



Australian Government

Australian Bureau of Agricultural and
Resource Economics – Bureau of Rural Sciences



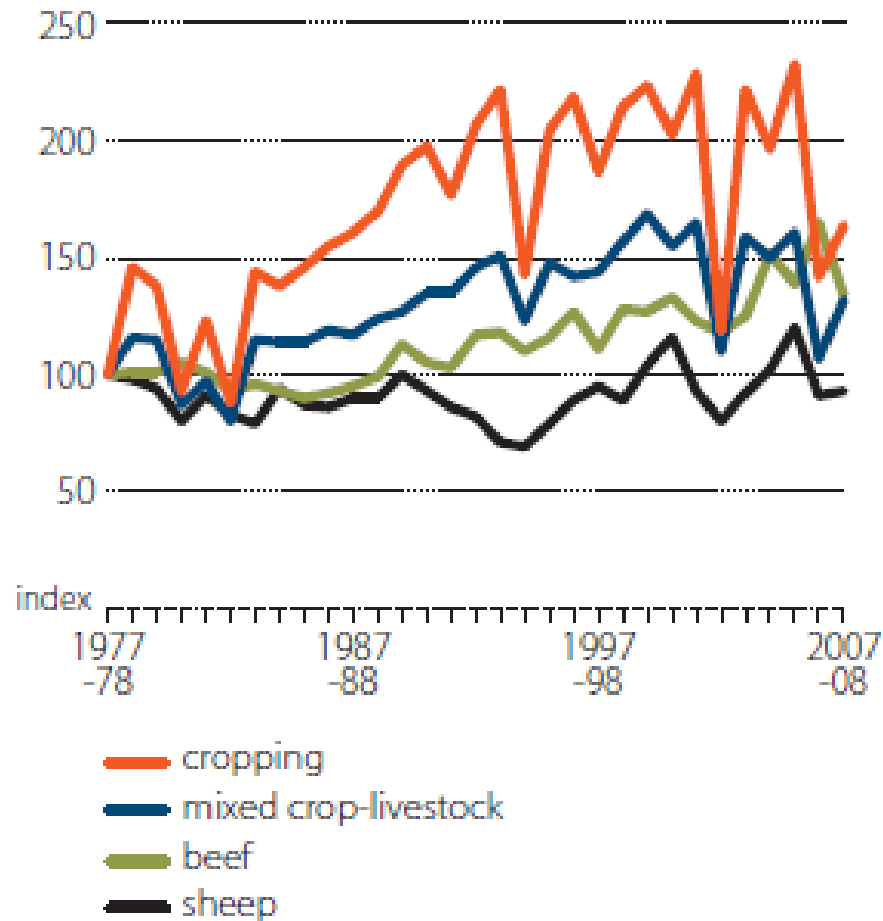
Productivity pathways: Climate adjusted production frontiers for Australian broadacre agriculture

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Motivation

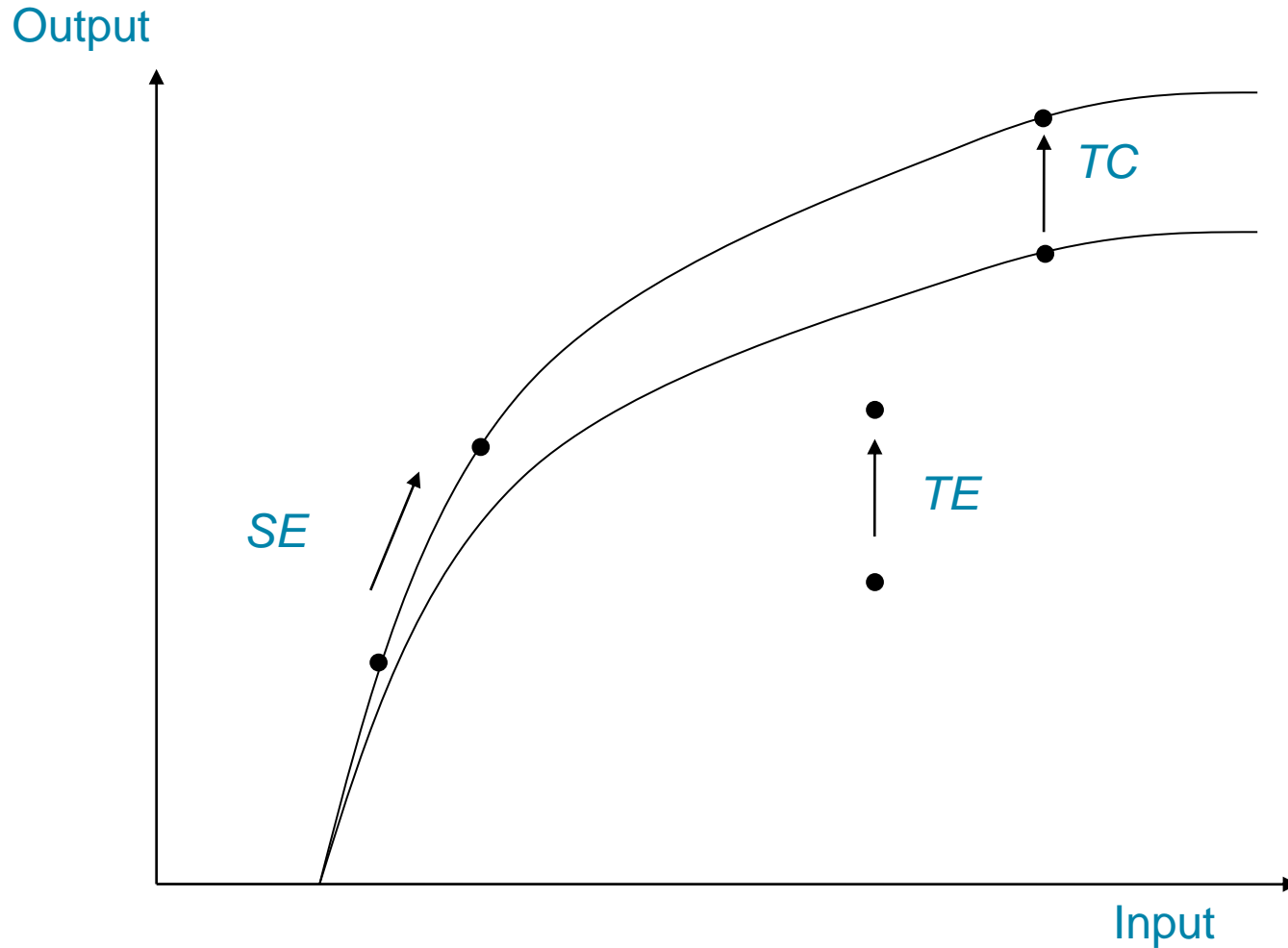
Australian broadacre TFP 1977-78 to 2007-08



Objectives

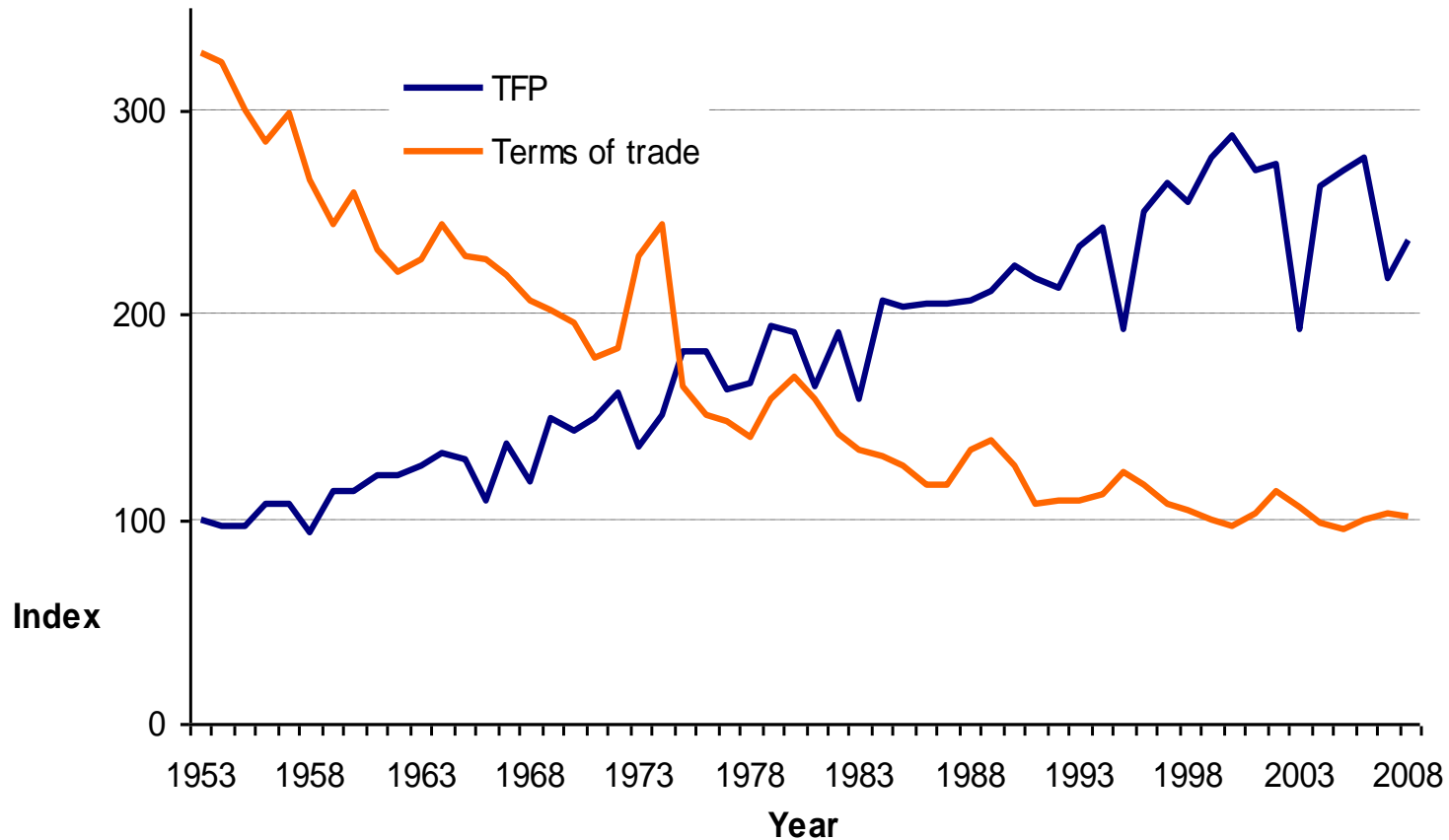
- Decompose productivity change into key components
 - Use panel data to estimate production frontiers
 - Stochastic Frontier Analysis (SFA)
- Control for the effect of climate variability on productivity
 - Match spatial climate data to farm production data
 - Estimate climate adjusted production frontiers and productivity change estimates

Productivity pathways



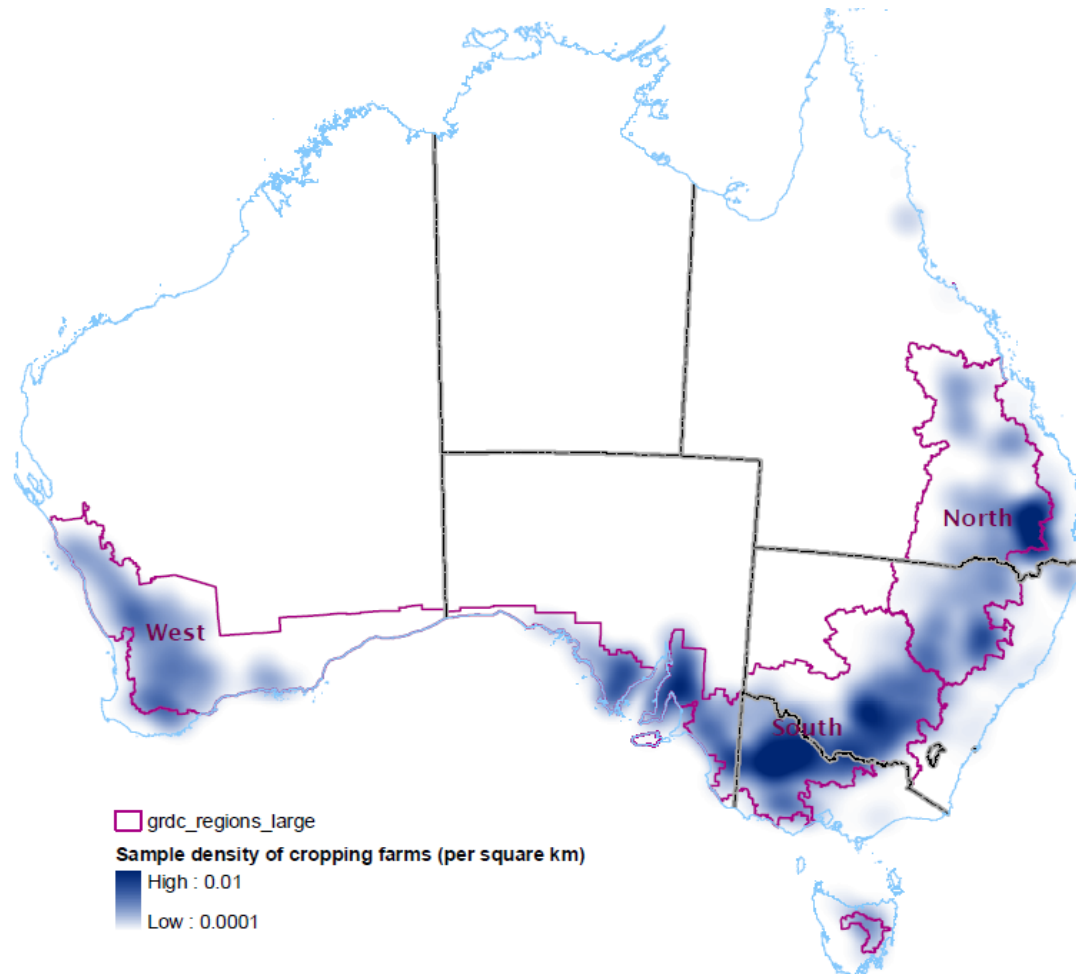
Profitability pathways

- Terms of trade



Method

- AAGIS Farm survey, 1977-78 to 2007-08, 13,430 obs.
 - Output, Land, Labour, Capital and Materials indexes



Method

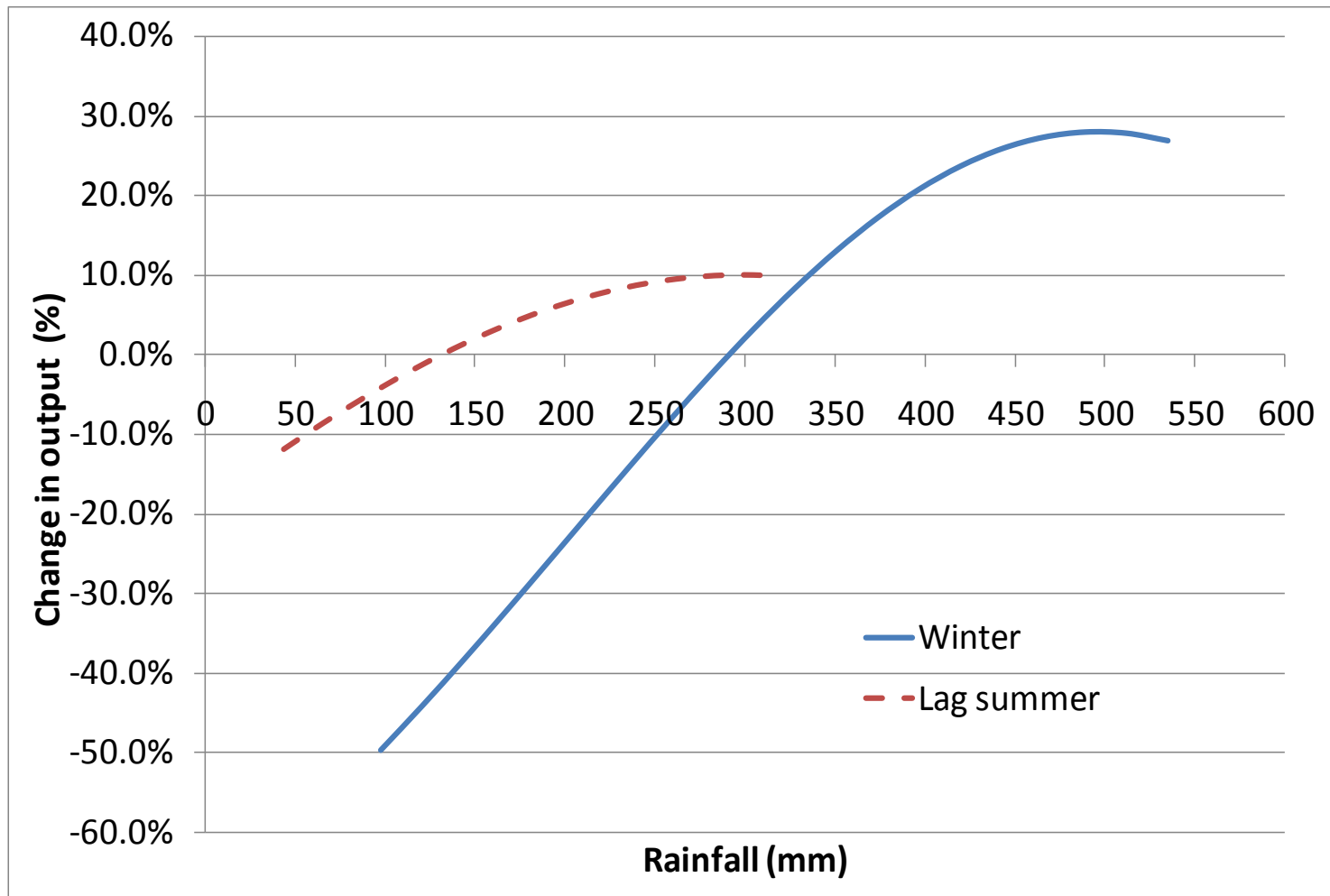
- Review of relevant climate variables
 - Moisture availability proxy
 - Winter and summer growing season rainfall
 - Temperature extremes proxy
 - Average maximum and minimum temperatures
 - Lagged effects and interaction terms
- Spatial (5 km grid) climate data available from AWAP
- Match climate data to individual farms via GIS

Method

- Stochastic frontier analysis (SFA)
 - Accounts for statistical noise (unlike DEA)
 - Composite error term
- Production frontier
 - Translog, quadratic time trend and climate responses
- Technical inefficiency
 - Time varying, truncated normal distribution
- Estimated parameters define:
 - Climate effects index (CEI)
 - TFPCA, TC, TE, SME

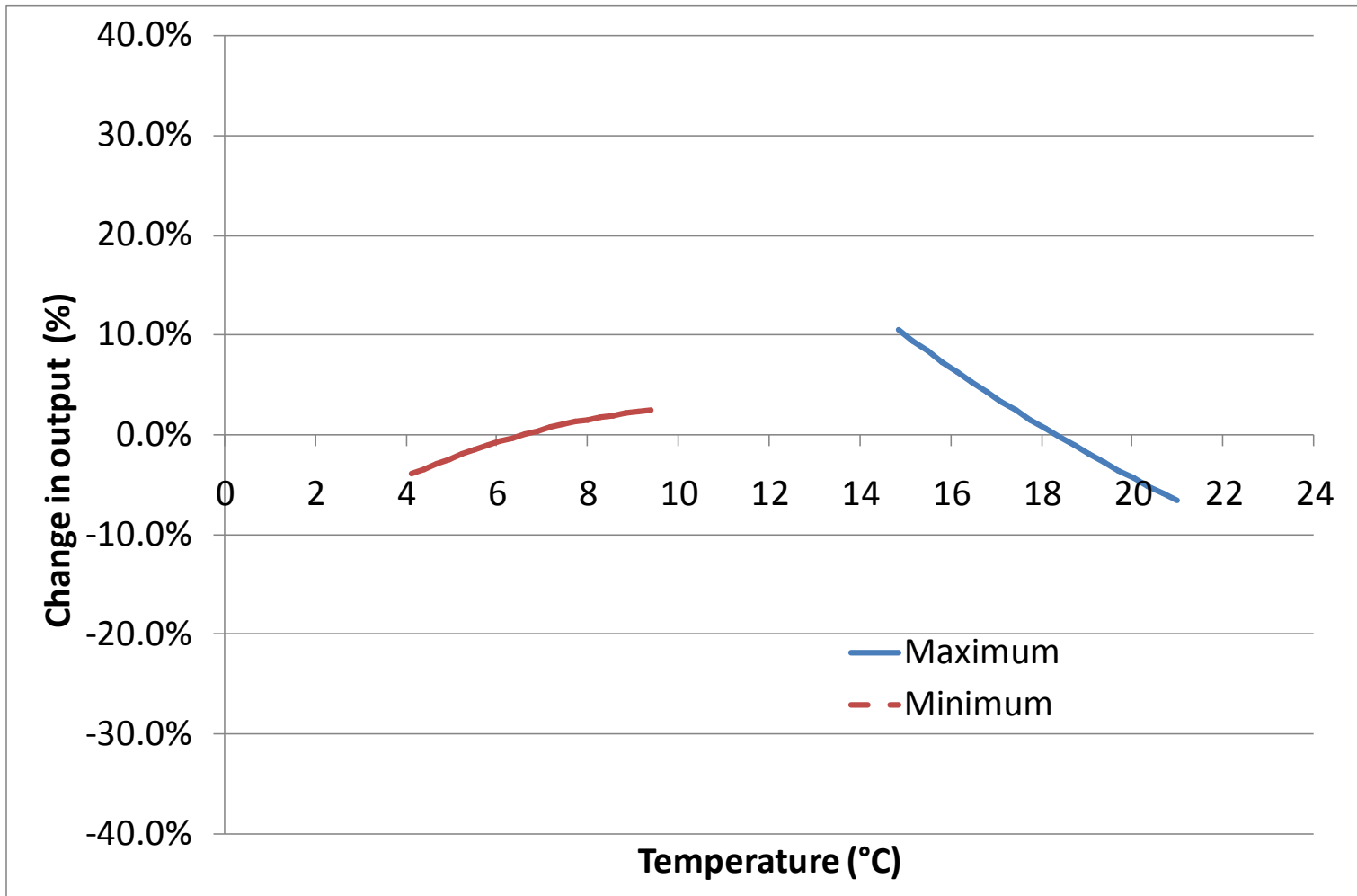
Results

- Climate response curves, rainfall southern region



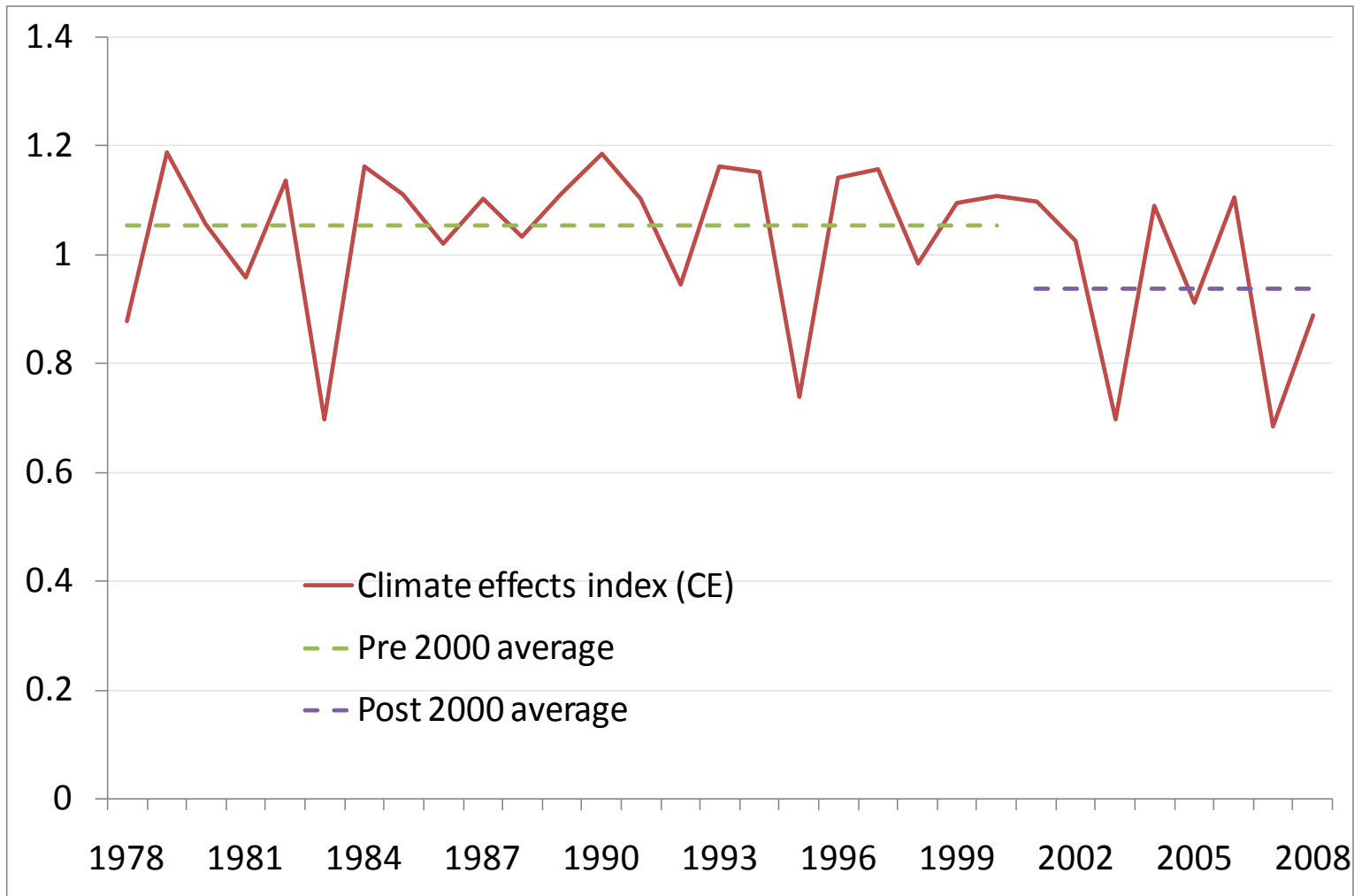
Results

- Climate response curves, temperature southern region



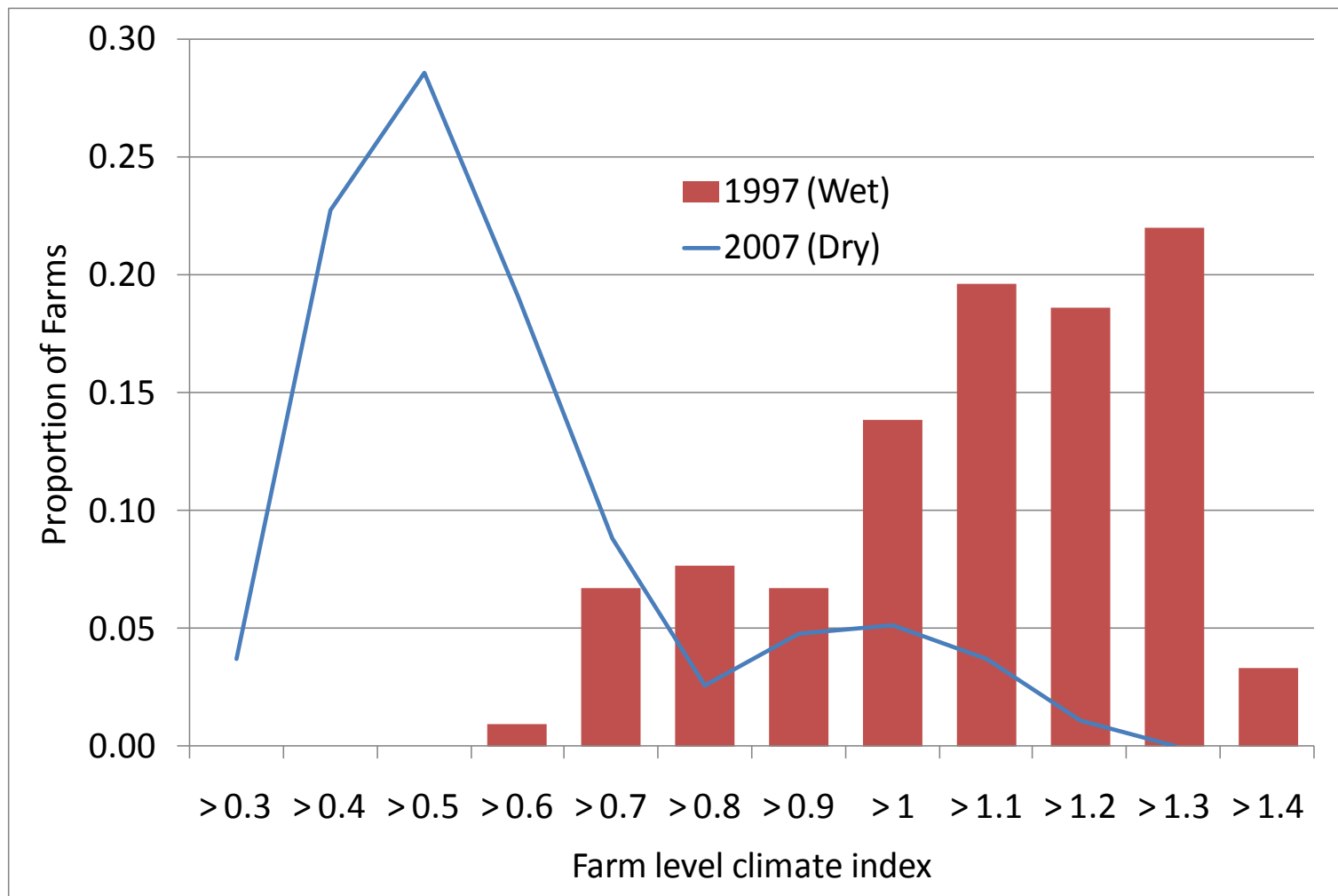
Results

- Climate effects index (CEI)



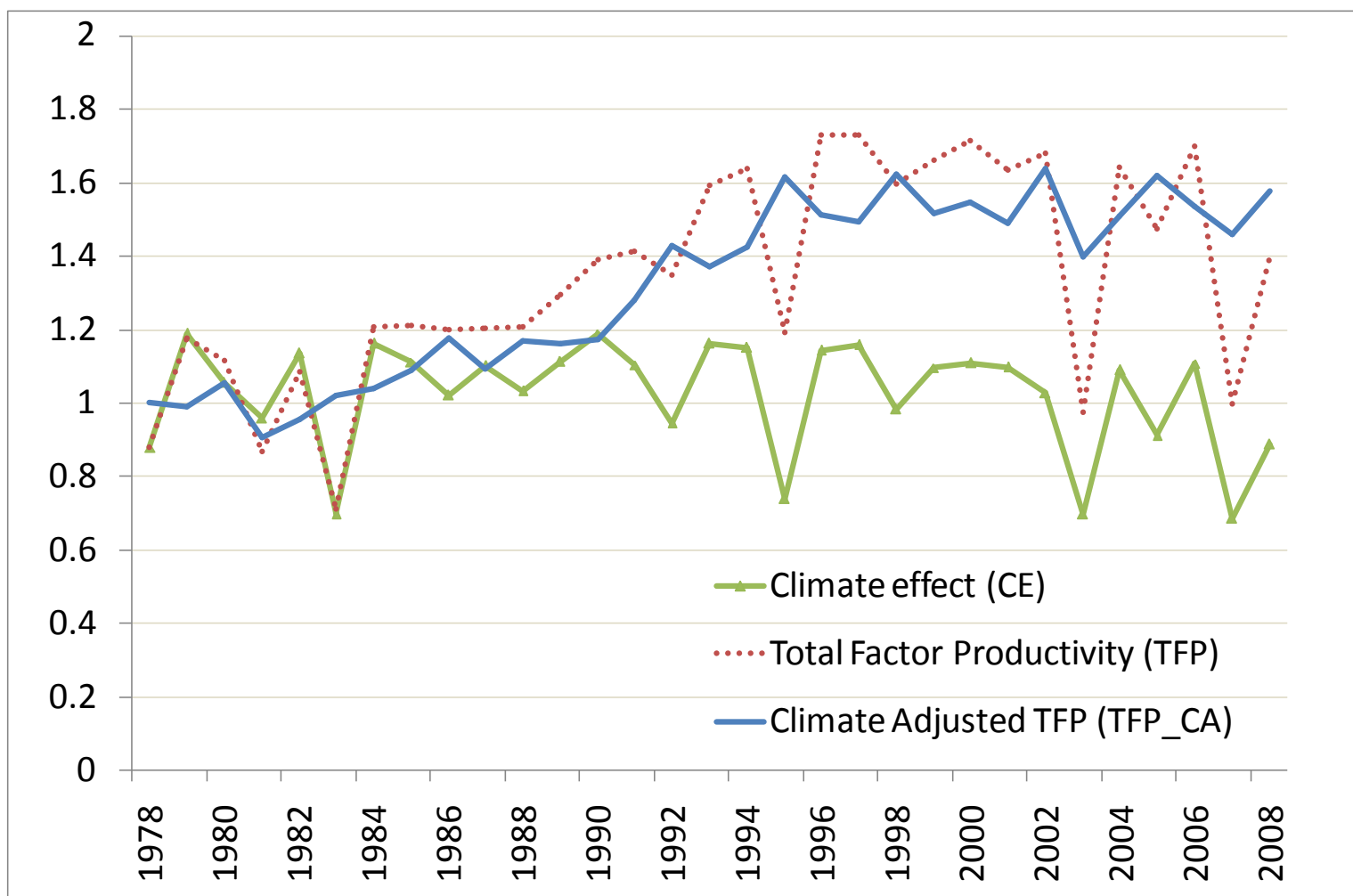
Results

- Farm level CEI distribution, 1997 and 2007 (Southern)



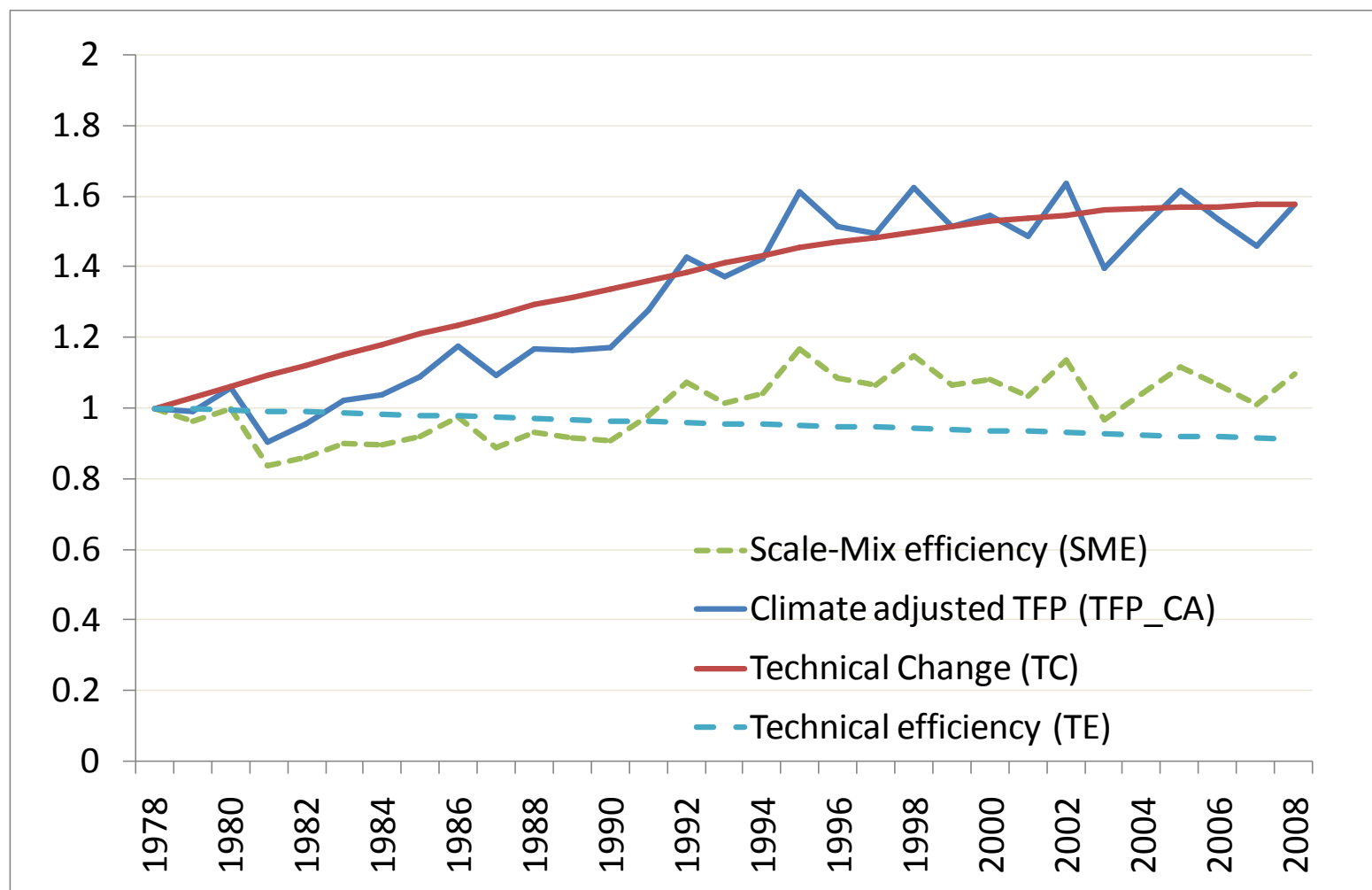
Results

- Climate adjusted productivity



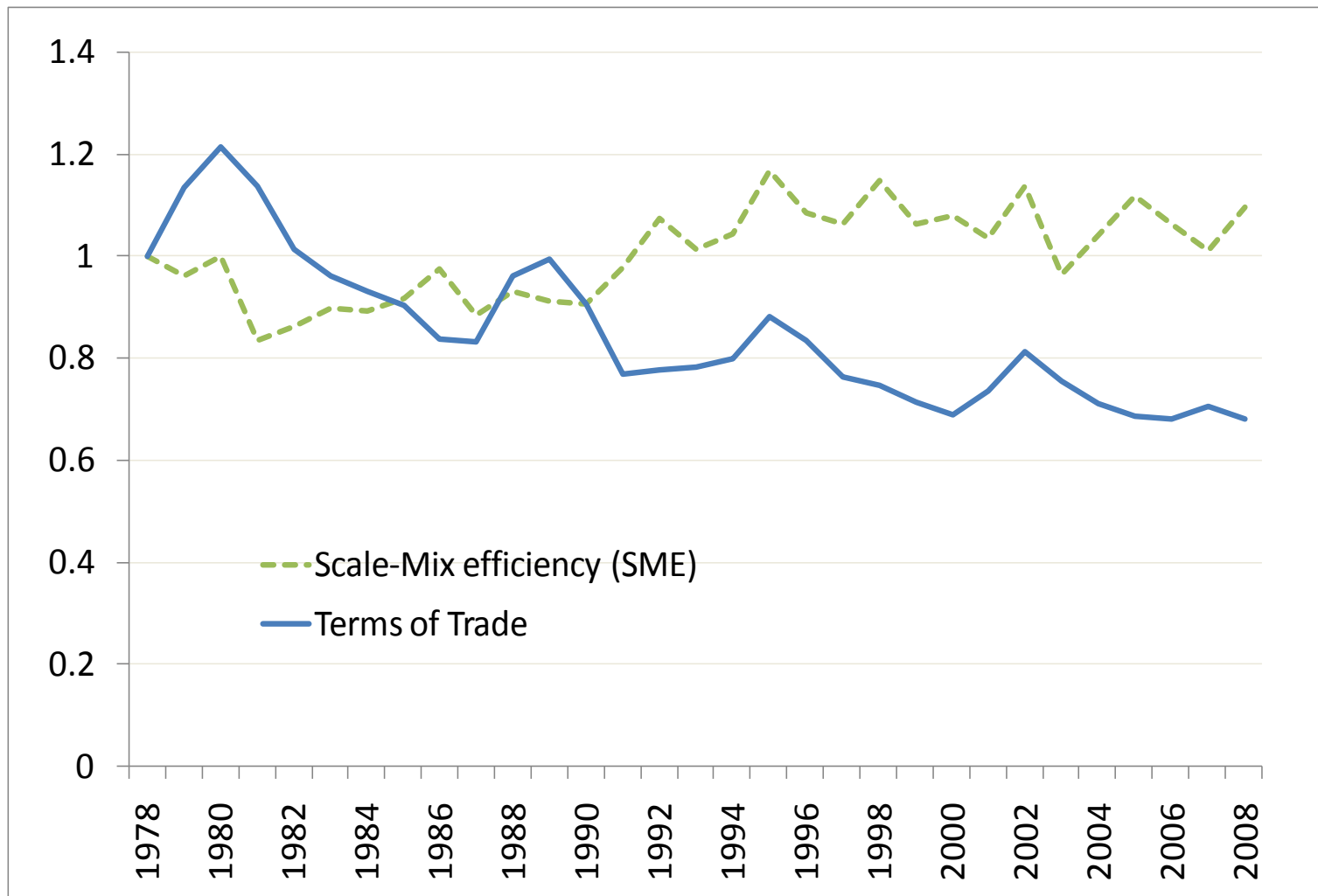
Results

- Productivity decomposition



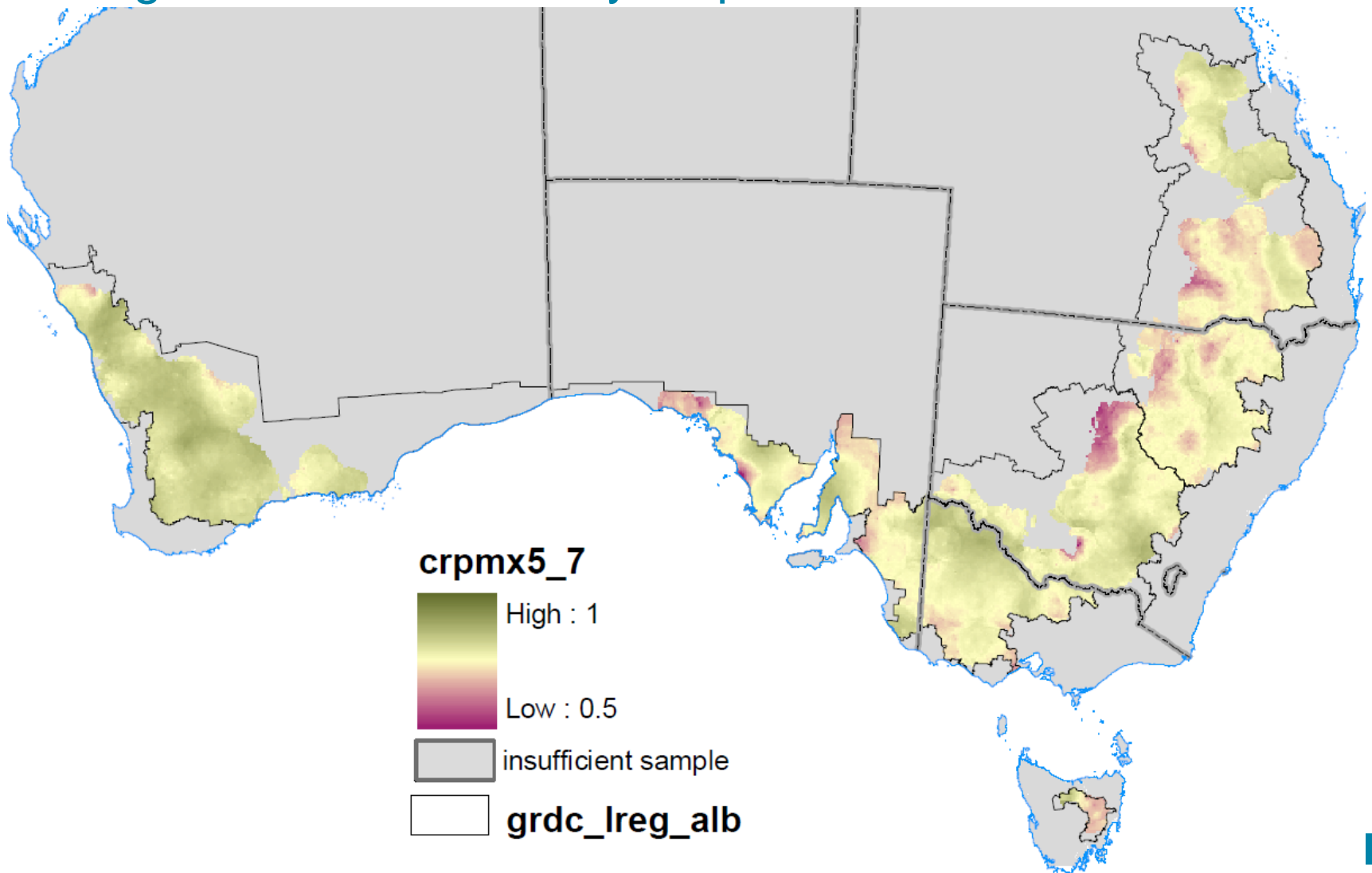
Results

- Scale-Mix efficiency vs Terms of Trade



Results

Average technical efficiency map



Conclusions

- Climate methodology proved effective
 - Has a number of advantages over alternatives
- Productivity decomposition
 - Slowing rate of technical change
 - Technical efficiency decline
- Future research
 - Ongoing climate adjusted TFP series, determinants of technical inefficiency, land quality



Thank you

Science and economics for decision-makers