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An application of Malmquist productivity index to compare
technological and growth differences between traditional and
non-traditional dairy regions in New Zealand

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Abstract

The NZ dairy industry has adopted an encompassing measure of performance, total factor productivity (TFP), as a target measure to guide on-farm improvements.

Dairy farmers pay a levy in order to fund agricultural research and extension. Extension services and R&D will continue to be of critical importance to maintain and improve productivity at the farm level. Consequently, it is in the best interest of the dairy industry to adequately target R&D and extension funds and make the best use of resources.

To date, the methodology employed to estimate productivity growth has some shortcomings that seriously hamper the ability of potential users to extract useful information from it. First, productivity growth has been reported as an aggregate for the entire dairy industry. Second, it makes no assumption about the efficiency with which resources are being used. Third, it implicitly assumes that all farms face the same technology.

Productivity growth can be achieved either through better (more efficient) use of the technology applied, through the adoption of a new technology (technical progress) or a combination of both. Given that the sources of productivity change—technical progress and technical efficiency change—are fundamentally different phenomena, they are, in turn, influenced by different factors. This distinction is important for policy orientation because different instruments/tools may be required to address them. Furthermore, empirical evidence suggests that a variety of farming systems have emerged as a result of dairy farming geographical expansion.

Farm-level panel data were used to estimate the Malmquist productivity change index. This index can provide additional insights since it can be decomposed into two additional components, one that measures changes in technical efficiency (i.e., whether firms are getting closer to the production frontier over time), and one that measures changes in technology (i.e., whether the production frontier is moving outwards over time). Hence, it provides individual (farm) estimates of TFP. Moreover, the methodology applied allows to test whether farms in the two regions considered in this study are operating under the same

technology. These two regions were the long-established dairy areas of Waikato-Taranaki and the newly developed dairy areas of Canterbury-Southland.

Results for farms in Waikato-Taranaki indicate that annual TFP change is modest, ranging from 0.29% per annum to 0.59% per annum. Most importantly, technical progress is the only source of TFP change in all four models. Therefore, it is necessary to encourage investments in new R&D targeted to remove the technological constraints that impede the realisation of further productivity gains in the regions. However, important differences in the estimates of TFP, technical progress and change in technical efficiency between models were found for farms in Canterbury-Southland. Estimates of TFP change ranged from 0.7% per annum to 2.8% per annum. Even though technical progress and change in technical efficiency contributed to total factor productivity growth (TFPG), the latter component was the most important contributor in three of the four models. Moreover, in two models the rate of technical progress was negative (i.e., technical regress).

The analyses indicate that dairy farms in Canterbury-Southland were on average 10% more productive than farms in Waikato-Taranaki when farms in both regions faced the frontier. These results were consistent for all the input/output set chosen. Furthermore, the null hypothesis that the two regions do not face the same production technology (i.e., each region has its own production frontier) was accepted irrespective of the input/output set chosen. The rejection of the null hypothesis, that farms in traditional and non-traditional dairy regions were operating under the same underlying technology (and hence face the same production frontier), called for a review of the traditional approach to R&D in one central experimental station, strengthening the need for a local approach through the promotion of networks and synergies with universities and other research institutions.

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