

A deeper understanding of farm productivity

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Key messages

- Productivity growth and the variability in that growth are positively correlated; so high growth often means higher volatility.
- The change in productivity for growing farms is double that for less secure farms.
- The change in productivity for crop farms is treble that for sheep farms.
- Productivity growth has mostly been the principal source of farm profitability and wealth creation.
- Training, R,D&E and policy innovation are vital to drive efficiency gains and technical change that are fundamental to productivity growth.

Introduction

Australian agriculture's international competitiveness is often said to principally rely on ongoing gains in productivity. Nossal and Sheng (2010) show that from 1977-78 to 2007-08 Australia's largest agricultural sector, known as broadacre agriculture, achieved total factor productivity (TFP) growth of 1.4 percent per annum. However, from 1997-98 to 2007-08 TFP declined – a fall attributed mainly to drought effects.

Rather than report changes in sectoral productivity, this paper examines productivity change for 270 WA broadacre farms from 2002 to 2011. A detailed analysis identifies causes of farms having different productivity growth. The findings have implications for investments in training and R,D&E.

Aim

Provide a deeper understanding of what drives broadacre farm productivity in WA through analysing farm data.

Method

Data describing 270 WA broadacre farm businesses were supplied by agricultural consulting firms for the years 2002 to 2011. Since the data are from farms able to afford agricultural consultants, these farms may not necessarily be truly representative of the wider farming community. The data nonetheless are unique longitudinal datasets that describe the farm production and financial records of each farm over the decade.

Complementing the physical and financial datasets were socio-managerial and training data on the farm families that owned and operated these farms. Drawing on each farm's financial and physical records, a suite of farm performance financial indicators was derived, including measurement of business equity, operating profit per hectare, return on capital, debt to income ratio and income diversity. Generalised linear mixed effects models were used to fit a range of explanatory variables and interactions to these business indicators. Estimates of the total factor productivity of each farm in each year were generated using the approach outlined by O'Donnell (2012). For more detail regarding the research methods and analyses interested readers are referred to Kingwell et al. (2013).

The datasets on training, human capital, innovation use and farm productivity and farm performance were used in a structural equation model (Vinzi et al 2010) to examine the nature and strength of causal links. Again, for more detail on the nature of training and innovation use by these farm families, interested readers are referred to appendix two in Kingwell et al. (2013).

Results

Productivity

Figure 1 displays the productivity ($dTFP$), profitability ($dPROF$) and terms of trade (dTT) for different groups of farms. The change in productivity for crop dominant farms is treble that for sheep dominant farms. Also the change in productivity for growing farms is double that for less secure farms. There is a strong positive change in farm profitability ($dPROF$) for crop farms whereas sheep farms display no growth in profitability over the study period.

These productivity findings are in broad agreement with those of Hughes et al (2011) for cropping specialists in south-western Australia. The business and adaptation strategy that many farms have employed is to increase farm size and/or the size of cropping programs, and thereby reap the benefits of scale economies. In undertaking this often successful expansion strategy, farms have tended to rely on new or existing technologies and to improve their use of best practice methods. Underpinning this strategy often has been a greater reliance on wheat production that has supported the growth and resilience of a majority of farm businesses during the study period.

How training, farm management and innovation affects productivity

Output from structural equation modelling is shown in Figure 2. Results indicate that the extent of training by the farm family (TR) significantly and positively impacts on the farm family's human capacity (HC). Note that training is not the level of formal education but rather the extent of enterprise training provided by the private and government sectors that members of the farm family have participated in. Such training increases the farm family's human capacity (HC) which in turn significantly positively impacts on adoption of such things as livestock system innovations (LSI), land management innovations, NRM practices (LMI) and electronic and other recent farm management technologies (EM).

The farm family's human capacity also has significant positive impacts on the farm manager's skill in organization and time management (OTM) and business planning (BP). Farm performance (FP) is reflected significantly in rates of growth in total factor productivity ($gtfp$) and equity growth ($mlgr$).

Of all the modeled latent variables affecting farm performance (FP), and therefore productivity and equity growth, only the farm manager's preparedness and ability to use cropping innovations (CI) and their skill in organization and time management (OTM) have significant positive impacts on farm performance. Among the more important cropping innovations are use of minimum tillage techniques, air seeders, press wheels, use of pasture phases to reduce weed burdens and strategic seeding to lessen weed problems.

Considering the statistically significant path coefficients, the key influences upon farm performance are as follows:

Training and human capacity

- Involvement in training, especially crop specific training and finance and business management training helps increase farm families' human capacity.
- Human capacity is also boosted by the cumulative days per week that members of the farm family reside on the farm and their years of experience on the farm.
- The farm family's human capacity positively and significantly affects the farm manager's skill in organization and time management (OTM) and business planning (BP).

Cropping innovations, organisation and time management

- The use of cropping innovations has a significant positive effect on farm performance (FP) as does the farmer's skill in organization and time management (OTM). These are the only two significant path coefficients linked to farm performance (FP).

The important role in positively influencing farm performance (FP) played by the farm manager's preparedness and ability to use cropping innovations (CI) is no surprise. The WA grainbelt from which the farm sample was drawn is a region in which cropping is increasingly important, both as a share of farmland and as a major source of farm revenue. Overall, farmers with a preparedness and ability to use cropping innovations would have seen these innovations deliver profitability and productivity improvements.

The significant positive effect on farm performance of the farmer's skill in organization and time management (OTM) is also worth emphasizing. Kingwell (2011) has reported that modern farming in Australia is no longer simple. Farms are often large, multi-enterprise businesses underpinned by expensive capital investments, changing production technologies, volatile markets and social and climate challenges. Kingwell et.al (2011) found that highly profitable farming systems typically were complex and required farmers to be skilled in organization and time management.

Conclusion

We find productivity growth from 2002 to 2011 is principally observed for crop dominant farms and growing farm businesses. When cropping innovations have been adopted then, on average, farm productivity and profitability has been enhanced. An implication is that a main ingredient to future farm performance will be on-going investment in agricultural R,D&E to ensure farmers have access to profitable crop-based innovations.

Another finding is that the farmer's skill in organization and time management is a significant positive influence on farm performance. Furthermore, this skill is in turn positively affected by the farm family's human capacity, and training that enhances human capacity. One implication is that provision of farm management and business training and education is likely to generate beneficial productivity and profitability outcomes through the beneficial effect of training on the farm family's human capacity.

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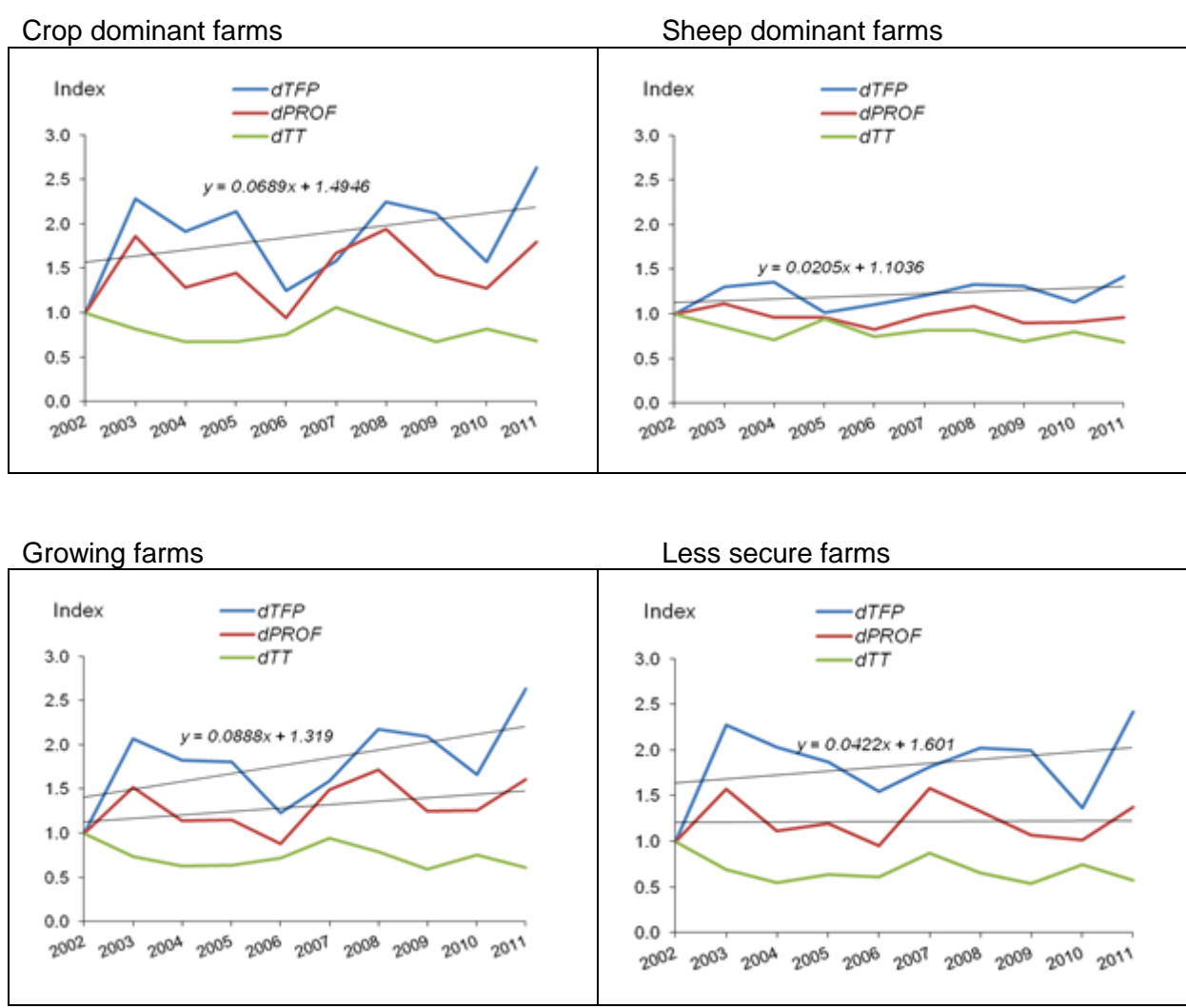


Figure 1 Changes in productivity (*dTFP*), profitability (*dPROF*) and terms of trade (*dTT*) for different groups of farms.

Note: A business which achieved a profit at least seven years in ten and showed an increase in equity from 2002 to 2011 was classified as a growing business. By contrast, less secure businesses failed to achieve a profit after allowing for their finance cost, depreciation and unpaid family labour; and their equity declined as a consequence from 2002 to 2011.

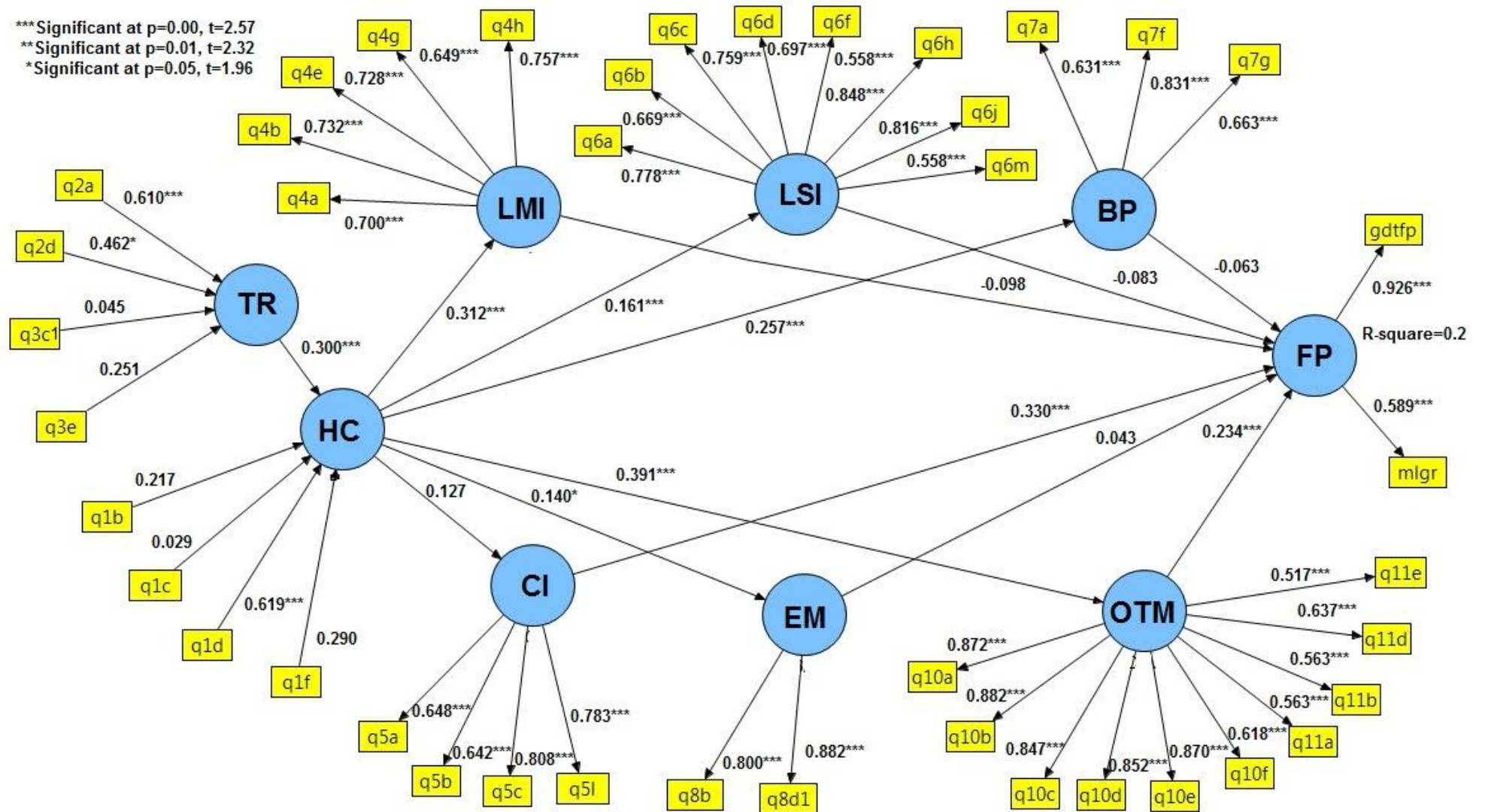


Figure 2 The best-fit structural equation model showing the estimated path coefficients between latent variables and their statistical significance.