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THE IMPACT OF GOVERNMENT INTERVENTION
IN THE AUSTRALIAN DAIRY INDUSTRY*

by

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IN THE AUSTRALIAN DAIRY INDUSTRY

ABSTRACT

This study assesses the economic impact of existing Australian dairy pricing policies on resource allocation and income distribution among participants in dairy markets. Australia is used as an example because it recently became the first major producing country to decide to eliminate federal intervention in the dairy price discovery process. Results indicate that significant costs and transfers can be attributed to the influence of government intervention. Also, evidence of policy bias favoring producers over consumers is found.

Keywords: dairy products, government intervention, pricing policies, regulated monopoly, economic impact, Australia

THE IMPACT OF GOVERNMENT INTERVENTION IN THE AUSTRALIAN DAIRY INDUSTRY

The dairy industries of all major producing countries are subject to government intervention (Schelhaas). The existence of intervention in the pricing process implies that a governments' second-best approach is better than a competitive market. Such a conclusion is being challenged increasingly worldwide because of the dairy product surpluses which exist (Dairy Industries International). Dairy policies are criticized for being designed to favor producers at the expense of consumers. It is argued that where such policy bias exists, inefficiencies are introduced into production and marketing systems, which adversely affects the performance of the policy itself (Samuels, et al.). As a result, there is a need to evaluate the performance of dairy policies against standards of economic efficiency. Therefore, the objective of this study is to assess the economic effect of existing Australian dairy pricing policies by quantifying the costs and benefits resulting from their use, and the impact of government intervention on resource allocation and income distribution among participants in Australian dairy markets. Australia is used as an example because that government recently evaluated its dairy policies and decided to gradually eliminate federal intervention in the price discovery process - becoming the first major producer to do so.

This paper is organized into three sections. First, a brief description of Australian dairy policy organizations and instruments is presented. Next, the economic effects of pricing policies are estimated. Finally, policy effects are assessed concerning their relative impact on producers and consumers.

Policy Organizations and Instruments

The following sections outline the organizational arrangements and consider to what extent use of existing policy instruments can be explained by an economic model.

The Organizations

The Australian Dairy Corporation (ADC) is presently involved in administering legislation dealing with the marketing arrangements for prescribed dairy products (butter, certain cheeses, wholemilk powder, skim milk powder/buttermilk powder, and casein). Under existing marketing arrangements, a "stabilization levy" is set separately for each prescribed product at the difference between the assessed export price (AEP) and the desired domestic bulk wholesale price.¹ The ADC makes recommendations to the Minister for Primary Industry on the level of both stabilization levies and assessed export prices. Upon the sale of products for domestic consumption, manufacturers pay levies into separate product accounts of the Dairy Products Stabilization Trust Fund (which is administered by the ADC). The ADC makes interim stabilization payments to manufacturers from the Stabilization Fund. All exports of prescribed dairy products are pooled at the minimum export (permit) price fixed by the ADC.

State dairy industry authorities are the second source of government intervention in the pricing process. In each state and the Australian Capital Territory, a statutory dairy industry authority (DIA) or similar body is responsible for the organization of the purchase, production, supply, manufacture, treatment, storage, transport, packing, sale and distribution of milk and dairy produce so as to ensure the continuous availability of all classes of milk. Specifically, DIAs set market (fluid) milk prices to farmers and the margins payable at all stages of the marketing system.

All DIAs have first claim to milk to ensure adequate market milk supplies. Most DIAs use a market milk contracting system to guarantee supplies. Contracts for the delivery of milk to factories are surrendered by dairy farmers. Factories compensate dairy farmers for milk delivered under contract. Farmers receive the current market milk price for the proportion of their output surrendered under contract, and they receive the lower manufacturing milk price for additional output.

An important feature of the milk supply system is that no market milk is traded across state borders. Although the federal government has the authority to intervene in the market milk sector it has chosen to allow each state to administer their own supply system. This action has, in effect, created a regulated monopoly for market milk in each state.

The Instruments

This section describes the major instruments of dairy policy using a profit-maximizing model. To begin with, it is assumed that milk and dairy product producers, similar to other economic agents in society, would like to maximize their profits. By collectively restricting domestic sales, the industry would be able to keep prices at a level above that which would occur under freely competitive conditions. However, each producer individually would still like to increase his sales at the higher price that would result. Therefore, a monopolizing agent is needed to enforce the desired individual behavior for the collective good. For the purposes of this study, the model assumes that the ADC and DIAs act as agents for the producers as a group to enforce the collective action on each individual producer. This leads to a consideration of the behavior of a constrained or regulated monopolist (on the domestic market).

The processing sector is assumed to be competitive. The evidence available on concentration, exit, entry, pricing, trade practices, state regulations and retailers' demand suggests that, generally, the processing sector behaves competitively (Blank and Campbell, IAC 1976, IDF). Therefore, processing costs can be considered as independent of the output decisions of dairy producers, and it is assumed here that they are constant over the relevant range of output.

Considered first is the most significant aspect of Commonwealth arrangements for the manufacturing sector: the process of equalization. This involves pooling - separately for each product (or product group) - the returns from

domestic and export sales of dairy products, and means that manufacturers receive an average, or equalized, price for all their production of a particular dairy product.

Legislation implementing the scheme, essentially aimed at protecting the domestic price structure, became effective on 1 July 1977. The legislation provides for maintenance of a differential between the domestic and export prices of prescribed products. The price differential is maintained by imposing compulsory levies on domestic sales of these products with each levy equivalent to the difference between the domestic bulk wholesale price and the assessed export price (AEP) of the product.

The levy is payable by the manufacturer of prescribed products which are sold for domestic consumption or used in own manufacture, but stabilization payments are made uniformly across all production of each product irrespective of whether it is sold on the domestic or export market. All stabilization payments must be passed on in an equitable manner to all suppliers of the milk from which the product was made.

The levies are set three times each year by the Minister for Primary Industry. Before making a decision, the Minister considers recommendations on levy amounts made by the ADC and the Australian Dairy Industry Advisory Committee. Domestic levy amounts are derived after the desired domestic bulk wholesale price level has been identified. In fact, domestic levies are determined by subtracting the AEP from the preferred domestic price ($BWDP - AEP = DL$). Therefore, the ADC's recommendations for domestic levies are based on their expectations of what the appropriate prices will be on domestic wholesale markets.

Price discrimination operates through the equalization system. Prescribed products which cannot be sold domestically at the supported price are disposed of on foreign markets "at a loss," in the sense that the opportunity to receive the higher domestic price is lost. The different prices serve to maximize the

revenues on total sales and increase the profits of the industry as a whole above the level which it would earn without price discrimination.

The extra revenues earned through price discrimination constitute a transfer from the domestic consumer to the producer. Insofar as the higher price reduces consumption domestically, there is also a net welfare loss.

The fact that equalization enables domestic prices to be maintained above export prices has provoked widespread debate over the true value of such a program. Turnovsky showed that publicly announced forecasts (such as those made for domestic wholesale prices) can have a price-stabilizing impact. Yet Veeman showed that potential long-term transfer and social costs are substantial when prices are supported above equilibrium levels. Godden, in attempting to measure the resource misallocation costs associated with the Australian dairy equalization scheme, found that those costs were large and that they increase significantly as export prices fall.

The second policy instrument, the Underwriting Scheme, began with an agreement in 1975 between Commonwealth and state governments to underwrite the equalized value of SMP. In subsequent years the scheme was extended to include all prescribed products.

Government contributions to a stabilization fund are needed when the equalized price of a product is below its underwritten price. Underwriting places a lower limit on the equalization value of a product as a means of providing assistance to the dairy industry. Underwriting levels are now determined by a formula which is 95 per cent of the average of estimated pool returns for three years (a forecast for the year in question and actual values of the two previous years). The assessment of the current scheme is that it has a potholing effect, in that it protects the dairy industry against unexpected and sharp price declines without masking long-term market trends (IAC 1983).

Export policies influence the dairy industry also. In Australia, as in nearly all other exporting nations, dairy exports constitute a residual market because export volumes represent a small proportion (18 per cent) of total production (BAE 1983a). Australia has an unwritten goal of remaining self-sufficient in all major dairy products. Therefore, production is encouraged to remain at that level plus a buffer stock to guard against shortfalls created by shocks to the productive system (ADC). This means that any production above that self-sufficiency-plus-buffer level will be available for export.

A profit-maximizing industry exports only if revenue cover the costs of the exports. However, once output is subsidized, a wedge is created between marginal revenue received by the producer (which includes equalization payments) and the marginal revenue originating from the buyer. The subsidized industry will export its output until marginal costs exceed the marginal revenue from the foreign purchaser. Thus, the value of a price equalization scheme is reduced by extra costs of production as output expands until marginal cost is equal to marginal revenue from abroad plus the equalization payment.

For market milk the most significant Australian policy instrument is the market milk quota system (or its equivalent) operating in each state. Their purpose is to restrict market milk supplies so that a price premium can be maintained. The New South Wales market milk quota (MMQ) system is typical: the DIA grants a minimum quota per week to newly registered dairies after they have produced for 12 months. For a farm to share in the growth of market milk sales, at least 110 per cent of current quota volume must be produced in each of 13 four-week periods. To gain additional quota from the pool of surrendered quota, a dairy farmer must have produced 120 per cent of quota for 12-months. For production of 100-110 per cent of quota, no change will be made in a farmer's quota, while production of less than 100 per cent of quota over a 12-month period will lead to a reduction in the size of quota allocated for

the next year. The net effect of this price discriminatory quota system is that surplus production is encouraged (Samuels et al.).

In summary, it is clear that Australian pricing arrangements act to significantly reduce the level of competition between domestic suppliers of dairy products. The effects of this reduced level of competition are to raise the domestic (equilibrium) market price and to create the capacity to effect a transfer from consumers to producers. An artificial market price has been created, therefore, as a consequence of the specific instruments chosen.

Quantitative Analysis

This section presents estimates of the economic effects of current Australian dairy policy. Prices paid by consumers are compared with marginal costs of production and with the competitive outcome.

Marginal Costs

In states which have relatively large market milk quotas, producers are allowed to expand beyond the point at which price equals "normal" marginal costs. In these states, producers get a "super-normal" return above the return that the market would generate without price and supply management in the dairy sector. Insofar as this "super-normal" return includes price benefits of the dairy program, there is some waste of resources.

In states where market milk quotas are relatively small, production is kept nearer the point at which marginal cost equals price and "normal" competitive returns are earned. The equalized price of manufacturing milk is the same there as in the states with no scarcity of market milk quota, but output is held to a level where costs are lower.

States in which less than the Australian national average of 29 per cent of total milk production is sold as market milk² are assumed to be constrained by market milk quota: Victoria and Tasmania are identified as having marginal costs constrained near the competitive level (even though most producers do

receive some additional profit from market milk sales). It is noteworthy that these two States contributed 65.1 per cent of total Australian milk production during 1981-82, with 59.4 per cent coming from Victoria alone.

States which consume more than the national average of their total milk production as market milk are assumed to have enough market milk quota (or its equivalent) so that a majority of producers benefit significantly from "super-normal" returns. Therefore, producers in South Australia, Queensland, Western Australia and New South Wales are not significantly constrained by the competitive level of marginal costs, on average.

Clearly, it is to a milk producer's benefit to gain market milk quota. As an indication of how valuable farmers perceive MMQ to be, in Queensland - the only state in which quota can be sold - the negotiable value of surrendered weekly MMQ was \$50/l during 1980-81. For a producer currently operating at the margin, this price represents an investment requiring a payback period of approximately six years.³

The average price differential between market milk and manufacturing milk has been significant in recent years. As shown below, the differential has been 75-80 per cent of the value of manufacturing milk, on average, across Australia.⁴

	<u>1981-82</u>	<u>1982-83</u>
Market milk	28.1	30.9
Manufacturing milk	<u>15.6</u>	<u>17.6</u>
Differential	12.5¢/L	13.3¢/L

Skim Milk Powder

One of the features of the dairy program is price discrimination in the market for SMP (and other prescribed products). Due to equalization, the domestic price of powder is maintained above the price at which the so-called "surplus" is sold on world markets.

A competitive market could not sustain a differential between domestic and export prices (apart from transportation costs) even where such a market was protected from imports. Competition among producers would bid the domestic price down to the world price or to the price at which all powder produced could be sold domestically, whichever is higher.

It is shown in this section that all powder produced could not be consumed domestically at a price above the world price; and since no producer need accept less than he could get on the world market, the domestic price would not fall below the world price. Thus, the competitive price for SMP which is compared with the current regime is the world price. (Average Australian F.O.B. export prices are used as a proxy for world prices.) Consumption and prices for calendar years 1980-81 and 1981-82 are used (taken from BAE 1983a). Prices have been converted to 1981-82 dollars using the consumer price index. Average volumes and prices (in real terms) have been used to reduce the effects of year to year fluctuations partly due to statistical reporting methods.

The elasticity of domestic demand for SMP used here is -0.28 , taken from Song and Hallberg. Although this elasticity comes from American studies, it is expected that an Australian figure (none exist at present) would be similar. This expectation arises from the fact that results of Australian studies of fluid milk (Street, Nelson) have been very similar to results of American (George and King) and Canadian (Lu and Marshall) studies. Strictly, this elasticity is applied to farm prices but has been used with respect to wholesale prices. This may produce a slight underestimate of the consumer response to changes in prices that are calculated here. However, Nelson notes that if there is a constant percentage mark-up between the two, wholesale and farm price elasticities will be the same. As noted previously, the milk processing sector is treated as competitive so that changes in wholesale prices result in the same absolute changes in price received by the producer.⁵

*only one estimate of value in the USA?
| Street's
of assumptions*

If the quantity consumed domestically at the domestic price is significantly less than total current output, then competition among producers would drive the domestic price down to the world price. Since elasticity of demand (n) is -0.28 , the increase in quantity consumed domestically (ΔQ) which would result from lowering the domestic price to the world price is:

$$\begin{aligned}\Delta Q &= nQ \Delta P/P \\ &= 0.28 \times 33K (1,035 - 900)/1,035 \\ &= 1.2 \text{ kt}\end{aligned}$$

This would have increased domestic consumption to about 34 kt for 1981-82, far short of total output (78 kt). Therefore, the world price would have prevailed under competition. Using data for 1980-81 to 1981-82, the average annual transfer from consumers to producers has been:

$$\begin{aligned}(P_{sd} - P_{sc}) Q_d &= (1,012 - 945) 39.3K \\ &= \$2.6m\end{aligned}$$

where P_{sd} is the domestic price, P_{sc} is the competitive price and Q_d is domestic consumption. The net welfare loss is approximately equal to:

$$\begin{aligned}(0.5) n (P_{sd} - P_{sc})^2 Q_d / P_{sd} &= (0.5) (.28) (1,012 - 945)^2 39.3K / 1,012 \\ &= \$24,406\end{aligned}$$

In other words, SMP price discrimination has imposed an average annual cost of approximately \$2.7m on Australian consumers of which \$2.6m accrues to the dairy industry and about \$24,000 is net social loss. This is \$2.6m more revenue than a competitive market (even one protected from imports) would generate and is, therefore, part of the receipts attributable to government intervention.

The Competitive Outcome

So far, price differentials have been measured relative to marginal costs at protected levels of output. In this section the change in costs associated with an expansion to the competitive outcome is considered. The purposes are, first, to establish the price that consumers would pay and, second, to compare

the costs they currently expect to face with the revenues producers expect to receive under price management in excess of the competitive outcome.

It is assumed that Victoria's and Tasmania's marginal cost of production at current levels of output would be nearly the same following a rationalization of the industry due to competition. That is, there is little adjustment for the effects of relocation due to removal of market milk contract constraints.⁶ The elasticity of the marginal cost of production schedule with respect to changes in costs (i.e. the elasticity of the competitive supply schedule) is assumed to be 1.0, taken from a range of likely estimates considered by Godden and the IAC (1975). Blank found that the elasticity of the aggregate derived demand schedule for Australian manufacturing milk⁷ is approximately $-.82$. The change in amount demanded, ΔQ , due to a fall in price, ΔP , is equated to the change in supply, ΔQ , accompanied by a rise in costs, ΔC , which would result from a move to the competitive price and quantity. The change in demand (ΔQ) is approximately:

$$\Delta Q = n Q_d \Delta P / P_w$$

where n is the elasticity of aggregate demand ($-.28$) for domestic milk products with respect to the wholesale price P_w (for which the average 1981-82 price of milk in Cheddar is used - 25.9¢/L).

The change in supply ΔQ is approximately:

$$\Delta Q = n' Q_d \Delta C / C_1$$

where n' is the elasticity of the cost schedule (1.0) and C_1 is marginal cost at output Q_d and has been estimated above, for Victoria and Tasmania, as 15.6¢/L .

Given that the current differential⁸ between the competitive price and C_1 is estimated at $\Delta P + \Delta C = 3.7\text{¢/L}$, it is possible to solve these three equations for ΔC , ΔP and ΔQ . The results are

$$\Delta C = 1.4\text{¢/L}$$

$$\Delta P = 2.3\text{¢/L}$$

$$\Delta Q = 379 \text{ ML}$$

An adjustment to the competitive outcome would cause marginal costs to rise by 1.4¢/L from their current level as output increased by 379 ML (7.3 per cent), and would cause competitive consumer prices to drop to 2.3¢/L below current levels.⁹

Cheese

The costs and benefits associated with pricing cheese above marginal costs are calculated in this section. The data for these calculations are taken from BAE (1983a). Annual average volumes have again been used for the years 1980-81 and 1981-82. It is assumed that price management raises the prices of domestic and imported cheese by the same absolute amount.

All cheese is considered as a single homogeneous product equivalent to cheddar. Cheddar and variety cheeses are aggregated by weight. The price used for all cheese is the domestic bulk wholesale price of cheddar as at July 1982 which is more than the competitive world price by approximately the amount of the domestic levy (\$600/t of cheese in 1981-82). This single price assumption may bias calculation of the transfer from consumers to importers.¹⁰ For domestic cheeses, the single price assumption is not likely to have a serious effect on estimates of costs and benefits associated with the dairy program, as these are based mainly on changes in prices rather than absolute prices.¹¹

A Bureau of Agricultural Economics study of Australian demand for cheese in 1978 gave a value of -0.5 for the price elasticity of cheese. More recent estimates by the International Dairy Federation give an elasticity in the range

-0.12 to -0.7 for EEC members. In this case, -0.5 is used because it is considered to be most representative of the Australian market.

In this paper, the effect of higher prices for imports is measured as a "transfer from consumers to importing agents." This is certainly a cost to consumers, but it is not clear who benefits and whether they benefit by the whole amount. The economic rents associated with the right to import cheese into Australia may accrue to a diverse group of economic agents. Thus, "importers" is hereafter used generically to refer to all of these agents, and there is no attempt to distribute the benefits among them.

The transfer from consumers to domestic producers amounted to:

$$600 (101.3 - 14.6) \text{ kt} = \$52\text{m}$$

The transfer from consumers to cheese importers amounted to:

$$600 (14.6 \text{ kt}) = \$8.8\text{m}$$

This transfer is relatively small because volumes allowed to be imported have been small relative to consumption.

The additional cost to consumers of exporting cheese (55.1 kt annual average for the period 1980-81 to 1981-82) amounted to:

$$231 (55.1 \text{ kt}) = \$12.7\text{m}$$

This sum represents the amount Australian cheese consumers are paying to "subsidize" cheese exports. It is estimated by calculating the amount by which marginal costs exceed those that would exist if production were reduced to eliminate all exports (\$231/t), and multiplying it by export volumes.¹² In other words, the resource misallocation cost of producing cheese which is eventually exported is \$12.7m annually.

In addition to the transfers already calculated, it is also possible to estimate the net welfare loss to the consumer arising from restricting consumption to a level where the value to the consumer exceeds the marginal cost of cheese. It is approximately equal to:

$$(0.5) n (P_d - P_c)^2 Q/P_d$$

where Q is total consumption, at the wholesale price P_d .

The net welfare loss is calculated as:

$$(0.5) 0.5 (600)^2 101.3 \text{ k/1,907} = \$4.8\text{m}$$

Market Milk

Volume and gross value of production data for 1981-82 (BAE 1983b) is used to calculate annual consumer transfer and welfare costs related to market milk.

The consumer transfer to market milk producers is estimated to be the difference between the average unit values of market milk and manufacturing milk (the market milk premium) multiplied by the volume of market milk, which is:

$$(28.05 - 15.63\text{¢/L}) 1,526 \text{ ML} = \$189.53 \text{ M}$$

This estimate is based on the fact that some milk could be supplied to consumers at the manufacturing milk price - 3,673 ML were supplied at that price during 1981-82. One common justification for the premium is that milk production is seasonal, requiring additional production costs to maintain milk supplies during the "off season." It was discovered, however, that despite higher costs, the premiums paid during 1977-78 resulted in net returns per unit of milk which were about 20 per cent higher for market milk than that for manufacturing milk (BAE 1981). Therefore, it is likely that a significant portion of the current market milk consumer transfer can be considered gross profits to producers. This is not entirely surprising since the market milk quote scheme in most states requires a producer to deliver milk consistently for at least a year before being granted a quota. This implies that the producer must be able to at least breakeven at the manufacturing milk price (unless he is gambling that he will receive a quota at the end of an unprofitable year).

One important implication of the above analysis is that state DIAs, in their effort to ensure a steady supply of market milk, may be setting market milk price premiums at a level which is high enough to cover all exceptional

seasonal production costs incurred at the most costly time of year rather than at an average level for the entire year.

The net welfare loss to market milk consumers can be estimated using the same method as that used for cheese in the previous section. It is approximately equal to:

$$(0.5) 0.15 (12.4\text{¢/L})^2 1,526 \text{ ML}/28.05\text{¢} = \$6.27 \text{ M.}$$

The market milk price elasticity of demand used above, -0.15, was chosen from a range of Australian estimates (Tedesco and Collins).

Potential Gains from Interstate Tradeability of Quota

The current administered allocation of market milk quota (or its equivalent) has given rise to a disparity between states in marginal costs of production and a consequent waste of resources used in the production of the total Australian milk output. Efficient producers in Victoria and Tasmania cannot, given the level of MMQ, produce more milk profitably. In those states the average return covers competitive marginal costs and little more. In states where MMQ is not a binding constraint, average returns are allowed to exceed competitive marginal costs, and additional profits are earned.

The implication of this disparity in marginal costs is that those states in which quota is scarce could produce some of the milk produced in the other states at less cost. With interstate tradeability of quota, efficient states would be prepared to buy some of the market milk quota from the states which hold relatively more quota. Eventually a free market in quota would result in a transfer of quota (in quantity X) such that efficient states (group A) would expand output to Q'_A and less efficient states (group B) would contract their output to Q'_B where their marginal costs were equal at C' (adjusted for transport costs).

The net saving in resources used to produce milk is the difference between the value of resources released in less efficient states and the value of the extra resources used to expand production in efficient states.

Using $n=1$ as the elasticity of the aggregate marginal cost schedule (Pandey, et al.), and assuming this elasticity also applies to regional components of total supply and is constant over the relevant range,¹³ it is possible to calculate the net welfare gain in relocating production. (The difference between marginal cost in the quota-scarce states and the average price is about 3.7¢/L.)

Resources released in less efficient states are approximately:

$$xC' + 0.5 (3.7-y)$$

where y is the difference between current marginal costs in efficient states (C_A) and costs with trade. (Therefore, $y = C' - C_A$.)

Resources brought into use in efficient states are valued roughly at:

$$xC' - 0.5 xy.$$

The net saving in resources is the difference between these, namely:

$$1.85x .$$

It is now possible to calculate the quantity reallocation (x) between the two groups of states for 1981-82 from the elasticity of the cost schedules, given that actual total output $Q_A + Q_B$ equalled 5,199 ML and the constrained states produced about 65 per cent of the total.

Quantities and cost changes are related by the formula:

$$\Delta Q = nQ \Delta C/C$$

where

$$n = 1 \text{ for both groups}$$

$$C_A = 15.6\text{¢/L}$$

$$C_B = 19.3\text{¢/L}$$

$$Q_A = 65 \text{ per cent of } 5,199 \text{ ML}$$

$$Q_B = 35 \text{ per cent of } 5,199 \text{ ML.}$$

The change ΔQ is equal to x for both groups. Therefore:

$$x = 0.65 (5,199)y/15.6$$

and

$$x = 0.35 (5,199) (3.7-y)/19.3$$

Solving for x , it is found that an efficient industry would relocate 243 ML of production from less efficient states to more efficient states. Substituting $x = 243$ ML in the estimate for the difference in resource costs indicates that this relocation of production would reduce resource costs by roughly \$4.5m annually.

Losses Due to Exports

Despite declining volumes in recent years, the wholemilk equivalent of total Australian dairy exports was still 1,094 ML in 1981-82. As noted earlier, the average value of all milk produced during 1981-82 was 19.3¢/L, or 3.7¢/L above marginal costs of efficient producers. Therefore, 3.7¢/L (1,094 ML) = \$40.5m is the current annual value of the deadweight loss to the Australian economy of "subsidizing" exports of milk products. This is a deadweight loss rather than a transfer to foreign consumers since the volume of Australian exports would presumably not affect world prices. Foreign consumers would have been able to purchase dairy products at those prices in any case.

Deadweight losses are one of two types of distortions in the allocation of resources caused by the equalization scheme which pays dairy farmers a price equalling the average value of all manufacturing milk produced during a year.

A financial loss occurs on all milk which is sold for less than the cost of producing it. Such losses occur on some export sales because producers extend production to the point where marginal costs equal average (equalized) revenues, rather than marginal revenues.

A deadweight loss occurs on all milk which is sold for less than the expected value of that milk (valued at the time of production). Such losses

occur on all export sales because the expected (equalized) value of all exports exceeds the marginal value of those goods. Deadweight losses are not incurred by the dairy industry - farmers receive the expected value for their milk. Instead, the losses are incurred by the Australian economy because resources were allocated to dairying which could have made a larger contribution to national product had they been allocated to some other industry.

Summary of Annual Costs and Transfers

An estimate of total costs and transfers resulting from dairy pricing policies for 1981-82 is presented in Table 1 as \$354m. This figure includes all the estimates described earlier in this study plus estimates for the three remaining prescribed products - butter, WMP and casein - which were calculated in the same manner as those of SMP, and cheese.

The largest components of the \$354m total are consumer transfers. Each year domestic consumers pay domestic producers nearly \$97m more for dairy products and about \$190m more for market milk than would be required under competitive market conditions. To put these costs and transfers into perspective, note that the total of \$354m represented 35.3 per cent of the farm level gross value of milk production (GVP) during 1981-82. The total of \$153.67m for manufacturing milk was 26.8 per cent of the GVP for that sector, while market milk's total of \$200.3m represented 46.8 per cent of the farm level GVP of that portion of the dairy industry (BAE 1983b).

Assessment of Policy Effects

Critics of the dairy program are concerned about the extent to which the program has favored producers and processors at the expense of consumers. The analysis undertaken in this paper thus far appears to justify this concern. This section, then, attempts to assess more precisely whether or not milk producers and processors have been favored by dairy pricing policies.

TABLE 1: SUMMARY OF ANNUAL COSTS AND TRANSFERS: 1981-82

Product	Consumer transfer \$Am	Welfare loss \$Am	Transfer to importers \$Am	Loss from exporting \$Am	Interstate resource misallocation \$Am
SMP	2.6	.02	0	(a)	(b)
Cheese	52.0	4.8	8.8	(a)	(b)
Butter	34.6	2.4	0	(a)	(b)
WMP	6.6	.27	0	(a)	(b)
Casein	1.03	.04	0	(a)	(b)
Manufacturing milk total	96.83	7.54	8.8	40.5	(b)
Market milk	189.53	6.27	0	0	4.5
Total	286.36	13.81	8.8	40.5	4.5
Total of annual costs and transfers = \$353.97m					

(a) The amount for each product is included in the final total - only the loss of cheese exports was calculated separately, as outlined in the text.

(b) This cost was calculated using volumes of milk, therefore it does not apply to any particular processed product. As outlined in the text, it reflects costs arising from market milk policies.

NOTE: Several of these estimates were calculated from averaged data, as explained in the text.

Procedures used by Song and Song and Hallberg are used here to specify the nature of any bias in Australian dairy pricing policies. Estimates for each of 21 years are made, subject to the condition that the actual amount of milk that was available for processing in each year must be produced, for (1) a set of prices for market and manufacturing milk that would have maximized consumers' welfare from consumption of these types of milk, and (2) a set of prices for market and manufacturing milk that would have maximized milk processors' aggregate gross income. Actual farm-gate returns are compared with the optimal prices generated from these two solutions to assess the extent to which pricing policies were biased toward either producers or consumers in each of the 21 years from 1962-63 to 1982-83.

For the sake of comparison, two "optimal" solutions are generated. To determine which price-quantity combinations will maximize dairy producer revenues, it is necessary to specify a demand function. The analysis used here follows that of Song and Hallberg. If there are n products made from milk, the annual farm level demand function can be written:

$$(1) \quad Q_i = a_i + \sum_j b_{ij} P_j,$$

where $i, j = 1, 2, \dots, n$; Q_i represents consumer demand for milk used in the i th product; and P_j represents the price of milk used in the j th product. A maximum aggregate processor gross income can be found by solving the quadratic programming problem:

$$(2) \quad \text{maximize } R = \sum_i P_i Q_i = \sum_i P_i (a_i + \sum_j b_{ij} P_j),$$

subject to

$$(3) \quad a_i + \sum_j b_{ij} P_j = Q_i \text{ for all } i,$$

$$(4) \quad \sum_i Q_i = TQ,$$

$$(5) \quad P_i, Q_i \geq 0 \text{ for all } i.$$

Maximum consumer welfare is defined here as the maximum utility accruing to consumers from consumption of all milk. Therefore, using the demand functions defined by equation set (1), the price-quantity combinations that will maximize consumer welfare can be found by solving the problem:

$$(6) \text{ Maximize } U = \sum_i \int_0^{Q_i} (A_i + \sum_j B_{ij} Q_j) dQ_i,$$

subject to

$$(7) A_i + \sum_j B_{ij} Q_j = P_i \text{ for all } i,$$

$$(8) \sum_i Q_i = TQ,$$

$$(9) P_i, Q_i \geq 0.$$

It is easily shown that marginal utilities in all markets must be equal. It is also assumed that the nature of demand is identical for the two markets considered.

For this study, both market milk and manufacturing milk were considered. The two sectors were assumed to constitute separate markets, but the demand for each product was assumed to be a function of its own price as well as the price of the other product.

Own-price and cross-price elasticities shown below were taken or derived from the demand studies cited earlier and from George and King. These are used with a quadratic programming algorithm much like that of Ladd and Updegraff to obtain solutions for each year.

	Market Milk	Manufacturing Milk
Market milk	-0.25	0.01
Manufacturing milk	0.02	-0.45

The results presented in Tables 2 and 3 indicate that producers' gross income could have been increased in each year by a reallocation of milk actually used among the two products under a more discriminatory pricing scheme. This increase would have been possible had more milk been marketed in the form of

TABLE 2: ACTUAL AND "OPTIMAL" MILK PRICES (SELECTED YEARS)

Year	Market milk \$/kg butterfat	Manufacturing milk \$/kg butterfat	Weighted average \$/kg butterfat
ACTUAL PRICES			
1962-63	2.31	0.96	1.23
1967-68	2.40	0.95	1.27
1972-73	2.74	1.23	1.57
1977-78	4.61	1.53	2.36
1982-83	7.92	3.62	4.78
"OPTIMAL" PRODUCER PRICES			
1962-63	3.78	0.90	1.39
1967-68	3.93	0.88	1.35
1972-73	4.49	1.14	1.78
1977-78	7.54	1.37	2.78
1982-83	12.96	3.25	5.24
"OPTIMAL" CONSUMER PRICES			
1962-63	1.09	1.09	1.09
1967-68	1.06	1.06	1.06
1972-73	1.32	1.32	1.32
1977-78	1.73	1.73	1.73
1982-83	3.88	3.88	3.88

NOTE: The actual and "optimal" prices were recorded or calculated for all 21 years.

TABLE 3: MILK PRODUCER GROSS REVENUE UNDER "OPTIMAL" CONDITIONS
(SELECTED YEARS)

Year	Under producer revenue maximization		Under consumer welfare maximization	
	Estimate	Deviation from actual	Estimate	Deviation from actual
	\$Am	%	\$Am	%
1962-63	396	+13.0	310	-11.4
1967-68	391	+ 6.3	307	-16.5
1972-73	526	+13.4	390	-15.9
1977-78	646	+17.8	402	-26.7
1982-83	1,219	+13.4	873	-18.8

manufacturing milk at lower prices and less market milk sold at higher prices (to the extent possible considering the nature of the pricing arrangements).

On the other hand, had milk been priced to maximize consumer welfare, gross producer income would have been lower. Consumers would have preferred a decrease in price and increase in quantity of market milk marketed, and an increase in price and decrease in quantity of manufacturing milk in each year.

It is important to note that the actual weighted average price has been closer to that price which would have maximized producer revenues, rather than that which would have maximized consumer welfare.

Therefore, it can be concluded that Australian milk prices are not set to maximize consumer welfare or producer revenue. Hence, producer and processor revenue is currently higher than if products were priced more in line with consumer interests, but not as high as it would be if producers were able to charge the optimal monopoly price. As expected, dairy pricing policies have resulted in price levels falling between those of the extremes of monopoly pricing and perfectly competitive pricing systems. So, although the dairy industry has been receiving some monopoly profits, the amounts are less than those which an unregulated monopoly would have received.

The implication of the above results is that the influence of consumers is felt through their impact on markets. In the price-setting process, the nature of consumer demand affects information pertaining to the ten criteria considered by the ADC. The net result is that consumer demand acts as a limiting factor on production decisions - just as the theory of market equilibrium states.

Summary and Conclusions

Australia recently became the first major dairy product exporter to decide to eliminate federal intervention in the price discovery process. Therefore, Australian dairy policies are presented as a case study. Of concern here is whether existing forms of government intervention improve the performance of Australian dairy product markets compared to the competitive market which would operate in the absence of intervention. } *contradict*

Both federal and state organizations play active roles in the Australian dairy price-setting process. The instruments of dairy pricing policy are mechanisms for controlling output produced at the artificially elevated domestic price. The policies result in producers receiving ^{misleading word} misleading price information and, consequently, producing more than would be generated in a competitive market.

As a result of federal and state policies, both milk producers and manufacturers receive a higher price than they would receive in a competitive market. Federal policies create price discrimination on domestic markets and subsidize exports. State policies distort the spatial allocation of productive resources by requiring that dairying must exist within each state whether or not it is efficient.

Annual costs and transfers resulting from existing dairy pricing policies are estimated to have totalled about \$354 million in 1981-82.

Dairy pricing policies have favored dairy producers and processors at the expense of consumers, but the additional revenues received by processors amount to less than those which would have been received in an unregulated monopoly. } *BRIEF*

The economic impact of government intervention in the Australian dairy industry is significant. As a consequence of policies allowing domestic prices to move above international price trends, domestic consumers are providing

increasingly higher levels of assistance to the dairy industry. If this trend is maintained, it will continue to encourage consumers to find substitutes for dairy products. Additional consequences would be increased pressure on relaxation of import restrictions and the use of resources to produce dairy products sold on export markets at a deadweight loss to the Australian economy.

FOOTNOTES

1. The AEP is the estimated average return from all export sales of a product manufactured in a particular period. The desired wholesale price is calculated by the ADC using ten criteria, but it is most often characterized as "what the market will bear" (Blank).
2. Market milk as a percentage of total milk production for 1981-82, by state, was: Victoria -- 13.7, Tasmania -- 13.7, South Australia -- 44.1, Queensland -- 47.4, Western Australia -- 55.5, New South Wales -- 64.4.
3. This was calculated by finding the average price per liter per year that a bid of \$50/L (per week) represented, $\frac{\$50}{52} = 96.2\text{¢/L}$, then dividing that amount by the Queensland differential between market and manufacturing milk prices ($31.9 - 15.6 = 16.3\text{¢/L}$) to get an average payback of $\frac{96.2}{16.3} = 5.9$ years.
4. The values used here for market and manufacturing milk are average unit values calculated using the gross value of production and total production figures from BAE (1983b).
5. Theoretically, this means that transfers from the consumer accrue wholly to producers and are not shared with processors. Of course, this is not really the case - processors do benefit from consumer transfers, despite the degree of competition and government intervention.
6. This possibly biases marginal costs downwards, though the bias is small since the relatively efficient states (constrained by quota) dominate the industry, producing about 65 per cent of Australian output, and further rationalization could possibly generate further economies of scale.
7. This is derived from the elasticities of demand for the joint products SMP and butter, and for cheese because those products represent a majority of total demand. Using both (inelastic) domestic and (perfectly elastic) export elasticities in the calculations gives an estimate of

-1.02 for the joint products and -.58 for cheese. A weighted sum for the two markets gives an estimate of -.82 for the elasticity of total demand.

8. This differential is estimated by subtracting the average price of manufacturing milk (15.6¢/L in 1981-82) from the average value of all milk (19.3¢/L in 1981-82). The average value of milk is simply gross value of product divided by total milk production (both figures are quoted in BAE 1983b).
9. This estimated increase in quantities demanded and produced assumes that aggregate demand (domestic and export) increases and that the ADC wishes to maintain export markets. If maintaining export market contacts is not of concern, it is possible that additional quantities demanded by domestic consumers will be provided by reducing exports and, therefore, production and production costs will not increase.
10. The model assumes that a change in domestic supply has the same absolute effect on the price of all cheese including imported cheese. It could be argued that the same proportional price change is more likely because an increase in prices of cheaper domestic cheeses causes a substitution of demand towards more expensive imported varieties, bidding the price of imports up further. If this is the case, this analysis underestimates the transfer from consumers to importing agents.
11. The only bias which might be expected is due to using the demand elasticity as the measure of responsiveness to wholesale price changes rather than retail prices changes. The assumption that the processing and retail sectors are competitive is maintained so that changes in the price of manufacturing milk result in the same absolute price changes at both the wholesale and the retail levels.

12. This change in production costs is estimated using the same method as that used in the competitive outcome section. The total of \$231/t represents the increase in costs incurred when cheese producers increase production with the expectation of increased revenues from equalization.
13. The assumption of identical supply elasticities for both groups of states is used because regional estimates are not available. Since it is expected that those elasticities do vary between regions, the estimates given here understate the actual effects somewhat.

REFERENCES

- Australian Dairy Corporation, Australian Dairy Corporation Annual Report, 1981-82, Melbourne, 1983.
- Blank, S., An Economic Evaluation of Australian Dairy Pricing Policy, Bureau of Agricultural Economics Occasional Paper No. 84, Australian Government Publishing Service, Canberra, 1983.
- Blank, S. and Campbell, D., Recent Developments in the Australian Cheese Market: Implications for Protection, Bureau of Agricultural Economics Occasional Paper No. 69, Australian Government Publishing Service, Canberra, 1982.
- Bureau of Agricultural Economics, Dairy Products: Situation and Outlook 1983, Australian Government Publishing Service, Canberra, 1983a.
- _____, Trends in the Australian Rural Sector, No. 105, Australian Government Publishing Service, Canberra, March, 1983b.
- _____, Comparative Efficiency Between Australian and New Zealand Dairy Industries and Implications for Trans-Tasman Trade, BAE Occasional Paper No. 60, Australian Government Publishing Service, Canberra, 1981.
- Collins, D., An Analysis of Demand for Fluid Milk in Australia, Honours thesis, University of New England, Armidale, 1981.
- Dairy Industries International, "Milk and Milk Products: Supply, Demand and Trade Projections, 1985," 44(1979):37-47.
- George, P. and King, G., Consumer Demand for Food Commodities in the United States with Projections for 1980, Giannini Foundation Monograph No. 26, University of California, Berkeley, 1971.
- Godden, D., "The Resource Misallocation Costs of Equalization - Again," Review of Marketing and Agricultural Economics 46(1978):141-149.
- Industries Assistance Commission, Dairy Industry Marketing Arrangements, Australian Government Publishing Service, Canberra, 9 September 1976.

_____, Dairy Industry, Australian Government Publishing Service, Canberra,
23 October 1975.

_____, Dairy Industry Underwriting, Australian Government Publishing Service,
Canberra, 1983.

International Dairy Federation, The World Market for Cheese, International
Dairy Federation Document 146, Brussels, 1982.

Ladd, G. and Updegraff, G., Allocation of Milk Among Products to Maximize Gross
Income of the Nation's Dairy Farmers Under 1964 Demand Functions,
Iowa Agricultural and Home Economics Experiment Station Research Bulletin
567, Iowa State University, 1969.

Lu, W. and Marshall, R., A Demand Analysis for Fluid Milk in Ontario, University
of Guelph, 1973.

Nelson, P., "Demand Model for Fluid Milk," Quarterly Review of Agricultural
Economics 30(1977):341-352.

Pandey, S., Piggott, R. and MacAulay, T., "The Elasticity of Aggregate Australian
Agricultural Supply: Estimates and Policy Implications," Australian
Journal of Agricultural Economics 26(1982):202-219.

Samuel, N. et al., An Economic Analysis of Dairy Marketing Arrangements,
monograph submitted to the Industries Assistance Commission's inquiry
into the dairy industry, May 1983.

Schelhaas, H., Trends of the World Trade for Milk Products, International Dairy
Federation Document No. 96, Brussels, 1977.

Song, D., "An Economic Analysis of Agricultural Price Policy Bias Toward
Producers or Consumers: A Case Study of U.S. Dairy Pricing Policies,"
Journal of Rural Development 4(1981):133-147.

Song, D. and Hallberg, M., "Measuring Producers' Advantage from Classified
Pricing of Milk," American Journal of Agricultural Economics 64(1982):1-7.

Street, J., "Demand for Milk," Review of Marketing and Agricultural Economics
42(1974):100-112.

Tedesco, R., The Factors Influencing Demand for Wholemilk in New South Wales,

Masters thesis, University of Sydney, 1980.

Turnovsky, S., "The Distribution of Welfare Gains from Price Stabilization:

A Survey of Some Theoretical Issues," Stabilizing World Commodity Markets,

F. Adams and S. Klein, eds., Lexington Books, Lexington, Mass, pp. 119-148,
1978.

Veeman, M., "Social Costs of Supply-Restricting Marketing Boards," Canadian

Journal of Agricultural Economics 30(1982):21-36.