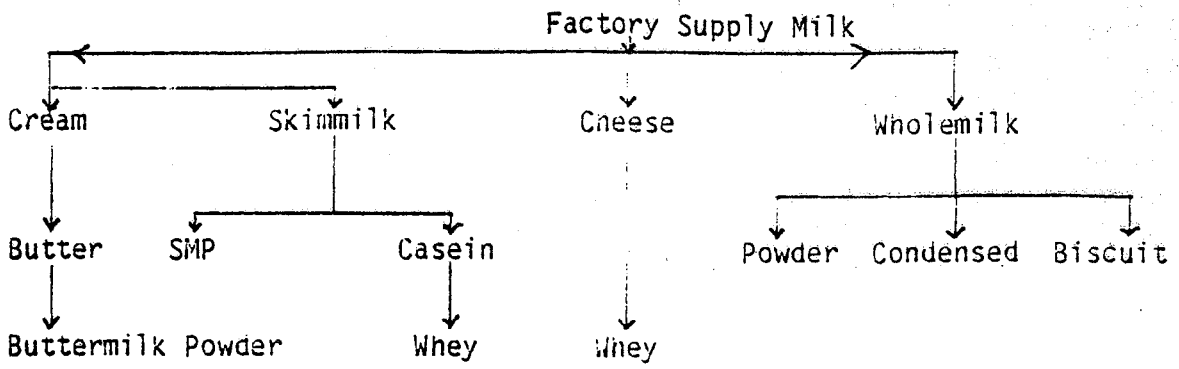
Depending on ruling output prices and relative costs, the products will compete for the various milk fractions. The solid non-fat products are essentially by-products from butter processing, but these too may compete for components of the raw milk. Therefore, market returns may be 'hidden' within any given output payment system.

Clearly the choices made by manufacturing companies are the result of a complex decision matrix. However, assuming that the necessary production facilities are available, a primary decision is whether to produce butter or other fat based products such as cheese, wholemilk powder, and condensed milk since both cannot be produced from the same milk.

If cheese is produced, the excess (whey) is used to produce lactose directly, liquid stock feed or whey butter. If butter is produced, the resulting non-fat (skim) milk can be manufactured into either buttermilk powder, skim milk powder (SMP), or casein. Therefore, other fat-product processing excludes butter, casein and SMP production, and the production of casein excludes the production of SMP.

Approximately 3% of milk is protein, of which about 80% is in the form of casein. This casein protein is available directly by extracting the casein via an acid or rennet process or by drying skim milk to form SMP. As the proceeding discussion has indicated, the solid non-fat products are produced in conjunction with butter, and are essentially by-products of butter production. Therefore, the quantity of the various milk produced is closely related to the relative profitability of the various combinations of each 'group' of products. These relationships are summarised in Figure 3.3 below.

Figure 3.3: Summary of Dairy Processing Options



Because each of the fat based product groups considered here; butter, and other fats, uses different fractions of the available milkfat, they are expressed in terms of milkfat equivalents. The production of solid non-fat products is similarly expressed on a skimmilk basis. To provide a consistent basis for comparison prices are also reported in terms of the fat and solid nonfat milk values using the yield conversion factors described in Appendix 2.

Each equation in the manufacturing block is described below:

3.3.2 Butter Processing

The production of butter can be equivalently considered as a input demand function for milkfat. That is, of any given milkfat produced, butter must compete with the other potential uses of the milkfat. Relative guaranteed offer-to-purchase prices of butter and products such as cheese and wholemilk powder will largely determine the allocation. However, the returns for producing butter also involves revenue from producing butter by-products such as skimmilk powder and casein, and should be given explicit consideration. Also, due to butter's high milkfat content(84%) it tends to dominate changes in milkfat availability. Thus total supply of milkfat is included as an explanatory variable. (Similarly, total expenditure is included in typical demand equation systems). Finally, during the early 1980's New Zealand imported butter from the US for re-export to the USSR. This depressed New Zealand's export demands, and consequently processing demands.

Least squares estimation of the butter processing equation is presented below in Table 3.4. All the estimated coefficients were significantly different from zero at a 0.10 level of significance and indicated consistent a priori responses. The own-butter/skimmilk-price response elasticity at the mean was calculated as 0.117 and a relatively strong cross price elasticity for the cheese (representing the price for other fat products) was calculated as -0.159. The milk avaliability elasticity was calculated at 0.805, and highlights the dominance of butter in milkfat utilisation.

Table 3.4: Summary of Butter Processing Equation Estimation

Dependent Variable: QSBTFNZ Explanatory Variables:	
CONSTANT	51.35 (2.04)
(PSBT+PSSM) ---------- CPINZ	414.96 (1.47)
(PSCHNZ) -------- CPINZ	-508.50 (-1.50)
QSMMNZ	0.63 (12.43)
IBTNZ	-0.40 (-2.82)
DW	1.65
R^2	0.93

3.3.3 Non-fat (Skimmilk) Processing

By converting skimmilk powder and casein into their skimmilk equivalents, an equation expressing the processing of solid non-fat products can be specified. Here, solid non-fat production is given as a linear function of: (1) own-price (using the guaranteed offer-to-purchase price for skimmilk powder in skimmilk equivalents); (2) lagged production levels to represent the constraints of technology and relatively higher levels of capital investment required in skimmilk powder and casein manufacture; and (3) the current level of butter processing, which is the final limiting factor on any growth in skimmilk processing.

Ideally, the simultaneity between butter and solid-nonfat processing should be approached as a two equation simultaneous system, and this issue is will adressed in future work. In its present form, estimation suggests that decisions regarding nonfat processing follows the decision of what level of butter to process. This may or may not be an overly simplifying assumption in the model. Of course, given the annual nature of the data, it is valid to suggest that the entire model would be better estimated as a system. Again this issue will be the focus in future work.

The least squares estimation results of the nonfat processing equation reported in Table 3.5. show that this specification provided good statistical results. All the cofficients are significant at high confidence levels, and the overall fit is tight. Based on these results the calculated own-price elasticity mean is 0.119, and the mean

adjustment lag length is less than one year. 90% adjustment in desired production is acheived in 2.6 seasons which suggests that investment in plant development etc provides only a very loose constraint on desired nonfat processing levels. The calculated elasticity mean for the availability of butter is 0.985 and highlights the close interdependence between butter and nonfat processing decisions. That is, a 1% change in butter production yields an almost equivalent response in nonfat processing.

Table 3.5: Summary of Solid-Nonfat Processing Equation Estimation

	Dependent Variable: QSSNFNZ
Explanatory Variables:	
CONSTANT	-67.72 (-2.52)
PSSMNZ / CPINZ	975.69 (2.24)
QSSNFNZ(-1)	0.42 (4.14)
QSBTNZ	0.76 (5.99)
DW	1.62
R^2	0.98

3.3.4 Other-Fat Processing

To close the system , the manufacture of other products in milkfat equivalents, is defined as the residual between total milkfat supplied and that proportion utilised in the manufacture of butter. This identity ensures that all available milkfat is used and is constrained by the product transformation elasticity calculated from the parameter on the total milkfat variable in the butter equation above.

The identity is expressed as:

QSOTFNZ = QSMMNZ - QSBTFNZ

3.4 Domestic Retail Demand

In New Zealand almost all dairy products are produced for the export market. Of these, only butter and cheese are consumed on domestic markets to any degree. Table 3.5 below displays the relative importance of domestic sales for a number of manufactured dairy products.

Table 3.5: Domestic Consumption of Dairy Products in N.Z.
'000 t of product

	1965	1970	1975	1980	1985
Butter	51.3	50.7	46.3	43.8	39.3
% of production	(21.4)	(21.9)	(19.7)	(17.0)	(13.3)
Cheese	8.6	11.6	15.3	26.5	27.3
% of production	(8.0)	(11.6)	(17.3)	(25.1)	(23.2)
SMP	4.5	8.6	5.7	5.6	1.1
% of production	(5.5)	(7.7)	(2.3)	(3.3)	(0.5)
Casein	0.0	0.0	0.0	0.0	0.0

Source: NZDB.

Clearly the relative importance of the domestic consumption of SMP, casein and other products is so small that little would lost from the model if they were treated as exogenous in the models current specification.

Per capita consumption of butter in New Zealand is high by international standards. Moreover, it has declined steadily over the last 20 years as New Zealand consumers have made substantial adjustments in their eating habits and attitudes toward butter and other fatty products in dietary behaviour. As Clough and Isermeyer(1985) note, this reduction in butter consumption has been inversely related to the direction of its price. Until 1974 the sale of butter's major competitor, margarine, was banned, and large butter subsidies maintained its price advantage until the late 1970's. However, this movement in relative price appears to have had no effect on the rate of decline in butter consumption.

For cheese, per capita consumption has displayed an overall growth trend over the last twenty years as a result of vigorous advertising strategies by manufacturing companies, and its relative price competitiveness as a source of protein. However, the rate of growth has levelled off somewnat since the late 1970's.

As expected, preliminary examination of various demand specifications for per capita consumption of butter failed to yield any degree of normal association between price, income and consumption. This was largely due to the dominant role that the unobservable changes in tastes and preferences were playing. Consequently, butter per capita consumption was modelled simply as a function of a log-of-time trend variable, chosen to express these steadily changing attitudes. Per capita consumption of cheese was regressed against lagged

consumption, the retail price deflated by the CPI index, and CPI deflated disposable income. The least squares estimation results for these regressions are reported in Table 3.6.

Table 3.6: Summary of Per Capita Consumption Equation Estimation

Dependent Variable:	PCDBTNZ	PCDCHNZ
Explanatory Variables:		
CONSTANT	0.14 (19.89)	0.003 (1.43)
LT	-0.03 (-17.57)	
PDCHNZ/CPINZ		-0.01 (-2.03)
PCYNZ/CPINZ		0.18 (1.49)
PCDCHNZ (-1)		0.75 (6.88)
DW	1.59	1.13
R^2	0.98	0.97

The estimation results from the per capita consumption of butter equation highlight the trend nature of the relationship. For cheese, the own price and income elasticity means are calculated as -0.541 and 0.332 respectively based on parameter estimates which show both theoretical consistency and statistical significance. The relevant t values in Appendix 3. indicate all the parameters are significantly different from zero at a 0.10 level of significance. The parameter on the lagged consumption variable suggests a slow adjustment process. The associated mean adjustment lag length is calculated as 3.03 years, and 90% of the desired adjustment in cheese consumption patterns is expected to take 8 years.

Despite the good fit on the basis of a high R squared, their appears to be some serial correlation in the residuals of the cheese equation. This is despite the inclusion of a lagged dependent variable, and suggests that the equation may be still mis-specified due the absence of any competitive price variables. The consequences of this result on a dynamic simulation is discussed in Section 4.

3.5 Dairy Product Exports

Based on the specification of the domestic supply and demand mechanisms in New Zealand, the treatment of stocks as exogenous to the model, and the non-endogenising of world prices into the net exporting sector at this stage, exports of dairy products can be constructed from the supply-disposition identity. Also, for our purposes we may consider imports into New Zealand are negligible, except for the one-off imports of butter in the early 1980's.

Therefore, all production not utilised domestically, either for consumption or as stocks, is exported. Further work would of course include considerations such as world demands, trade restrictions and regulations. At this stage however, since a world market is not included explicitly, the following specification of net exports would seem appropriate:

XBTNZ = (QSBTFNZ/1.19) - (PCPBTNZ*POPNZ) - DSBTNZ

XOTFNZ = QSOTFNZ - ((PCDCNZ*POPNZ))/MFCHNZ) - QDWMFNZ - DSOTFNZ

XSNFNZ = QSSNFNZ - (QDSNFNZ) - DSNFNZ

It is important to note that based on the model's overall specification the export of other fat products equation (XOTFNZ) represents the residual identity from the rest of the model. That is, errors in the other sectors in the model feed through to this export equation. The production of other fat products (QSOTFNZ) is itself a residual item, and the per capita consumption of cheese (PCDCHNZ) is an estimated behavioural equation. The consequences of this on the models, and in particular, this equation's simulation behaviour is discussed in Section 4.

3.6 Price Setting

3.6.1 Guaranteed Product Prices

In section 2.2 the price setting role of the New Zealand Dairy Board for manufactured dairy products was described. In summary, the mechanism links the world price to Dairy Board purchase price, and the farm-gate milk price. The Board sets offer-to-purchase for export prices for the processed products based on expected world market conditions, and stock holding capabilities. In general, the most recent information available is the previous years. Based on relative national average milkfat yields and costs of production these prices are then converted into the milkfat price paid to the farmer. These prices usually remain fixed through out the year until an end of season distribution is decided upon.

The New Zealand Dairy Board's buffer-fund scheme has typically only altered the offer-to-purchases prices marginally, and preliminary estimation which accounted for the availability of financial reserves proved insignificant. Table 3.7a indicates the balance of the Dairy Boards Reserve Account fluctuates around a zero mean. In periods of high world prices, as in the early 1970's and 1980's, substantial surpluses have been generated, but these have generally been followed by off-setting trading losses (as is expected given the volatile nature of world dairy prices). Thus it is safe to conclude that

despite the possibility of marginal adjustments to the price transmission process via accumulated funds or deficits, the expected world price is the dominant factor in influencing the begining of season guaranteed product-pricing decision.

Table 3.7a: Balance of the New Zealand Dairy Boards Buffer-Fund

Year	Trading Account Balance $NZ million	Reserve Account Balance $NZ million
1968	-1.6	-12.8
1969	-3.2	-16.0
1970	-4.1	20.1
1971	0.0	20.1
1972	33.9	13.8
1973	4.6	18.4
1974	-6.6	11.8
1975	6.0	17.8
1976	-43.0	-26.0
1977	23.1	-2.9
1978	0.8	-2.1
1979	-25.1	-27.2
1980	61.3	4.1
1981	97.0	51.1
1982	137.8	113.9
1983	124.2	168.1
1984	-16.1	152.0
1985	161.4	398.0
1986	-476.9	-48.4

Source: Statement of Accounts (NZDB) 1985, 1986.

The model requires explanation of butter, cheese, and skimmilk powder offer-to-purchase prices. Although these pricing decisions are probably made simultaneously (especially given the annual framework of the model) estimation of simple own-price equations involves no cross equation restrictions and so the contemporaneous error terms can be assumed uncorrelated.

Assuming the previous years average world prices in US dollars and the US to NZ exchange rate are the latest information available to the New Zealand Dairy Board, then nominal advance guaranteed offer-to-purchase prices may be represented as linear functions of lagged world prices in New Zealand dollars. This specification however raises two related issues. Firstly, since the world prices and offer-to-purchase prices are so closely linked, it is not surprising that evidence suggesting positive auto-correlation (or downward bias of the true least standard errors), was found in the residuals of the intial least squares estimates of these equations. Secondly, since there has not been any major shifts in the operation of the price linkage mechanism over the sample period, is a variable or constant elasticity representation more consistent with the data? The relationship between these considerations lies in the fact that mispecification of a functional form can easily lead to auto-correlation problems. When coupled with an underlying upward or downward trend in the economic variables, this generally surfaces as positive auto-correlation.

Appendix Four presents the results produced using a simple technique used to discriminate between functional forms. In this case the test is between a linear, and therefore variable elasticity formation, and a constant elasticity log-linear form of the world price transmission mechanism. The results of this testing suggest that the log-linear specification improves upon the linear form staistically, in terms of both higher predictive power, and the absence of auto-correlation. Overall this provides a subtantial improvement in goodness of fit.

The estimation results are presented in Table 3.7b. All the coefficient estimates are significant at 0.01 levels of significance based on the critical t-values listed in Appendix 3, and indicate strong associations between world prices and offer prices. This result is consistent with prior notions of the reliance on world market conditions, and exchange rates, which are taken here as being as exogenous to the model.

Although the adoption of a log-linear functional form implies the potentially restrictive assumption of constant elasticity, it is interesting to note that the transmission elasticities implied by the log-linear specification are very similar to the means of the variable elasticity linear forms. The world price transmission elasticities are all high: 0.872, 0.954, and 0.904 for butter, cheese and skimmilk powder respectively in the log-linear model, and 0.902, 0.961, and 0.914 repectively in the linear model.

The high elasticity for cheese supports a hypothesis that short-storage life products are the most responsive to market prices. Moreover, results indicate that the New Zealand Dairy Board places a significant weighting on world trading prices when setting their guaranteed product prices.

Table 3.7b: Summary of Guaranteed Product Price Equation Estimations

Dependent Variables:	LPSBTNZ	LPSCHNZ	LPSSMNZ
Explanatory Variables:			
CONSTANT	-6.11 (-19.03)	-6.74 (-23.32)	-6.37 -(16.04)
LOG (PWBT(-1)/XRNZ(-1))	0.87 (19.08)		
LOG (PWCH(-1)/XRNZ(-1))		0.95 (23.31)	
LOG (PWSM(-1)/XRNZ(-1))			0.90 (14.04)
DW	1.45	1.48	1.27
R^2	0.95	0.97	0.92

3.6.2 Guaranteed Farm-gate Milk Price

As indicated in Table 3.9 below, the government's supplementary minimum price scheme and the Board's end of season distribution schemes have had only minimal influence on the total farm-gate milk price paid to producers. Based on the pricing mechanism for processed dairy products presented above, and the annual framework of the model, an appropriate specification of the milkfat price paid to producers in any year is posited as:

$$PSMFNZ = f(WTMMPNZ, DUM72)$$

Where WTMMPNZ represents the wholemilk equivalent offer-to-purchase price for butter and skimmilk powder adjusted for their yield factors as described in Appendix 2.

Since WTMMPNZ is an ex-factory price it includes all collection and processing costs. The dummy variable for 1972 is included to account for the jump in the farm-gate milk price in that year. This was caused by the high end of season payment. The Board anticipated high international prices in the following year as the world agricultural commodity boom began to take hold. The actual world prices for most products began to rise in late 1972 to early 1973.

Table 3.9: New Zealand Average Producer Milk Price $/kg milkfat (current)

Year ending May	Advance Price	End of Season Payment	Total Milk Price
1966	0.81	0.00	0.81
1967	0.81	0.00	0.81
1968	0.75	0.00	0.75
1969	0.71	0.00	0.71
1970	0.72	0.00	0.72
1971	0.83	0.03	0.86
1972	1.08	0.13	1.24
1973	1.12	0.03	1.15
1974	1.28	0.00	1.28
1975	1.24	0.03	1.27
1976	1.31	0.10	1.41
1977	1.36	0.17	1.53
1978	1.51	0.17	1.68
1979	1.66	0.07(SMP=0.07)	1.80
1980	1.85	0.23	2.08
1981	2.30	0.35	2.65
1982	2.85	0.49	3.33
1983	3.18	0.43	3.61
1984	3.40	0.10	3.50
1985	3.81	0.15	3.96
1986	4.00	0.00	4.00
1987	2.25	0.95(F)	3.20(F)

Source: NZDB Annual Reports - various and pers comm
(F) - From 1986 the advance price can be adjusted several times during the year. The final average price is expected to be around $3.20 as world market conditions pick up.

For this price transmission linkage a log-linear specification is again considered, and the results from testing this specification are reported in Appendix 4. The data does not reject the constant elasticity form based on the differences between the residual sums of squared residuals. The log-linear estimation results are summarised in Table 3.10 below. All the coefficients are statistically significant at a 0.01 level of significance and yields a constant transmission elasticity of 0.998. This figure indicates that the weighted ex-factory offer price (which include margins for industry costs), measured in wholemilk equivalents, can be related virtually in direct proportion to the farm price.

By way of comparison, the mean transmission elasticity from the linear model is calculated as 0.989. Given the low residual sums of squareds reported in Appendix 4 for both the log-linear and linear models, it is not particularly surprising that the two elasticities are so close.

Table 3.10: Summary of NZDB Guaranteed Farm-Gate Wholemilk Price Equation Estimation

Dependent Variable:	LMMKPNZ
Explanatory Variables	
CONSTANT	-0.37 (-10.88)
LOG WTMMPNZ	0.99 (73.81)
DUM72	0.33 (8.97)
DW	1.62
R^2	0.99

3.6.3 Domestic Retail Price

As described in Section 3.4, of the dairy products consumed domestically that are considered in the model, only cheese appears to subject to any relative price effect. Therefore, retail prices for butter SMP, casein and other products such as wholemilk powder and condensed and evaporated milk may be excluded from consideration in the model.

Domestic retail prices have been affected, to a large extent, by Dairy Board intervention whereby returns must be equalised for the manufacturer from the local market and from export sales. Also, the Department of Trade and Industry, until 1981, determined the margins between the ex-factory and retail prices. These fixed margins are relatively small for butter compared with its main competitor margarine, thus keeping its real retail price reasonably constant. For cheese, which is not subject to controlled margin selling, competition

between manufacturers has seen a steady decline in the real retail price over the last ten years. As a result of this regulated system of equalisation and margin prices, retail prices are very much linked to current offer-to-purchase prices and retailing costs.

Least squares estimation results for the retail cheese equation is reported in Table 3.8. The specification is a simple margin equation, and as indicated by the t statistics on current offer-to-purchase and the wage rate index are strongly significant. Both variables display positive response elasiticities. The calculated retail price transmission elasticity mean is calculated as 0.76.

Table 3.8: Summary of Retail Cheese Price Equation Estimation

Dependent Variable:	PDCHNZ
Explanatory Variables:	
CONSTANT	26.69 (7.07)
PSCHNZ	88.40 (4.03)
WAGENZ	2.18 (4.68)
DW	1.51
R^2	0.99

Section 4 Model Validation

4.1 Introduction

Models such as the one described in the preceding sections are generally referred to as conditional models in that they are systems of equations that cannot be solved without additional information, typically the values of the variables which the model takes as predetermined or exogenous. Given this information the structural econometric model of the New Zealand dairy industry can be statistically analysised via a dynamic, deterministic, ex-post, control simulation over the estimation period, 1967 to 1986.

Generally the statistical results obtained during estimation supported the models structure as specified. However, while individual regression results are indicative of the complete model's validity, verification is formalised by examining the overall fit given the interactions among variables across individual equations. By adopting an ex-post approach all the values of the endogenous variables are used to 'drive' the model and lie within the data set used for estimation. This provides a pure test of the quality or 'validity' of the model since if other than actual values are used to simulate the model, any errors in the solution may not be due to mispecification of the model but may instead reflect the fact that the model was solved with inaccurate information. (See for example McNees(1982) for a discussion on this and other issues relating to role of econometric models in policy analysis).

A dynamic simulation requires the use of simulated rather than actual values for lagged endogenous variables in the model. Therefore, any serial correlation in the estimated equation's error terms will feed through the system of equations and may distort the simulated values of the model. Such an approach thus provides an additional demanding test for the models overall ability to capture the systems operation over time.

The overall 'validity' of the complete model as judged by the simulation process can be discussed in terms of both statistical and graphical results. The summary statistics of the validation solution for the 11 behavioural equations and 7 identities are presented in Table 4.1. The verification statistics reported are the mean absolute percentage error, MA%E, the percentage root mean squared error, %RMSE, Theil's inequality coefficient (version one), U, the correlation coefficient, r, between the actual and predicted series, and the regression coefficient, b, of the actual on the simulated or predicted series.

Each of these statistics highlight slightly different aspects of the model verification process. The MAPE captures the size of prediction errors in relation to the actual series, while the %RMSE weights large prediction errors. Theils U statistic is a measure of forecast accuracy in terms of prediction of changes in actual endogenous variables. These verification statistics are derived and fully explained in most standard econometric and time-series texts such as Pindyck and Rubinfeld (1981). Summarising however, values for the MA%E, %RMSE, and Theils U approaching zero indicate simulation solutions which reproduced the actual series with increasing accuracy. Of the other statistics, the squared correlation coefficient, r, measures the strength and direction of association between the actual

and predicted series. Values of r equal to positive one imply perfect association between the two series, while the value for b, the regression coefficient, provides a numerical indication of the size of the relationship.

Before discussing the results from the historical simulation however, it should be noted that while the aim of model validation is to test the overall system of equation's ability to generate a time path close to the actual, there must still remain judgmental trade-offs among all the verification criteria. The final acceptance or rejection of a particular model is still a result of the 'art' of model validation more than the 'science'.

4.2 Validation Results

Equations based on a lagged structure perform worst as expected, and the model's poorest performing equation, the identity to explain the export of other fat products, incorporates the errors in simulation accumulated from all the production and consumption related equations.

However, despite these problems the overall results are encouraging. As indicated by the results presented in Table 4.1 the correlation and regression coefficients are of acceptable magnitudes in general, and the Theils U statistic is surprisingly low in most instances given the demanding nature of dynamic simulation.

In its current form the model appears to provide a useful and statistically supported description of the operation of the New Zealand dairy industry and policy over the sample period. By and large the model operates in response directly to price signals. Therefore, if, as is suggested by government and Dairy Board initiatives, New Zealand dairying is to be even more market lead in the future, then this model should provide a useful base on which to initiate policy and further modelling work.

Additional verification of the model's overall descriptive ability may be provided by examining such factors as starting-point and coefficient sensitivity, and ex-post forecasting. Ex-ante forecasting analysis for 1987 and 1988 will be an important goal for the model in future research as data on the exogenous variables becomes avaiable.

As a final validation check the model's reaction to one-off exogenous shocks (exogenous-variable sensitivity) is tested. For this purpose it is proposed that the rainfall variable, RAINNZ, which represents climatical conditions will be altered to its nistorical average. 1978 was actually a severe drought year and any improvement in soil moisture availablity such as this should have immediate impacts on milk yields, production and exports. In a well performing simulation model a change in the time path of an exogenous variable should not drastically alter the long-run time path of the simulation. Also, if the overall simulation solution is stable then following the intial impact, responses should diminish in magnitude.

Table 4.1: Simulation Summary Statistics

Variable:	%RMSE	MA%E	U	r^2	b
PSBTNZ	2.3	4.6	0.12	0.95	1.00
PSSMNZ	2.5	2.2	0.10	0.91	1.00
PSCHNZ	1.1	1.3	0.14	0.97	1.00
MMKPNZ	1.3	2.7	0.05	0.97	1.02
WTMMP	2.1	3.6	0.11	0.95	0.97
YIELD	3.1	2.7	0.03	0.90	1.08
NHNZ	2.7	2.2	0.03	0.98	1.04
COWNZ	8.8	7.3	0.03	0.65	1.03
QSMMNZ	6.3	6.0	0.05	0.84	1.04
QSBTFNZ	4.5	3.5	0.05	0.78	1.10
QSOTFNZ	10.2	8.8	0.13	0.67	0.92
QSSNFNZ	5.8	4.8	0.06	0.72	0.99
PDCHNZ	6.1	4.4	0.05	0.99	0.98
PCDCHNZ	10.6	7.6	0.09	0.90	1.04
PCDBTNZ	3.0	2.1	0.03	0.97	1.06
XBTNZ	7.2	5.5	0.05	0.70	0.88
XOTFNZ	15.1	13.3	0.18	0.46	0.62
XSNFNZ	7.1	6.0	0.06	0.94	1.02

One way to quantify these responses is to calculate the impact and dynamic percentage multipliers associated with the exogenous shocks. These determine the percentage change in an endogenous variable that would result from a percentage change in the exogenous variable under consideration. The results of a five year multiplier analysis are presented in Table 4.2, in the form of multiplier response functions for a number of key endogenous quantity variables.

Altering the 1978 value for RAINNZ to its historical average resulted in a 51.8% improvement the soil moisture deficit. Calculating the first period impact multipliers for these variables highlights the associated responses in the quantity variables. These calculated multipliers ranged from 0.290 for the export of other-fat products to 0.100 for the processing of solid-nonfat products. The speed at which stability in the system is re-established is indicated by the sum of the impact and subsequent dynamic multipliers. This calculated five year long-run multiplier ranges from 0.586 for the exports of other-fat products to only 0.220 for the production of butter.

Together, these measures provide clear support of the models overall stability under historical exogenous shocks.

Table 4.2: Rainfall Shock Response Functions

Percentage Impact and Dynamic Multipliers

Period:	0	1	2	3	4	5	Long-run
Variable:							
YIELD	0.138	0.060	0.026	0.012	0.006	0.003	0.245
QSMMNZ	0.155	0.036	0.029	0.014	0.006	0.003	0.243
QSBTFNZ	0.124	0.055	0.023	0.011	0.005	0.002	0.220
QSOTFNZ	0.267	0.120	0.049	0.021	0.008	0.005	0.470
QSSNFNZ	0.100	0.089	0.055	0.033	0.018	0.009	0.304
XBTNZ	0.167	0.072	0.025	0.014	0.006	0.003	0.287
XOTFNZ	0.290	0.161	0.088	0.027	0.012	0.008	0.586
XSNFNZ	0.084	0.091	0.050	0.036	0.019	0.009	0.289

4.3 Exchange Rate Policy Adjustment

Policy analysis has traditionally been an important role of econometric models. To this end it would be useful to examine the models predictions for the New Zealand dairy industry under some adjustment to a given policy rule. This is done in an ex-post framework were it is proposed that for the period 1979 to 1983 exchange rates were set ten percent lower than their actual levels. The resulting improvement in world prices can then be traced through the model and the resulting changes compared with the base dynamic simulation results. This procedure gives a clear idea of the operation of the model by mapping out the consequences of this policy adjustment on prices, production, and exports. However, it is important to

remember that this model treats world prices outside the system. It is not until all the regions are linked via the regional trade model that the endogenous determination of impacts of shifts in production and exports on world prices can be accounted for.

A summary comparison of this scenerio with the base results is provided in Table 4.3. Only a few variables are represented here, but the results are consistent with the rest of endogenous variables in the model. Exchange rate devaluation occurs in 1979, however, given the annual data the built-in expectations structure is such that the model does not record any response to the higher world prices until the following year. In 1980, the Board sets the product purchase and farm-gate milk prices based on the higher expected returns for that year, but the model does not anticipate any change in total milk production in 1980 because of the biological delays. This constraint on milk supply together with the cross-price substitution in processing leads to a reallocation of milkfat between butter and other-fat products as these products compete for the available milkfat. Butter processing is seen to decline as other-fat utlisation expands. The overall response from 1981 to 1983 is as expected, with higher prices feeding through into larger herds, increased yields, processing and exports.

As soon as the adjustment to the policy rule for exchange rates is removed in 1984 (corresponding to an actual major devaluation), prices revert to there previous levels. However, as before, the response is delayed one year. Production, processing and exports continue at higher levels due to the lags in the system, but the incremental response appears to be rapidly diminishing in 1986 as the model attempts to re-establish its stable time-path.

Table 4.3: Base-Simulation and Exchange Rate-Adjusted Estimates

	QSBTFNZ '000t		QSOTFNZ '000t		QSMMNZ '000t		MMKPNZ log($/100kg)	
	Base	Adjusted	Base	Adjusted	Base	Adjusted	Base	Adjusted
Year								
1978	198.2	198.2	55.3	55.3	5289.5	5289.5	2.0	2.0
1979	207.3	207.3	56.6	56.6	5443.2	5443.2	2.1	2.1
1980	222.3	221.3	63.6	64.6	5892.9	5892.9	2.2	2.3
1981	210.1	210.7	66.7	69.1	5758.9	5821.7	2.4	2.5
1982	197.5	199.6	76.0	78.8	5770.3	5873.7	2.6	2.7
1983	208.0	211.0	59.8	63.4	5623.5	5761.8	2.9	3.0
1984	232.6	236.8	77.0	81.9	6436.3	6625.8	2.9	3.0
1985	244.3	251.0	83.9	87.9	6878.4	7100.5	2.9	2.9
1986	255.3	260.1	98.6	101.5	7378.5	7536.6	3.0	3.0

Section 5. Conclusion and Caveats

As part of a joint USDA-AERU world dairy-trade modelling exercise, an analysis of the New Zealand dairy industry was undertaken to complement earlier studies by Clough and Isermeyer (1985), Johnston (1985), and the monitoring work conducted by the New Zealand Dairy Board. To assist this analysis, an econometric model of the industry was constructed using historical data, 1967 to 1986. This model details the economic aspects of milk production, processing, domestic consumption, international trade, and the mechanisms and influence of New Zealand dairy policies are described, estimated, and inferences drawn from the results.

The results of the model themselves appear quite robust under standard diagnostic testing, and the simulations of the model are used to examine the sensitivity of the industry to adjustments in exchange rates, as well as climatic fluctuations. As expected, an unanticipated shock to soil moisture availability has a significant and immediate impact on production and trade, but these effects quickly disipate over following seasons. A maintained 10% devaluation of the New Zealand exchange rate over the period 1979 to 1983 suggests improvements in prices, production and trade which would have altered the industries structure and performance well into the late 1980's.

In its present form the model is quite transparent and can be easily reduced in size and linked with the other regional models with out losing much of its current flavour. Hopefully, the results of the combined modelling exercise will provide further understanding of the international dairy-trade policy environment and form a basis for examining the international ramifications of alternative policy scenerios.

However, there remain a number of areas of concern with the current models specification that are likely to effect its accuracy and usefulness in policy analysis. These deficiencies clearly provide excellent opportunities for continued and extensive work in this area. The first problem relates to the potential simultaniety in the model, and the efficiency of parameter estimates from single equations versus a full simultaneous systems approach. Secondly, the model fails to account for the relative profitability of dairying to other farming enterprises. This is an important issue if other agricultural or horticultural activities compete for dairy farm land. Thirdly, the absense of endogenously derived world market clearing-prices is a source of bias in simulation results. This issue is rectified however in the complete regional trade model.

Finally, as with most modelling in agricultural policy, macro economic variables such as exchange rates and general price levels are treated as exogenous to the model. In many cases this distinction between the macro-economy and agriculture is well justified. However for large sectors of the economy such agriculture, (and within that the dairy industry), this may be a rather naive formulation. When placed in a dynamic setting these types of exogeneity restrictions take on important significance for policy modelling. That is, they deny the possibility that feedback mechanisms exist within the timepaths of agricultural variables to the macro economy. In the literature Sims(1980) discusses this treatment of exogenous variables in macro-econometric models, while for example, Orden(1986) has related these issues to the modelling of macro-economic/agricultural linkages.

APPENDIX 1

MAJOR REVISIONS IN MODEL SPECIFICATION

a) Overall, this version of the model uses only 18 equations and identities to describe is milk production, milk product manufacture and utilisation, and the price setting mechanism of the New Zealand Dairy Board. The original model consisted of 26 equations. Because of the underlying longterm objective of constructing a small manageable world dairy trade model it was decided that a simpler specification would better suit this purpose. There exists a natural progression from the current specification to that used in the world model. The world trade model itself is a set of regional specifications which summarise the effects of the range of policy instruments used in the major exporting regions, and can be used to aid medium term forecasting of future patterns of trade in milk products.

b) The utilisation of milk is now expressed solely in terms of four related milk products: fluid milk; milkfat used in the manufacture of butter; milkfat used in the manufacture of other milkfat based products; and the manufacture of non-milkfat (skimmilk) products. Since fluid milk incorporates milk used on-farm, but represents such a small proportion of total milk utilisation it is treated exogenously to the model.

c) As a consequence of the aggregation of product groups a simpler manufacturing block is employed with behavioural equations required only to describe the demand of milkfat used in butter manufacture, and the demand for skimmilk used in non-fat products. The demand for milkfat used in other fat-products is simply the residual from the total supply of milkfat.

d) The farm-gate price for milk is determined from the guaranteed prices for butter and skimmilk products adjusted for their respective yield factors. These joint products represent the fat and non-fat components of milk and ensure almost total utilisation of any given quantity of milk. In New Zealand prior to 1965, cheese was used as the basis for determining the milk price because it contained both a fat and solid non-fat component. However, the present method should provide a base consistent with the methods employed overseas. In addition, discussion of the farm-gate milk price is no longer in terms of its advance and final components but as an average seasonal price.

e) The determination of the guaranteed purchase prices for manufactured dairy products is now described for only three products: butter, cheese, and skimmilk powder. The cheese price represents the price of a major competitor for the milkfat used in butter production, while the skimmilk powder price represents the value of non-fat product manufacture.

APPENDIX 2.

DATA DEFINITIONS AND SOURCES

ENDOGENOUS VARIABLES

QSBTNZ	Manufacture of creamery butter,AMF and Ghee in '000t of 84% milkfat butter equivalent.
QSBTFNZ	Manufacture of QSBTNZ in '000t of milkfat equivalents.
QSSNFNZ	Manufacture of butter non-fat by-products (principally spray and roller process skimmilk powder and casein), converted to a skimmilk equivalent using yield factors presented in Appendix 2. -'000 t.
QSOTFNZ	Manufacture of other milkfat based products in '000t of milkfat.(Principally Cheese and Wholemilk powders).
QSMMNZ	Supply of milkfat for manufacture '000t of wholemilk.

Source: NZ Dairy Board(NZDB) Annual Reports - various.

PSBTNZ	Begining of year guaranteed offer-to-purchase price for butter in $/kg of product.
PSCHNZ	" " " " " cheese " " "
PSSMPNZ	" " " " " skimmilk powder

Source: NZDB Annual Reports - various, and pers comm.

PDCHNZ	Average retail price for cheddar cheese in $/t of product

Source: NZDS Prices,Wages and Labour - various.

PCDBTNZ	Average per capita consumption of butter - t of product
PCDCHNZ	" " " " " cheese " " "

Source: NZDB Annual Reports - various

XBTNZ	Exports of butter,AMF and Ghee in '000t of product
XOTFNZ	" " other milkfat based products in '000t of milkfat
XSNFNZ	Exports of butter by-products in '000t of skimmilk.

Source: NZDS Export Statistics - various, NZDB Annual Reports - various

NHNZ	Number of factory supply farms as at 31 Jan

Source: NZDB Production Reports - various.

YIELD	Milk yield per cow used to produce milk for processing in New Zealand in t's of milk. Constructed as QSMMNZ/COWNZ
COWNZ	Total producing cow numbers on factory supply farms '000hd - as at 31 Jan

Source: NZDB Production Reports, NZ Department of Statistics (NZDS) Agricultural Statistics - various

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MMKPNZ	Total farm-gate guaranteed milk price - $/kg of wholemilk (ave 4.6% milkfat)
WTMMPNZ	Weighted average ex-factory guaranteed offer-to-purchase price for wholemilk in - $/kg (constructed)

Source: NZDB Annual Reports - various

EXOGENOUS VARIABLES

MMKFNZ	Average milkfat content in wholemilk used in processing
MFCHNZ	Cheese milkfat yield factor

Source: NZDB pers comm and calculated(see Appendix 2.)

PWBT	World butter price - NZ f.o.b unit value - US$/t
PWCH	" " cheese " " " " " "
PWSMP	" " SMP " " " " " "

Source: constructed from NZDS Export Statistics and Value of Exports - various

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DSBTNZ	Change in stocks of butter Jun-Jul '000t product
DSOTFNZ	" " " " other milkfat products
DSSNFNZ	" " " " butter non-fat by-products

Source: calculated as residual from supply less demand less exports

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PCYNZ	Per capita disposable income '000 $.
POPNZ	NZ population
RWAGNZ	Non-farm wage rate index, June quarter.
CPINZ	June year average consumers price index
XRNZ	June year average NZ to US dollar exchange rate

Source: NZDS Monthly Abstract of Statistics - various

RAINNZ	Days of soil moisture deficit weighted by the distribution of dairy cattle.

Source: NZ Meteorological Service.

HSNZ	Average herd size on factory supply farms = COWNZ/NHNZ
DUM72	Dummy for 1972
T	Time trend
FARMUS	On farm use of milk
FLUIDMK	Milk consumed domestically as fluid milk
QDWMFNZ	Domestic Consumption of wholemilk powder and condensed milk converted to milkfat equivalents

NOTES:

1) The yield conversion factors for butter, skimmilk powder and casein are based on those reported up until 1981 in the New Zealand Dairy Board Annual Reports. These yield factors have remained relatively constant over these reported years and represent relative milkfat and non-fat contents. The average yield for cheese has changed dramatically over the sample period as the types of cheeses produced have altered. The milkfat/solid non-fat yields used are reported below:

Butter	- 1.19
Cheese	- 2.43 to 3.13
Skimmilk Powder	- 1.78
Casein	- 0.60

These factors can be interpreted as, for example, 1.19 kg of butter is equivalent to 1 kg of milkfat, or 1.78 kg of skimmilk powder is equivalent to 1 kg of solids non-fat.

The yield factor used for the other fat based dairy products such as: wholemilk powder, and condensed milk are based on data from Dairy Facts and Figures, produced by the Dairy Farmers of Canada organisation(1986). It is assumed that similar yields apply in New Zealand:

Wholemilk Powder	- 3.70
Condensed Milk	- 12.5

2) When converting to a milk equivalent the following conversion factors are used and are again based on Dairy Facts and Figures (1986). It is assumed that for 3.6% milkfat milk the production of 1kg of butter requires 23.4 kg of wholemilk and the production of 1 kg of skimmilk powder requires 11.0 kg of skimmilk. These conversion factors are then scaled according to an average New Zealand milkfat in milk basis of 4.67%.

APPENDIX 3

CRITICAL t STATISTICS AT VARIOUS SIGNIFICANCE LEVELS

Number of observations = 20

Degrees of Freedom	Significance level			
	0.20	0.10	0.05	0.01
18	1.33	1.73	2.10	2.88
17	1.33	1.74	2.11	2.90
16	1.34	1.75	2.12	2.92
15	1.34	1.75	2.13	2.95

VALUES OF UPPER AND LOWER DURBIN-WATSON STATISTICS AT 0.05 SIGNIFICANCE

Parameter Vector Size	Degrees of Freedom	D upper	D lower
2	18	1.39	1.16
3	17	1.54	1.02
4	16	1.73	0.86
5	15	1.97	0.69

Taken from Pindyck and Rubinfeld (1981).

APPENDIX 4

CRITERIA FOR CHOOSING FUNCTIONAL FORM OF TRANSMISSION ELASTICITIES

As noted in Section 3.6, the choice of variables to include in the specification for the world to domestic price transmissions should by guided by a priori knowledge and theoretical considerations. The choice of an appropriate functional form, on the other hand, is influenced by data and theoretical considerations simultaneously. That is, does the proposed functional representation make economic sense?

Typically, a simple specification would be chosen over a more complex form, if both can explain the problem equally well. More specifically, we may wish to attempt to evaluate the predictive power of the competing forms. For example, select the form which maximises the adjusted squared correlation coefficient. (minimise the residual sum of squares). However, direct comparison of the error terms requires that the alternatives have the same dependent variable. Clearly, in the case of a linear and log-linear specifications the dependent variables are not equivalent.

The problem is that of the absence of an appropriate constant scaling factor, C:

natural numbers * C = natural logs

Following Rao and Miller(1971), the case of linear vs log-linear specifications can be expressed as:

$$\text{Var}(C\,Yi) = C^2\,\text{Var}(Yi) \qquad \text{(A.1)}$$

$$\text{Var}(\ln C\,Yi) = \text{Var}(\ln C) + \text{Var}(\ln Yi) \qquad \text{(A.2)}$$

$$= \text{Var}(\ln Yi)$$

In equation A.1, the variance of Yi changes with the units of measurement of Yi. In A.2, the variance of Yi is independent, and therefore does not change, with the addition of the constant, C.

Now, because the Var(e) = Var(Yi) we can make the residual sum of squares, (e'e), of one form smaller than another simply by the choice of the units of measurement- that is, the choice of the scaling constant, C.

Therefore, the aim is to standardise (transform) Yi such that its variance does not change with the unit of measurement, and the residual sum of squares from any two forms being compared are on a common basis.

In the case of the linear and log-linear forms with the same dimensioned parameter vectors, Rao and Miller suggest a suitable transformation as:

$$Yi^{*} = CYi,$$

where,

$$C = \exp(-(\text{Sum}\ln Yi/N)) = \text{the inverse of the geometric mean of } Yi$$

and, N = the number of observations

The appropriate regressions then become:

$$Yi^{*} = a + bX + e1^{*}$$

and, $$\ln Yi = \ln a + b \ln X + e2^{*}$$

Now, the two residual sum of squares are directly comparable, and one would choose the functional form producing the larger adjusted squared correlation coefficient. In addition, a simple likelihood ratio test of the differences between the residual sums of squared can be conducted to conclude if one specification is statistically significantly 'better' than another.

The results of Rao-Miller test for linear vs log-linear functional forms of each of the butter, cheese, skimmilk powder world price transmission mechanisms are presented in Table A4.1 below. Although semi-log-linear specification tests were also conducted, they provided such poor fits to the data that their results are not reported here. The statistics of relevance here are the residual sums of squared (e'e), the Durbin-Watson test statistic for autocorrelation, and the likelihood ratio statistic (LR). The critical value for the LR is 3.84 at 0.05 significance, and is distributed Chi-squared with one degree of freedom

Table A4.1: Summary Statistics for Rao-Miller Test -World Linkages

	Linear	Log-linear
Butter:		
e'e	0.531	0.293
DW	1.343	1.450
	LR =5.966	
Cheese:		
e'e	0.654	0.234
DW	1.299	1.478
	LR =7.063	
Skimmilk Powder:		
e'e	0.880	0.802
DW	1.198	1.273
	LR =0.933	

The results suggest that based on the Rao-Miller transformation, the log-linear specification provides statistically improved predictive power over the linear specification for butter and cheese. Although the residual sum of squares in the log-linear skimmilk powder equation is also lower, it is not statistically significantly so. However, this specification reduces the serial correlation as measured by the Durbin-Watson statistic. Thus solely on the basis of data analysis, a log-linear specification appears superior to the linear for all the world price transmission equations.

The results from the same procedure applied to the domestic processer's offer-to-purchase/milk-producer price linkage equation is presented below in Table A.4.1. The results again suggest the constant elasticity or log-linear form produces the best fit of the data.

The economic validity of the assumptions that these specifications places on the economic behaviour of the New Zealand Dairy Board in setting the domestic product and farm-gate milk prices based on information on world prices is discussed in Section 3.6.

Table A4.1: Summary Statistics for Rao-Miller Test -Domestic Linkage

	Linear	Log-linear
Farm-gate Guaranteed Milk Price		
e'e	0.021	0.032
DW	2.24	1.62
	LR =4.355	

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Information for Agricultural Adjustment

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SUMMARY

Agricultural information may be described in terms of its geographic and temporal characteristics. The geographic breakdown considered is the individual farm, the region, and nation, and the world. Time periods identified are the past, the present, and the future, with the future being further subdivided into the short, medium and long terms.

Data capture is not instantaneous. Therefore current data is actually an estimate based on known historic data. Forecasts of the future tend to be forecasts based on estimates of the current situation. This movement from historic data through to forecasts is a movement from certainty to uncertainty.

Data is most useful in a time series form to show trends in the industry. The use of data distributions also provides better information.

The New Zealand Meat and Wool Boards' Economic Service provides information in many of the categories discussed. The role of the Economic Service Sheep and Beef Farm Survey is to provide factual information on trends in the industry and provide the base data for policy decisions and forecast work. Examples are given of data contained within the Survey.

THE NATURE OF AGRICULTURAL INFORMATION

Agricultural adjustment is taking place continuously and is a process that occurs at several levels.

Geographic Information

Individual farmers respond to the signals they perceive as coming from the marketplace. Adjustment made by an individual farmer is not significant at the regional or national levels but is of importance to the farmer. However, the combined actions of many individual farmers may impact upon the regional and national levels of the agricultural industry.

This identifies three levels of the agricultural industry as being subject to adjustment, namely the individual farm, the region, and the nation. To complete the picture, the international situation must also be considered.

An example of adjustment taking place was seen in the autumn of 1986, when many farmers withheld a proportion of their breeding flock from the ram. Other farmers withdrew the ram from the ewe flock earlier than usual.

At the individual farm level, some farmers will now be suffering from reduced income because of these actions given the hindsight of the high skin prices received this year. At the regional level the numbers of ewes put to the ram dropped by between 3 per cent in Otago/Southland and 10 per cent in the North and South Auckland regions. Nationally the reduction was 5 per cent. The regional and national consequences of fewer ewes put to the ram have been fewer lambs available for slaughter and lower export meat production.

While it is often difficult to establish a causal relationship, the reduction in numbers of ewes put to the ram has contributed to lower farm incomes, lower throughput in regional slaughtering facilities, lower employment and lower regional incomes.

Temporal Information

As agricultural adjustment is a process then the collection of information on or for agricultural adjustment must also be a process. In a changing world, a "snapshot" picture of the agricultural industry will not provide much useful information on the process of adjustment. Therefore, to provide information on the process of adjustment or the trends within the industry, information is of most use in a time series form.

A characteristic of most agricultural information is that it cannot be captured instantaneously. Inevitably there is a time lag between an event occurring, measurement of that event, and collection of that measurement. This means that any information we know with certainty must be historic. It also means that information describing the current situation must be estimated. Forecasting the future therefore is not a forecast based on known current data, but is usually a forecast based on an estimate of the current situation. The movement along the time series from historic data through current estimates to forecasts of the future is a movement from certainty to uncertainty.

In terms of usefulness from either a trading or a policy view point, the most useful information is that regarding the future. But this information is not known with certainty.

The future itself can be broken down into the short term, the medium term, and the long term. In an agricultural context, these might be defined as follows:

	Time Horizon	Risk	Uncertainty
Short term	0-6 months	High	Low
Medium term	1-3 years		
Long term	5+ years	Low	High

where: Risk implies that a probability may be applied to a particular event, whereas uncertainty implies that no probability is available for that event.

Note also that the time frames do not overlap, leaving "grey" areas which could be described by either of the adjoining time frames.

This suggests that short term information is limited by risk elements (e.g. seasonal conditions, lambing percentage) while long term information is limited by uncertainty (e.g trade access, consumer preferences).

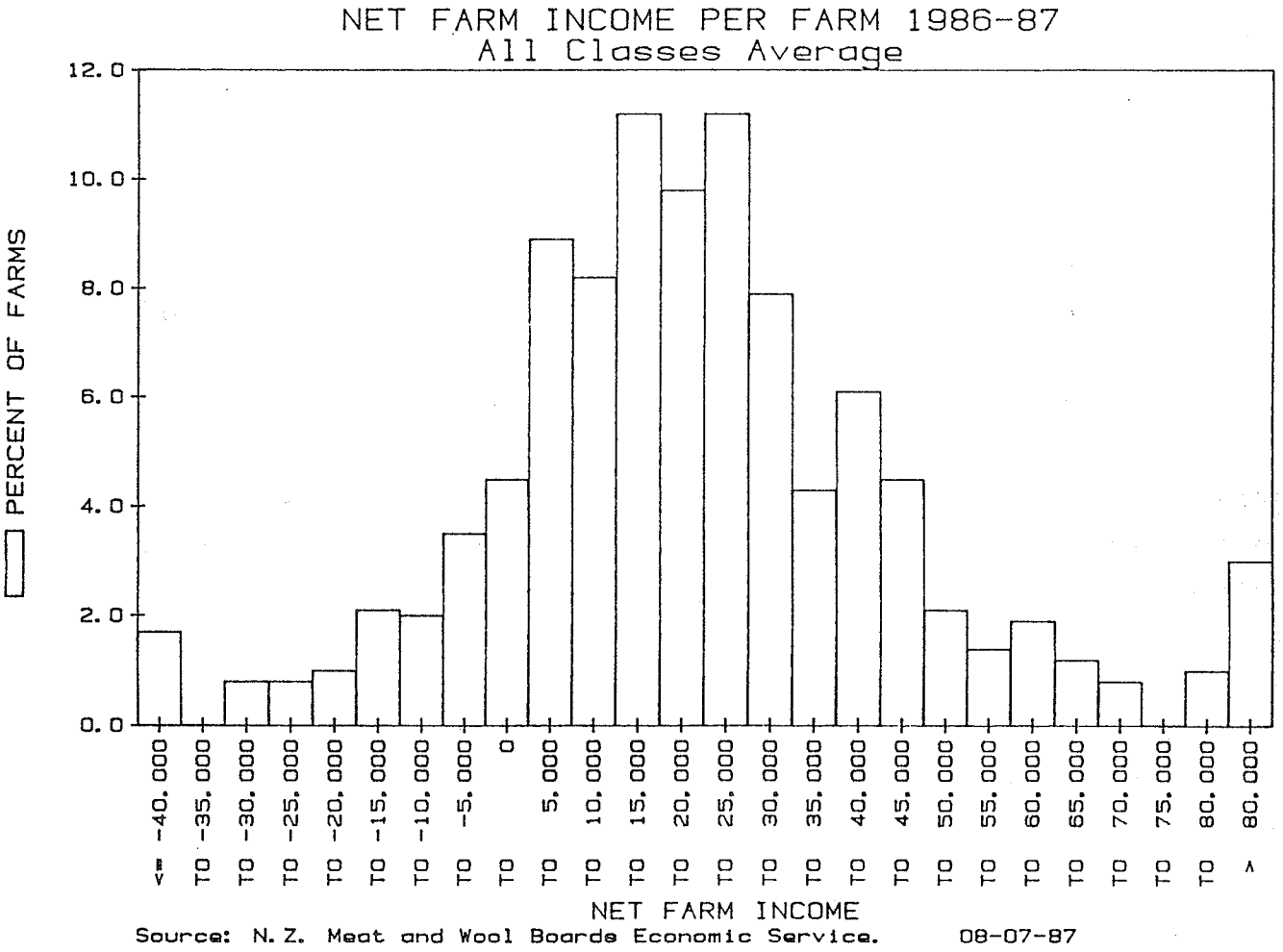
For trading purposes, it is the short term future which is of most significance. On the other hand, for strategic or policy purposes, medium and long term information is of most significance, although short term information may alter the path of adjustment within a strategic framework.

Data Variability

In addition to the data variability through time already covered, data items are variable around their mean values within a time period. This variability may be represented by a distribution of that data item, or in statistical terms a distribution type and variance.

For policy purposes, the availability of data distribution is far more valuable than providing mean values alone. For example, the information that the expected net farm income on sheep and beef farms for 1986-87 was $19,900 tells us that the net farm income for 1986-87 is up on the level of 1985-86 ($14,200), but down on the level of 1984-85 ($34,208). However, provision of a data distribution could also tell us that 16 per cent of sheep and beef farms made a loss, and that 26 per cent made more than $30,000. The data distribution provides a much better picture of the industry. The data distribution referred to above is shown in Figure 1.

FIGURE 1:



The use of data distributions also encourages more thinking on the validity of the mean as a measure of central tendency. In the above example, although the mean was $19,900, the median income was $17,600. This immediately poses the question "Which of these two measures better represents the current situation of the industry"? The point of the illustration is not to try and answer this question but rather to demonstrate the different pictures of the industry that can be obtained with good information.

To summarise to this point, the following three aspects of information have been identified as being of importance in reporting on or planning for agricultural adjustment:

(1)	(2)	(3)
Geographic	Temporal	Variability
Individual farm	Historic	Distributions
Regional	Current	Means
National	Future - short term	Medians
International	- medium term	
	- long term	

The New Zealand Meat and Wool Boards' Economic Service provides information in most of these categories. This information is either used directly by organisations involved in the agricultural industry (Meat Producers Board, Wool Board etc) or used as input into further analysis of the industry.

The remainder of this paper will look at the data produced by the Economic Service and give examples of the use of this information.

ECONOMIC SERVICE INFORMATION

The Economic Service

The N.Z. Meat and Wool Boards' Economic Service was established in 1950 with the brief "to study the economics of the pastoral industry and provide the N.Z. Meat Producers Board and the N.Z. Wool Board with sound statistical information for policy decisions". The Economic Service is jointly funded by the two Boards, and through them, the farmers.

The Economic Service employs 8 professionally trained Field Staff in 5 offices in the main farming districts, plus 5 staff in Head Office. Administrative and support staff bring total numbers up to 22.

The Survey

The Economic Service Sheep and Beef Farm Survey provides the base data from which current estimates and forecasts of the future are derived. In order to maintain the accuracy of the estimates and forecasts, it is essential that the survey provides consistent base data.

More fundamentally, the Survey provides a factual record of what actually occurred in a given income year. Prior to the existence of the Survey, no definitive data was available to provide the basis for sound policy decisions. Even now, the Survey remains the only comprehensive and consistent data source for sheep and beef farms.

The survey consists of 520 randomly selected sheep and beef farms stratified by flock size and geographic distribution. In addition, farms are classified into 8 classes which give a good coverage of the types of farms in the sheep and beef farm sector. Each farm must be a full time privately owned commercial operation with at least 750 stock units and must not be a stud or dealer-type operation.

Physical and financial information is obtained from the farmer in an interview situation. Further information may be collected from the farmer's accountant and stock firm. Up to 620 data items are collected for each farm each year.

Once the basic collection of data has occurred, a considerable amount of work goes into standardising the data so that valid comparisons may be made between farms and between years.

Standardisation particularly applies to farm accounts. Multiple accounting entities are aggregated to describe the whole farm situation with book entries between accounting entities cancelled out. Income and expenditure items are standardised to a consistent basis. A revaluation of land, buildings, and livestock is carried out at balance date to show the true net worth position of the proprietor.

After standardisation, there is a rigorous data validation process. This ensures that the data is internally consistent. For example, it ensures that stock reconciliations balance, that income is produced when livestock are sold, and that the flow of funds statement is in balance.

Survey Analysis and Interpretation

The results of the Survey are presented as farm class averages in the Survey publication (The New Zealand Sheep and Beef Farm Survey 1984-85, Publication No. 1957). However, these averages represent a range of data. In another publication (Supplement to the New Zealand Sheep and Beef Farm Survey 1984-85, Publication No. 1967) emphasis is placed on the range of data by showing distributions of the data items.

An example of the data contained in the survey may be found in the recent paper "Analysis of Sheep and Beef Farm 1984-85 Fixed Liabilities", paper No. 1965. That paper analysed the changes in fixed liabilities that took place on sheep and beef farms during 1984-85. Special emphasis was placed on new borrowing with the analysis showing the reasons for borrowing and the sources of finance. Figures 2 and 3 show the reasons for new borrowing and the sources of finance respectively. The result tables for this analysis are in Appendix 1.

This example illustrates the value of the Survey. It allows a detailed analysis to be carried out on the structure of the industry and of changes that have taken place through time. An understanding of this historic data is essential if forecasts of the future are to be relevant.

Survey Time Series

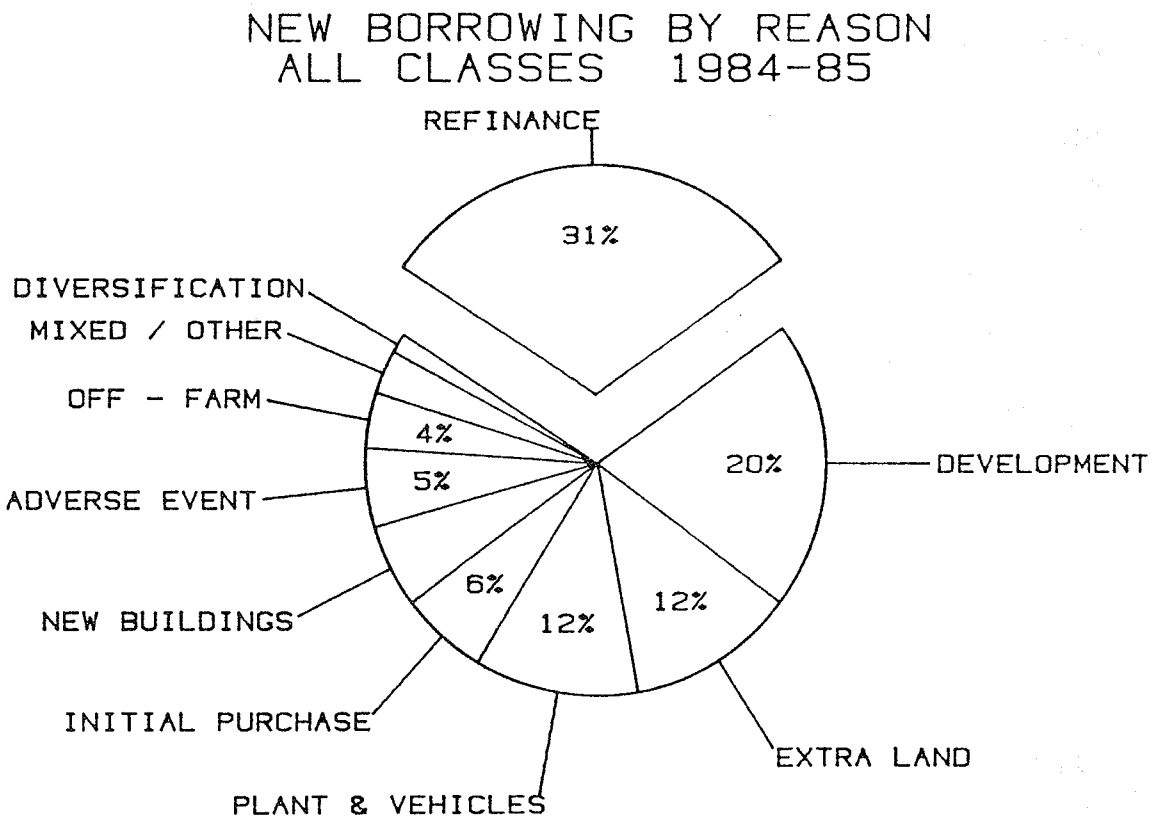
Data from the annual Survey goes into the Economic Service Survey Time Series database. This allows ready access to farm class average data on a consistent basis in a time series format. An example printout from this system is in Appendix 2 showing selected physical and financial statistics for the All Classes farm.

This time series is the culmination of many years of Survey work. It has been estimated that the total cost of building this database through the years is in the order of $20 million in current terms.

A perceived weakness of the Survey is its timeliness though this is not a problem in practice. The Survey is largely dependent on farm accounts as a data source and there is a lag between balance date and availability of the accounts from the accountant. This lag can vary from 3 months to 17 months after balance date. For this reason, the Survey is not normally completed until 18 months after the close of the financial year. However, there is always a trade-off between timeliness, detail and accuracy. We believe detail and accuracy are important hence the attention given to these aspects. As the need for timely data is largely filled by the "Income and Production System" discussed below, the timeliness of the Survey itself is not the weakness it would appear to be.

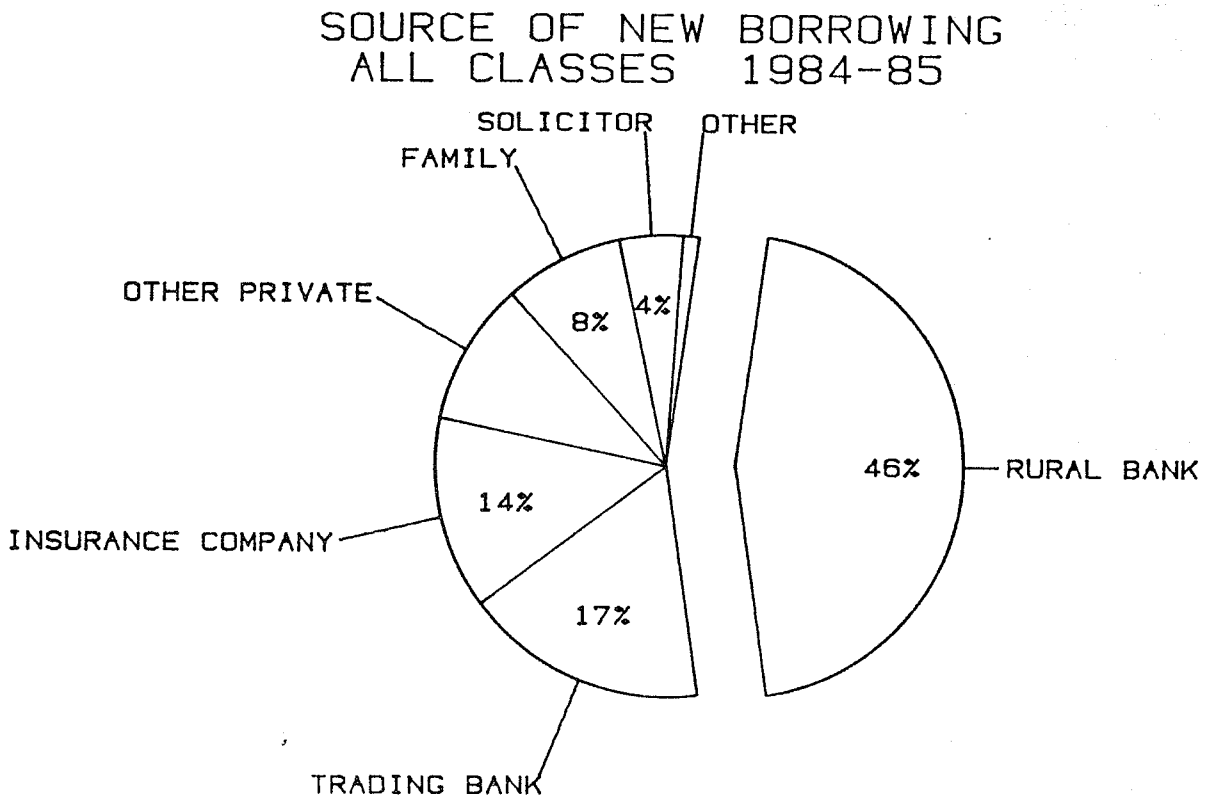
Much of the Survey data is in well before the completion date mentioned above. This early data is used to help estimate the actual survey result and act as an early guide in forecast work.

FIGURE 2:



Source: N. Z. Meat and Wool Boards Economic Service

FIGURE 3:



Source: N. Z. Meat and Wool Boards Economic Service.

The Income and Production Forecasts

A major forecasting tool used by the Economic Service is the "Income and Production System". It operates in a similar manner to the Survey itself. That is, it builds up data from the Class and Region levels to the national picture. It also builds from the known Survey data base to forecasts.

The income and production system starts from the basic level of stock reconciliations. From the stock reconciliations, wool production and livestock trading are derived. These are then transformed to the various trading accounts through the application of prices to the trading activities. Expenditure is estimated by our Field Officers and net farm income derived.

The above process is carried out at for each farm class in each region. These results are then weighted to the class total level, the regional total level, and the national All Classes level.

The summary page for the latest run of the Income and Production system is shown in Appendix 3.

The value of the Income and Production system is that it builds on the known data provided by the Survey to provide soundly based estimates of the present situation and near future.

Meat and Wool Production Estimates

At the start of each season, the Economic Service makes a detailed report on the likely regional and national production of meat and wool. These reports are based on regional stock numbers, stock performance, and inter-regional flows of product.

The meat production estimates may be updated during the course of the season to take account of seasonal weather conditions and other factors. For example, a drier than normal season is likely to mean lightweight lambs and therefore a lower meat production.

Wool production estimates usually remain unchanged through the season as the linkage between current seasonal conditions and production is less direct than is the case for meat. Also, patterns of wool flow can show marked variability from year to year making mid-season sales figures an unreliable guide to total production.

AVAILABILITY OF ECONOMIC SERVICE INFORMATION

Most information produced by the Economic Service is readily available to those in the industry. The Survey and Supplement publications are produced annually as is an Annual Review of the New Zealand Sheep and Beef Industry.

In addition, the Economic Service produces a number of one-off papers during the year which detail the latest position of the sheep and beef industry or highlights various facets of the industry using Survey data. These papers are available to the public for a fee, or subscriptions to the key publications are available. If further information is required from the Economic Service database, this may be provided on a contract basis.

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N. Z. MEAT AND WOOL BOARDS' ECONOMIC SERVICE

ANALYSIS OF NEW BORROWING FOR 1984-85

ALL CLASSES AVERAGE

T A L L Y T A B L E (No. of Loans)

	RURAL BANK	INSURANCE COMPANY	TRADING BANK	OTHER PRIVATE	VENDOR	FAMILY	SOLICITOR	OTHER	T O T A L
EXTRA LAND	75	190		35	23				322
INITIAL PURCHASE	58					110			166
REFINANCE	360	521	855	220		366	109		2,428
DEVELOPMENT	1,647	10	58					58	1,772
DIVERSIFICATION	128	35	167						328
PLANT & VEHICLES	396		919	937		82	35	229	2,594
NEW BUILDINGS	459	23	45	35		69	23		654
OFF - FARM	52	144	75	52		52			374
MIXED / OTHER	23	92	105	55		56	52	202	583
ADVERSE EVENT	742								742
T O T A L	3,935	1,013	2,220	1,333	23	735	218	489	9,960

P R I N C I P A L T A B L E (Dollars per Farm)

	RURAL BANK	INSURANCE COMPANY	TRADING BANK	OTHER PRIVATE	VENDOR	FAMILY	SOLICITOR	OTHER	T O T A L
EXTRA LAND	540	437		394	62				1,434
INITIAL PURCHASE	375					364			740
REFINANCE	559	990	1,157	157		486	414		3,763
DEVELOPMENT	2,351	5	109					23	2,488
DIVERSIFICATION	94	5	81						179
PLANT & VEHICLES	327		473	499		74	24	23	1,420
NEW BUILDINGS	559	13	41	19		49	41		721
OFF - FARM	106	196	94	39		47			482
MIXED / OTHER	16	41	100	110		8	47	44	367
ADVERSE EVENT	671								671
T O T A L	5,599	1,686	2,055	1,218	62	1,029	526	89	12,264

N. Z. MEAT AND WOOL BOARDS' ECONOMIC SERVICE

ANALYSIS OF NEW BORROWING FOR 1984-85

ALL CLASSES AVERAGE

I N T E R E S T T A B L E (Per Cent)

	RURAL BANK	INSURANCE COMPANY	TRADING BANK	OTHER PRIVATE	VENDOR	FAMILY	SOLICITOR	OTHER	T O T A L
EXTRA LAND	7.5	17.0		12.0	16.0				12.0
INITIAL PURCHASE	7.5								3.8
REFINANCE	12.2	16.7	17.7	19.2		4.8	20.9		15.4
DEVELOPMENT	8.6	15.5	18.5					9.4	9.1
DIVERSIFICATION	12.4	16.6	18.7						15.5
PLANT & VEHICLES	18.6		18.3	21.0			16.8	14.4	18.2
NEW BUILDINGS	9.5	14.4	18.2	7.3		8.7	22.1		10.7
OFF - FARM	7.5	16.3	13.8	20.0					12.6
MIXED / OTHER	7.7	13.5	17.6	18.8		16.5	20.1	13.6	16.8
ADVERSE EVENT	9.4								9.4
T O T A L	9.6	16.6	17.7	17.4	16.0	2.8	20.7	12.9	12.7

T E R M T A B L E (Years)

	RURAL BANK	INSURANCE COMPANY	TRADING BANK	OTHER PRIVATE	VENDOR	FAMILY	SOLICITOR	OTHER	T O T A L
EXTRA LAND	23	15		5	10				15
INITIAL PURCHASE	23					1			12
REFINANCE	17	14	5	3		1	3		8
DEVELOPMENT	15	1	5					15	15
DIVERSIFICATION	12	5	3						8
PLANT & VEHICLES	5		3	3		1	3	3	3
NEW BUILDINGS	16	1	3	15		1	1		13
OFF - FARM	10	13	4	15		1			9
MIXED / OTHER	10	7	4	1		2	5	10	4
ADVERSE EVENT	14								14
T O T A L	16	14	5	4	10	1	3	9	11

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N.Z. MEAT & WOOL BOARDS' ECONOMIC SERVICE

EXAMPLE TIME SERIES LISTING FOR CONFERENCE OF NZ

BRANCH AUSTRALIAN AGRICULTURAL ECOMOMICS SOCIETY

YEAR	LAMBING PERCE -NTAGE PER FARM CLASS 9	CALVING PERCE -NTAGE PER FARM CLASS 9	STOCK UNITS PER HECTARE PER FARM CLASS 9	GROSS MARGIN PER S.S.U PER FARM CLASS 9	GROSS MARGIN PER C.S.U PER FARM CLASS 9	GROSS FARM INCOME PER SU CLASS 9	INTEREST PER SU CLASS 9	NET FARM INCOME PER FARM CLASS 9	RATE OF RETURN (%) PER FARM CLASS 9	CAPITAL TURNOVER (%) PER FARM CLASS 9
1968-69	98.2	78.0	5.7	5.39	4.56	6.86	0.56	5,956	5.3	21.0
1969-70	101.2	82.5	5.5	5.45	5.44	7.29	0.60	6,337	4.3	18.0
1970-71	97.3	81.8	5.5	4.86	6.23	7.15	0.67	5,822	3.7	16.9
1971-72	98.6	84.7	5.5	5.15	7.24	7.91	0.75	7,108	4.6	18.4
1972-73	96.5	85.5	5.7	10.46	8.11	12.85	0.76	18,820	9.0	21.1
1973-74	93.2	81.2	5.6	10.56	7.08	12.60	0.89	14,259	5.2	16.9
1974-75	97.5	80.9	6.2	6.87	4.26	9.05	0.99	5,368	1.3	12.3
1975-76	99.5	81.7	6.2	11.85	6.29	13.67	1.18	13,625	4.3	16.1
1976-77	99.9	83.1	6.2	16.10	6.17	17.30	1.30	20,194	5.3	17.1
1977-78	97.6	80.6	6.3	12.42	4.93	16.48	1.64	14,985	3.4	15.2
1978-79	98.1	78.9	6.1	14.81	6.85	19.93	1.91	19,495	3.4	14.4
1979-80	103.4	80.4	6.3	19.30	11.64	24.43	2.34	24,771	3.5	14.1
1980-81	106.4	84.2	6.5	17.54	11.72	25.09	2.70	21,697	2.2	11.9
1981-82	99.0	82.1	6.8	20.66	11.34	28.39	3.60	21,401	1.9	12.0
1982-83	102.1	80.0	6.7	21.07	12.04	31.72	4.45	23,395	2.7	14.1
1983-84	99.8	81.8	6.6	21.17	17.00	32.55	5.07	18,491	2.1	13.3
1984-85	108.3	82.6	6.8	26.07	20.29	40.32	5.39	34,208	4.6	18.6
1985-86p	104.1	84.4	6.6	17.87	11.61	32.40	6.49	14,200		
1986-87e	99.7	80.9	6.6	22.43	11.74	36.13	7.23	19,900		

p = provisional e = estimate f = forecast

Source: N.Z. Meat & Wool Boards' Economic Service
Sheep and Beef Farm Survey.

SHEEP & BEEF FARM SURVEY INCOME & PRODUCTION ESTIMATES 9.6.240

CLASS 9 TOTAL ALL CLASSES

		1980-81	1981-82	1982-83	1983-84	1984-85	PROVISIONAL 1985-86	ESTIMATE 1986-87	FORECAST 1987-88
NO.	IN SAMPLE	509	528	547	531	520			
01	SUMMARY PER FARM:								
02	INCOME PER FARM $								
03	WOOL ACCOUNT	32,040	39,046	39,434	38,448	46,954	41,800	49,000	
04	SHEEP ACCOUNT	28,317	32,086	34,521	36,154	44,411	24,500	29,700	
05	CATTLE ACCOUNT	13,875	14,650	17,811	14,023	21,745	17,600	18,400	
06	DEER ACCOUNT	60	-39	34	-403	121	900	900	
07	GOAT ACCOUNT				26	300	200	300	
08	CASH CROP ACCOUNT	7,480	8,228	11,656	14,205	16,444	15,900	14,700	
09	OTHER ACCOUNT	1,479	1,615	1,917	2,322	2,648	2,900	2,400	
10	TOTAL GROSS INCOME	83,251	95,586	105,373	104,775	132,623	103,800	115,400	
11	EXPENDITURE PER FARM $								
12	FERT. LIME & SEEDS	8,074	9,785	10,275	10,801	14,146	8,800	9,600	
13	REPAIRS & MAINTENANCE	6,880	8,284	8,207	8,539	9,387	6,400	6,900	
14	INTEREST	8,964	12,137	14,782	16,305	17,736	20,800	23,100	
15	OTHER EXPENDITURE	37,636	43,979	48,714	50,639	57,146	53,600	55,900	
16	TOTAL EXPENDITURE	61,554	74,185	81,978	86,284	98,415	89,600	95,500	
17	NET FARM INCOME PER FARM	21,697	21,401	23,395	18,491	34,208	14,200	19,900	
18	REAL NET INCOME PER FARM	10,991	9,345	9,036	6,849	11,346	4,142	5,000	
19	REAL EXPENDITURE/HECTARE	53.81	56.49	57.05	60.84	63.03	50.70	50.22	
20	PRICES PAID CHANGE %	23.0	17.1	10.1	0.3	10.1	13.2	7.6	
21	SHEEP % CHANGE	2.1	0.2	-1.2	0.1	-3.0	-0.4	-0.4	
22	CATTLE % CHANGE		-6.2	-12.7	6.7	0.7	3.4	2.0	
23	DEER % CHANGE				66.7	20.0			
24	GOATS % CHANGE				66.7	50.0			
25	WOOL SOLD PER FARM KG	14,082	13,282	13,214	13,018	13,747	13,202	13,006	
26	NO. EXPORT LAMBS SOLD	1,295	1,249	1,373	1,322	1,517	1,375	1,265	
27	SHEEP STOCK UNITS	2,602	2,658	2,669	2,631	2,649	2,581	2,546	
28	CATTLE STOCK UNITS	716	709	653	581	628	623	648	
29	DEER STOCK UNITS				5	9			
30	GOAT STOCK UNITS				2	3			
31	TOTAL STOCK UNITS	3,318	3,367	3,322	3,219	3,289	3,204	3,194	
32	EFFECTIVE HECTARES	508	498	495	487	487	487	487	487
33	S.U. PER EFFECTIVE HA.	6.5	6.8	6.7	6.6	6.8	6.6	6.6	
34	TONNES FERTILISER APPLIED	53.3	52.5	45.1	48.2	53.4	29.2	29.8	

FEASIBILITY OF INSURANCE AS A RISK MANAGEMENT OPTION IN NEW ZEALAND AGRICULTURE

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The views expressed in this paper are those of the author and do not reflect the official view of the Ministry of Agriculture and Fisheries

FEASIBILITY OF INSURANCE AS A RISK MANAGEMENT OPTION IN NEW ZEALAND AGRICULTURE

BACKGROUND

Risk management has evolved as an integral part of farm management in the modern day agriculture, eventhough their objectives are not always consistent with each other. Risk management in agriculture has also commanded substantial resources from farmers, agricultural lenders, agribusinesses, and the public sector. It is also noted that the current risk environment is more complex and demanding on managerial skills than in the past. While greater rewards are to be expected for superior risk management, it also requires greater investment to develop these skills in firms, government units, and policy making (Barry, 1984).

Risk management in agriculture can take two primary approaches: (i) Measures to reduce the probability of occurrence (or the severtiy) of an unfavorable event, and (ii) Measures to reduce the adverse consequences when they do occur. (Patrick, et.al., 1985). Insurance is one important example of the second kind in managing production risk in agriculture. Irrigation, diversification, flexibility in farm operations and management practices fall into the first category, where the degree of success in achieving their desired objectives varies with the farming region, farming systems and the farming skills of operators. Moreover, the above on-farm measures are initiated by farmers themselves, while insurance has to be provided by private commercial agencies or facilitated by the public sector.

Insurance is a contingent contract between the insurer and the insured, an agreement in which the insured pays a price, the premium, after which, the uncertain outcome influenced by the insured hazards outside the control of the insured, determines the indemnity or payout to be made by the insurer to the insured. The essential function of insurance therefore, is to replace the risk of a large uncertain loss with a "small" known cost, which is the insurance premium.

In reality however, many insurance schemes in agriculture are affected by problems related to moral hazard and adverse selection. When the probability of the unfavourable event is actually increased by the actions of the insured, this situation is referred to as moral hazard. Adverse selection arises due to the difficulty of the insurer to identify characteristics of the insured required for assessing the risk of the hazard, due to lack of specific information. Adverse selection therefore, adds to the information costs of formulating an appropriate insurance contract and moral hazard adds to the costs of enforcing the contract (IAC, 1978).

In many countries around the world Agricultural insurance is an important means of managing production risk. But they are often operated by the Governments or receive subsidies and were generally

introduced after repeated failure of private schemes, eg, US Federal Crop Insurance Program (Kramer, 1983). In countries such as Australia and New Zealand, however, comprehensive insurance schemes have not been viewed favourably as an effective risk management option for farmers to be facilitated, if not provided, by the public sector. While the high cost involved in developing successful insurance schemes, apparent problems with overseas programs, the lack of private interest and initiatives, and other reasons are cited for this attitude, potential benefits to the nation as well as the farmers of such programs have generally not been given adequate attention.

Objectives of the Paper

Given the above setting, the objectives of this exploratory paper are as follows:

(i) to provide an overview of the risks faced by the different sectors, the risk management measures currently available for New Zealand farmers, and discuss their effectiveness in handling production variability,

(ii) to evaluate the factors determining the demand for and the supply of insurance and insurance schemes in agriculture, including the determination of an actuarially fair insurance price,

(iii) to consider the government's role in insurance schemes vis a vis adverse events relief measures used in disaster situations, and

(iv) to discuss some of the issues involved in developing and operating successful crop and livestock insurance schemes, including the problems related to adverse selection and moral hazard.

EFFECTIVENESS OF AVAILABLE RISK MANAGEMENT MEASURES

A recent MAF discussion paper looked at the strategies available to New Zealand producers for risk management and income stabilisation (Rastamizadeh, 1985a). The income stabilisation schemes covered included (i) voluntary schemes, such as the Farm Income Equalisation Scheme, (ii) Statutory Schemes, such as the Wool, Meat and Diary Industry income stabilisation arrangements, and (iii) the Government operated schemes covering output subsidies (SMP's), input subsidies, and export incentives. While the voluntary income equalisation scheme may still be in operation in some form or other, and the statutory schemes operated by the producer boards donot hold their accounts within the Reserve Bank any more, and have to carry the cost of large deficits themselves, the Government schemes on output and input subsidies and export incentives have been eliminated altogether (Bushnell and Durbin, 1986).

The risk management strategies discussed included risk sharing strategies such as insurance and the futures market, price strategies,

and managerial strategies such as flexibility in farm production and financial activities. As production risk is the focus of this paper, price strategies and the potential for the development of a futures market for New Zealand commodities will not be addressed here. The emphasis in the next section is on the extent of aggregate production variability for industries within the pastoral, horticultural, and arable sectors of New Zealand, including the correlation of production among these industries. The scope for diversification, irrigation and other drought management strategies, as well as the financial viability of an insurance pool are examined in relation to the above empirical relationships.

Variability and correlation of Production

Pastoral Sector

While aggregate production variability is not a good measure of the extent of farm level variation of production in the various regions of New Zealand, it does provide an overall indication of production fluctuations, some of it admittedly policy induced. National production figures from 1975-1986, for Beef, Mutton, Lamb, Wool, Dairy and Pigmeat are used to compute the mean and the co-efficient of variation of production at the Industry Level (table 1), and the correlation co-efficients between industry production levels (table 2). For consistency in the scale of measurement, the production levels are evaluated at thousands of tonnes of bone-in-weight for meat products, fleece weight for wool, and milk fat weight in the case of Dairy industry production.

Industry co-efficient of variation was the highest for Lamb production (8.9) and lowest for Pigmeat (0.6); for Dairy (2.4) and Wool (2.6), it was moderate while being quite significant for Beef (3.8) and for Mutton (3.2) (table 1). These estimates are generally supported by figure 1, covering the same period (1975-86), where lamb production appears to show the greatest variability around an increasing trend, and beef production around a decreasing trend. Beef production was at the highest level in 1976, while lamb and mutton production were at their peak in 1985 along with pigmeat production, and wool production in 1981 (table 1).

But of greater interest to diversification as well as insurance is the correlation of production of these pastoral industries. Table 2 shows that over the period 1975-86, lamb and wool production levels were correlated by about 90%, as anticipated. But lamb and wool production were also strongly correlated with dairy production at about 70% and 45% respectively, while it was about 55% negatively correlated with beef production. Beef and mutton production levels were also negatively correlated at 40% and so was beef with dairy production at about 45%. The correlation between mutton production and of lamb and wool was also more than 70%.

Strong correlation observed between production levels of many pastoral industries is mainly the result of widespread effects of weather on both pasture as well as livestock growth. This raises questions about the effectiveness of diversification of some enterprise combinations within the pastoral sector for handling production variability when

ideally a strong negative correlation is required for maximum benefit. Here the exceptions are beef and lamb as well as wool (-0.55) and possibly beef and dairy (-0.45) and also beef and mutton (-0.38). An insurance pool made up of producers from other pastoral industries will not be sufficient to maintain adequate reserves.

Arable Sector

An analysis of variability and correlation of production was carried out for the two main enterprises, wheat and barley, in the arable sector. In addition to variability in aggregate production, area and yield variability and correlation, were also studied. In table 1, barley production exhibits more than five times as much variability than wheat production with co-efficients of variation of about 53 and 9, respectively. Area variability however, appears to be mainly responsible for this difference in production variability, with co-efficients of variation of about 8 and 2.2 respectively. Yield variability for wheat and barley was not disimilar at 0.042 and 0.075, respectively.

The correlation of aggregate production between wheat and barley was only 20%; but yield correlation was 90%, and area was negatively correlated at around 25% (table 3). Wheat production was correlated with wheat area by 83%, while barley production and area were correlated by 95%. Wheat production and wheat yields were correlated by only 31% and barley production was correlated with barley yields by more than 70%. The above observation of high yield correlation is illustrated by figure 2 on aggregate yield variability for wheat and barley from 1975-86, which appear to follow one another very closely. It is important to note that the extent of correlation of yields was much greater than that of production at the aggregate level in the arable sector, and is likely to be the case with production level by animals in the livestock sector as well.

Horticultural Sector

Based on production, area, yields, and real price data for the apple and kiwifruit industry from 1975-86, the variability and correlation were estimated (table 4). Industry co-efficients of variation for production levels and area were significantly high for both apple and kiwifruit, reflecting mainly the growth phase of these industries, especially kiwifruit. Comparing the variability of yields measured in tonnes per hectare and the variability of real prices in terms of 1983 $ values per tonne, there appears to be greater variability (ie, co-efficient of variation) of yields in the case of apples (0.66) than kiwifruit (0.24). But real price variability is estimated to be significantly higher for kiwifruit (191) than for apples (3.9) (see figures 3 and 4). A decomposition of income variation by price and quantity (Rostamizadeh, 1985b) carried out for apples and kiwifruit, should reaffirm the main source of income variability for apples to be yields and for kiwifruit, the real prices.

Aggregate production is significantly correlated with the area for both apples (0.933) and kiwifruit (0.916), as to be expected for these expanding industries. But correlation of production with yields is significant only for apples (0.939), and not for kiwifruit (0.378).

The area under apple and kiwifruit production (table 4) is also significantly correlated (0.982), while the area under wheat and barley (table 3) were negatively correlated (-0.25), indicating the particular nature of the growing regions for these two important enterprises in the horticultural and arable sectors, respectively. More importantly however, apple and kiwifruit yields are not significantly correlated (0.185), while wheat and barley were (0.90). Apple and kiwifruit prices nevertheless, are highly correlated (0.861), while the correlation between yields and prices was positive for apples (0.811) and negative for kiwifruit (-0.119). These observations suggest important considerations for the potential for diversification and also for the viability of an insurance pool within the horticultural sector.

Implications for managing production risk

While more detailed regional and farm level data on crop and livestock production is required to study the extent of production risk and the potential for specific risk management strategies, more aggregate data used here does provide an overall picture of the nature of risk by sectors and industries, and the relationships among them. Within the pastoral sector, the main farming system which has emerged in the various parts of New Zealand, namely the Beef/Sheep combination is consistent with the natural advantages arising from strong negative correlation between aggregate beef and lamb/wool production (-0.55). It does not appear however, that systems with other combinations of industries, including Dairy and lamb/wool, are advantageous for managing production variability. The risk characteristics of the newly emerging livestock industries such as Deer and Goats in relation to the established ones, require more close examination to understand if there are any advantages to such systems for managing production risk, besides handling market uncertainty for which they appear to have mainly evolved (Sandrey, 1987).

For the arable sector, both wheat and barley yields were highly correlated with a correlation co-efficient of 0.90 for the 1975-86 period, which is indicative of the widespread direct effects of climatic factors on crop growth. This is illustrated by the fluctuation of yields, between about 2.5 and 4.5 tonnes per hectare, around an increasing trend reflecting technological advances (figure 2). The scope for diversification within this sector is therefore, very minimal in managing production variability. Furthermore, it has been reported that almost all income variation in the wheat industry is production oriented (Rostamizadeh, 1985b), which is probably true for barley as well. The same study also found that about 70% and 85% of income variation in lamb and beef industries respectively, was also production oriented, while for wool 90% of the income variation was price related. In the case of apple and kiwifruit industries, the level of correlation between aggregate average yields was very low (0.185), but the real prices were highly correlated (0.861). There was also much greater variability of production for apples, and significantly higher real price variability in the case of kiwifruit (figures 3 and 4).

In summary, it appears that in many industries, production variability is the main source of income variability for New Zealand farmers, regardless of whether they are in the pastoral (eg, beef and lamb),

arable (eg wheat), or horticultural (eg apple) sector. This is not in any way to argue that low prices for agricultural commodities is not a problem, but that price variability evidently has been a lesser problem than production variability, at least in the past. The above discussion on intra-sectoral correlation of aggregate production also indicates that diversification of enterprises is not an effective answer for many producers in handling production risk.

While irrigation may be an effective long term solution and also cost effective for some regions and enterprises (Greer, 1984), it will not be a good insurance against drought and also very expensive for the others (Ritchie, 1982). It has been estimated that about 500,000 hectares of land is irrigable in New Zealand (Taylor and Ritchie, 1982), of which only a small portion is irrigated at present. The variation in pasture production under relatively frequent irrigation was reported to be about 10-14%, compared to 48% under no irrigation.

Drought management strategies, on the other hand, can be effective as temporary contingent measures if executed well (Crabb, 1983), but involve a significant opportunity cost and also the loss of efficiency in the long run (Dent and Beck, 1983). In light of the discussion so far on the effectiveness of risk management measures currently available for New Zealand farmers, it is apparent that there exists a vaccum as regards an effective alternative method for managing production risk. It remains to be seen however, whether a comprehensive insurance scheme can be a suitable option for this purpose. In the next section, the factors determining the demand and the supply of insurance, and its effective delivery are considered. Industry wide insurance schemes currently available for wheat through United wheat growers NZ Ltd, and the Apple and Pear Boards' Hail program are not comprehensive insurance schemes, and are also mandatory (Dickinson and Sandrey, 1986), and will be considered in a subsequent section.

INSURANCE - FACTORS INFLUENCING ITS DEMAND AND SUPPLY

The conditions required for a financially viable and effective insurance scheme impact through the factors determining, the demand for insurance by the potentially insured, the supply of insurance by the insurers, and thus the organisation and operation of the insurance market. These conditions for agricultural insurance are not much different from any other form of insurance. They have been identified as (i) the relationship of benefits from insurance to returns from alternative investments, liquidity costs for self insurance, as well as the loss of income from insured hazards, (ii) the size and characteristics of the insurance pool, (iii) mutual awareness of both parties involved on the nature of risk insured, (iv) low administrative costs, (v) and limited opportunities for the insured to alter the probability of a claim (Bardsley, et. al, 1984).

Under a voluntary insurance scheme, insurance purchase is an individual decision. An individual faced with an uncertain loss from natural hazards has to consider two kinds of losses; cost of the loss itself (actuarial loss), and the cost of risk bearing arising from the unpredictable nature of the loss. While the actuarial loss is what the insurer is obliged to the insured, the insured have to take into

account their subjective variance of income, the level of risk aversion, and the financial ability to bear income fluctuations, known as liquidity cost. The insurer on the other hand, also incurs the cost of bearing the risk transferred to him by the insurance contract as well as the administrative and operating costs. The insurance premium charged by the insurer therefore, has to cover the actuarial cost, which is actual claims over time the insurer expects to pay out based on past losses, the cost of risk bearing due to remaining sufficiently liquid to meet any claims, and the administrative cost.

Risks and Returns

The correlation between benefits or returns from insurance and the income stream from farming of insured producers, more specifically the reduction in income due to the natural hazards insured, should be sufficiently high. But as not all income variation is production or output oriented, often not all risks are covered by the insurance contract, and as a deductable is usually included to address mainly the problem of moral hazard, the above correlation is generally less than one. When this (negative) correlation tends towards zero, the amount of insurance purchased will also approach nil. In New Zealand, eventhough production variation is much greater than price variation in many industries (eg, beef, lamb, wheat, and possibly apple), due to the requirement of a deductible the above correlation will be less than unity even under an all-risk insurance scheme.

The Insurance Pool

The size and nature of the insurance pool is also an important factor determining the financial viability and liquidity of the insurance fund. In addition to being large for maximising the gains from risk bearing, the insurance pool should also consist of insureds whose risks are similar (eg weather), but are less correlated, if not independent. While the compulsory insurance schemes in New Zealand for wheat, Pears and apples may have ensured a sufficiently large insurance pool, by their very nature of being commodity oriented they are also at a disadvantage due to the high correlation of risks faced by the insured farmers in the respective pools. These New Zealand programs are nevertheless mutual insurance schemes, unlike crop insurance programs overseas which are usually reserve based. Ideally, the risks in an insurance pool should be spread over space among different enterprises and sectors, as well as over time.

Cost of Information

The overseas experience with mainly crop insurance programs has been that administrative costs are particularly high, partly due to the expense of collecting sufficient information for handling the problems of adverse selection and moral hazard (IAC, 1986). These problems can lead to market failure, with socially undesirable equilibria or non-existent equilibrium (Bardsley, et.al, 1984). Failure of the insurance markets to provide the required form of insurance at an acceptable premium price has been attributed to the unequal distribution of information necessary for avoiding adverse selection and moral hazard (Ahsan, et.al, 1982). Besides the scarcity of information to determine the relevant risks and the problems involved in defining hazards and

damage, the high risk that damage could be widespread and catastrophic in proportions was suggested as an important reason for the high cost and limited availability of private insurance (IAC, 1978).

The high initial cost of collecting and then continually updating statistical data, as well as the size of financial reserves or the level of re-insurance required to cover a widespread calamity such as drought, are likely to increase the administrative cost and the cost of risk bearing respectively, for the insurer. It is also necessary to consider whether there are any institutional or other impediments to the supply of insurance by the private sector, such as provisions in the insurance act which may act as disincentives to providing comprehensive agricultural insurance (Cahill, 1985). Another important issue as regards information is that of property rights in the ownership and use of information on the risk characteristics of the potential insureds. If other firms are able to benefit from the cost incurred by one firm in establishing an insurance scheme, it will be an obvious disincentive for an insurance firm to enter the agricultural insurance market.

The Role of Government

The question that arises as a result of issues discussed so far in this section is, does government involvement lower the real costs of supplying insurance. If government had better information or greater powers of enforcement of contracts than private operators, government provision of insurance including reinsurance might permit cost savings (IAC, 1978). It is not reasonable, however, to conclude a priori that governments command more knowledge than individuals (Dickinson and Sandrey, 1986). The insurance schemes operating in overseas countries are usually government operated and/or receive significant government subsidies. The economic rationale for government assistance in adverse events relief and insurance programs has been the subject of several studies in Australia (Quiggin and Anderson, 1979; Bardsley, et.al, 1984; and IAC, 1986), and of a recent study in New Zealand (Dickinson and Sandrey, 1986).

The theoretical arguments considered relevant in evaluating the potential role of governments in natural disaster relief which is provided free to all those affected, are not the same as those important in providing insurance, regardless of whether it is subsidised or not, voluntary or mandatory, but involving a cost for participation by farmers. The arguments of public good, externality and transaction costs are used to describe the situation under which adverse events relief is provided for farmers. Externality arises since people other than farmers are affected directly and indirectly by adverse events such as droughts or floods. But it is suggested that their existence alone is not adequate justification for government action (Dickinson and Sandrey, 1986). Other considerations in this respect are evidence of substantial economic losses and market distortions associated with assistance measures used for disaster relief (Freebairn, 1983; IAC, 1986).

The rationale for a government role in insurance markets, on the other hand, is based on market failure in the form of a missing risk market, the incapability of private capital markets to spread risks optimally

and provide liquidity, and the high administrative and operational cost for the private insurer in collecting the relevant information for reducing adverse selection and moral hazard. To this may be added the institutional and technical impediments, and the issue of property rights regarding ownership and use of information obtained at high cost.

In comparing the merits of adverse events relief measures used on an ad-hoc basis both in Australia and New Zealand to proposed insurance schemes, from both efficiency and equity point of view, the conclusion of all the studies cited are in favour of a participatory insurance scheme. They have also concluded that providing some form of subsidy by the government for such an insurance scheme to increase participation is preferred to the continuation of adverse events relief currently provided, since insurance introduces a concept of market signal as well as a principle of self help (IAC, 1986). Furthermore, there is evidence that past public policy in relation to adverse events relief has resulted in expectations of future assistance, which has altered the private response by individuals with regards to risk management strategies, including the demand for insurance, and the development of insurance markets (Dickinson and Sandrey, 1986).

Even in the US where a subsidised crop insurance program has been in operation for nearly 50 years, the cancellation of the disaster payments program was required to make insurance as the major form of protection, and thus increase participation levels in the expanded Federal Crop Insurance Program (Kramer 1983). A case study of the wheat industry in New South Wales, using a mathematical model of insurance supply and demand, however, concluded that insurance even when subsidised would not make a major contribution to risk management in this industry (Bardsley, et.al, 1984). But it was recognised that the conclusions are likely to vary for different industry and country situations. The way in which the insurance pool was conceptualised in this study, ignoring the likelihood of assets uncorrelated with wheat industry risks in the insurance pool, and the treatment of administrative costs as a percentage of baseline cost under no insurance, instead of as a percentage of premium income or payout, were suggested as possible reasons for the pessimistic conclusions (Quiggin, 1986).

OPERATIONAL FEATURES OF AGRICULTURAL INSURANCE

When discussing agricultural insurance schemes, a clear distinction has to be made between multi-peril or all-risk insurance programs and insurance contracts written for covering individual hazards, such as hail insurance found in many countries, including New Zealand. It is not satisfactory to extend hail insurance contracts to cover extraneous perils such as fire, windstorm, frost, and even drought. But they should rather be designed and developed according to the needs of the regions in a more far reaching and comprehensive manner to cover all natural hazards. In the absence of such schemes and contracts, the usual practice in the insurance industry to cover agricultural situations is to find an insurance contract with some similar features elsewhere and modify it, resulting generally in a less than satisfactory outcome for both parties.

The concept of insurance is not easily understood by an average farmer, when there has not been previous association with crop or livestock insurance. An insurance program which promises possible future benefits for an immediate premium payment is completely foreign to their way of doing business (Kasten, 1986a). A concerted effort on the part of the extension service and or the marketing force of an insurance company at grassroots level will be required to overcome this lack of understanding, even in countries with well developed agriculture.

In evaluating the feasibility of insurance as a potentially viable risk management option for New Zealand, one has to also consider the operational features of successful crop and livestock insurance schemes overseas, and evaluate them in relation to conditions and attitudes observed here. The emphasis should be on the initial selection of enterprises, methods of participation, the needs of farmers, types of coverage, informational requirements and their current availability, and the measures to minimise moral hazard and adverse selection, while encouraging participation when the programs are voluntary.

Selection of Enterprises

In the planning stages of an insurance program, it has been common practice overseas to limit the number of enterprises or activities covered, but not necessarily the hazards covered. The choice is between a nation-wide program for one or two enterprises (eg Philippines) or pilot projects for a few enterprises (eg US, Canada, Japan, Australia), carefully selected based on their national significance in production, exports or domestic consumption, level of information and expertise available, felt needs of the farmers, and sufficient concentration of activity.

The pilot projects should preferably include the high, medium and low risk areas, and are usually planned for a testing period of about 5 years during which some diversity in weather will be experienced. This also allows for the program to expand gradually and correct or modify its features to overcome the problems encountered at minimal cost to the insurer. In the New Zealand context, the choices appear to be quite clear if pilot projects are envisaged to test the project concept due to the predominance of the beef and sheep industries in the pastoral sector, and the prevailing programs for wheat, apples, and pears. Nevertheless, the wheat program currently available in New Zealand neither covers drought nor floods when they occur more than once in previous ten years (Dickinson and Sandrey, 1986), and the apple and pear program only covers damages due to hail. These features of the current programs donot strictly qualify them as pilot projects, despite their existence for upto 6 years. But they could provide some useful information on the risk characteristics and loss experiences to establish voluntary all risk insurance schemes on a test basis.

Ideally, the test projects for the selected enterprises should pool their insurance reserves to take advantage of inter-industry differences, if any, in risk exposure and loss experiences. Insurance should not however, be used as an incentive or policy instrument to change the pattern of existing farming systems or expand production into marginal areas prone to higher risks.

Method of participation

The nature of the insurance scheme as regards participational arrangements can be very important in determining its success. While many overseas programs are operated on a voluntary basis (eg US, Canada) those in New Zealand are compulsory. There are some obvious advantages in a compulsory program, such as full participation, reduced administrative costs, and minimal adverse selection except for that which is introduced by the compulsory nature where known high risk operators also have to be insured. The result will be the cross subsidisation of high risk farmers by the low risk farmers, resulting in dissent among the latter group, and also the inability of the insurer to provide a range of different options or coverage.

The voluntary program, on the other hand, while avoiding the enforcement and cross subsidy problems, can suffer from high administrative costs, low participation levels, as well as adverse selection. A semi-compulsory program, however, can overcome some of the disadvantages of the above extremes of participational arrangements (Kasten, 1986a). It can take one of three forms and be compulsory (i) only for farmers who take out production loans, (ii) only to insure the major enterprise, and (iii) only for the purchase of a basic coverage, and extend both later on a voluntary basis if required.

A related issue in voluntary or semi-compulsory programs such as those described above is the unit of insurance. While plot units may be satisfactory for uni-risk crop insurance programs such as hail insurance, farm units consisting of all plots used for the same enterprise have to be insured in a multi-risk crop insurance programme to avoid adverse selection.

Extent of Coverage

The issues included under this heading are the range of natural hazards covered by the insurance contract (eg uni-risk, multi-risk or all-risk insurance), the focus of coverage (eg yield, production cost, production credit or income), as well as the duration and the stages of coverage. The main problem with uni-risk or specific risk coverage is that it is often difficult to separate the damage from the insured hazard (eg hail) from the uninsured (eg wind), in loss assessments. Further, it is common for farmers to identify one or two causes (eg hail) as the main risk, due to the dramatic nature of their effects, while many other forms of risks which systematically influence production are discounted.

The insurance coverage usually focuses on the physical aspects of production such as yields, either based on average or normal yields, or based on expected yields, when the technology may have significantly changed the present and the immediate future outcomes from those in the past. But the coverage is normally based on a percentage of the average yield, mainly to address the problem of moral hazard. If the coverage is actually fixed at 100% of the average yield, extreme moral hazard would result as the farmer will be equally well off with an insurance claim as with caring for the farm operation. More importantly the premiums would be extremely high to cover such a

"luxury" or "profit" insurance (Kasten, 1986a).

This reduction in coverage known as the deductible however, should not be excessive as financial stability objective of the program will be compromised and thus disuade farmers from participating. In crop insurance programmes (eg, US program) the deductible varies between 25% 50% of the loss of yield (Patrick 1985), and in livestock insurance the sum insured is usually 80% of the market value of animals or include a 20% deductible (Kasten 1986b). The coverage can also be relative to the production cost or the out-of-pocket expenses, where the objective is to ensure continued activity after a loss. When coverage is relative to production credit, the premium will be part of the loan, the lenders are assured of payment and the farmers credit rating is protected in the event of a loss. Income coverage, on the other hand, covers the profit element in addition to the production costs, but results in very high premiums as well as moral hazard.

Informational Requirements

An actuarially sound crop or livestock insurance program requires a large volume of data on production variability and loss experience between years or seasons, and by farms and/or regions for a sufficiently long period of time. Even in industrial countries, these statistics are obviously gathered for purposes other than insurance in mind, and are averaged and generalised thus being of little use for insurance calculations (Kasten, 1986a). This has prompted some to suggest that an insurance program should be postponed until such statistics can be accumulated. But it is not reasonable to expect that statistics collection will proceed in a statisfactory manner without the insurance scheme in operation, preferably on a pilot basis.

The importance of the statistical data is for carrying out the risk analysis for the different coverage levels, and to ensure that a stable insurance fund will be maintained in the long run. The final recommendations of premium rates to be adopted during a pilot project are based mainly on an objective analysis of past available data. But limited initial data implies that the adequacy of premiums and excesses will have to be monitored to ensure early correction of any unexpected influences indicated by actual insurance experience (Kasten, 1986a). A uniform rate helps farmers in the high risk areas to insure and may also be considered as socially equitable; but farmers in the low risk areas who will be subsidising this activity will resent this and leave the program, resulting in the insurer being unable to balance premiums and claims.

There are three strategy options for charging premiums depending on whether they are uniform or risk-related premiums. A uniform rate applied to all farmers can be adjusted by a loss experience premium discount for the individual farmer or a group of farmers, and thus become a variable rates premium between risk areas or a variable rate for each farmer.

The balance however, may be achieved when some form of government subsidy is involved to make the program attractive again for the low risk farmers or by making partipation compulsory. In the New Zealand case, the latter approach has been adopted in the absense of subsides.

A no-claims discount scheme can also give some relief to the low risk areas based on their risk experience, in voluntary and compulsory programs. This will however, result in slightly higher initial premiums due to loading for the no-claims discount, but is generally preferred to lower initial premiums and a surcharge on farmers after a loss. A combination of discount and surcharge is another approach that can be used to reduce the premium load (Kasten, 1986a).

An additional consideration in determining premium and compensation levels are the affordability of premiums relative to other costs and income from farming. Premium costs ranging from 1-4% of the cost of production are considered to be acceptable to farmers, while providing a realistic coverage. The premium levels are kept within limits (eg less than 10%) by avoiding areas subject to persistent and heavy damage, as well as farmers with excessive claims due to conscious neglect.

Special features of Livestock Insurance

The stock of animals in the agricultural sector represent a significant part of the rural economic wealth. Methods applied in animal husbandry have also undergone great changes, and large investments in animals and production plants are the present day features of animal production. The basis for traditional livestock insurance appears to be to ensure the financial success of livestock operations by mitigating the factors that impinge on animal health and mortality, and which are outside the control of the operators (Kasten, 1986b). Insurance schemes covering the factors which determine variations in pasture and/or forage availability and thus fluctuations in animal productivity which are also outside the farmers' control, are not currently available in most countries (exception - Canada).

Besides the influence of weather conditions impacting indirectly on animal production through feed availability, the main risks involved in animal production are epidemics, accidents, thefts, technological risks as well as natural hazards. With regard to risks of epidemics, the limits of insurability are reached when the insurer is no longer in a position to calculate the risk, such as slaughter orders by the state as part of epidemic control (Kasten, 1986b). With forms of traditional livestock insurance, it is claimed that the problem of moral hazard is somewhat greater due to the intimate knowledge of owners of the peculiarities of their animals leading to exaggeration of values, under statement of ages, and concealment of physical defects. This is known as anti-selection in the insurance portfolio. But adequate safeguards are available for the insurer to limit anti-selection by including specially set deductibles. In this respect this situation is no different from the exclusion of uninsurable areas and the different types of coverages available in crop insurance schemes.

The traditional livestock policy covering loss of animals due to accident or diseases operates for periods of up to twelve months, where the insurer's liability is limited to the market value of the animal at time of death or the sum insured, which ever amount is smaller, and usually the death and the circumstances causing them must both fall within the period of insurance. Another feature of livestock policy is that it contains no provision for renewal, and requires a new policy

for ensuing periods due to the changing circumstances of the animal. Age limits also apply and vary between the animal categories (Kasten, 1986b).

Insurance of animal stocks as opposed to individual animals is another feature of significance when the value of the individual animal is of subordiante importance as in the case of large stocks of animals. This type of insurance of animal stocks is based more on economic data, rather than on veterinary expertise as in the insurance of individual animals of greater value, but also covers only the risk of death due to disease or accidents. Further, these stock insurance policies also incorporate provisions for variable deductibles and indemnifications, whereby according to the size of the stock insured, the absolute deductible per year could be zero or the value of several animals and the indemnity, a certain percentage of subsequent loss of animals, increasing in proportion with additional loss, and reaching 100% at some stage, usually with the loss of more than 10% of the stock.

As noted before, of more interest from the farmers' point of view, however, are insurance schemes which can address variability in animal productivity resulting from fluctuations in pasture and forage conditions on farms caused mainly by climatic variations, particularly rainfall. While the insurance of individual high value animals and animal stocks is of importance, they do not address the variability in production directly, which is evidently the main source of income variabiltiy for many industries in the livestock sector. The forage crop insurance schemes being experimented or operated on a trial basis in Canada are of interest in this regard, and are based on weather based crop growth models (Selirio and Brown, 1979).

Summary and Implications

The objective of this paper was to consider the feasibility and the effectiveness of insurance as an option for managing production risk in New Zealand agriculture. For this purpose, the characteristics of risk faced by several industries in the pastoral, arable and horticultural indutries was examined, and the appropriateness of currently available risk management measures, such as diversification, drought strategies etc were evaluated.

Due to the widespread effects of weather conditions on both pasture and crop growth, indicated by the empirical data and the estimated correlation of production, the potential for successful diversification ventures was considered to be limited within the sectors. It was noted that some of the income stabilisation schemes which were available for New Zealand farmers in the past have been eliminated or have become less effective, thus exposing farmers more to their risky environment. This has made private initiatives on the part of farmers more important, but the knowledge of the availability of ad-hoc measures provided by the government through adverse events relief under disaster situations has been partly responsible for the lack of interest in participatory schemes, such as insurance. Furthermore for most industries in New Zealand agriculture, production variation has been observed to be the main source of income variation in the past, thus emphasising the need for measures to manage production risk.

In this context, the factors determining the demand for and the supply of insurance were considered, and the twin problems of adverse selection and moral hazard in insurance schemes were addressed. Lack of adequate information specific to the risk characteristics of regions, enterprises, and individual farms was identified as the main cause for this twin problem.

The operational aspects of insurance schemes such as the method of participation, extent of coverage and the information requirements for premium and indemnity computation and other topics were discussed in general, and some additional features in relation to livestock insurance schemes noted. The measures to be taken in a voluntary scheme to enhance participation was addressed, and the importance of insurance schemes initially established on a pilot project basis to acquire important information specific to the industries, and to gain valuable experience in limiting adverse selection and moral hazard problems was emphasised.

The potential role for the government in adverse events relief measures vis a vis insurance schemes was discussed both on theoretical grounds as well as experiences overseas. The findings of most studies have been that participatory insurance schemes, even if subsidised by the government, are preferrable to government involvement in ad-hoc adverse events relief measures, based on both efficiency and equity considerations. The insurance schemes presently available in New Zealand for wheat as well as apples and pears on a mandatory industry wide basis donot cover most risks faced by the producers, and also have constrained themeselves by being commodity oriented and unable to pool the insurance funds across uncorrelated risks.

Despite the apparent problems in the provision of crop and livestock insurance schemes, there appears to be some interest by the insurance industry in agricultural insurance as suggested by the recent conference organised to discuss these issues. This could be due to their realisation of the potential for an insurance market in New Zealand agriculture in the new policy environment. But some major issues relative to the role of government in facilitating this development remains to be resolved. One such issue is whether the administrative costs should be subsidised to some extent, in place of the expenditures on adverse events relief measures. Another is related to the property rights on the ownership and use of pertinent information collected for establishing insurance schemes.

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Table 1: Aggregate Production Variability in Pastoral and Arable Industries: 1975-86

	Pastoral Sector						Arable Sector					
							Wheat			Barley		
	Beef	Mutton	Lamb	Wool	Dairy	Pigs	Prodn (000' Tonnes)	Area (000' Hectares)	Yields (T/Ha)	Prodn (000' Tonnes)	Area (000' Hectares)	Yields (T/Ha)
	Thousands of Tonnes (Bone-in Weight)			Thousands of Tonnes (All Wool)	(Milk Fat)	(Bone in Wt)						
Industry Mean:	493.2	177.2	407.2	342.3	295.8	38.7	315.5	82.0	3.86	359.2	93.6	3.780
Industry Coefficient of Variation:	3.8	3.2	8.9	2.6	2.4	0.6	8.6	2.2	0.042	53.2	7.8	0.075
Range:												
Low (Year)	418.9 (1984)	146.7 (1986)	327.0 (1975)	294.0 (1975)	251.0 (1978)	32.5 (1981)	179.8 (1975)	57.7 (1975)	3.120 (1975)	228.3 (1980)	66.5 (1980)	2.516 (1975)
High (Year)	599.0 (1976)	227.4 (1985)	500.9 (1985)	381.0 (1981)	350.0 (1986)	47.7 (1985)	392.0 (1986)	103.7 (1976)	4.580 (1984)	644.4 (1985)	152.3 (1985)	4.553 (1984)

Table 2: Correlation Coefficients for Aggregate Pastoral Industry Production Levels: 1975-1986

	Beef	Mutton	Lamb	Wool	Dairy
Beef	-	-0.380	-0.579	-0.553	-0.437
Mutton		-	0.711	0.721	0.177
Lamb			-	0.896	0.675
Wool				-	0.440
Dairy					-

Table 3: Correlation Coefficients among Aggregate Production, Area, and Yield Levels for the Arable Sector

	WHEAT			BARLEY		
	PRODN	AREA	YIELDS	PRODN	AREA	YIELDS
WHEAT						
PRODN	-	0.83	0.31	0.20	0.08	0.47
AREA		-	-0.26	-0.21	-0.25	-0.02
YIELDS			-	0.74	0.57	0.90
BARLEY						
PRODN				-	0.95	0.71
AREA					-	0.49
YIELDS						-

FIGURE 1

NZ PASTORAL INDUSTRIES

AGGREGATE PRODUCTION VARIABILITY

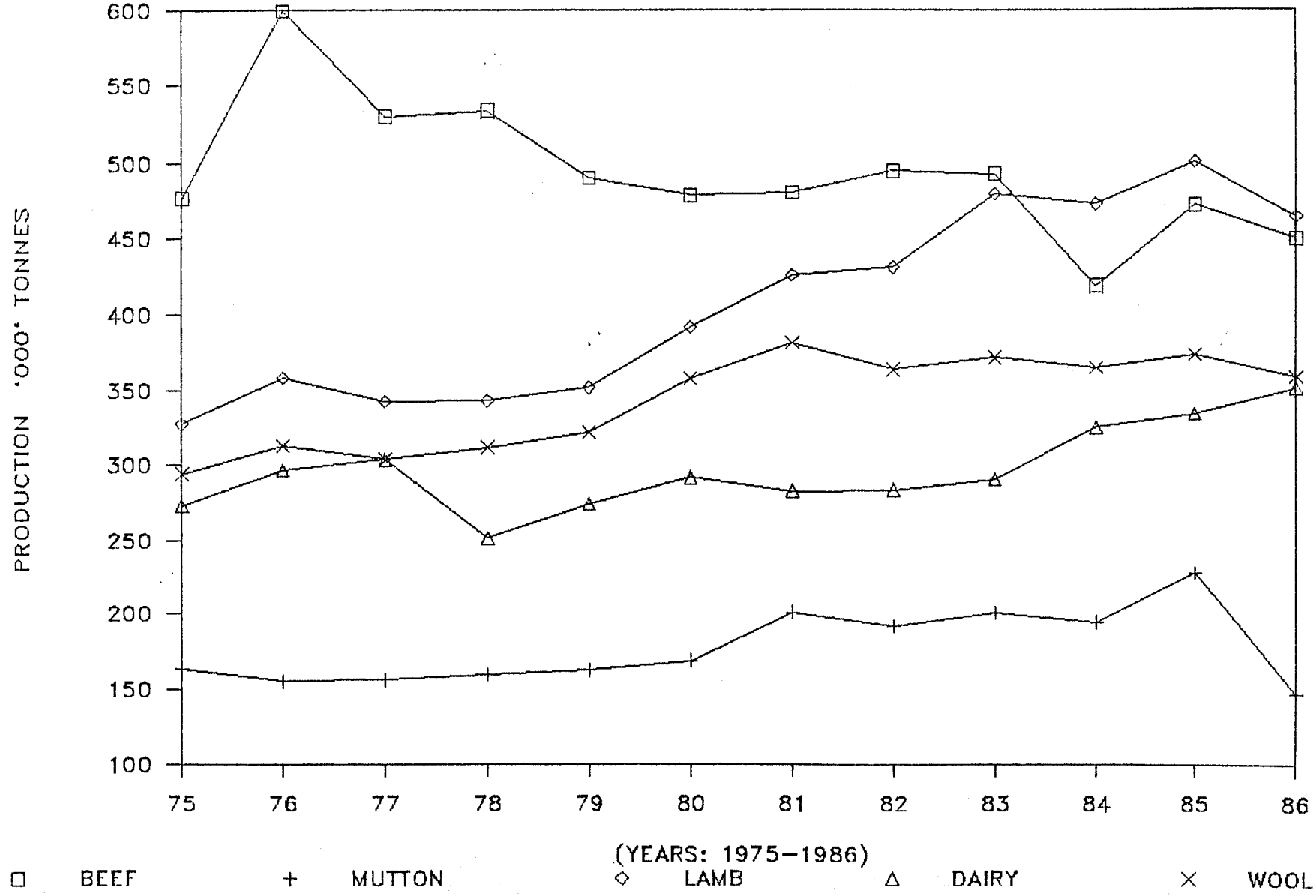


FIGURE 2

NZ ARABLE INDUSTRIES

AGGREGATE YIELD VARIABILITY

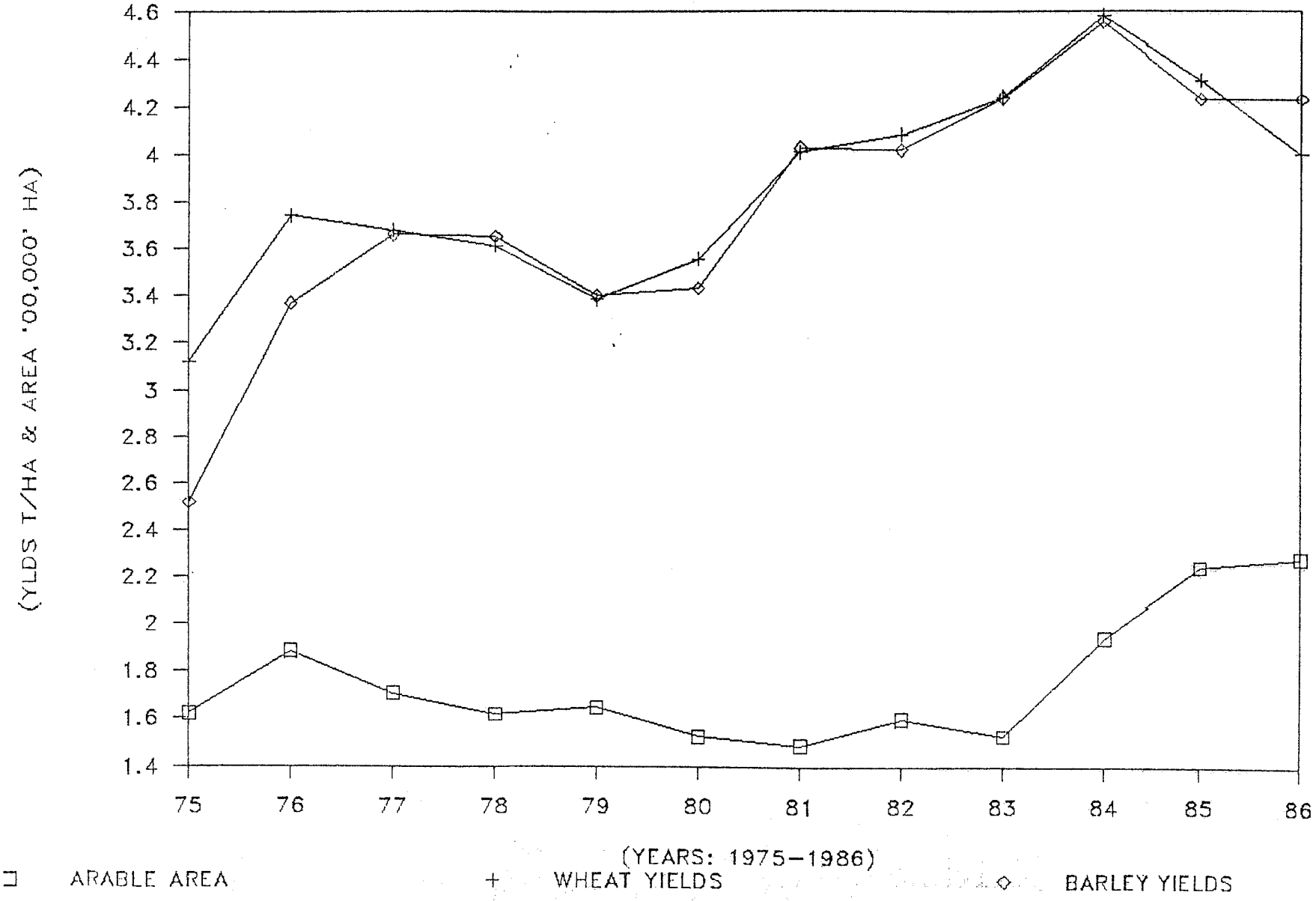


Table 4: Production Variability and Correlation Levels among Horticultural Industries: Apple & Kiwi Fruit (1975-86)

	Apple				Kiwifruit			
	PRODN (Tonnes)	AREA (Hectares)	YIELDS (T/Ha)	REAL PRICES (83$/T)	PRODN (Tonnes)	AREA (Hectares)	YIELDS (T/Ha)	REAL PRICES (83$/T)
Industry Mean:	218,742	6128	35.24	189	34,096	8068	4.22	2063
Industry Coefficient of Variation:	13,826	96	0.66	3.9	31,945	4952	0.24	191
Correlation Coefficients								
APPLE:								
PRODN		0.933	0.939	0.953	0.962	0.948	0.183	0.792
AREA		-	0.760	0.980	0.922	0.982	0.053	0.787
YIELDS			-	0.811	0.853	0.810	0.185	0.724
PRICES				-	0.932	0.969	0.064	0.861
KIWIFRUIT:								
PRODN					-	0.916	0.378	0.723
AREA						-	0.002	0.794
YIELDS							-	-0.119
PRICES								-

FIGURE 3 NZ HORTICULTURE INDUSTRIES

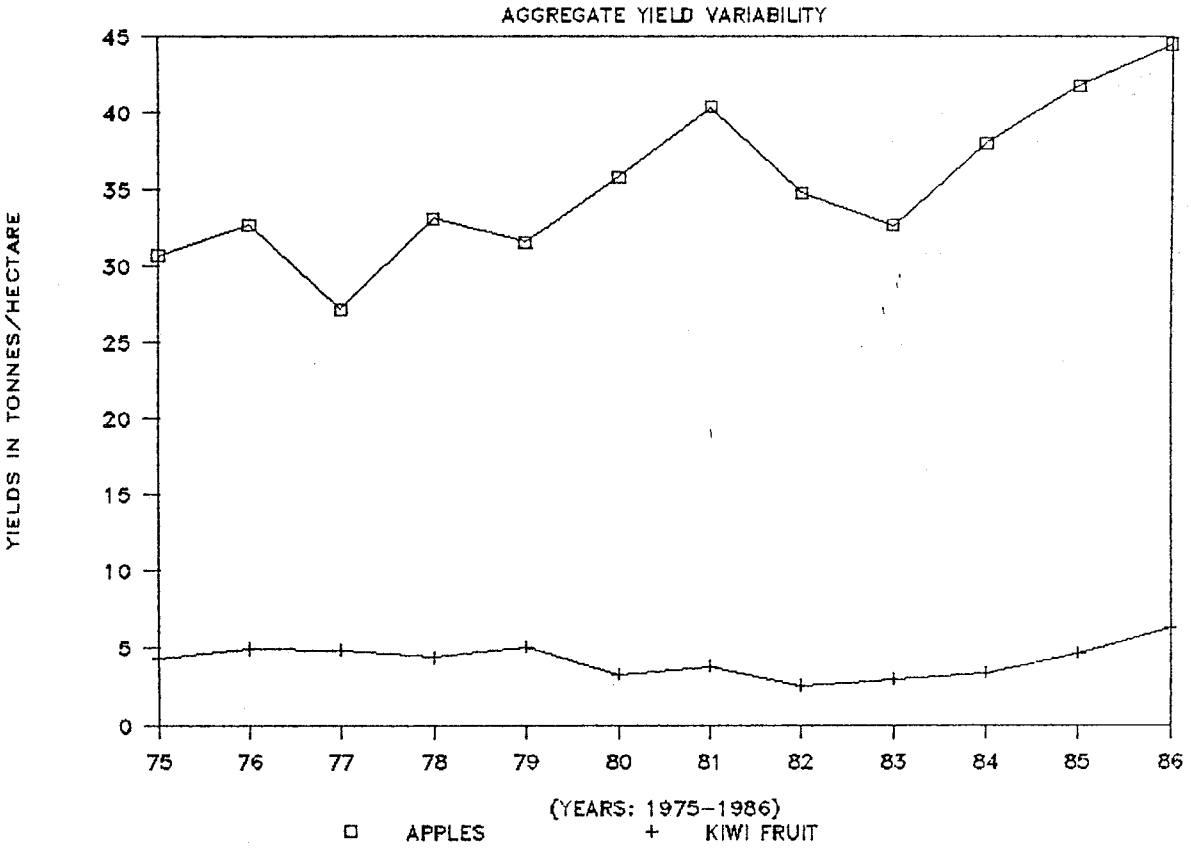
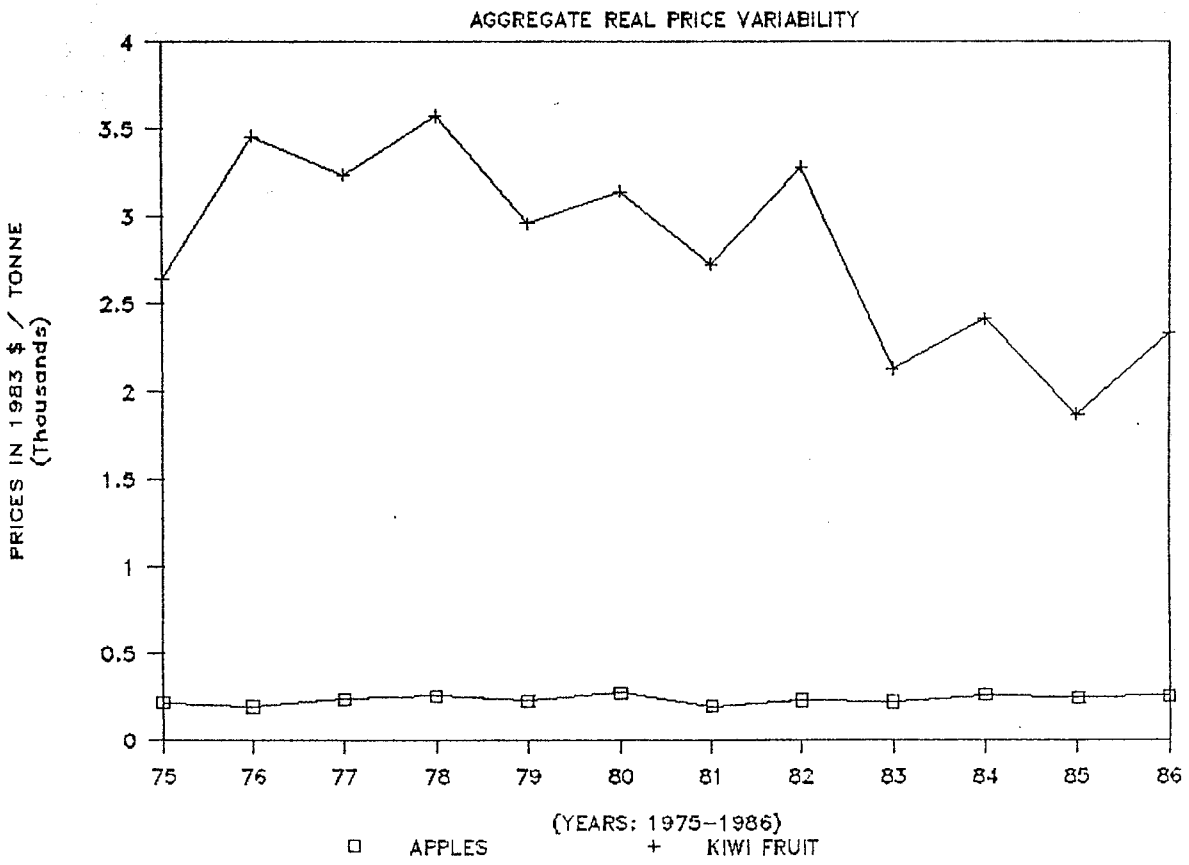


FIGURE 4 NZ HORTICULTURE INDUSTRIES



INCIDENCE OF TAX REFORM BY INCOME GROUPS

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SUMMARY

A major tax reform was proposed by the state of Oregon. Principal features of the reform included imposition of a 5% retail sales tax on most goods and a reduction of existing income and property tax rates.

The distributional effects of the changes on the effective tax rates of six broad income classes were examined. Both the initial and final incidence of household and business tax payments were estimated. This involved assumptions of how much of the tax changes would be exported to out-of-state consumers and to the federal tax system. In addition, several scenarios were developed to measure the shifting of business taxes to households.

Under a plausible set of assumptions about tax shifting by businesses, the short-run effect of the proposed changes was to make Oregon's tax system slightly more proportional. Effective tax rates for the lowest and highest income classes decreased slightly but increased for the middle three income classes. The long term effects on economic growth and expenditure patterns were not addressed.

Keywords: Tax Reform, Tax Incidence, Oregon.

INTRODUCTION

Recently the state of Oregon considered a proposal to restructure its tax system. This proposal was to impose a 5% sales tax on most goods sold in Oregon and use the revenues to reduce income and property tax rates.

By restructuring the tax system in this manner, the measure would alter the tax burden of households and businesses. The objective of this study was to measure how the tax changes might effect the progressivity of Oregon's state and local tax system across several income groups. The incidence (measured as effective tax rates) of existing and proposed tax systems were individually estimated and then compared to ascertain the net change in the distribution of tax burden. The long term adjustments of supply and demand to the proposed changes were not explored.

In the study a distinction was made between the intial incidence (the direct tax burden on households) and the final incidence of a tax (the direct and indirect burden on households after all shifting of taxes and tax relief by firms and households has taken place). Ultimately, households in different income classes pay the taxes intially paid by firms or receive the tax relief gained by firms. Taxes and tax relief may be shifted to households in three ways: as lower or higher profits for business owners, wages for employees and/or prices for consumers.

There is virtual agreement among economists that the general sales tax on final consumption items is shifted forward to consumers. There is little consensus, however, about the final incidence of business taxes. The economics literature contains little or no discussion of the shifting of sales taxes paid by businesses on goods used in their operation. For business property and income taxes there is serious disageement among economists about the final incidence (Phares, 1980 and Pechman, 1974). The ultimate destination of business tax shifting can be influenced by market conditions for products of the firm, types and sizes of firms and entrepreneur preceptions about changes in effective tax rates (Due, 1942). To reflect the range of professional opinions and the variety of market structures found in Oregon, we have examined three scenarios about shifting in the analysis of tax distribution (these are discribed in the following section).

INCIDENCE OF EXISTING TAX SYSTEM

Oregon state and local government currently rely upon two taxes to support their activities: the state income tax and the local property tax. Two assistance programs reduce the tax burden for individual households: the Property Tax Relief (PTR) program and the Homeowners and Renters Relief Program (HARRP).

To allocate the current tax burden, six income classes were established and the number of households in each approximated. The existing tax burden was allocated based on tax returns and published survey data. An allowance was also made for exporting of a portion of Oregon state and local taxes to the federal tax system through the use of itemized deductions.

Initial Incidence

Ignoring possible shifts in taxes to households by the business sector, Oregon's tax system is basically progressive. Except for the lowest income class, the effective tax rate paid by each class increases with income (Table 1). Effective tax rates range from 4.1% for the second lowest class to 7.3% for the highest income class.

Final Incidence

In the foregoing analysis, state and local taxes paid by businesses were not included. Firms do however pay a substantial amount of state taxes through the property and income taxes. Businesses will ultimately pass these taxes onto households. Which income classes these shifts are distributed to, and where these individuals live, determine the final incidence of the tax.

Some of the taxes paid by Oregon firms are exported from the state. There are three mechanisms for the export of taxes: federal deductability of state and local taxes, sales of Oregon goods and services to out of state purchasers, and reduced property income of non-Oregon stockholders of resident businesses. Estimates of the magnitude of each of these items were made based on available evidence: 30% of business income and property taxes are exported to the federal tax system, 40% of taxes shifted to prices are exported, and 25% of taxes shifted to profits are exported.

To address the question of who receives the incidence of business taxes we have used an assumption found in several incidence studies where one-half of the taxes shifted to consumers and one-half to owners of capital (Phares, 1980 and Pechman, 1985). Under what we call the benchmark assumption, half of non-exported business income and property taxes are allocated among income classes in proportion to the consumption expenditures made by each class (U.S. Department of Labor, 1984). The other half of these taxes are allocated in proportion to the property income received by each class (U.S. Bureau of Census, 1985a). Since there is no theoretical basis for assigning corporate income and property taxes to wage earners and since the distribution of wages and salaries among income classes falls between consumption expenditures and property income, no allocation of taxes based on wages and salaries was attempted.

Table 1 shows the estimated final incidence of the current state and local tax system. Using the benchmark assumption, the tax system appears to be progressive with the exception of the effective tax rates of the lowest income class. The lowest and highest income classes appears to bear the largest burden with final tax incidence at more than 10% of personal income. The 'U' shape of the distribution is similar to that of the average U.S. state and local tax system reported by Pechman (1985) (Figure 1).

These results are sensitive to changes in the assumption about shifting. Under the assumption that business taxes are all shifted to consumers, in the form of higher prices, the final incidence of Oregon's tax system would be more regressive than the benchmark scenario, particularly with the lowest two income groups (see the 'all prices' row in Table 1). At the opposite extreme, if all taxes are assumed to be shifted to owners of capital in the form of lower profits and property incomes, the final incidence of the state and

Table 3 indicates the impact the proposed system would have on the effective tax rates of six income classes. Under the benchmark assumption, the net effect of business shifting of taxes is to reduce slightly the effective tax rates of all income classes. Since this shift, after accounting for export of taxes, is small, the net difference between initial and final incidence is less than 0.4% for all classes.

The final incidence of the tax reform, when compared with the current system, would make the Oregon tax burden slightly more proportional by lowering the tax rate of the lowest and highest income groups and raising the rates of the other four income classes (Figure 1). The net change in effective tax rate is less than 1% for all income classes.

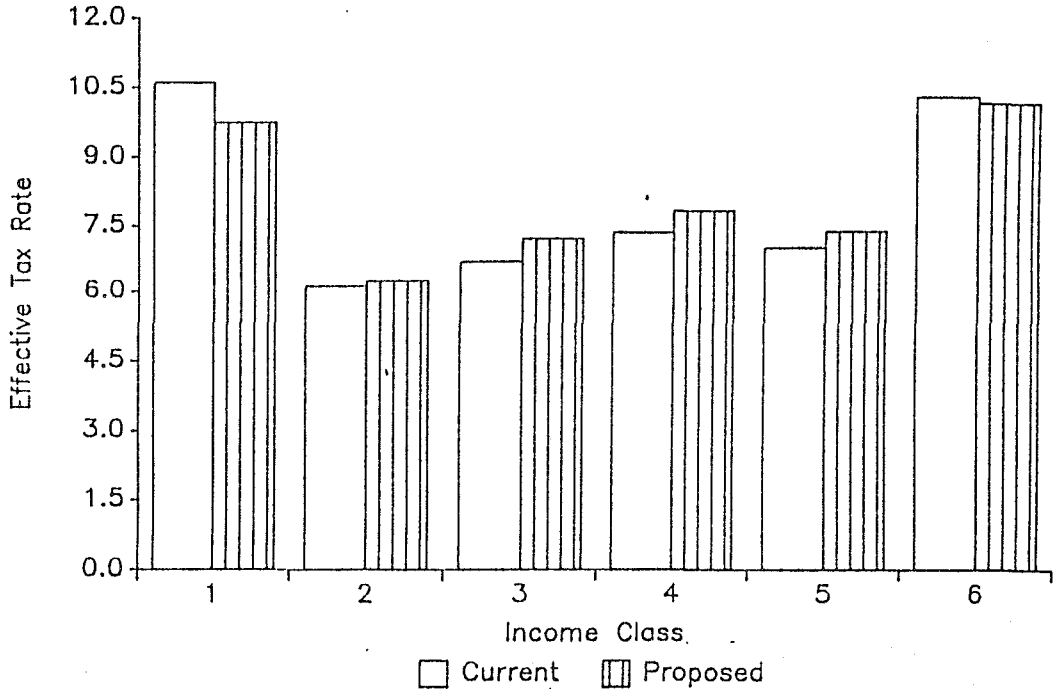
These results were not particularly sensitive to alternative assumptions about business tax shifting (e.g. all to prices or all to profits). Use of alternative scenarios casued the effective tax rate of the lowest income group to vary by less than 0.4% and less than 0.2% for the remaining 5 income groups when compared with the the benchmark assumption (Table 3). This narrow variance is not suprising giving the small net change (relative to total tax revenues) in business tax payments in the proposed system.

Table 3: Estimates of Final Tax Incidence* By Income Class: Current and Proposed Tax Systems.

	Income Class ('000's of 1986 U.S. dollars)					
	Under $6.8	$ 6.8- $13.6	$13.7- $20.4	$20.5- $27.2	$27.3- $40.8	Over $40.8
Current	10.61%	6.12%	6.68%	7.35%	7.00%	10.27%
Proposed						
-Benchmark	9.75	6.24	7.20	7.83	7.37	10.14
-All prices	10.11	6.36	7.24	7.87	7.40	10.05
-All profits	9.37	6.16	7.14	7.78	7.34	10.24
Net change**						
-Benchmark	-0.86	+0.12	+0.52	+0.48	+0.37	-0.13
-All prices	-0.50	+0.24	+0.56	+0.52	+0.40	-0.22
-All profits	-1.24	+0.04	+0.46	+0.43	+0.34	-0.03

*Effective tax rate.
**Proposed system tax rate minus current system tax rate.

Figure 1: Final Incidence of Current and Proposed State and Local Tax System



CONCLUSIONS

This study examined the distributional impacts of a proposed tax reform on Oregon households. Based on estimates of the net changes in effective tax rates the reform would only make a slight reduction in the progressivity of the state and local tax system. The regressive nature of the retail goods tax would be largely offset by tax relief and assistance schemes. Further, it was found that the inclusion of business tax shifts to households can influence estimates of the overall distribution of tax burden.

These results should not be viewed as definative due to the difficulties in accurate measurement of tax burden by income class. Several measurement and identification problems warrant some elaboration. First, assignment of households to the six income groups and proper identification of their consumption patterns were made difficult by the incompatibility of various data sources. Second, exact measurement of exporting and shifting of taxes has not been undertaken. This required crude inference from other studies and general economic theory to be made. Third, a high level of aggregation across households was specified. Thus an average consumption and property ownership pattern was assumed, this may not accurately reflect the true economic behavior of individual households in each of the income classes. Fourth, the import of taxes from other states was ignored. Lastly, the possible adjustments of supply and demand to the proposed tax changes (and subsequent income effects) have not been addressed in this study.

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