Articles and Notes

Dairy Industry Policy

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Current dairy industry policy facilitates discriminatory pricing of milk used for market milk, domestic manufactured products and for export products. A variant of the Parish model is used to estimate transfer and efficiency costs of these arrangements. Transfers from consumers to producers represent about a third of gross farm returns. Efficiency costs of too little consumption are small. Estimated costs of excess production are between $25 million and $65 million a year. The model suggests important changes to the way in which the Industry Commission calculates rates of assistance to the dairy industry.

1. Introduction

Once again dairy industry policy has been under the scrutiny of the Industry Commission, the Prices Surveillance Authority, and the State governments. A system of regulated prices and supply quotas imposed by State governments for market milk results in transfers of income from consumers to producers and a deadweight loss from too little consumption. Under the Dairy Produce Act of 1986, generally referred to as the Kerin Plan, a levy collected on all milk is used to subsidise exports of manufactured milk products. One effect of the subsidy is to raise the domestic price of manufactured dairy products above export parity prices. This results in another transfer from consumers to producers and a deadweight loss from too little consumption. Producers receive a weighted average price from sales to the domestic and export markets, and this pool price is above export parity. The particular form of the average price varies across the States, but in all cases it results in excess production and associated deadweight losses. The main objectives of this paper are to model the transfers and efficiency losses and to estimate the magnitudes involved. Another objective is to critique the Industry Commission's approach to measuring nominal and effective rates of assistance to dairying.

A variant of a model originally constructed by Parish (1962) to measure the transfers and economic surplus losses is developed in the next section. Particular attention is given to the specific institutional and policy factors, including differences across the States, to the trade status of the industry under competitive market conditions, and to differences in costs between winter milk and milk produced at other times. Estimates of the magnitudes of effects of the current policies are provided in Section 2, using data for 1988-89 and key supply and demand elasticities drawn from the literature. Industry Commission estimates of nominal rates of assistance to the dairy industry are compared and contrasted in Section 3 with estimates obtained from the model developed in this paper. A final section includes a discussion of the implications of some policy options for moving towards a less interventionist policy.

2. Modelling Dairy Industry Arrangements

Market outcomes under current policy arrangements are compared against the benchmark outcome of a competitive market in which current discriminatory pricing arrangements are eliminated. Because of the relative importance of transport costs on low value and bulky manufactured dairy products,[1] and hence the wide gap between import parity and export parity prices, the traded status of a competitive Australian dairy industry significantly affects the policy assessment. While the dairy industry at present is a net exporter, with about a quarter of production being exported, it is

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[1] Transport costs for products from New Zealand to Australia are estimated to be between 9 per cent and 13.5 per cent of the c.i.f. price (Industry Commission 1991, p.72). Transport costs would be higher again for market milk.

not entirely clear what the competitive market situation would be. Consequently, three market outcomes of a net exporter, a net importer and an autarkic industry, are assessed. In all cases the model refers to farm level prices and quantities, and hence the demand curves are derived demand curves for the farm level milk input.[2]

2.1 Alternative Competitive Market Outcomes

The three potential competitive market outcomes of a net exporter, a net importer and a non-traded industry are depicted in panel A, panel B and panel C, respectively, of Figure 1.

Aggregate demand for milk for domestic use, either as market milk or as manufactured dairy products, is shown as D_d, milk supply is shown as S, and Australia is shown as a small country with a perfectly elastic export demand curve at the export parity price P_e and with a perfectly elastic import supply curve at the import parity price P_i, and P_i-P_e represents high transport costs. Given the relatively small share of Australian exports in world trade, the small country assumption seems a reasonable approximation.[3] Under current policy arrangements, Australian farmers receive a weighted average price indicated by the locus WAP, resulting in production Q and a surplus for export. The precise form of WAP varies from State to State and is considered in detail below. Also, the volume of exports under current policy is not determined in the Figures as drawn.

In panel A, the industry is assumed to remain a net exporter in a competitive market. The competitive market outcome is described by price P_c, production Q_c, and exports of AB. This net export outcome is more likely the closer the weighted average price is to the export parity price and the more inelastic is milk supply; and to a lesser extent it is more likely the more inelastic is aggregate domestic demand and the smaller is the gap between current domestic consumer prices and the export parity price.

A net importer competitive market outcome is shown in panel B with import parity price P_i, production Q_c, and imports CD.[4] The net importer outcome requires the weighted average price locus and the supply curve to intersect at a price above the import parity price P_i. A net importer competitive outcome is more likely the greater is the price differential WAP - P_i, and the more elastic is the milk supply function. Finally, a competitive market outcome whereby the free market supply and demand curves intersect at a price P_n between the import parity and export parity prices, and dairying becomes a non-traded product, is illustrated in Panel C.

As illustrated by Figure 1, the supply elasticity and the relationship of the weighted average price to the import parity and export parity prices are key determinants of the trade status of the dairy industry under a competitive market policy scenario. In light of the uncertainty about the supply elasticity it is not possible to be dogmatic about which option is the likely outcome for Australian dairying in the 1990s.

2.2 Net Exporter Competitive Outcome

The first situation is where Australia continues as a net exporter and the export parity price, P_e, is the competitive market reference price. The essence of the present policy arrangements relative to a competitive market outcome is described in Figure 2. Separate demand panels are shown for market milk consumption and for domestic consumption of manufactured dairy products. Exports are not identified in Figure 2 but are given as a residual between supply and aggregate domestic demand. The third panel shows supply of milk and the weighted average price.

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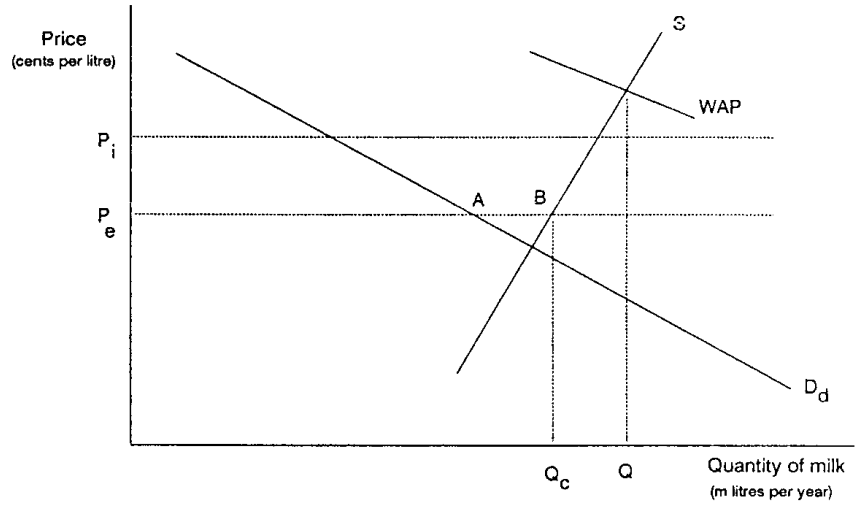
[2] In addition to simplifying the analysis, focussing on milk at the farm level does at the same time invoke, at least implicitly, strong assumptions about the off-farm dairy industry. The simplest set of implicit assumptions includes constant absolute margins for off-farm storage, transport and processing, and a constant transformation ratio between farm milk and the various final products. These convenient and approximating assumptions also underlie the Industry Commission (1991) analysis.

[3] Australia provides about 6 per cent of world trade and 3 per cent of world production of manufactured dairy products. Even though bilateral quota arrangements restrict world trade, over 90 per cent of Australian exports go into non-quota markets.

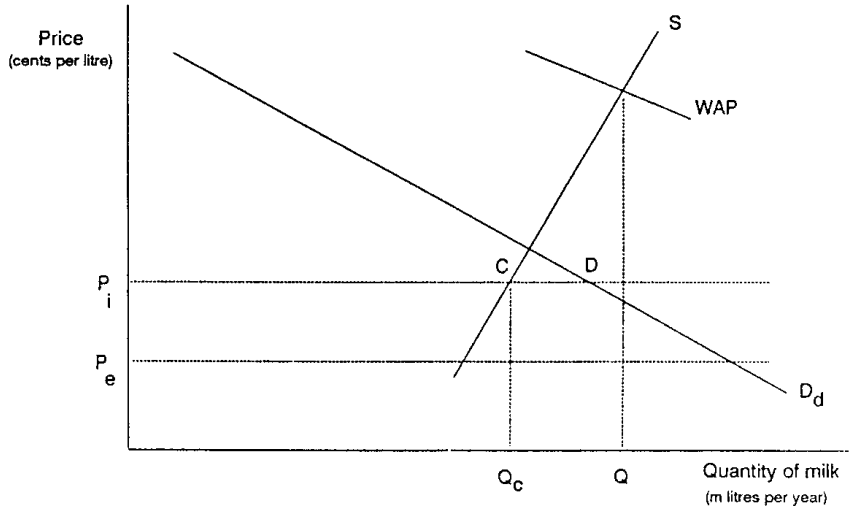
[4] The net importer situation envisaged is one in which Australia is self-sufficient in market milk, but imports increased quantities of the relatively less transport intensive manufactured dairy products.

Figure 1
Possible Competitive Market Outcomes

1.A Remain a net exporter



1.B Become a net importer



1.C Become a non-trader

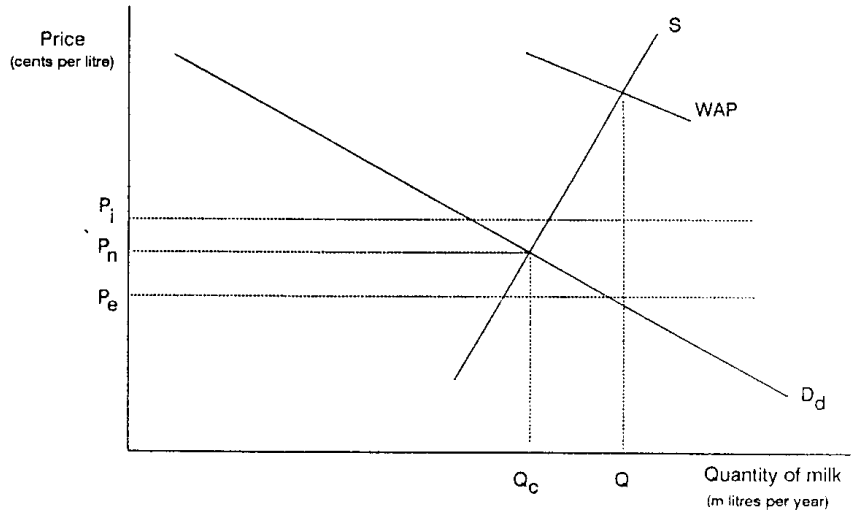
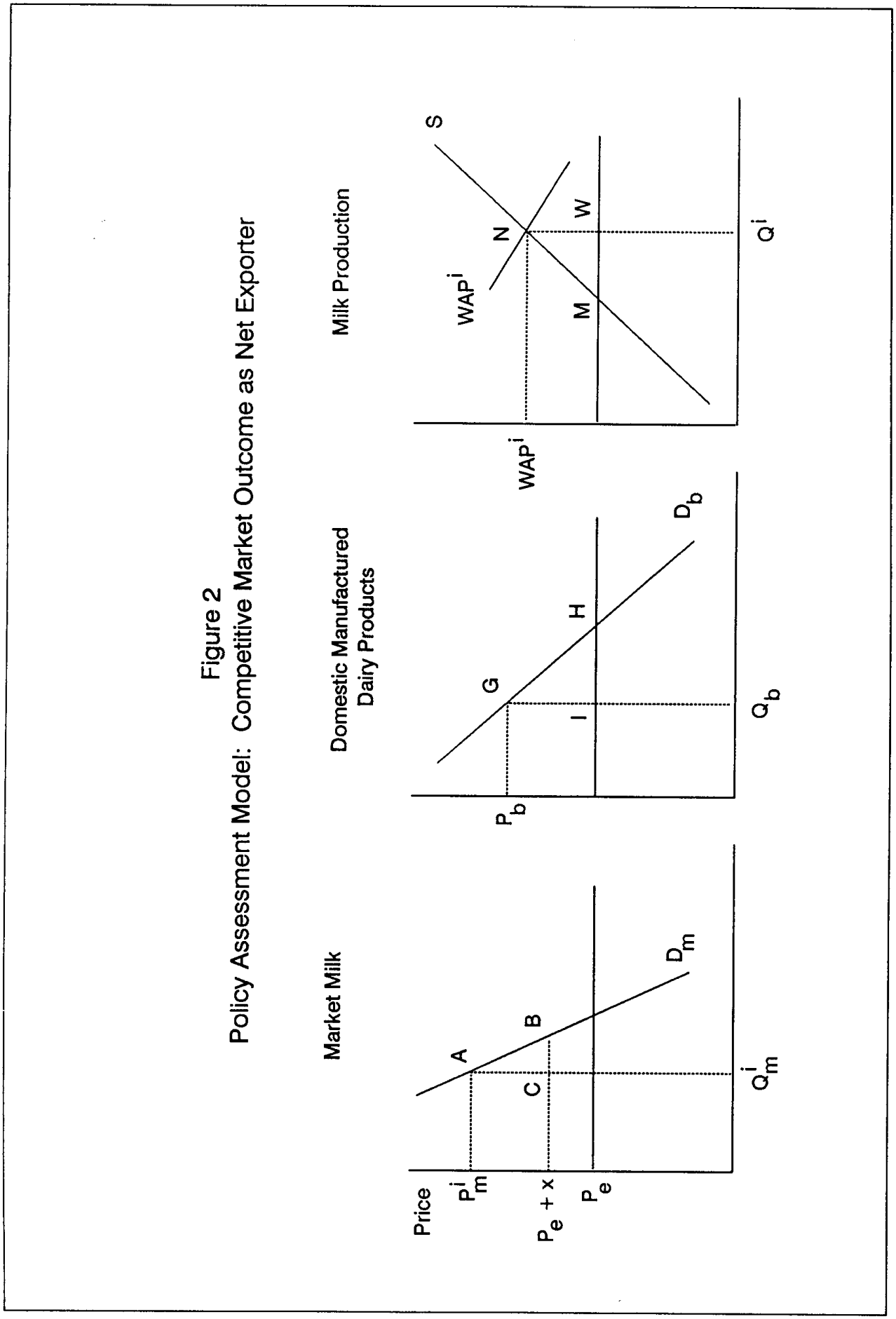


Figure 2
Policy Assessment Model: Competitive Market Outcome as Net Exporter



The conventional single region and single period model is generalised in two ways. First, to allow for different policy arrangements and for different ratios of consumption and production, the first and third panels of Figure 2 are disaggregated into particular State demand and supply functions. The superscript i denotes different States. Second, in recognition that a seasonal premium may have to be paid to draw forth year round milk supply for market milk, but not necessarily for the production of manufactured dairy products, a winter premium, x, is allowed. This might take the form of a direct premium, and/or extra transport charges from the climatically favoured Victoria and Tasmania to their northern States. It is assumed that the x premium is not so high that $(P_e + x)$ exceeds the import parity price.

Policies affecting the price and supply of milk for market milk are set by State governments. While they differ in detail, there are key similarities between the States. A relatively high market milk price, P_m, currently more than double the export parity price, P_e, is set by regulation. Consumers purchase as much as they want, Q^i_m, at this price. Various quota schemes and other regulations restricting the supply of milk for market milk sale, including arrangements to control intrastate and interstate trade, ensure that the regulated prices are not undercut.

The relatively high market milk price results in consumers losing welfare of area $(P_e + x)\, P^i_m\, AB$. This represents a transfer to producers of the rectangle $(P_e + x)\, P^i_m\, AC$, and, in the absence of market distortions and second best considerations, a deadweight loss of too little consumption of the triangle area **ABC**. The deadweight loss is greater the larger is the price differential $P^i_m - (P_e + x)$, and the greater is the elasticity of derived demand for milk used for market milk.

In the first instance, the policy arrangements for market milk do not, themselves, generate production distortions. This is because quota arrangements restrict milk supply for market milk sales to that demanded by consumers at the high market milk price. If the quotas were freely transferable, together with an active and well informed market, in time the quotas would be purchased by the lowest cost (including opportunity cost of using resources in other pursuits) producers. This is becoming the case within some States. However, restrictions on quota transferability, imperfect knowledge and uncertainty, together with current administrative arrangements, mean that some production distortions are incurred in those States with some transferability of market milk quotas. Further, quotas are not transferable between States.

Where quotas are not transferable, as a legacy of history, some producers with costs above the weighted average price, WAP^i, but below the market milk price, P^i_m, are denied the right to produce while higher cost producers have quotas. Lembit, Topp, Williamson and Beare (1988) estimated potential cost savings for New South Wales of transferable quotas at $2.8m per year. Estimates of this magnitude, especially when compared with the efficiency cost estimates reported in Table 3 below, indicate significant efficiency losses due to inappropriate quota allocations for the production of market milk.

Federal government policies under the 1986 Kerin Plan strongly influence the domestic price for manufactured dairy products, P_b. A levy of t cents per litre is placed on all milk production; currently this is about two cents per litre. Revenue from the levy is used to fund a subsidy on export sales. Formally, the levy and subsidy can be linked as:

$$s = t\, Q / Q_e \qquad (1)$$

where s is the per unit subsidy paid on export sales (expressed here in terms of cents per litre of farm milk), t is the levy collected on all milk production (in cents per litre), Q is total milk production and Q_e is exports. With exports being about 30 per cent of production, the subsidy is about 3.3t, or about 6.7 cents a litre. The subsidy is larger the larger the levy and the smaller the share of production exported.

For producers of manufactured dairy products, arbitrage conditions require that domestic prices equal the export price plus the subsidy.[5] Formally,

[5] The simplified model assumes the same manufactured product price is paid to producers in all States. This logical interpretation is not supported by data reported by the Industry Commission (1991) where prices vary across the States, although by less than

the wholesale and export prices of the manufactured products can be expressed as:

$$P_b^w = P_e^w + s \quad (2)$$

where P_b^w is the domestic wholesale price of the product (expressed in terms of raw milk per litre), P_e^w is the export parity price of the manufactured product (again expressed in terms of raw milk per litre), and the subsidy, s, is as defined in (1). Assuming non-milk input costs and profits of manufacturers and distributors are not affected by the policy, (2) can be expressed in terms of farm milk equivalent prices as:

$$P_b = P_e + s = P_e + t\,Q/Q_e \quad (3)$$

where P_b is the price of milk per litre at the farm level used for manufactured products, P_e is the derived value of milk per litre at the farm level used for export manufactured products, and the other terms are as defined above. In terms of current arrangements, the derived value of milk used for manufacturing purposes is about 6.7 cents/litre above the implicit return to milk used in manufactured exports.[6]

This higher domestic price is sustainable, without import restrictions, only if it is below the import parity price. Very largely this is the case at present,[7] with imports consisting mostly of specialty products rather than bulk butter, cheddar cheese and milk powders.

In Figure 2, middle panel, the setting of domestic prices for manufactured dairy products above the export parity price results in a loss of consumer welfare of area **P_e P_b GH**. Of this aggregate loss, **P_bGI P_e** represents a transfer to producers and **IGH** represents the deadweight loss of too little consumption, assuming no second best and market distortion effects. The deadweight loss is greater the larger the price differential between the domestic price and export returns, $P_b - P_e$, or the size of the export subsidy term defined in (1), and the larger is the elasticity of derived demand for milk used for the production of manufactured dairy products for the domestic market.

The transfers from domestic consumers of market milk and of manufactured dairy products to producers are based on a system of price discrimination, where the highest price is set for the more inelastic market milk market, then a somewhat lower price for the more price responsive domestic manufactured milk products market, and the lowest price is set for the perfectly elastic export market. However, the opportunities for monopolistic exploitation are not taken in full.[8]

Consider next the prices paid to producers and their supply response. In all States a weighted average price, WAP, or pooling price system, applies, but the system varies across the States. Also, different prices are received because of different mixes of production and market shares across the States. In the case of the non-quota States of Victoria, Tasmania and South Australia, producers are paid a weighted average price for sales to the three markets (market milk, domestic manufactured dairy products and export manufactured dairy products) less the milk levy. Formally, the weighted average price received by farmers in these states, WAP^i, is:

$$WAP^i = [P_m^i Q_m^i + P_b (Q^i - Q_m^i)] / Q^i - t \quad (4)$$

$$= P_e + (P_m^i - P_e) Q_m^i / Q^i + t(Q/Q_e)(Q^i - Q_m^i)/Q_i - t \quad (4')$$

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4 cents/litre (for example, in 1989-90 Victorian farmers received the highest price of 25.1 cents/litre and South Australian farmers the lowest of 21.2 cents/litre). The exact reasons for these State differences are not clear, although it seems to be a combination of different product mixes and of differences in payout arrangements for transport and other services.

[6] This theoretical outcome varies from the implied subsidy in estimates reported by the Industry Commission (1991). From Table 5.4, the effect of the Kerin Plan on increased gross returns to manufacturing is estimated at 4.95 cents per litre, or about 25 per cent less than the figure estimated here. The reasons for this difference are not clear.

[7] The Industry Commission (1991) estimates the average subsidy on manufactured dairy products at 19 per cent. Assuming the off-farm value added of manufactured products equals that of the farm level milk input, this estimate corresponds with that derived from the current model, namely a subsidy of 6.7 cents/litre from (1) divided by 33.4 cents of manufactured product valued at export return (of 16.7 cents for each of farm milk and value added). The subsidy element is above the transport cost figure quoted in footnote 1.

[8] In fact, as discussed below, the elasticity values for both domestic consumption of market milk and of manufactured products are inelastic. In this situation a monopolist would restrict supply and raise price even further until demand becomes at least elastic.

where, P_m^i and Q_m^i are the price and quantity for market milk in State i, P_b is the price of manufactured milk defined in (3), Q^i is State i production, with $Q^i - Q_m^i$ being milk used for manufacturing, t is the all milk levy, P_e is the export price, and Q and Q_e are, respectively, national production and exports. Derivation of (4') involves rearrangement of terms and use of equation (3).

A number of observations about the weighted average price expression (4) and (4') can be noted. The first two right hand terms of (4') are the expressions for the pool price of the Parish (1962) model. Given that the last two terms together are positive for the actual situations in Victoria, Tasmania and South Australia,[9] the weighted average price exceeds the export price. The difference is greater the higher the mark-up of the market milk price over the export price, $P_m^i - P_e$, and the greater is the share of market milk sales in total State production, Q_m^i/Q^i. The third and fourth terms capture the effects of the Kerin Plan arrangements whereby a levy of t on all milk produced nationally funds a subsidy on export sales which, in turn, effectively raises the return on milk used for manufacturing above the export price. To the extent that extra State production flows into exports and increases the export share, the third term declines with greater State production. Overall, the WAP^i is a declining function of State production.

Producers in the quota States, New South Wales, Western Australia and Queensland,[10] receive a two-part payment for milk produced; the market milk price less the all milk levy for quota production; and the average price for milk used for manufactured products, P_b, less the all milk levy for production in excess of the quota. Because of an insurance value component of above quota production, Alston and Quilkey (1980) argue there is an implicit additional return on over-quota production to producers over and above the received market price. Whilst recognising the potential importance of the insurance value, it is not considered further here. Formally, the weighted average price received for non quota milk, WAP^i, is:

$$WAP^i = P_b - t \qquad (5)$$

$$= P_e + t(Q - Q_e) / Q_e \qquad (5')$$

where P_b is the domestic price for manufactured milk defined in (3), t is the all milk levy, Q is national production and Q_e is national exports. Expression (5') is obtained by substituting (3) into (5) and rearranging terms.

Inspection of (5) and (5') reveals several properties of the return paid to farmers in New South Wales, Western Australia and Queensland for milk production in excess of market milk quotas. To a reasonable approximation, the price received is independent of State production and depends on national production and market shares. The return is above export parity price, P_e, and it is higher the larger the all milk levy, t, and the smaller the share of national production exported.

From the third panel of Figure 2, because the weighted average price received by producers on marginal production exceeds the world price, the marginal return on export sales, milk is overproduced. Assuming no other distortions and market failure effects, the deadweight efficiency loss is given by the area **MNW**. The loss is greater the larger is the price differential, $WAP^i - P_e$, and the more elastic is the farm level milk supply. The underlying source of the production inefficiency is not the discriminatory pricing of domestic milk sales per se. Rather, as argued by Parish (1962), the excess production distortion arises from the policy of paying farmers a weighted average price or a pool price on extra production which exceeds the export parity price received on marginal sales.

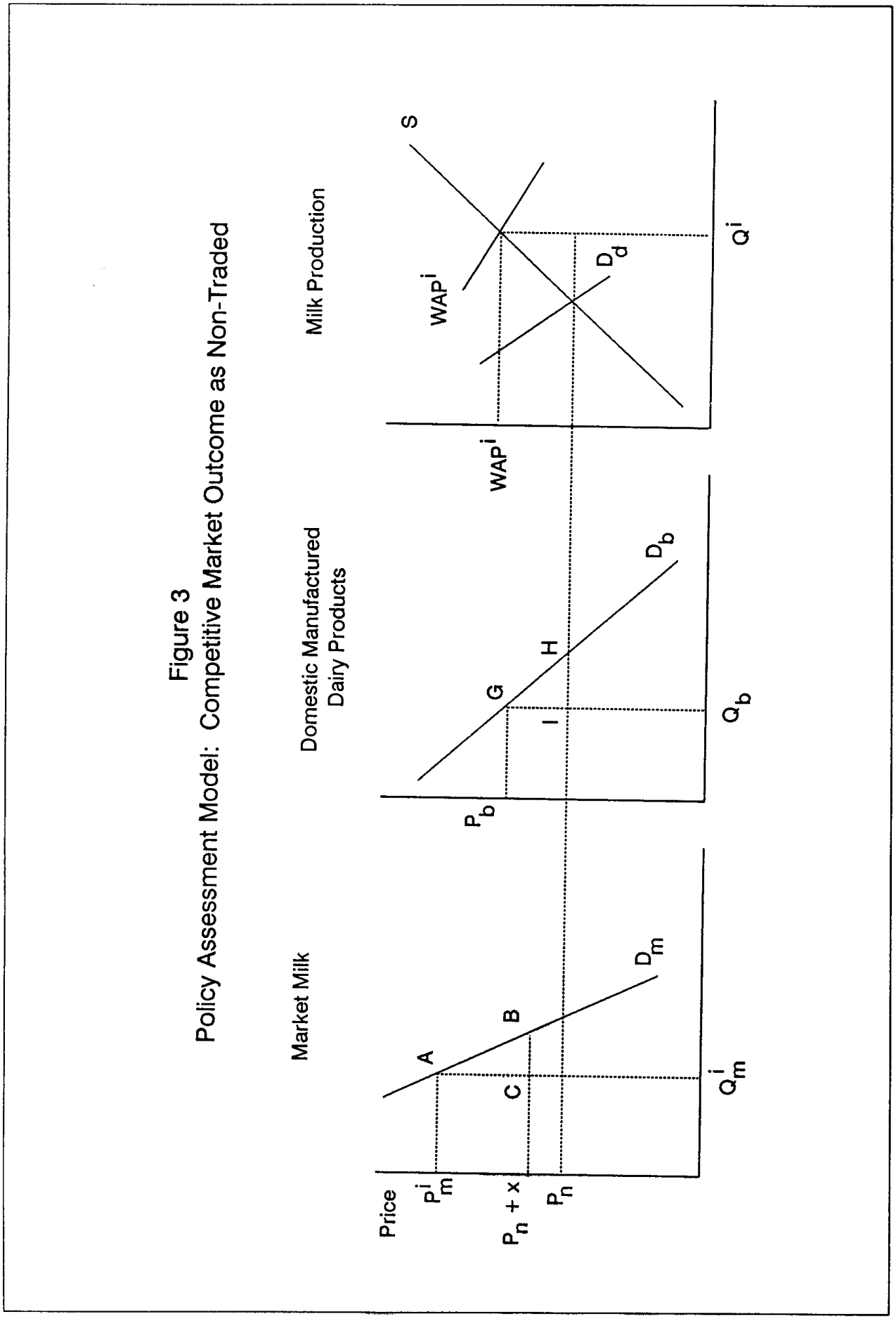
2.3 Non-traded Competitive Outcome

Consider next the comparison of the current policy market outcome with a competitive market outcome in which the Australian dairy industry would be a non-traded industry with free market price, P_n,

[9] Collectively, the third and fourth right hand terms of (4') are positive if $Q/Q_e > Q^i/(Q^i - Q_m^i)$, that is if the ratio of national production to exports (currently around 3.3) exceeds the ratio of State production to State milk used for manufacturing (currently about 1.14 for Victoria, 1.16 for Tasmania and 2.28 for South Australia).

[10] In Queensland, about 65 per cent of milk production is paid according to a quota for market milk and the average manufactured price on other milk. For the other 35 per cent of production, producers are paid a weighted average price on all milk sales. For simplicity, the dominant method is assumed for all of the State.

Figure 3
Policy Assessment Model: Competitive Market Outcome as Non-Traded

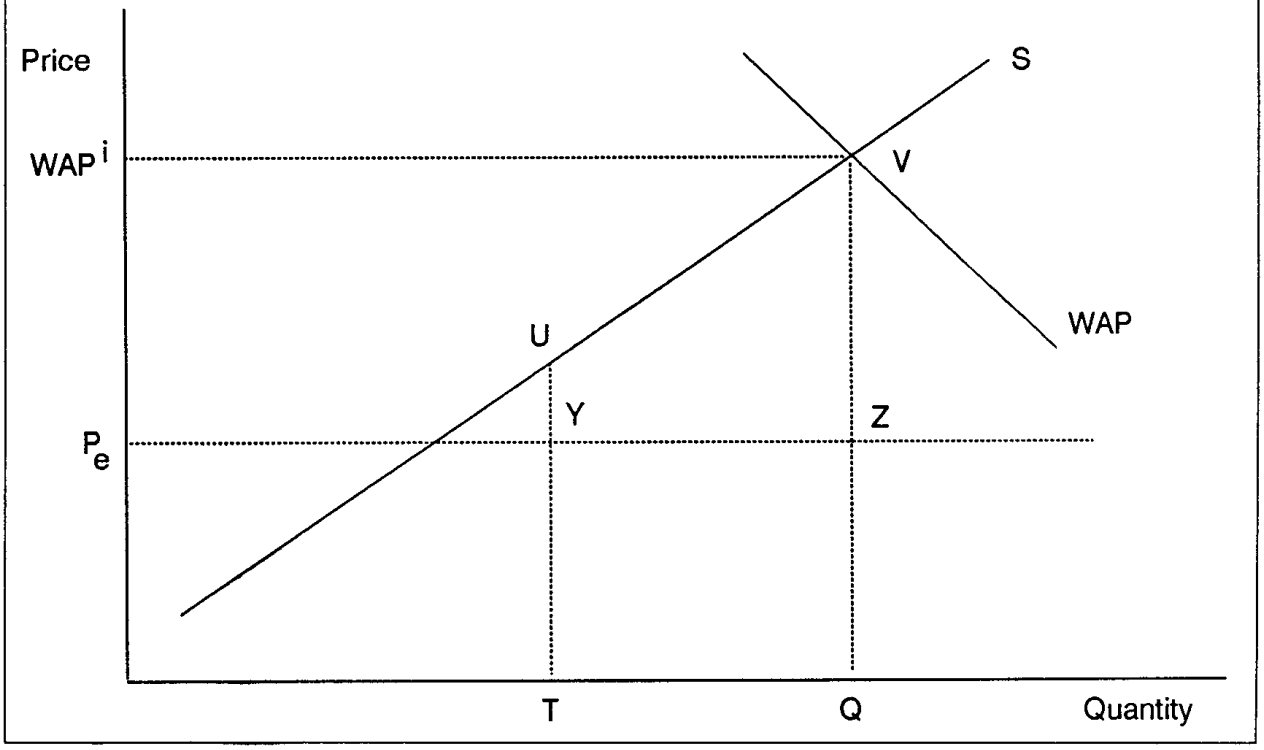


somewhere between the export parity and import parity prices, P_e and P_i. Figure 3 captures the essence of the comparison. The third panel repeats the situation in panel C of Figure 1, with aggregate domestic demand for milk for market milk and manufactured dairy products under a competitive market policy scenario intersecting with supply at price P_n. The first two panels of Figure 3 show the discriminatory pricing effects for market milk and for domestic sales of manufactured dairy products, respectively, and the third panel shows the effect of the weighted average pricing arrangement on supply decisions.

Effects of the current policy arrangements on consumers, relative to a free market outcome, are as described before, except that the non-traded competitive market price, P_n, rather than the export parity price, P_e, becomes the reference price. Consumers of market milk lose $(P_n + x)\ P_m{}^i\ \mathbf{AB}$, of which $(P_n + x)\ P_m{}^i\ \mathbf{AC}$ is a transfer to producers and **ACB** is a deadweight loss due to too little consumption. Domestic consumers of manufactured dairy products lose P_aP_bGH, of which P_aP_bGI is a transfer to producers and **IGH** is a deadweight loss associated with too little consumption.

The efficiency costs of excess production are assessed with the aid of Figure 4. Suppose the current policy outcome with weighted average price, WAP^i, and supply curve, S, gives production Q of which the quantity exported is given by TQ. These exports have marginal resource costs of the area under the supply curve, **TUVQ**, but they generate national returns from export sales of only **TYZQ**. Thus, the social cost of these exports is **YUVZ**. There are two points to note about this measure. First, the opportunity value of existing exports is given by reference to the export parity price, P_e, rather than the free market price, P_n, used in measuring the consumer transfers and consumer resource misallocation costs. Second, the exports only incur social costs to the extent that they involve marginal production costs above the export parity price.

Figure 4
Valuing Excess Production Efficiency Costs:
Non-Traded Competitive Outcome



2.4 Net Importer Competitive Outcome

Where the competitive market outcome is a net import situation, that is panel B of Figure 1 where the aggregate domestic demand curve crosses the supply curve at a price above the import parity price, a simple variant of the non-traded model applies. The discriminatory pricing of the market milk and of domestic sales of manufactured products involves transfers to producers and deadweight costs of too little consumption measured with reference to the import parity price, P_i. The social costs of excess production sold as exports is measured as in Figure 4 with reference to the area between the supply curve and the export parity price line for the quantity exported from current production.

3. Model Estimation

The models of the previous section are used to make estimates of the magnitudes of consumer to producer transfers and of resource misallocation efficiency costs associated with current dairy industry policy, for 1989-90 prices and quantities. Values of elasticities of demand drawn from the literature, and two arbitrarily chosen supply elasticities, together with the base prices and quantities, are used to specify linear supply and demand equations to reproduce the 1989-90 outcome. [11]

[11] For example, take the case of market milk demand in New South Wales. The price is 41.2 and quantity is 581 (Table 1). Assuming a demand elasticity of 0.05, the demand curve is specified as $Q_D^i = 610.05 - 0.7051\ P_m^i$, where $0.7051 = 0.05 * 581 / 41.2$ and $610.05 = 581 + 0.7051 * 41.2$.

Table 1: Price and Quantity Data for the Australian Dairy Industry, 1989-90

	Market Milk		Total Milk	Derived Weighted Average Price Paid to Farmers for Marginal Production, WAP^i (cents/litre)
	Sales, Q_m^i (m. litre)	Farm Price, P_m^i (cents/litre)	Production Q^i (m. litres)	
NSW	581	41.2	878	23
Vic	452	36.8	3787	24.4
SA	150	37.4	356	28.2
WA	149	37.3	267	23
Tas	47	44.4	345	25.7
Qld	316	43.4	629	23
Australia	1696	39.8	6262	24.2

Notes:

Australia

- manufactured milk production
  - domestic sales, Q_b : 2693 m. litres
  - export sales, Q_e : 1873 m. litres
- all milk levy, t : 2 cents/ litre
- derived subsidy on export sales, s : 6.7 cents/ litre
- winter premium, x : 5 cents/ litre
- average farm price, manufactured milk, P_b : 25 cents/ litre
- derived export parity price for farm milk, P_e : 18.3 cents/ litre

Source: See text.

3.1 Prices and Quantities

Data on prices and quantities for 1989-90 are given in Table 1. The figures for total production and sales of market milk are from Industry Commission (1991, Appendix B). From a national perspective, 27 per cent of production goes to market milk, 43 per cent to manufactured products for domestic consumption, and 30 per cent for exports. However, these ratios vary widely from State to State. For example, 66 per cent of New South Wales production goes to market milk compared to 12 per cent of Victorian production.

The data for prices in Table 1 are taken from the Industry Commission (1991) and derived prices using the formulae presented above. Given an average price for manufactured milk of 25 cents/litre and the derived export subsidy of 6.7 cents/litre (in turn derived from (1) using an all milk levy of 2 cents/litre), equation (2) yields an export parity price of 18.3 cents/litre. Then, relative to the implicit return for milk used for export sales, milk used for domestic manufactured product purposes has an average return some 37 per cent higher, and milk allocated to market milk sales has an average return of 101 per cent above the export price in Victoria and 143 per cent above in Tasmania.

Equation (4) is used to derive the price paid to farmers in the non-quota States of Victoria, South Australia and Tasmania, a weighted average price for all milk sold less the levy, and equation (5) is used for sales of non-quota milk sold by farmers in New South Wales, Western Australia and Queensland. Inclusion of market milk sales in the price received on marginal sales by the former group of States explain their higher return as compared with New South Wales, Western Australia and Queensland farmers who receive the weighted average return on milk used for all manufacturing purposes on marginal production. Relative to the derived farm level value of milk used for export sales, the perceived marginal return seen by farmers is 25 per cent higher in New South Wales, Western Australia and Queensland, 33 per cent higher for Victorian farmers, 40 per cent higher in Tasmania and 54 per cent higher for South Australian farmers.

3.2 Elasticities of Demand

A number of studies have made estimates of the elasticity of demand for dairy products. The elasticity of demand for fluid milk at the retail level is reported to be low: Bewley (1987) estimates around - 0.1, and Davidson, MacAuley and Powell (1989) report a zero response for New South Wales and Queensland and - 0.28 for Victoria. With farm gate milk being about half of the cost of retail level milk, and assuming that competitive or other behaviour maintains a constant absolute marketing margin,[12] a low derived demand elasticity for market milk at the farm level of -0.05 is used. A range of values have been estimated for the elasticity of demand for manufactured dairy products at the retail level, and generally wide confidence intervals around the point estimates are noted; see Davidson, MacAuley and Powell (1989) and references therein. A demand elasticity of unity is at the upper end of the spectrum of reported estimates. Given that the farm value of milk represents about a third of the retail value of butter, cheese, etc. and assuming a constant absolute processing and marketing margin, a derived demand elasticity for milk at the farm level for use in producing manufactured dairy products for domestic sale of -0.2 is used.

3.3 Elasticity of Supply

Much less is known about the critical parameter, the elasticity of supply. Econometric model estimates are dated and subject to various criticisms of model specification and estimation procedure. Estimates reported for the long run supply elasticity by Mules (1972) of 0.85, by Meikle, Smith and Smith (1981) of 0.3 and Freebairn (1982) of 0.85 are in the inelastic zone. ORANI-MILK used by the Industry Commission (1991) has an implied supply elasticity of 1.1 in a two year context (where land and capital are fixed) and 4.7 in an intermediate period context (where land only is fixed) arising from assumed production and substitution elasticities and competitive profit maximising behaviour. In Appendix G of the *Dairy Report* the Commission uses a medium term elasticity of 1.5 as a preferred estimate, and reports sensitivity

[12] This procedure implicitly assumes a constant input-output relationship between farm milk and market milk or manufactured dairy products. The assumption of a zero elasticity of substitution between farm milk and other inputs likely is a reasonable first approximation.

assessments for elasticities of 0.5 and 3.2. A programming model used by the Australian Bureau of Agricultural and Resource Economics (ABARE), and described in Topp *et al* (1989), has an implicit supply elasticity of 3.0. The very much larger elasticity values implicit in the ORANI and programming models relative to the econometric model estimates may simply reflect the fact that these models do not allow for sticky changes in expectations, for adjustment rigidities, and for satisfying and habitual behaviour (see, for example, Colman 1983, and Hall and Menz 1985). These simplifying assumptions suggest that the ORANI and programming model supply elasticities err on the high side.

3.4 Competitive Market Benchmarks

For illustrative purposes, and as part of a sensitivity analysis, two values for the supply elasticity, 0.5 and 1.5, are used. For the chosen elasticities and the prices and quantities of Table 1, linear demand and supply curves are estimated to pass through observed 1989-90 price and quantity outcomes. Under these assumptions, the lower supply elasticity value generates a competitive market outcome with Australia continuing as a net exporter, whereas the larger elasticity value results in a non-traded competitive outcome (Table 2). In fact, a supply elasticity in excess of about 0.85 is projected to end Australia as a net exporter of dairy products under

Table 2: Simulated Outcomes for the Australian Dairy Industry Under Current Policy and Under a Competitive Market Policy Scenario, 1989-90

	Current Policy[1]	Competitive Market[2]	
		Es = 0.5	Es = 1.5
Quantities (m litres/year)			
Production	6262	5496	4544
Market milk sales	1696	1742	1739
Domestic manufact. sales	2693	2837	2805
Export sales	1873	917	0
Derived Farm Level Price (cents/litre)			
Market milk	37 to 44	18.3 to 23.3[3]	19.8 and 24.8[3]
Manufactured milk	25	18.3	19.8
Return to Farmer for Marginal Production (cents/litre)			
NSW	23	18.3	19.8
VIC	24.4	18.3	19.8
SA	28.2	18.3	19.8
WA	23	18.3	19.8
TAS	25.7	18.3	19.8
QLD	23	18.3	19.8

Notes:

1 From Table 1.

2 Assumed demand elasticities of -0.05 for market milk, -0.2 for domestic manufactured products and infinity for exports. Linear demand and supply curves fitted through actual 1989-90 prices and quantities. Assumes no policy intervention or market segmentation.

3 Includes 5 cents/litre premium for winter production.

a competitive policy scenario.

Other analysts, including ABARE (1991) and the Industry Commission (1991), fairly confidently project Australia's continuance as a net exporter of dairy products if present assistance supports were removed. Given their use of models with relatively high supply price elasticities - of 3.0 in the case of

Table 3: Estimated Effects of Current Dairy Industry Policy Relative to a Competitive Market Outcome on Transfers from Consumers to Producers and the Efficiency Costs of Distorted Production and Consumption

(1989 - 90 $ million per year)

	Competitive Market Outcome of Continued Net Exporter (supply elasticity of 0.5)	Competitive Market Outcome of Non-traded (supply elasticity of 1.5)
Transfer from Consumers to Producers:		
market milk	337	311
manufactured products	180	140
Total	517	451
Efficiency Cost:		
too little market milk cons.	4	4
too little manuf. product cons.	5	3
too much production	24	65
Total	33	72

Notes:

Transfers are calculated as $(P_c - P)Q_c$, where P_c is current price, P is the competitive market price, and Q_c is current quantity. The prices and quantities are taken from Table 2, with the addition of a winter premium of 5 cents/litre for four months for market milk.

Efficiency costs of too little consumption are calculated as $^1/_2(P_c - P)\ \Delta Q = {}^1/_2\ (P_c - P)^2\ (Q_c/P_c)\ E_d$, where E_d is the elasticity of demand (of 0.05 for market milk and 0.2 for manufactured products), ΔQ is the change in quantity demanded, and the other terms are as above.

Efficiency costs of too much production for the net export competitive market outcome are calculated for each State as $^1/_2(WAP - P_e)\ \Delta Q = {}^1/_2\ (WAP - P_e)^2\ (Q_c/WAP)E_s$, where WAP is the weighted average price paid on marginal production, P_e is the export parity price, ΔQ is change in quantity supplied, and E_s is the elasticity of supply (= 0.5).

Only a crude estimate (almost certainly an underestimate) of the production efficiency distortion for the non-traded competitive market outcome is made. It is measured as the area under the aggregate Australian supply curve and above the export parity price for current exports of 1873 million litres and an average weighted average price of 24.2 cents/litre.

ABARE and of 1.5 for the Industry Commission - this result is puzzling. The apparent conflict means that they anticipate much smaller reductions in the farm price of milk in shifting to a competitive policy strategy than derived in this paper.[13]

3.5 Redistributive Effects and Efficiency Costs

Estimates of the redistributive and economic efficiency effects of the current dairy industry policy, relative to a competitive market outcome in which milk prices are the same for all end uses, are reported in Table 3. Estimates are provided for two situations; one in which Australia remains a net exporter and in which the supply price response is inelastic (assumed elasticity of 0.5); the other in which the supply price response is elastic (assumed to be 1.5) leading to a contraction of output such that dairying becomes a non-traded commodity.

The redistributive effects are large, especially relative to the current farm value of milk production of $1723 million per annum. Using the export parity price as a reference point, consumer to producer transfers are around $500 million, or 30 per cent of farm receipts. With a higher competitive reference price under a non-traded outcome scenario, the transfer is reduced. The transfer from consumption of market milk is larger than that from manufac-

[13] The Industry Commission (1991, Appendix G) in its simulations considers partial deregulation. In Scenario C, for example, the export subsidy on manufactured exports is reduced only by 5 per cent, which by implication means assistance of about 10 per cent for the derived value on the farm level milk input, and market milk prices are kept at 20 per cent above this assisted manufactured product price. By contrast, the estimates here reduce assistance to zero. Even so, the Commission's estimates that such dramatic changes would reduce the average price to Australian producers by just 2.9 per cent, with those in Victoria falling by 5.5 per cent and those in New South Wales, Queensland and Western Australia actually rising, is puzzling. By contrast, this study has the price of marginal production falling by 25 per cent for New South Wales, Queensland and South Australia, 33 per cent for Victoria, 40 per cent for Tasmania and 54 per cent for South Australia.

Table 4: Estimates by the Industry Commission of the Transfers from Consumers to Producers and the Efficiency Costs of Distorted Production and Consumption, 1989-90 ($ million per year)

	Supply elasticity of 0.5	Supply elasticity of 1.5
Transfer from Consumers to Producers:		
market milk	176	176
manufactured products	108	108
Total	284	284
Efficiency Cost:		
too little market milk cons.	8	8
too little manuf. product cons.	1	1
too much production	7	20
Total	16	29

Notes:
Consumer efficiency losses for preferred demand elasticity estimates of -0.15 for market milk and -0.25 for manufactured products.

Production efficiency losses are the sum of losses estimated for State marketing arrangements and those for the Kerin Plan.

Source: Industry Commission (1991, Table 4.2 and page 78).

tured products even though only a quarter of milk goes for market milk and a half is used for manufactured products. The magnitude of the transfers depend primarily on the current discriminatory pricing patterns for market milk, and for milk for manufactured products, relative to the national return to milk used for exports.

Estimated efficiency costs of the current dairy industry policy are relatively small for distortions to consumption decisions but are much larger in the case of the distortions to production decisions. Low demand elasticities explain the small effects of high prices on reduced consumption and the deadweight costs of these prices. The magnitude of the supply price elasticity is the key factor determining the deadweight cost of current pool pricing arrangements in the industry. Overall, deadweight costs of $24 million, or 1.4 per cent of farm value, are estimated if the supply elasticity is 0.5, with the numbers rising to $65 million and 3.8 per cent for a supply elasticity of 1.5.

Alternative estimates of transfers and efficiency costs associated with current dairy policy compiled by the Industry Commission (1991) are reported in Table 4. Although the pattern of these estimates is similar to those obtained in this paper and shown in Table 3, they differ in magnitude by a factor of as much as two.

The differences can be reconciled as follows. Whereas the Commission estimates that Australia will continue as a net exporter, even with a supply elasticity as large as 3.2, this analysis finds production will fall so far that exports would cease for an elastic supply curve. In keeping with the assumption that Australia will remain a net exporter, the Commission uses the same competitive price benchmark to measure consumer to producer transfers and consumer efficiency costs for the different supply elasticity assumptions. By contrast, in light of the finding of this paper of a change in trade status with the more elastic supply curve, a higher competitive market price is used to estimate the transfer and efficiency effects in moving the supply elasticity from 0.5 to 1.5 (namely the export parity price of 18.3 cents/litre for the 0.5 supply elasticity and the non-traded market clearing price of 19.8 cents/litre for the 1.5 supply elasticity).

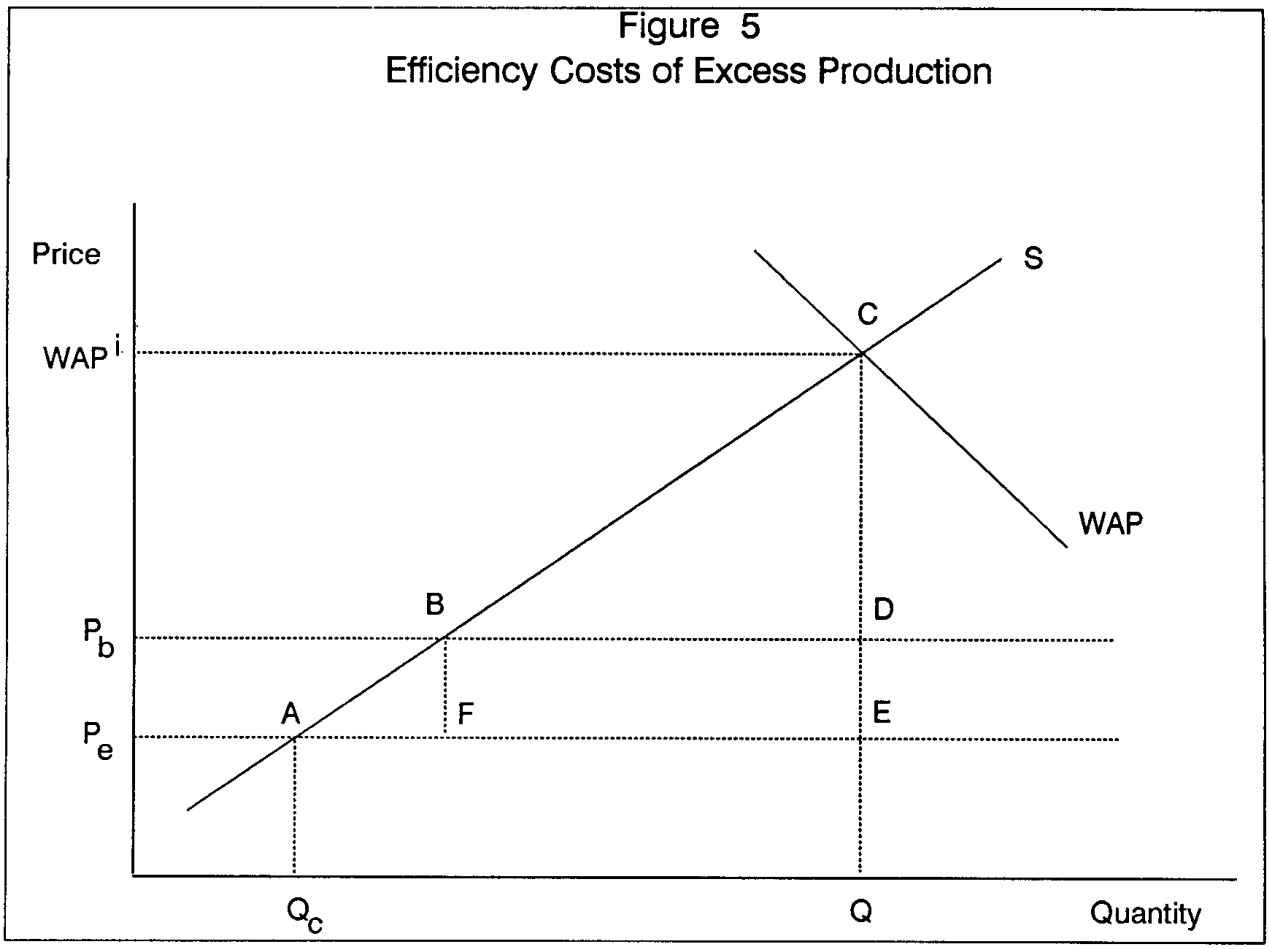
In the case of market milk, this analysis uses the export parity price as the competitive market reference price, whereas the Commission uses the manufactured price which is the export price plus the subsidy. This explains most of the very large difference in the estimated transfer between market milk consumers and producers in Tables 3 and 4. From a national efficiency perspective, the export price, not the subsidised manufactured product price, is the appropriate benchmark.

More minor differences in the estimated transfer from manufactured product consumers to producers in Tables 3 and 4 are due to the Commission's estimated subsidy associated with the Kerin Plan of 4.95 cents/litre versus the estimate of 6.7 cents/litre derived in this analysis.

Both Tables 3 and 4 report small numbers for the estimated efficiency costs of too little consumption. However, the actual numbers vary because of different price comparisons discussed above and because different demand elasticities are assumed.

More important are the reasons for differences between the estimated efficiency costs of over production derived in this analysis and shown in Table 3 and those reported by the Commission and shown in Table 4. In part, the differences are due to the lower subsidy estimated by the Commission. Moreover, in making separate estimates of the efficiency costs due to State regulations and the Kerin Plan, the Commission makes a methodological error which underestimates social costs of excess production in the non-quota States of Victoria, Tasmania and South Australia. The estimates for the quota States of New South Wales, Queensland and Western Australia are not subject to this criticism. Consider Figure 5 which shows a supply curve S, export price of P_e, manufactured price of P_b and a weighted average price of WAP (for market milk and manufactured product sales less the all milk levy). The social costs of excess production estimated in Table 3 is area **ACE**. The Commission estimates the efficiency costs as area **BCD** due to the State pricing regulations and **ABF** due to the Commonwealth Kerin Plan. Aggregating these two, as does the Commission, underestimates the social cost by rectangle **FBDE**. This area explains most of the higher estimate reported in Table 3 relative to

Figure 5
Efficiency Costs of Excess Production



the estimated production efficiency cost in Table 4.

Overall, the estimates of Table 3 are preferred on methodological grounds to those of Table 4. However, uncertainty about the key elasticities of supply and demand and about the prices under a competitive market outcome cautions one in placing too much confidence in the actual numbers in Table 3. Given these reservations, clear messages from Table 3 (and also Table 4) are the very large transfers from consumers to producers, and that current policies bearing on prices paid to farmers, namely price averaging, are of more consequence as a cause of efficiency losses than the distortions associated with discriminatory pricing of domestic consumers.

4. Nominal and Effective Rates of Assistance

The Industry Commission regularly publishes estimates of nominal and effective rates of assistance for market milk, manufacturing milk and total milk, along with estimates for other agricultural, mining and manufacturing industries, as indicators of resource distortions in the economy (see, for example, *Annual Reports* and specifically Industry Commission 1991). The results reported in this paper offer a framework for assessing these estimates. While there are many similarities, there are some significant contrasts at the conceptual level and at the empirical level between the Commission's estimates and those reported in this paper.

Nominal rates of assistance provide guides to price distortions influencing consumption decisions. In principle, the rate is given by the difference between the current, policy distorted, consumer price and the competitive market opportunity price. This is in agreement with the Industry Commission.

In the case of the net exporter competitive market outcome, Figure 2 above and the Commission's assumed reference situation, nominal rates of assistance to consumers would be given by $P_m^i - P_e - x$ for market milk and by $P_b - P_e$ for manufactured products. The Commission uses a much higher competitive market price for calculating nominal

assistance to market milk. First, it uses the manufactured price, $P_b = P_e + s$, where s is the subsidy funded under the Kerin Plan by the all milk levy. Yet, export sales, not domestic manufactured product sales, represent the social opportunity return on milk. In addition, the Commission adds a 20 per cent margin, essentially the winter premium, x, for all States for all the year to ensure reliable supply throughout the year. This seems very generous, especially for the large exporting States, Victoria and Tasmania, at all times of the year, and for all States in the non-winter period. Consequently, the Commission underestimates the nominal rate of assistance to market milk.

For manufactured dairy products the Commission and this analysis use the same framework, although there is a difference in interpretation. The Commission estimates its rate for the wholesale value or f.o.b. export value of manufactured dairy products, whereas this analysis focusses on assistance relative to the derived farm gate milk inputs. Assuming a constant absolute margin for off-farm input costs and value added, a nominal assistance measure is obtained about double that reported by the Commission as a consequence of using a different denominator, namely prices for farm level milk rather than for wholesale level manufactured products.

Discussion of whether the export parity price or the import parity price should be the reference comparison price raises interesting issues generally and specifically in the case of dairying. The distinction is potentially important for low value bulky products where there is a sizeable gap between import parity and export parity and where the trade status of a competitive market outcome may differ from the present trade status. As the discussion of Figure 1 illustrates, in some circumstances where a non-traded status is appropriate, as arises with the dairy example in this paper with a supply elasticity of 1.5, the appropriate competitive benchmark price will be somewhere between the export parity price and the import parity price.

However, it is in the area of measuring the effects of dairy policy on incentives to producers that the Industry Commission estimates of nominal and effective rates of assistance are most in need of conceptual reappraisal. The analysis of this paper indicates that the focus should be on the weighted average price paid to producers, WAP^i, as the return on marginal production influencing supply. The nominal rate of assistance affecting production resource allocation should be $(WAP^i - P_e)/P_e$. In general, the reported Industry Commission measures, and especially those for market milk and for total milk production, are inappropriate.

The market milk price is a marginal return for very few farmers, and even then, production quotas constrain, if not fully prevent, resource allocation responses. In the large producing States of Victoria, Tasmania and Western Australia, market milk returns are pooled with manufacturing milk returns, with the latter being far more important. For the other States, most farmers produce in excess of the quota, and in this case the manufacturing milk price is the marginal return. Only for those few farmers who are on the verge of producing or not producing the quota quantity, and no more, is the market milk return the marginal return.

For farmers in the quota States of New South Wales, Queensland and Western Australia, who produce in excess of their quota, the Industry Commission assistance estimates for manufactured milk are an appropriate indicator of returns received above the national opportunity return. That is, the price of manufactured milk less the all-milk levy is the weighted average price received on marginal production.

In the case of farmers in the non-quota States of Victoria, Tasmania and South Australia, the appropriate marginal return, or WAP^i, is an average of sales for market milk and manufactured milk less the all milk levy. Since the ratios of market to manufactured milk vary across these States, and differ from the national average, the Commission estimate for national total milk production is not appropriate.

Under current policy the nominal rate of assistance to producers varies widely from State to State. Using the data from Table 1, the nominal rate of assistance to producers is 26 per cent for most farmers in New South Wales, Western Australia and Queensland, 33 per cent for farmers in Victo-

ria, 40 per cent for farmers in Tasmania, and 54 per cent for those in South Australia. Using Industry Commission data on value added, the effective rates of assistance would be about double these nominal rates.

5. Some Policy Options

So far the paper has focussed on two extreme policy options, the current arrangements and a competitive market option. The results obtained suggest priority steps for the path of reducing current high rates of assistance to the industry.

From an efficiency perspective, distortions to consumption decisions are relatively small if the assumed low demand elasticities are accurate. The most important distortions are due to overproduction which arises as a consequence of the pool pricing arrangements. Allowing prices for market milk to adjust towards world prices, perhaps by allowing inflation to erode the real value of current nominal prices, would reduce production distortions in Victoria, Tasmania and South Australia; but this would have no effect in the other States. Alternatively, these States could follow New South Wales, Queensland and Western Australia by having marketable quotas for market milk and paying non-quota milk an average manufactured price. Phasing down the Kerin Scheme assistance arrangements, both the magnitude of the all milk levy and the associated subsidy on exports, would reduce production distortions and distortions to the domestic consumption of manufactured dairy products.

As a transitional arrangement, a new and more complicated scheme of marketable quotas for both market milk and for manufactured milk products for the domestic market, and payment of non-quota milk at the world parity price, offers some pluses and minuses. Equity suggests that quotas be based on current shares of domestic sales. A schedule of prices for both market milk and for manufactured milk for domestic sale would be set by regulation. An indicative schedule for, say, the next five years would phase the prices down to the world parity price. The quotas would be readily tradeable within and across States. Relative to the present scheme, the advantages of this proposal include: a phased reduction of discriminatory pricing of milk so long as government policy is not altered; protection of the current distributional pattern; and correct price signals to farmers at the margin, both in terms of the location of production of quota milk and the production of non-quota milk. The proposal is more complicated and requires skilful administration relative to the present arrangements. Continued government involvement in price setting, and opportunities for lobbying to play with quota allocations, provide temptations for policy changes and for reversals of a strategy of adjustment towards the longer term competitive ideal. On balance, it is not clear that the proposal offers net benefits.

Concerns for distributional equity and also for efficiency favour an extended period of phased reductions in current levels of discriminatory industry pricing. The relative importance of industry transfers in industry receipts, up to a third, indicate substantial income redistribution effects of a rapid dismantling of the present arrangements. Given the lengthy productive periods of investment in cattle, buildings and equipment, it will take many years to reduce industry output by the 15 per cent to 20 per cent projected to follow a complete dismantling of current industry assistance. These types of concerns lie behind the Industry Commission's (1991) recommendation for a period of five to ten years to reduce current levels of industry assistance.

6. Conclusions

Current dairy industry policy contains arrangements which enable discriminatory pricing of milk used for market milk purposes and for the domestic sale of manufactured dairy products. State marketing arrangements involving regulated market milk prices and supply quotas result in prices for market milk about double export parity prices. In turn, these arrangements involve transfers from consumers to producers of at least $300 million per year, but at small efficiency costs. Under the Kerin Plan, a subsidy on exports, financed by a levy on all milk produced, results in domestic manufactured dairy product prices some 35 per cent above export parity prices, another transfer from domestic consumers to producers, and a relatively small deadweight loss due to too little consumption. The pool pricing arrangements provide farmers with

price signals in excess of the export parity price of from 25 per cent for New South Wales, Western Australia and Queensland, 33 per cent for Victoria and 40 per cent for Tasmania. The resulting excess production involves considerable deadweight costs estimated at $25 million a year for a supply elasticity of 0.5 and $65 million a year for a supply elasticity of 1.5.

Policy options to reduce the distortions should focus on reducing the adverse effects of the pool pricing arrangements for farm returns. The relative importance of the transfers between consumers and producers suggests the need for a pre-announced strategy of gradual reductions in discriminatory pricing arrangements.

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