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New Zealand Agricultural and
Resource Economics Society (Inc.)

MEASURING SECTOR PRODUCTIVITY

Kay Cao & Rod Forbes
Monitoring & Evaluation, MAF Policy

**Paper presented at the 2007 NZARES Workshop, Wellington,
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Ministry of Agriculture and Forestry
Te Manatu Ahuwhenua, Ngāherehere

MEASURING SECTOR PRODUCTIVITY

Kay Cao & Rod Forbes
Monitoring & Evaluation, MAF Policy
NZARES Workshop, 23rd August 2007



Purpose & Outline

- Purposes:
 - What MAF's doing and future research;
 - Discussion of an alternative method.
- Outline:
 - o Background
 - o Current results
 - o Current method and data
 - o Alternative method (Labour share)
 - o Results comparison
 - o Conclusion & Future research



Background

- MAF's Growth and Productivity project
- Productivity measurement, Trade performance, and others
- Started 06/07, now second year
- Productivity measurement works with Statistics NZ and Massey University;
- Currently using 2 methods: Index number (Statistics NZ data) and Malmquist (Massey's project using MAF's Farm Monitoring data)

Some Definitions

- Total Factor Productivity, not partial productivity;
- TFP measures production efficiency;
- Changes as a result of changes in management practices and technology;
- Important source for long term growth;
- BUT not a measure for profitability;
- TFP contributes to profitability BUT doesn't incl. price effects;
- MAF's TFP measures at aggregated industry level;

Current TFP results

Agriculture, forestry, and downstream sectors TFP growth (annual average growth rate %, 1972-2006)

Time Period	Agriculture	Food, Beverage & Tobacco Manufacturing	Forestry & Logging	Wood & Papers Manufacturing	SNZ Measured Sector
1972-2006	2.0%		2.6%		
1972-1984	-0.5%		1.3%		
1984-2006	3.4%		3.4%		
1988-2006	2.2%	1.0%	2.1%	0%	1.5%
1988-1993	-1.3%	1.8%	5.0%	-0.5%	1.1%
1993-2006	3.6%	0.7%	0.9%	0.2%	1.7%

Current data and method

- Data

- Industry aggregate data from Statistics NZ (GDP, productive capital stock, labour FTEs)

- Method

- Tornquist chained index
- Input index aggregated from K and L index weighted by their shares of total factor income
- K share derived by user cost of capital method; L is residual;

Method cont.

- User cost of capital

$$UCC = PK_{\text{current prices}} * (d + r)$$

Where d is capital depreciation rate, r is rate of return on capital.

- K share = $UCC / GDP_{\text{current prices}}$
- L share = 1 - K share
- Total factor input index

$$I_t = \left(\frac{K_t}{K_{t-1}} \right)^{\frac{1}{2}} \left(\frac{L_t}{L_{t-1}} \right)^{\frac{1}{2}}$$

where w_k is K share and w_l is L share

Alternative method

- Data now available for deriving Labour share
- Advantage:
 - use available National Account data (incl COE, GOS, Tax, Subsidy); and proportion of self-employed;
 - don't have to approximate capital ror and other data required for K share method
- $L \text{ share} = (\text{employee's wage} + \text{self-employed's wage} + \text{production tax attributed to L})/\text{GDP}$
- $K \text{ share} = 1 - L \text{ share}$

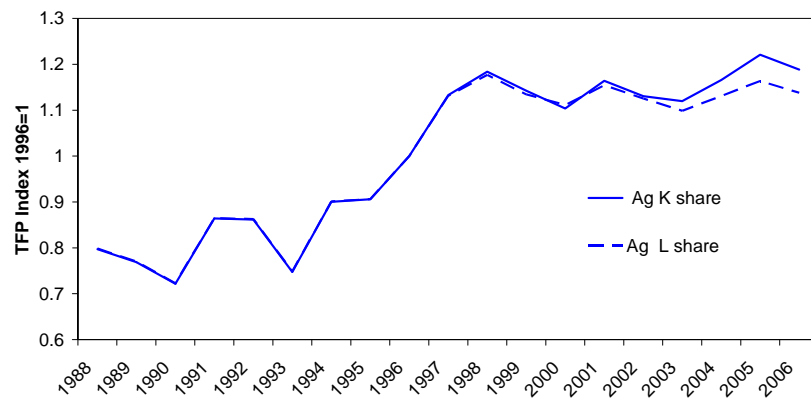
Results of L share method

Agriculture, forestry, and downstream sectors TFP growth
(annual average growth rate %, 1988-2006)

Time Period	Agriculture		Food, Beverage & Tobacco Manufacturing		Forestry & Logging		Wood & Papers Manufacturing		SNZ Measured Sector
	Capital share method	Labour share method	Capital share method	Labour share method	Capital share method	Labour share method	Capital share method	Labour share method	
1988-2006	2.2%	<u>2.0%</u>	1.0%	<u>0.7%</u>	2.1%	<u>1.7%</u>	0%	<u>0%</u>	1.5%

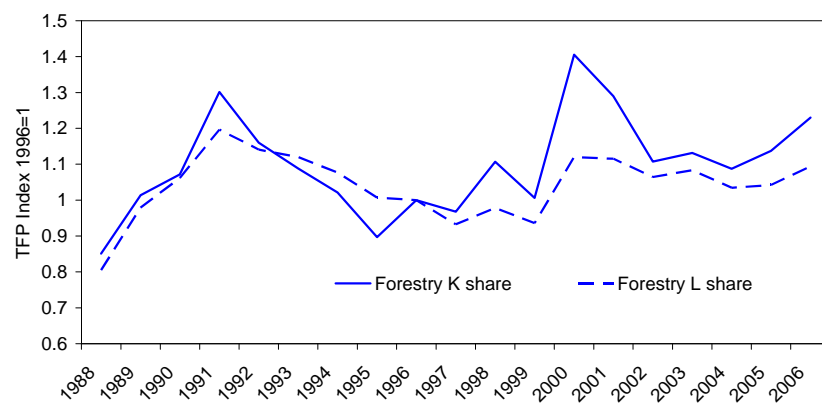
Results cont.

TFP Agriculture: method comparison



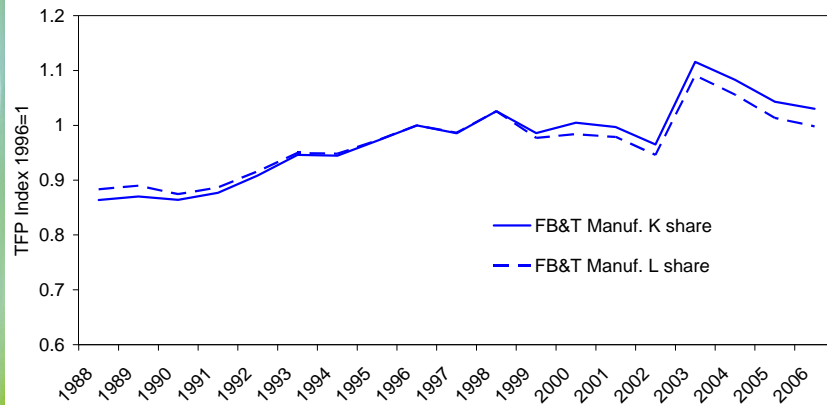
Results cont.

TFP Forestry: method comparison



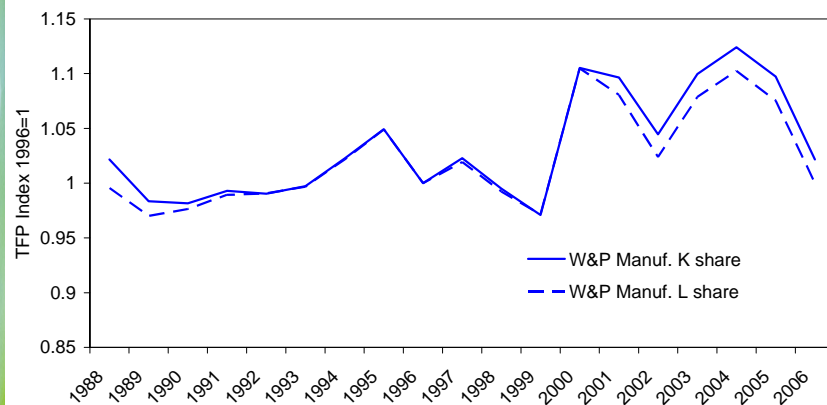
Results cont.

TFP FB&T: method comparison



Results cont.

TFP W&P: method comparison



Results cont.

Contribution of TFP, capital, and labour to sector GDP growth (annual average growth rate %, 1988-2006)

Time Period		Agriculture		Food, Beverage & Tobacco Manuf.		Forestry & Logging		Wood & Papers Manuf.		SNZ Measured Sectors
		Capital share method	Labour share method	Capital share method	Labour share method	Capital share method	Labour share method	Capital share method	Labour share method	
1988-2006	Output growth	1.5%	<u>1.5%</u>	2.0%	<u>2.0%</u>	4.0%	<u>4.0%</u>	1.8%	<u>1.8%</u>	2.7%
	K contribution	0%	<u>0.2%</u>	0.9%	<u>1.4%</u>	0.5%	<u>2.3%</u>	1.6%	<u>1.6%</u>	1.1%
	L contribution	-0.7%	<u>-0.7%</u>	0.1%	<u>0%</u>	1.3%	<u>-0.1%</u>	0.2%	<u>0.2%</u>	0.1%
	TFP contribution	2.2%	<u>2.0%</u>	1.0%	<u>0.7%</u>	2.1%	<u>1.7%</u>	0%	<u>0%</u>	1.5%

Conclusion & Future Research

- L share method shows;
 - Slightly lower TFP estimates
 - Higher K contribution;
 - Lower L contribution;
- Advantage of L share method: reflects better factor share as don't have to approx data;
- K share method underestimate K share as missing tax component and approx ror;
- New method only change TFP slightly due to changes in the weighting components NOT the real factor growth



Future Research

- Qualitative analysis of factors contributing to sector TFP growth;
- Modelling determining factors of TFP growth (Op research contract with Massey Uni);
- TFP measurement for sub-sector level using SNZ aggregate data;
- TFP measurement for sub-sector level using Farm-level data and possibly SNZ Longitudinal Firm Performance Data (LFPD / IBULDD)



Comments / Questions

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