Farm Cost Effects of Dairy Policies in New South Wales and Victoria

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Market milk policies pursued by statutory milk marketing authorities differ between states in Australia. The policy differences are particularly large between Victoria and New South Wales and are thought to produce different levels of farm costs. It was hypothesised that the New South Wales policies produced higher farm costs than the Victorian policies. This hypothesis was tested using three-year data for a set of dairy farms located on both sides of the border in a fairly compact and homogeneous part of the Murray River basin. Hence, farms were studied that operated under different milk policies but similar environmental conditions. The analysis found that the New South Wales policies did lead to higher farm costs.

1. Introduction

Market milk policies differ between states in Australia. These policy differences are particularly large between New South Wales and Victoria, the states with the largest production and consumption of milk. Compared with Victoria, New South Wales has adopted policies that result in far more regulation, which is thought to have increased farm costs. This study tests the hypothesis that market milk policies in New South Wales produce higher farm costs than Victorian policies.

2. Dairy Policies

Milk in Australia has traditionally been produced for two distinct sectors — the market milk and manufacturing milk sectors. Market milk refers to fresh liquid milk used directly for human consumption; nearly 30 per cent of the total milk produced in Australia goes to the fresh liquid milk market (Table 1). The remaining milk is used to manufacture dairy products such as butter, cheese and milk powder. The proportion of milk absorbed by the market milk sector varies between states, being high in New South Wales and low in Victoria. Average prices are significantly higher in the market milk sector.

Policies for the manufacturing milk sector are formulated at the national level, whereas market milk policies are the responsibility of individual state marketing authorities. In New South Wales, this body is the New South Wales Dairy Corporation (formerly the New South Wales Dairy Industry Marketing Authority), and in Victoria it is the Victorian Dairy Industry Authority.

Market milk policies are characterised by a high level of regulation. Both the New South Wales and Victorian authorities are empowered to regulate production, processing and distribution of market milk. Milk prices and marketing margins are administratively determined and interstate trade is prevented. These regulations are reflected in the dissimilarities in the levels of assistance given to the two sectors. According to the Industries Assistance Commission (1984), the effective rate of assistance to the market milk sector in the years 1980–81 to 1982–83 was between 91 per cent and 100 per cent, compared with only between 16 per cent and 48 per cent for the manufacturing milk sector. These are high rates of assistance, considering that the average rate of assistance for the farm sector as a whole during the same period was between 8 per cent and 16 per cent.

2.1 Market Milk Policies: Victoria

Although it has the power to acquire all milk in the state, the Victorian Dairy Industry Authority does not need to do so because voluntary offers of market milk from producers are more than enough to meet requirements. Of the 3100 Ml of milk produced annually in Victoria, only 12 per cent is required as market milk. (Victorian producers, if allowed, could meet a substantial proportion of the market milk requirements of New South Wales as well.)

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Table 1: Market Milk as a Proportion of Total Milk Production and Average Prices: By State: 1982–83 (Average per farm)

State	Market milk as percentage of total milk	Average price	
		Market milk	Manufacturing milk
	%	c/l	c/l
New South Wales	61	30	16
Victoria	12	25	16
Queensland	48	33	16
Western Australia	63	26	13
South Australia	31	27	19
Tasmania	11	27	15
Australia	30	29	16

Before the end of June 1977, milk quotas (called milk contracts in Victoria) were farm-specific. The Authority then began to withdraw the quotas and redistribute them to dairy factories, paying compensation to farmers for the surrendered quotas. By mid-1983, only 16 per cent of Victoria's market milk was produced under farm-specific quotas. All quotas were finally withdrawn by June 1986.

The farmers who deliver milk to the factory in a given area share in the factory's quota in proportion to their contributions. The factory's quota is determined on the basis of its total intake of milk, expressed as a percentage of all milk received by all factories in the state. Thus, Victorian policy ensures that all producers have equal access to the higher priced market milk sector. Furthermore, producers are free to vary their milk supplies in different months or seasons of the year.

Market milk prices and marketing margins are set administratively and reviewed at least twice a year. Incentives are paid for production in winter. Farmers also receive a premium for milk with a butterfat content above the 3.9 per cent butterfat standard.

Farmers are paid monthly, and the documents accompanying the payment include details of volumes sold as market milk and for manufacturing, the returns from both, and the quantity of butterfat. The cost of transporting market milk from depot to processor is equalised across Victoria (Coopers and Lybrand 1983).

2.2 Market Milk Policies: New South Wales

The New South Wales Dairy Corporation acquires all milk produced in the state. Of the total annual production of around 900 Ml, about two-thirds is sold as market milk. Production of the higher priced market milk is controlled by means of non-transferable milk quotas. These quotas are allocated to producers (unlike in Victoria, where quotas are allocated to factories) and allow them to supply a set volume of market milk. A newly registered farm is granted a quota of at least 800 l a week after it has proved it can produce at this level for a year.

Until the start of 1984–85, one requirement for retaining a quota entitlement was that the holder produce 100 per cent of the quota in all 13 four-week periods of a year. Failure to do so meant the quota was decreased. There was a slight change to this policy during 1984–85, when a quota holder was permitted to produce below the quota in one four-week period

without being penalised. This was extended to two four-week periods in 1985–86. If a producer supplies significantly more than the quota in all 13 periods, entitlements can be increased. Despite this, and unlike Victorian farmers, quota holders in New South Wales have limited opportunity to vary production between seasons. Thus, another feature distinguishing New South Wales and Victorian market milk policy is the variability of producers' access to the market milk sector.

Market milk prices are set by the Corporation on the basis of past movements in such variables as the estimated cost of milk production and the other costs. (Details of the milk pricing formula can be found in New South Wales Dairy Corporation 1984.) A feature of market milk pricing policy for the years studied is that no premium was paid to producers for milk with butterfat composition greater than standard (unlike the situation in Victoria).

Each producer is paid at four-weekly intervals and is given a document recording the volumes sold as market milk and for manufacturing, the returns from both, and other information such as the cost of transporting the milk from the farm to the depot or factory.

2.3 Effects of Policies on Farm Costs

To determine the effects of the different state policies on farm costs, it is necessary first to consider the effects of the policies on seasonality or within-year fluctuations in milk production. The New South Wales policy, which requires that quota holders supply set volumes of milk throughout the year, causes farmers to reduce the seasonal variation of output. To reduce seasonality, farmers need to use more inputs such as feed, concentrates and labour per unit of output, especially during the winter months. Farmers also have to invest more in farm machinery, equipment and structures. Hence, the need to reduce seasonality is expected to lead to higher farm costs.

Another important policy induced effect concerns access to the market milk sector. Due to the policy of allocating farm-specific quotas in New South Wales, access to the market milk sector varies widely among the New South Wales farms. Other things being equal, a New South Wales farm having greater access to the market milk sector is likely to have relatively less seasonal production, which in turn would cause a further increase in the farm costs.

To summarise, there are significant policy differences between New South Wales and Victoria. New South Wales policies are likely to lead to higher farm costs; that is, to an upward shift in the average total cost functions of individual farms. The problem of course is to separate the policy induced costs differences from those caused by other variables such as climate, soil, management and farm size.

3. Method

3.1 Model

To quantify the effects of the different state market milk policies on farm costs, it is essential to specify farm costs as a function of the policy and all other key variables affecting the costs. However, a large number of variables affecting the costs vary from farm to farm and often researchers face the problem of unavailability of data for several of these key variables. Such a problem was largely circumvented in this study by selecting New South Wales and Victorian dairy farms located in the Murray River basin. Because environmental conditions such as climate, soils and water are fairly homogeneous in the river basin and the river itself forms the boundary between New South Wales and Victoria, the basin provides something approaching a controlled experimental setting. As shown in Figure 1, river basin

Figure 1: Australian Dairy Industry Survey Regions in New South Wales and Victoria

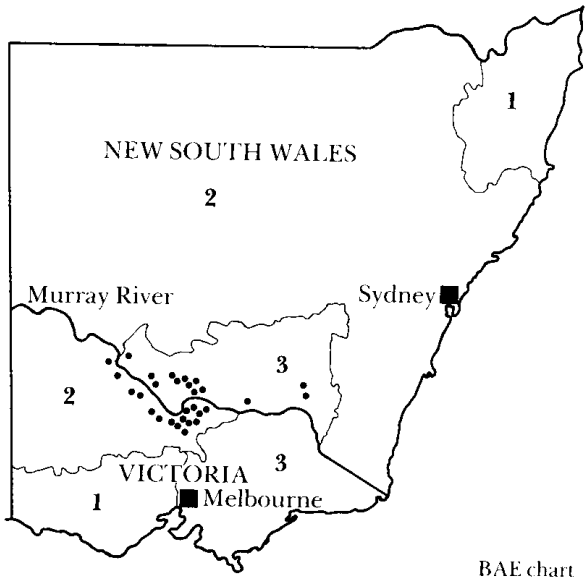

Table 2: Populations and Samples of Dairy Farms

Year	Estimated population of dairy farms		Original survey sample of farms		Sample of farms for this study	
	NSW3	VIC2	NSW3	VIC2	NSW3	VIC2
	no.	no.	no.	no.	no.	no.
1980-81	251	3 527	16	28	12	27
1981-82	207	3 090	16	27	13	27
1982-83	258	3 086	14	29	10	29

farms belong to region 3 of New South Wales (NSW3) and region 2 of Victoria (VIC2) in the Bureau of Agricultural Economics' (BAE) Australian Dairy Industry Survey (ADIS) (see BAE 1983 for survey details).

The average total cost (ATC) of a farm is a function of its dairy policy environment (POLICY), size (SIZE), and managerial or X-Efficiency level (Leibenstein 1966, p.412) (MANAGEMENT). Other factors such as climate and soils are assumed to be the same for the two regions. Thus, for the farm i in the year t:

$$(1) \quad ATC_{it} = f(POLICY_{it}, SIZE_{it}, MANAGEMENT_{it}).$$

The POLICY variable may specify the upward shift in the ATC function, and the specification of a given functional form for equation (1) enables the empirical estimation of this shift.[1,2]

ADIS farm level data for the three years 1980–81 to 1982–83 are used in the analysis. Except for some minor adjustments, the original survey samples for NSW3 and VIC2 form the basis of this study. Two farms in the east of NSW3 (see Figure 1) with atypical climate and soil conditions were excluded. Farms obtaining less than 60 per cent of their gross cash receipts from their dairy enterprises were also left out. Hence, the farms analysed are predominantly dairy enterprise farms, located in a fairly homogeneous climatic and agronomic region. The farm population represented by the original survey samples and the samples used for this study are shown in Table 2.

Physical and financial characteristics of the sample farms are presented in Table 3, and the seasonal pattern of milk production is shown in Figure 2. It is clear from the latter and from the coefficients of variation (Table 3, row 4) than milk production in NSW3 is less seasonal than in VIC2. Simple analysis of the data indicates that the measure of variation used here would, if anything, overestimate the seasonal component of production variation in New South Wales, and thus underestimate the policy induced difference between the two states. This is because the irregular component of variation in production is higher in New South Wales than in Victoria, and the coefficient combines both

1. Specification of interactions between POLICY, SIZE and MANAGEMENT variables in the model was considered but it was decided to not pursue such specification for the following reasons: (a) so far as we could determine, the conventional theory of firm relating to cost functions, which forms the theoretical basis of this study, was mute on the interactions; (b) nor was any guidance on the interactions available from previous studies on statistical estimation of cost functions in Australian agriculture; and (c) the model represented short term (annual) relationships and therefore the interaction effects, if any, were likely to be very small compared to the effects the individual variables were likely to have on the dependent variable.

2. It is conceivable that SIZE and MANAGEMENT are interdependent (endogenous) variables. However, the interdependency between them was more likely to be revealed in the long term rather than in the short term. Hence, for the short term model formulated in this study, it was reasonable to assume that the two variables were independent (exogenous).

Table 3: Characteristics of the Dairy Farms Used in this Study (Average per farm)

Item	Unit	1980-81 NSW3	1980-81 VIC2	1981-82 NSW3	1981-82 VIC2	1982-83 NSW3	1982-83 VIC2
Total farm area(a)	ha	181.72	93.79	178.46	81.46	195.60	130.86
		(16.0)	(8.3)	(12.8)	(12.2)	(11.1)	(21.7)
Dairy cows(a)	no.	124.54	108.93	119.09	105.14	131.96	105.37
		(7.4)	(4.4)	(6.7)	(4.9)	(9.0)	(5.5)
Total milk production	'0001	363.82	336.72	376.33	324.64	429.42	350.15
		(5.2)	(8.0)	(7.8)	(6.9)	(8.1)	(5.2)
Coefficient of variation of monthly milk production(b)	%	35.56	64.90	32.40	61.84	30.84	63.26
		(7.7)	(2.9)	(3.5)	(2.2)	(8.4)	(2.6)
Market milk as a percentage of total milk	%	37	12	44	12	43	12
		(7.5)	(4.5)	(5.1)	(1.2)	(6.4)	(2.1)
Milk yield per hectare of grazing area	kg butterfat	121.11	205.57	115.88	233.45	118.14	152.57
		(11.5)	(20.8)	(10.7)	(13.9)	(14.9)	(23.8)
Milk receipts	$'000	60.50	47.16	79.21	53.12	97.89	62.44
		(4.2)	(8.9)	(7.0)	(7.2)	(8.1)	(5.3)
Total cash receipts	$'000	77.68	58.23	101.53	61.62	128.28	74.56
		(6.4)	(4.4)	(8.9)	(6.8)	(10.3)	(5.3)
Total cash costs	$'000	47.00	34.93	69.97	37.47	103.20	48.78
		(10.3)	(16.2)	(12.9)	(7.4)	(11.7)	(8.5)
Farm cash operating surplus(c)	$'000	30.68	23.30	31.56	24.15	24.08	25.78
		(8.5)	(22.0)	(20.1)	(9.9)	(9.2)	(11.1)
Average total cost(d)	c/kg butterfat	539.04	442.17	694.82	539.36	945.42	651.41
		(9.2)	(11.3)	(10.2)	(4.5)	(5.3)	(5.3)

(a) At 30 June. (b) Coefficient of variation (CV) is a relative measure of dispersion of individual months' milk production during a year around the mean for the 12 months. CV = Standard deviation / mean x 100. (c) Farm cash operating surplus = total cash receipts - total cash costs. It represents the cash surplus available to the farm for consumption or investment. (d) Average total cost = total cost / total milk production in kilograms of butterfat.

Note: Figures in parentheses are relative standard errors (RSEs), expressed as percentages. An RSE is interpreted as follows: if, for example, total cash receipts per farm were estimated at $100 000, with an RSE of 6 per cent, there would be about 19 chances out of 20 that the census value of total cash receipts per farm would be within $12 000 (that is, 2 x 6 per cent x $100 000) of the survey estimate - that is, between $88 000 and $112 000.

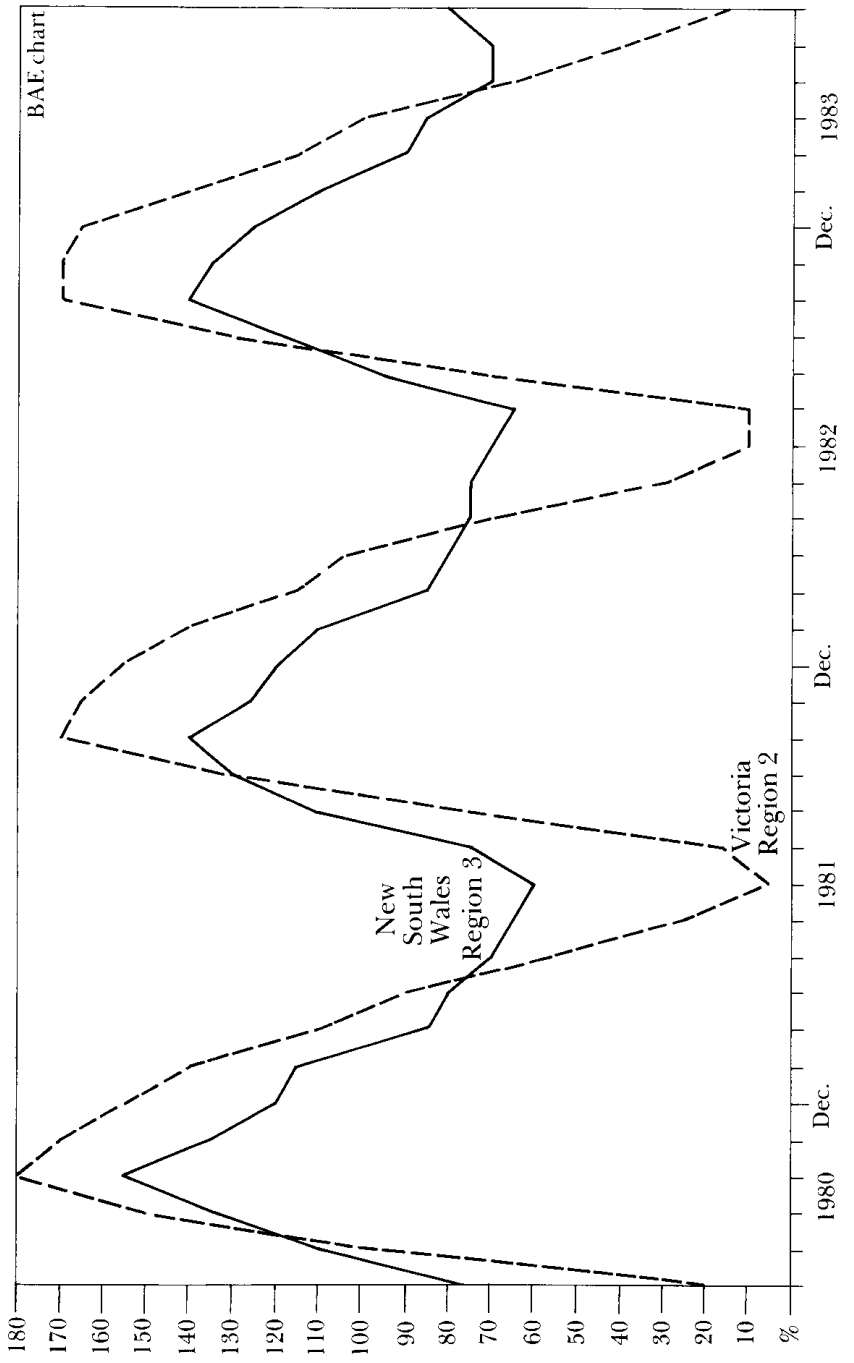

Figure 2: Monthly Milk Production as a Proportion of Average Monthly Production: by State

the seasonal and irregular components of variation. The difference in seasonality between New South Wales and Victoria is statistically significant at the one per cent level. The difference in seasonality may partly explain the higher average total cost for the NSW3 farms (see last row of Table 3). Thus, there is prima facie evidence of the farm level effects hypothesised earlier.

3.2 Estimation of the Model

Studies of the relationship between costs and size of Australian dairy farms (Mauldon 1969; Anderson and Powell 1973; Gargett 1984) and scatter diagrams of data for the sample farms suggest that equation (1) can be approximated by a linear logarithmic function. Such a function has the advantage of minimising the heteroscedasticity problem (Maddala 1977, p. 265). Hence, the estimation model is:

$$(2) \quad \log ATC_{it} = \log a + b\ POLICY_{it} + c \log SIZE_{it} + d \log MANAGEMENT_{it} + e_{it}.$$

ATC is the ratio of a farm's total costs to milk output in cents per kilogram butterfat.[3] POLICY is measured by three alternative proxies: (i) a dummy variable (POL1) defined by VIC2 = 1 and NSW3 = 0; (ii) a seasonality variable (POL2), defined by the log of the percentage coefficient of variation of monthly milk production; and (iii) a variable measuring the access of a farm to the market milk sector (POL3), defined as the logarithm of the percentage of total milk produced for the market milk sector. SIZE stands for farm size measured by the farm's milk output in kilograms of butterfat. MANAGEMENT is measured by three alternative proxies: (i) milk yield per cow in kilograms of butterfat (MGT1); (ii) milk yield per hectare of grazing area in kilograms of butterfat (MGT2); and (iii) percentage rate of return to capital and management (MGT3). The variable e_{it} is the random error term with zero mean and a constant variance. Correlation coefficient matrices for all independent variables were examined. The examination showed the variables to be not highly correlated, implying that estimates of regression coefficients (a, b, c and d) of equation (2) will be free from any significant multicollinearity problem.

Ordinary least squares (OLS) estimates of the coefficients of the variables for the different versions of equation (2) by individual years are shown in Table 4. Time series, cross-sectional estimation of the equation was not considered due to the limited time series data. The estimation technique used is design adjusted so that the standard OLS fit takes into account differential representation of the sample in the various size strata in the two regions (see Holt, Smith and Winter 1980). Note that estimates of the equation with MANAGEMENT proxy variables MGT1 and MGT3 are not presented in Table 4. This is because the regressions did not give as good a fit as those estimated using MGT2.

4. Results and Discussion

Table 4 shows that the estimation model fits the data fairly well. Most regression coefficients are at least statistically significant at the 5 per cent level, and all coefficients have signs consistent with *a priori* reasoning or economic theory. However, the results of the equation (2.1) version of the model, with state as a dummy variable, are disappointing. The regression coefficients for POL1 have large standard errors and are non-significant at the 5 per cent level for the first two years. This is because the dummy variable POL1 does not capture the different aspects of policy on individual farms within New South Wales as effectively as POL2 and POL3. The results of estimation of equation (2.1) are therefore not discussed further in this paper.

The negative coefficients of the SIZE and MANAGEMENT variables indicate that, in general, larger and better managed farms in the Murray River basin do have lower average total costs. Other recent studies of the Australian dairy industry reached the same conclusion (Samuel and Shaw 1983; Gargett 1984).

The variable of special interest in this study is the POLICY variable, used to measure the

3. Total costs include the costs of materials, services (excluding cost of transporting milk), hired labour and imputed wages of operator and family labour, depreciation (calculated on replacement value of farm improvements, structures, machinery and plant), and the opportunity cost of farm capital (calculated for each of the three years studied as 12 per cent of the value of land and depreciable items). Finally, the total was apportioned to dairy enterprises on the basis of dairy receipts as a proportion of total cash receipts from all farm enterprises to obtain the total cost.

Table 4: OLS Estimates of Average Total Cost (ATC) Functions

Year	Version of equation 2	Intercept (+)	Regression coefficients: POLICY proxy variable POL1 (-)	POL2 (-)	POL3 (+)	SIZE (-)	MANAGEMENT proxy variable MGT 2 (-)	$\bar{R}^2$
1980-81	2.1	9.912	-0.158			-0.272	-0.206	0.56
		(8.44)	(-1.34)			(-2.85)	(-1.85)	
	2.2	11.604		-0.315		-0.356	-0.161	0.42
		(10.13)		(-2.84)		(-4.03)	(-1.90)	
	2.3	9.440			0.212	-0.319	-0.168	0.45
		(7.86)			(2.24)	(-3.09)	(-1.75)	
1981-82	2.1	9.522	-0.155			-0.248	-0.133	0.83
		(10.31)	(-1.61)			(-3.26)	(-1.59)	
	2.2	10.082		-0.123		-0.248	-0.167	0.82
		(9.35)		(-1.03)		(-3.17)	(-2.21)	
	2.3	9.150			0.129	-0.256	-0.139	0.83
		(9.82)			(1.72)	(-3.47)	(-1.57)	
1982-83	2.1	8.643	-0.367			-0.127	-0.117	0.61
		(11.06)	(-4.36)			(-1.89)	(-1.50)	
	2.2	10.582		-0.418		-0.165	-0.153	0.65
		(9.24)		(-3.45)		(-1.83)	(-2.29)	
	2.3	7.784			0.314	-0.159	-0.114	0.70
		(10.04)			(5.20)	(-2.51)	(-1.66)	

Note: Signs at heads of columns are those theoretically expected. Numbers in parentheses below regression coefficients are t-statistics. Critical t-values for 35 degrees of freedom at 5 per cent and 1 per cent levels are 1.69 and 2.44, respectively.

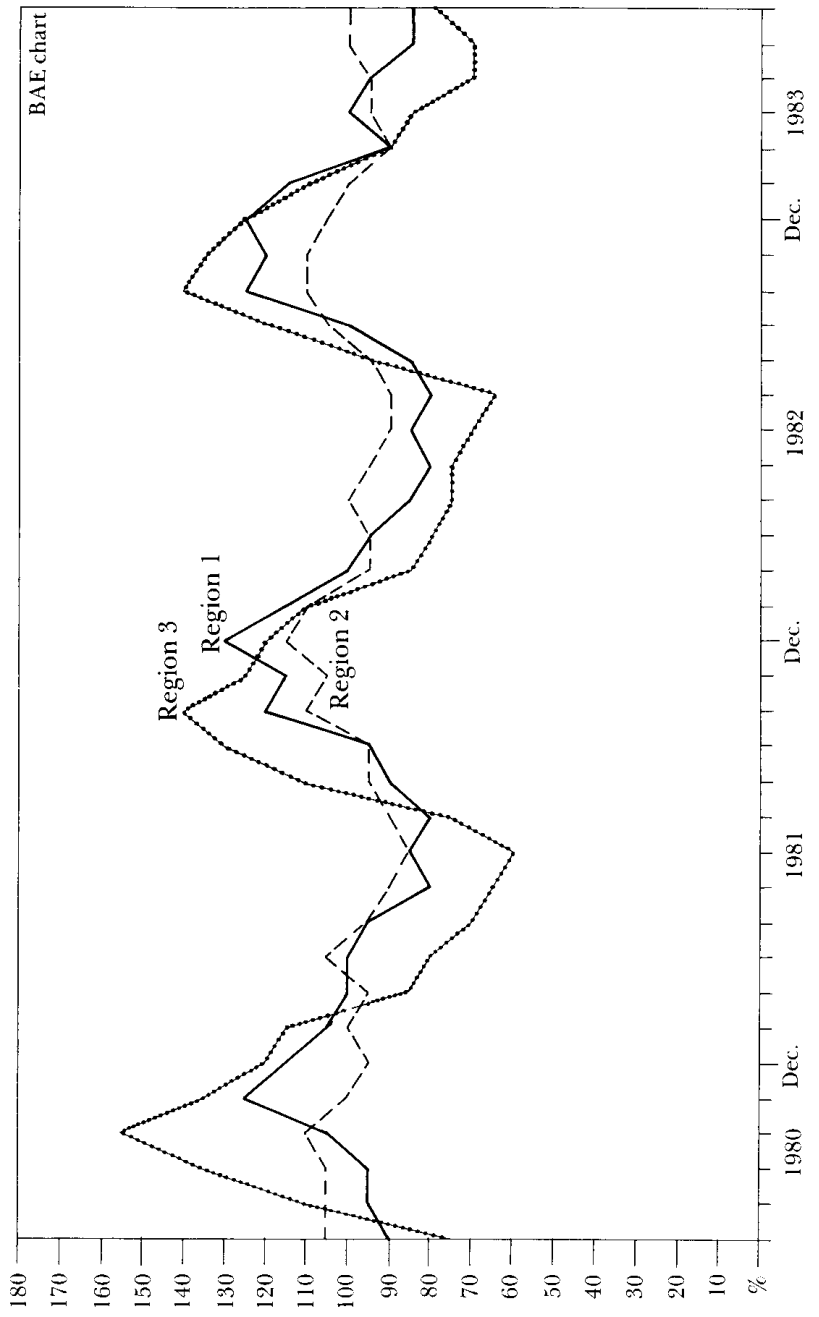

Figure 3: Monthly Milk Production as a Proportion of Average Monthly Production: by Region in New South Wales

upward shift in the average total cost function of dairy farms due to policy differences between the two states. As expected, the regression coefficients of the POLICY proxy variables — POL2 (seasonality) and POL3 (market access) — are negative and positive, respectively. Hence, if seasonality is decreased through policy intervention, average total costs will rise. From this, it can be inferred that NSW3 farms have a higher average total cost than VIC2 farms because there is less seasonal variation of production than in Victoria. This situation arises from rigidities of the quota system and inequitable access to market milk. An important policy implication, from the standpoint of efficient allocation of scarce resources, is that if the dairy policy in NSW3 were similar in all respects to that in VIC2, then the New South Wales farms would achieve measurable savings in their average total costs.

The regression analysis allows estimation of the magnitude of this possible cost saving for the NSW3 farms. First, the mean average total cost is estimated, for each year, at the NSW3 mean levels of the relevant variables (POL2 and POL3, SIZE and MGT2). Next, the procedure is repeated, substituting the VIC2 mean levels of the policy variables (POL2 and POL3), keeping other variables the same. This gives an estimate of the likely mean level of average total cost for the NSW3 farms if they were operating in the Victorian policy environment. The difference between the average cost figures is then an estimate of the *average* annual savings for the NSW3 farms under the assumption of Victorian policy. The cost savings estimated in this manner, which are of short term nature, are presented in Table 5.

To put these cost savings for the NSW3 farms in perspective, they are compared in Table 5 with the actual mean levels of average total cost. The comparison shows that the cost savings are of the order of 14–31 per cent. These are substantial savings, especially over the longer term. It may be emphasised that these savings are attributable not to differences between particular components of the policy packages of New South Wales and Victoria but to the overall difference between the policy packages of the two states.

It should be pointed out that the absolute values of average total cost, given on a per kilogram of butterfat or per litre basis in Tables 3 and 5, must not be regarded as *the unit cost* of producing a kilogram of butterfat or a litre of milk. Because the dairy survey is not designed to determine the cost of producing any single product, the absolute values of average total

Table 5: Savings in ATC by NSW3 Farms: Assuming Victorian Dairy Policy Environment and Mean Levels of ATC for NSW3 Farms(a)

Year	Mean of average total cost	Savings in average total cost			
		Seasonality		Market access	
	c/l	c/l	%	c/l	%
1980-81	22.64	3.97 (0.62)	17	4.59 (0.41)	20
1981-82	29.18	(b)		4.16 (0.28)	14
1982-83	39.71	8.90 (1.02)	22	12.52 (0.71)	31

(a) Values in cents per litre were derived by converting the cents per kilogram of butterfat values, assuming the milk contained 4.2 per cent butterfat. (b) Not estimated because the regression coefficient of seasonality (POL2) variable for 1981-82, equation (2.2), was not statistically significant at the 5 per cent level.

Note: Figures in parentheses are standard errors.

costs are only indicative. Hence, it is pertinent to concentrate on the percentage savings in average total cost rather than on the absolute savings.

The finding that cost savings from policy reforms would be possible for the NSW3 dairy farms in the Murray River basin raises the question: What might be the cost savings for dairy farms in other regions of New South Wales? Although this study was not aimed at quantifying the savings elsewhere, it is useful to examine Figure 3, which shows the seasonality of milk production for each of the three regions of the state. It is observed from the figure that production is less seasonal in regions 1 and 2 than in region 3 (NSW3). This suggests that the cost savings in those regions may be equal to, if not greater than, those for NSW3. Thus, for the dairy farms in New South Wales as a whole, the aggregate cost savings are likely to be very substantial.

5. Policy Implications and Conclusions

We can conclude that market milk policies in New South Wales have led to the average costs of New South Wales dairy producers in the Murray River basin being substantially higher than those of their Victorian counterparts. This difference in costs for the New South Wales farms was measured from the benchmark of Victorian dairy farms situated in the same river basin and subject to the markedly less regulatory policies of Victoria. An implication of this finding is that, if the institutional arrangements of New South Wales were replaced by those of Victoria, the New South Wales producers in the area could reduce costs per litre of milk produced by about 20 per cent. These cost savings may, however, be offset by some potential loss of revenue if current quota policies remain.

As outlined earlier, there have already been some changes in the New South Wales policies since July 1984. One aspect of the change is that the quota farmers are now allowed to produce below quota in two of the 13 four-week periods without being penalised. This change in policy will allow dairy farmers to reduce the cost of supplementary feeding for cows during four weeks in winter. A decrease in farm costs can therefore be expected to result. But when this is compared with the Victorian policy under which farmers are allowed to vary their milk production at any time and for any length of time, the policy change in New South Wales appears insignificant, and is not likely to generate substantial cost savings. To achieve substantial costs savings, there will have to be a major change toward more economically efficient policies such as the removal of quotas on all winter production. Such a change could have a number of far-reaching effects — for example, a shift in regional distribution of milk production within the state in favour of regions which have comparative advantage in supplying milk in particular months; lower prices of milk for consumers; and even some interstate trade in market milk. The move would be consistent with more efficient allocation of resources from the national viewpoint, benefiting both dairy farmers and milk consumers. Of course there would be some adjustment costs borne by particular farmers but these would be minimised by policies already in place such as the Rural Adjustment Scheme.

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