

MEASURING PRODUCTIVITY OF GIPPSLAND DAIRY FARMS

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Productivity gains are important to keep the dairy industry internationally competitive. Total factor productivity (TFP) for the Victorian dairy industry was low at 1.3% per year over a 20 year period from 1978-79 to 1998-99 (ABARE 2001). Total factor productivity can be measured by a number of techniques, and the input-output data can be treated in a number of ways. Data envelopment analysis (DEA) was used to determine the change in the TFP of 25 Gippsland dairy farms over 5 years from 1996-97 to 2000-01. This analysis is a non-parametric approach that uses linear programming to measure the technical efficiency and technological change of farms. Data envelopment analysis fits a frontier to the sample data and uses distance functions to determine the efficiency of each farm relative to the sample. As DEA is an extreme point technique errors in measurement and other variation can affect the results (Coelli *et al.* 1998).

Productivity is a measure of unit of output produced per unit of input used. The data set used here had limited physical data in comparison to financial data. Using the financial data as a measure of the physical data had the advantage of allowing for easy aggregation of variables, however, the value of inputs and outputs vary over time, and indices were required to ensure that the financial data consistently represented the physical data over time. In this analysis, some indices had to be generated from the data set.

Ideally, a DEA will use a large number of farms compared with the number of variables. For a given number of farms, increasing the number of variables cannot decrease the number of farms that will appear to be technically efficient. Chambers *et al.* (1998) reports that there should be at least 3 times as many observations as there are variables.

Three models were used to test the effect of aggregating variables. The variable definitions used in model 1 were based on ABARE (2001) and were; land, plant, livestock capital, livestock purchases, labour, materials and services and outputs. Model 2 combined land and plant into a single variable. Model 3 combined land, plant and livestock capital together into a single variable.

Farms were technically efficient more often in model 1 than in model 2, and in model 2 than in model 3. Ranking farms in each model by their TFP showed that different farms performed differently in different models. The farm that had the highest TFP ranking in model 1, ranked 22 and 24 in models 2 and 3, respectively. This variation in the relative performance of individual farms suggests that non-homogenous variables are being aggregated together, introducing bias.

Total factor productivity results of farms relative to other farms depended on the model used. Larger sample sizes require less aggregation of variables and provide greater confidence in results. Aggregation of variables limits the potential to distinguish the key variables that result in differences in productivity between farms. Sourcing large complete data sets is difficult - this analysis used data from 3 sources and encountered issues with data quality and consistency of measurement method. As TFP measurements are affected by the method used in the analysis, care should be taken both when devising the appropriate method, and drawing conclusions from the results, particularly when investigating individual farm results.

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