New Zealand Agricultural and Resource Economics Society (Inc.)

# MEASURING SECTOR PRODUCTIVITY

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## Purpose & Outline

- Purposes:
  - What MAF's doing and future research;
  - Discussion of an alternative method.
- Outline:
  - Background
  - Current results
  - Current method and data
  - Alternative method (Labour share)
  - Results comparison
  - 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 = $PKS_{currentprices}$ * (d + r)

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

- K share = $UCC/GDP_{currentprices}$
- L share = 1- K share
- Total factor input index

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

where wk is K share and wl is L share

# Alternative method

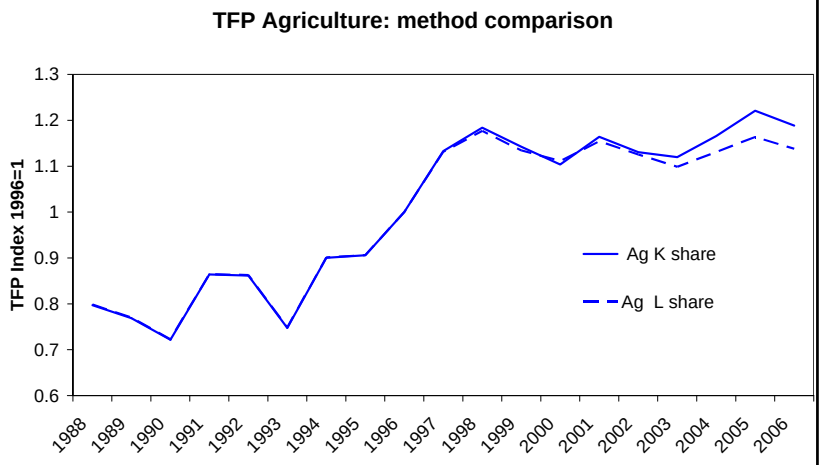
- Data now available for deriving Labour share
- Advantage:
  - use available National Account data (incl COE, GOS, Tax, Subsidy); and proportion of self-employed;
  - don't have to approximate capital ror and other data required for K share method
- L share = (employee's wage + self-employed's wage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

# Results of L share method

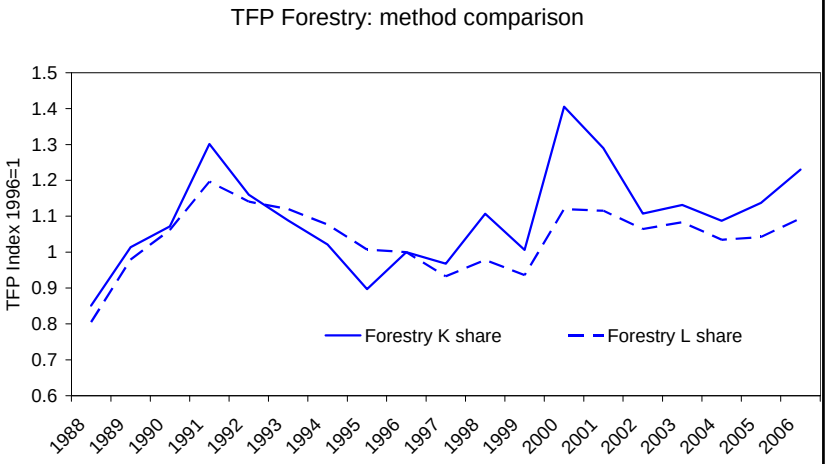
**Agriculture, forestry, and downstream sectors TFP growth**
(annual average growth rate %, 1988-2006)

| 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% | 2.0% | 1.0% | 0.7% | 2.1% | 1.7% | 0% | 0% | 1.5% |

# Results cont.

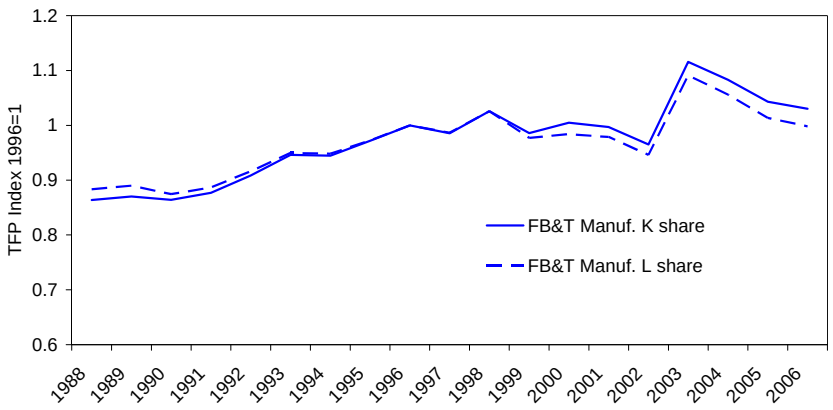



# Results cont.



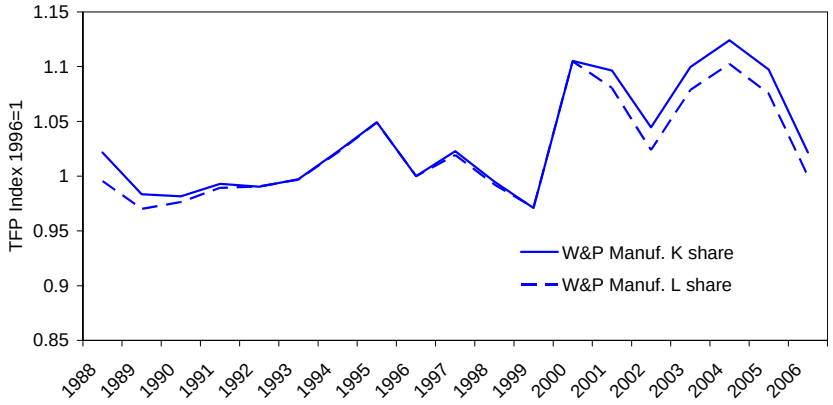
## Results cont.

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% | 1.5% | 2.0% | 2.0% | 4.0% | 4.0% | 1.8% | 1.8% | 2.7% |
| | K contribution | 0% | 0.2% | 0.9% | 1.4% | 0.5% | 2.3% | 1.6% | 1.6% | 1.1% |
| | L contribution | -0.7% | -0.7% | 0.1% | 0% | 1.3% | -0.1% | 0.2% | 0.2% | 0.1% |
| | TFP contribution | 2.2% | 2.0% | 1.0% | 0.7% | 2.1% | 1.7% | 0% | 0% | 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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