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A NOTE ON THE ECONOMIC SURPLUS FROM DAIRY HERD RECORDING IN VICTORIA*

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An input demand model was used to estimate the own price elasticity of dairy herd recording in Victoria. The net benefits to society over a 21 year period were estimated by determining the economic surplus accruing to participators each year and then subtracting all Government monies involved. The net social benefits, unlike the benefits reported for the New South Wales scheme, have on average been positive and have been consistently positive over the latter years of the data.

1 *Introduction*

The purpose of this study is to estimate whether the economic surplus derived by participants in the Victorian dairy herd recording scheme has exceeded the Government monies expended on the scheme. The methodology employed is similar to that used by James G. Ryan [4] in his recent evaluation of the New South Wales scheme and is based on an input demand model. The input demand model was chosen because it avoided the need to identify other input factors which contribute to increased production.[1] In addition, James G. Ryan [4, p. 34] holds that possible bias arising from managerial expertise is avoided with the input demand model.

The input demand model for the N. S. W. Group scheme yielded an estimate of an annual loss of —$67,000 (expressed in 1970/71 dollars) over the 25 year period commencing in 1946/47 (see James G. Ryan [4, p. 33]). On *a priori* grounds one might expect a different result for the Victorian scheme. The number of cows under test in Victoria in 1970/71 was approximately four times the number in the N. S. W. scheme (nearly 400,000 compared with 100,000). The fee per cow in the two States was similar being $1.84 in N. S. W. and $1.64 in Victoria. The Government monies (both State and Federal) were also nearly equal at $345,000 for N. S. W. and $340,000 for Victoria.

The structural organization of herd recording in the two States may appear similar, but the responsibilities differ. In New South Wales the service is basically Government provided. In Victoria, the local herd recording unit, operated by the participating farmers is responsible for employing the herd tester, for providing the requisite testing equip-

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[1] Noble and Curtain [3] in a world review of herd testing give estimates of the production increase which occurs when herd recording is undertaken. S. Walsh [5] in a survey of dairy farmers in an area in Victoria attempted to determine the causal factors, but was unable to resolve the issue. 'Thus the main advantage of herd testing as a performance recording system is that it aids management.' Walsh [5, p. 45].

ment, and for administration. The Victorian Department of Agriculture collates and reports the test data and has a small group of officers who are involved in herd improvement. The Department does not employ the herd testers.

2 *The Input Model*

Economic theory indicates, Horowitz [2, p. 128], that input demand depends on the price of the final product and the price of all other factor inputs. Table 1 presents two models which were selected on the basis of the expected sign on the coefficient of the herd recording fee variable, the significance of the coefficients and the non-rejection of the hypothesis of no serial correlation. The models were estimated in logarithms using 22 years of data between 1951/52 and 1972/73 obtained from the Victorian Department of Agriculture and from B. A. E. indices. The models differ from those estimated by James G. Ryan [4, p. 30] for N. S. W. in that the dependent variable is the ratio between the current and the previous year's observations and that the fee variable is not set up in the Fisher fixed-weight lag form. In addition, neither a capacity variable, nor a rainfall variable has been included, as they were not considered relevant to the Victorian situation. A model akin to James G. Ryan's [4, p. 30] equation A incorporating the Fisher fixed-weight lag form, but without the capacity and rainfall variables, was estimated with the Victorian data. The estimated coefficient on the fee variable did not have the expected sign, it was not significant at the 5 percent level, the Durbin-Watson statistic showed evidence of serial correlation, and the $\bar{R}^2$ was 0·84.

Considering the coefficients on the explanatory variables in equation 1 (see Table 1), and noting that the equation is estimated in logarithms, it appears that the PRD variable is having little effect, although one might argue on theoretical grounds that this variable should be retained. Equation 2 was therefore estimated and on statistical grounds it was taken as the preferred equation from which to obtain the own price elasticity for herd recording. For interest, the Fisher fixed-weight lag form was imposed on the CHR/PP variable and that equation estimated. The estimated coefficient had the expected sign, it was significant at the 5 percent (1 tail t-test), but $\bar{R}^2$ was 0·15.

The elasticity estimate of −0·46 is not strictly comparable to James G. Ryan's [4, p. 29] estimate of −0·4, since the latter is weighted over a 3-year period. It is, however, comparable to the Canadian arc elasticity of −0·83 quoted by James G. Ryan [4, p. 29]. In the next section, the economic surplus is estimated using the elasticity of −0·46, an elasticity one standard deviation above that of −0·6 and an elasticity of −0·8.

3 *Economic Surplus Estimates*

The economic surplus accruing to participants in the herd recording scheme was estimated in a similar manner to that detailed by James G. Ryan [4, pp. 25 and 32]. The procedure is to calculate the triangular area above the price line (the herd recording fee) and below the demand curve (in this instance a ray tangential to the curvilinear

TABLE 1

Input Demand Equations: Victorian Dairy Herd Recording[a]

Equation	Dependent Variable	Constant	log 10 (CHR/PRD)	log 10 (PP/PRD)	log 10 (CHR/PP)	d.f.	$\bar{R}^2$	D.W.
1	log 10 (Y_t/Y_{t-1})	−1·115	−0·602** (0·228)[b]	0·702* (0·340)[b]		18	0·327	1·69[c]
2	log 10 (Y_t/Y_{t-1})	−0·854			−0·464** (0·138)[b]	19	0·347	1·70[c]

[a] Data used over 22 years from 1951/52 to 1972/73.
Y_t —number of cows recorded in year t transformed by 10^{-3}.
CHR—cost per cow for herd recording each year.
PRD—B.A.E. index (Vic.) Prices Received for Total Dairy Products.
PP —B.A.E. index (Vic.) Prices Paid (All Farm Inputs).
[b] Standard errors are shown in parentheses, *, **, indicate significance at the 5 and 1 percent levels, respectively (1 tail t-test).
[c] The hypothesis of no serial correlation is not rejected.

demand curve which provides intercepts on the price axis).[2] The area of the triangle is one half the product of the number of cows recorded each year and the intercept term. The intercept term is calculated as the fee charged each year divided by the own price elasticity. The economic surplus is calculated for each of 21 years from 1952/53 to 1972/73. The net benefits to society are then obtained by subtracting the amount of Government monies involved each year. Estimates of the net benefits to society for each of the three elasticity estimates for 21 years are set out in Table 2. All dollar terms have been inflated to 1972/73 values using the Consumer Price Index for Victoria.

TABLE 2

Estimates of the net Benefits Accruing From Herd Recording in Victoria[a]

($'000)

Year	Elasticity		
	−0·46	−0·60	−0·80
1952-53	−84	−139	−184
1953-54	−59	−120	−171
1954-55	−15	−80	−133
1955-56	50	−24	−84
1956-57	82	2	−63
1957-58	117	29	−42
1958-59	98	13	−56
1959-60	135	44	−31
1960-61	137	47	−27
1961-62	163	65	−15
1962-63	211	104	15
1963-64	135	27	−61
1964-65	217	89	−16
1965-66	297	152	32
1966-67	403	229	89
1967-68	475	284	127
1968-69	490	294	134
1969-70	464	268	85
1970-71	429	240	85
1971-72	433	245	90
1972-73	455	265	109
Average (21 years)	221	97	−4
Average (last 10 years)	380	209	70

[a] Economic surplus less all Government monies.
All values are in 1972-73 dollars. The C. P. I. (Vic.) was the inflator used.

The average annual net benefit to society with the elasticity of −0·46 was $221,000 over the 21 years. The average annual benefits decreased to $97,000 with the more elastic −0·6 figure (one standard

[2] The implicit assumptions are that herd recording as an input is in perfectly elastic supply, that the income effect is negligible. When Government monies are subtracted it is further assumed that the social marginal utility of income is the same for all individuals. For a review of the concept of economic surplus, see Currie *et al.* [1].

deviation above —0·46) and decreased further to —$4,000 with the —0·8 figure. The average annual net benefits to society over the last 10 years of the data were much higher for all three elasticities.

The average economic surplus to each participator was estimated by dividing the total private surplus inclusive of Government funds, by the number of herds in the scheme. With the —0·46 elasticity the amount averaged $125 for the 21 years and $153 for the last 10 years. The amounts were correspondingly lower with the —0·6 elasticity being $96 over 21 years and lower again with the —0·8 elasticity being $88 over the 21 year period. These annual surpluses per herd compare with $64 (1970/71) calculated by James G. Ryan [4] for the Group scheme in New South Wales. Adjusting the $64 figure to 1972/73 dollar values gives a value of $73 per herd.

4 *Concluding Comments*

From the results presented in Table 2, it appears that the annual average net benefits to society and in particular over the last 10 years or so of the available data are positive. This result compares with the N. S. W. surpluses (see James G. Ryan [4, p. 33]), which were consistently negative (with one exception) over the years 1946/47 to 1970/71. The own price elasticity for the herd recording fee would need to increase to —0·8 before the net benefits with the Victorian scheme decreased to approximately zero.

Herd recording has been operative in Victoria since the early 1920's, therefore, it may be expected that farmers have had an ample opportunity to assess its worth and to express their estimations through their demand for the service. Externalities, by definition, do not enter the individual farmer's calculations and hence externalities would not be captured in the input demand model and in the resulting estimates of the economic surplus. Herd recording is necessary for the evaluation of sires for artificial breeding. The greater the genetic pool, the greater is the scope for progeny testing and the more rapidly the characteristics from the superior genotypes can flow to the industry as a whole. The individual farmer would not take full account of this positive externality as he could obtain the advantages from artificial breeding without the necessity of participating in the herd recording scheme himself.

To the extent that superior genotypes are identified at present and lead to an increased demand for herd recording, the above externality argument is weakened.

The production function model in the N. S. W. study [4, p. 37] provided evidence of complementarity on farms between herd recording and artificial breeding. The current trend in Victoria is to establish regional centres which will provide herd recording and artificial breeding services. The emphasis will be placed on herd improvement rather than on either service alone.

The evidence presented here is that the Victorian dairy herd recording scheme has increased social welfare in the Hicks-Kaldor sense and the increasing emphasis on herd improvement is likely to yield further benefits. One qualification should be made. The establishment of regional centres may lead to a transfer of duties from honorary posi-

tions under the current local unit structure to salaried positions under the regional establishment. Unless offset by economies of size elsewhere, these increased monetary costs would need to be debited against the current anticipated benefits.

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