# PRODUCTIVITY BACKCASTING: ECONOMY-WIDE TRENDS, 1993-2013

SHERWIN GABRIEL

# INTRODUCTION

- Productivity has been an important source of growth in South Africa, and partly reflects policy and institutional changes such as trade liberalisation and greater private participation
- The National Development Plan identifies employment and productivity growth as vehicles to raise income and living standards
- What have been the recent trends in productivity growth? Are there differences between industries?
- Using economy-wide data sets from 1993 to 2013, we take a backcasting approach using a CGE model to estimate productivity parameters that are consistent with the source data

# METHODOLOGY

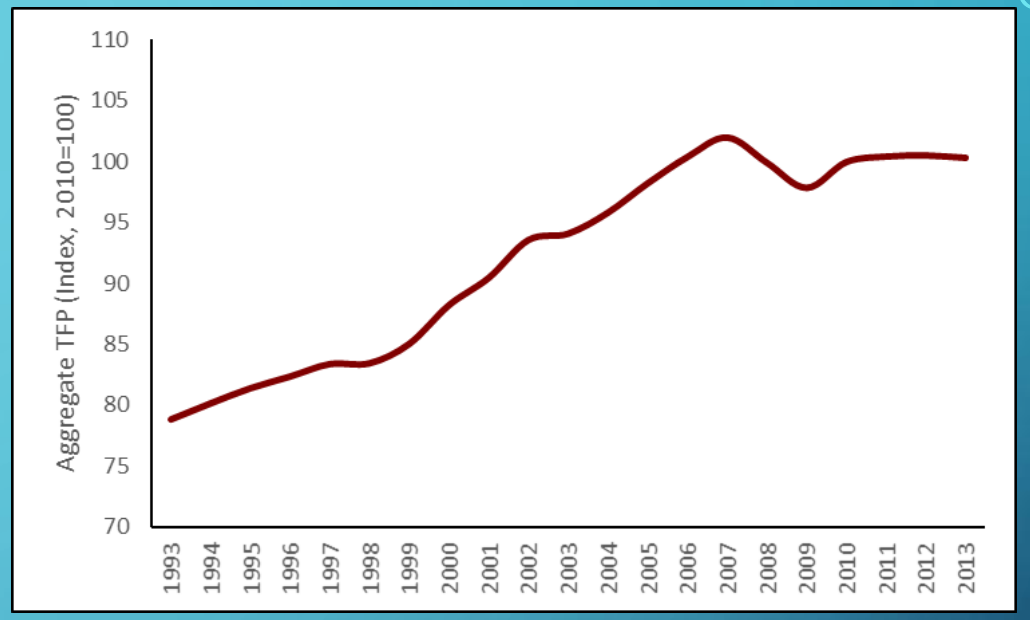
- South Africa's TFP growth has been widely studied, with most studies using a growth accounting framework (for example, Arora, 2006; Fulkner & Loewald, 2008; Anvari, Ehlers & Steinbach, 2014; Fedderke, 2002). Some research use non-parametric approaches, such as DEA (Tsebe & Biniza, 2015)
- In this research, we use a backcasting approach using a CGE model informed by a series of real and nominal mini-SAMs to estimate aggregate and sector-specific TFP variables over the period 1993-2013.

# BACKCASTING APPROACH

- Using a 2010 base year, we run a dynamic CGE model forward in time (to 2013) and backward in time (to 1993). The CGE model is a version of the IFPRI Standard Model adapted to the South African economy, and modified to allow for backcasting
- For each time period, we update exogenous data based on information derived from a series of real and nominal mini-SAMs (van Seventer, 2015)
  - Real GDP
  - Labour and capital quantities
  - Implicit price indices
  - Composition of value added and intermediate consumption
  - Tax, saving and other parameters
- Because the model is given observed data, it does not need to estimate them. Instead, we allow productivity parameters to become variable, and hold the observed data fixed. The model then solves for the parameters, ensuring they are consistent with the observed data.

# RESULTS: AGGREGATE

- Between 1993 and 2013, aggregate TFP growth averaged 1.2 per cent per annum
- This has slowed to an average of 0.1per cent between 2008 and 2013
- Acceleration in TFP growth between 1999 and 2006
- Declines in TFP growth in 2008 and 2009, however it has not yet recovered to pre-crisis levels.



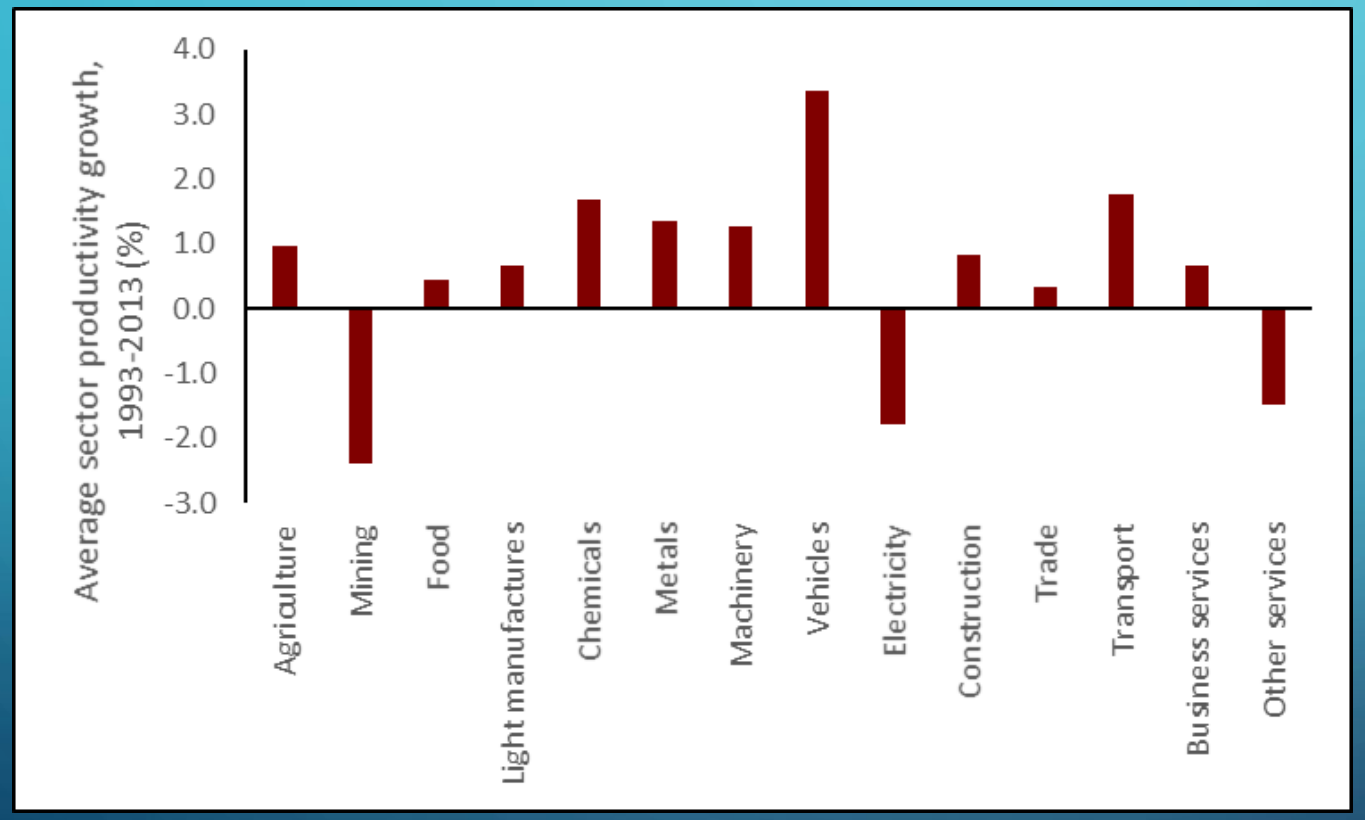

| Study | Period | TFP growth |
|---|---|---|
| Fedderke (2001) | 1990s | 1.07% |
| Arora (2006) | 1995-2003 | 1.3% |
| Eyraud (2009) | 1996-2006 | 1.1% |
| Anvari, Ehlers & Steinbach (2014) | 1990-1999<br>2000-2008<br>2009-2013 | 0.4%<br>2.0%<br>0.2% |
| Du Plessis & Smit (2009) | 1995-2004 | 1.86% |

# RESULTS: AGGREGATE

- Slowdown in productivity growth and labour growth is pronounced, despite fairly strong growth in capital stock.
- Weak productivity growth limits growth potential

| Average growth (%) | 1993-2013 | 1998-2013 | 2003-2013 | 2008-2013 |
|---|---|---|---|---|
| GDP growth | 2.9 | 3.1 | 3.2 | 1.8 |
| Aggregate TFP growth | 1.2 | 1.2 | 0.6 | 0.1 |
| Employment growth | 1.1 | 1.3 | 2.4 | 0.4 |
| Capital growth | 1.8 | 2.1 | 2.8 | 2.8 |

# RESULTS: SECTORAL




- Sectoral estimates show considerable variation between different sectors
- Sectors do not show especially strong growth in productivity
- Negative TFP growth in mining, electricity, and community services
- Productivity growth in vehicle manufacturing is high, but accompanied by lower employment

# RESULTS: SECTORAL

- Need to look at productivity trends alongside those in employment

| | | Employment growth | |
|---|---|---|---|
| | | Low | High |
| **Productivity growth** | High | | |
| | Low | | |

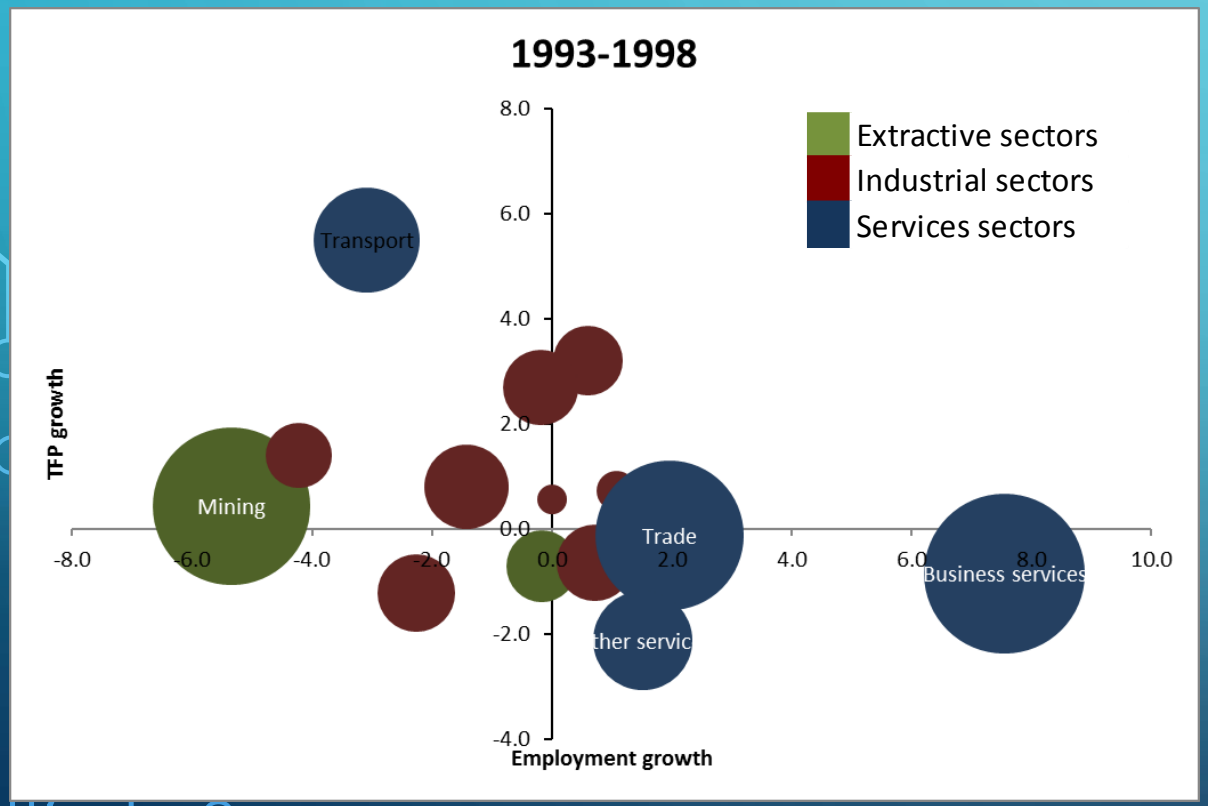
# RESULTS: SECTORAL

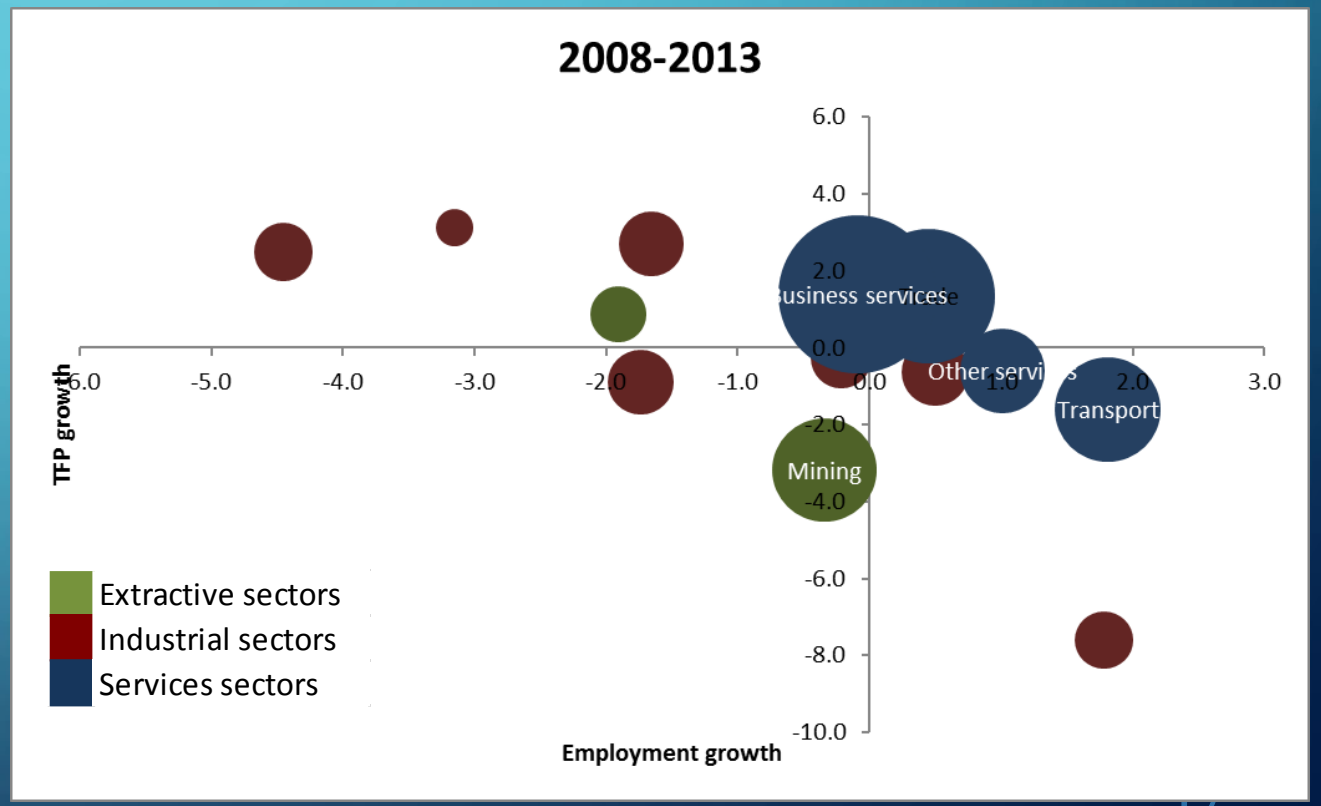
- Need to look at productivity trends alongside those in employment

| 1993-2013 | | Employment growth | |
|---|---|---|---|
| | | Low | High |
| **Productivity growth** | High | Vehicle manufacturing<br>Transport services<br>Chemicals<br>Metals<br>Machinery | |
| | Low | Agriculture<br>Mining<br>Food<br>Light manufacturing<br>Construction | Business services<br>Trade services<br>Community services<br>Electricity |

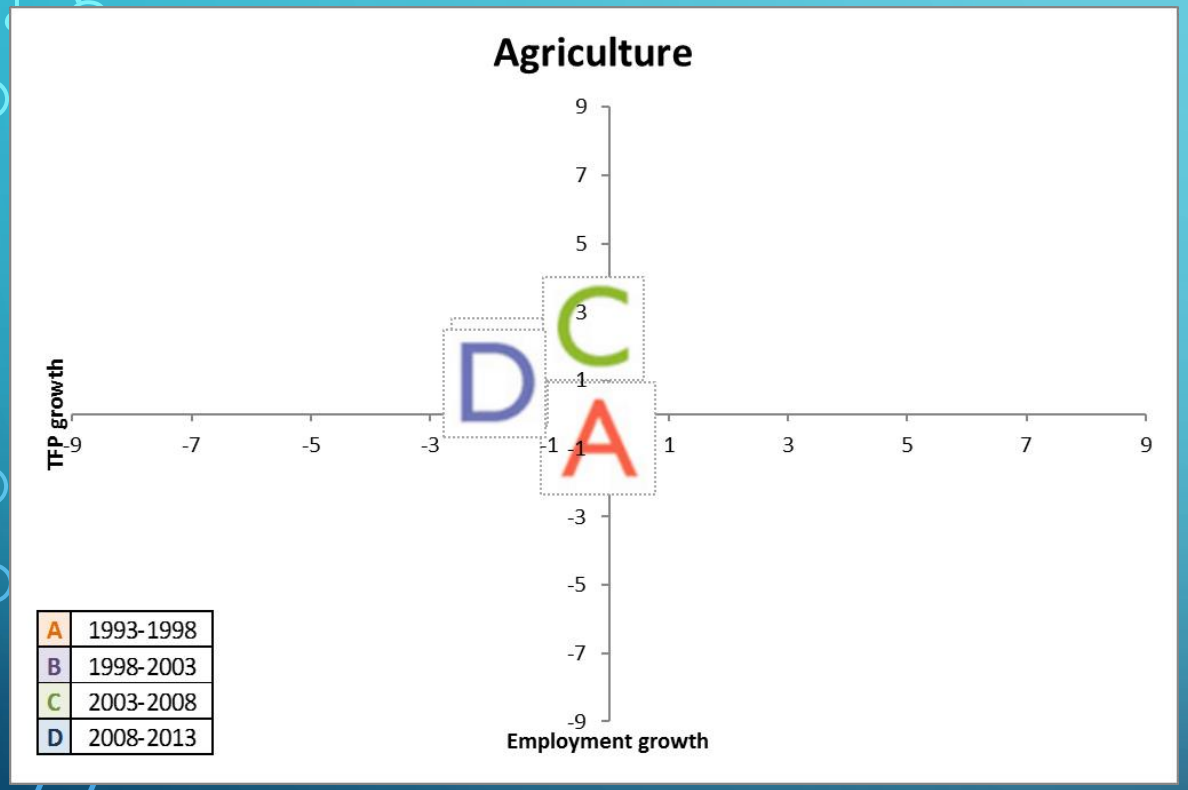
# RESULTS: SECTORAL

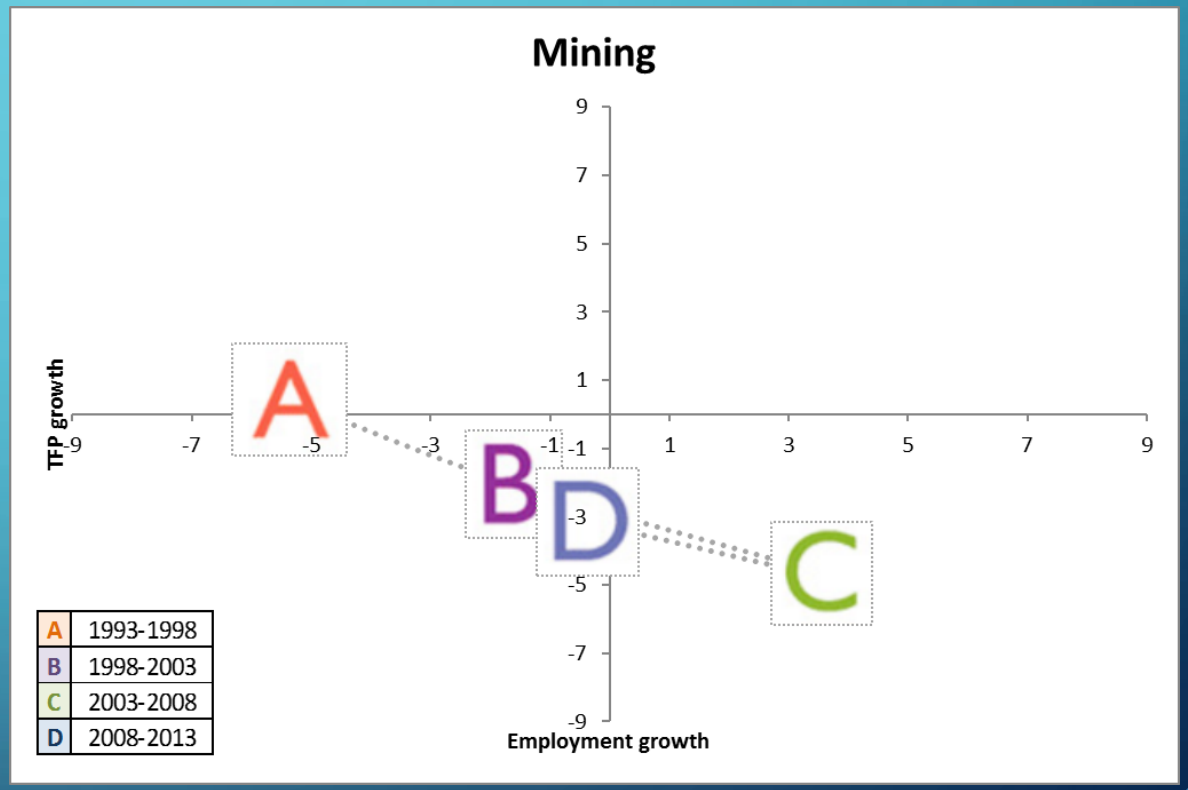
- Need to look at productivity trends alongside those in employment



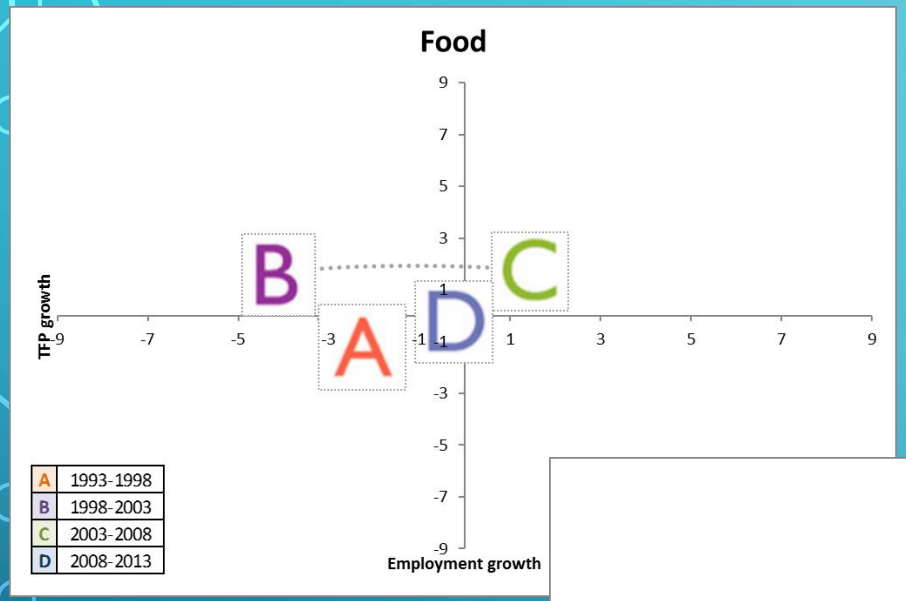



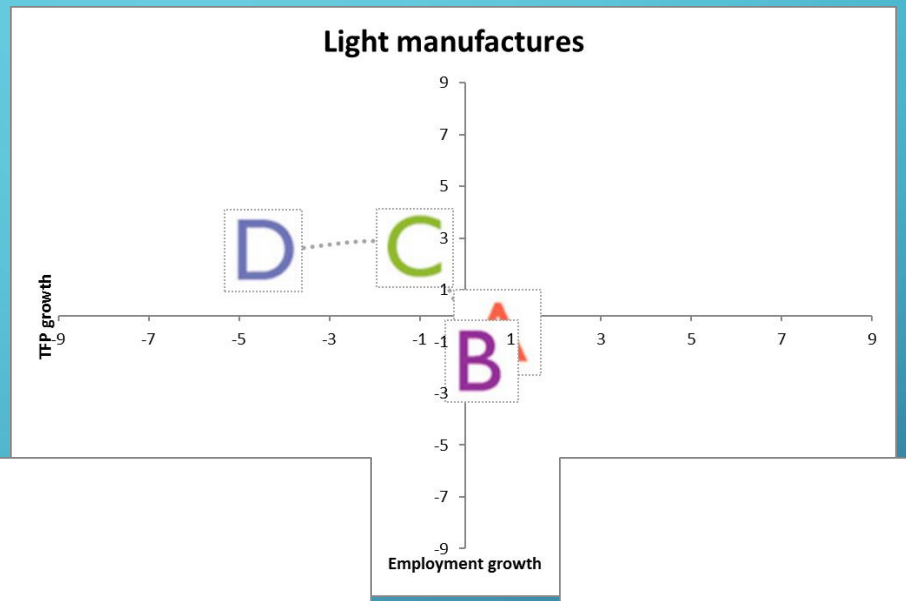
# RESULTS: SECTORAL

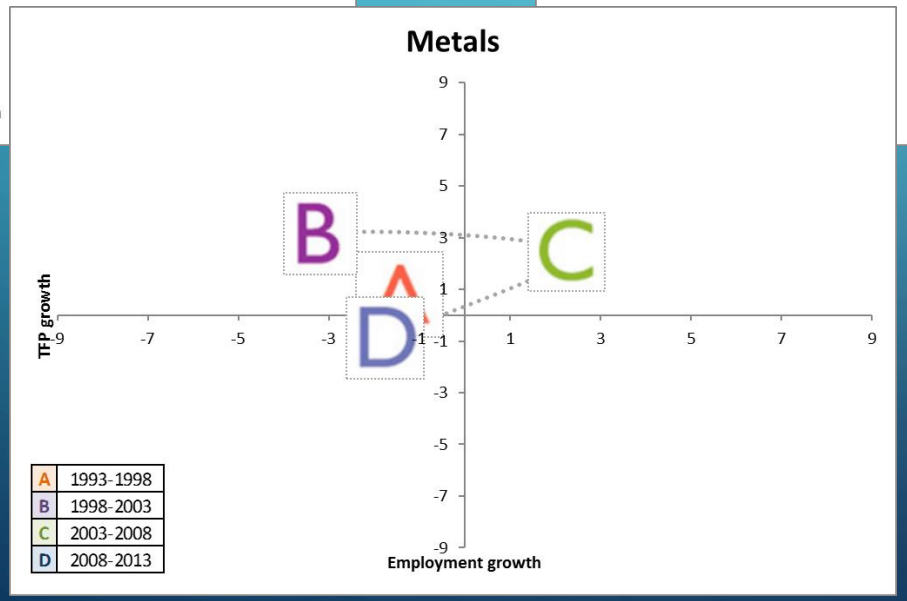


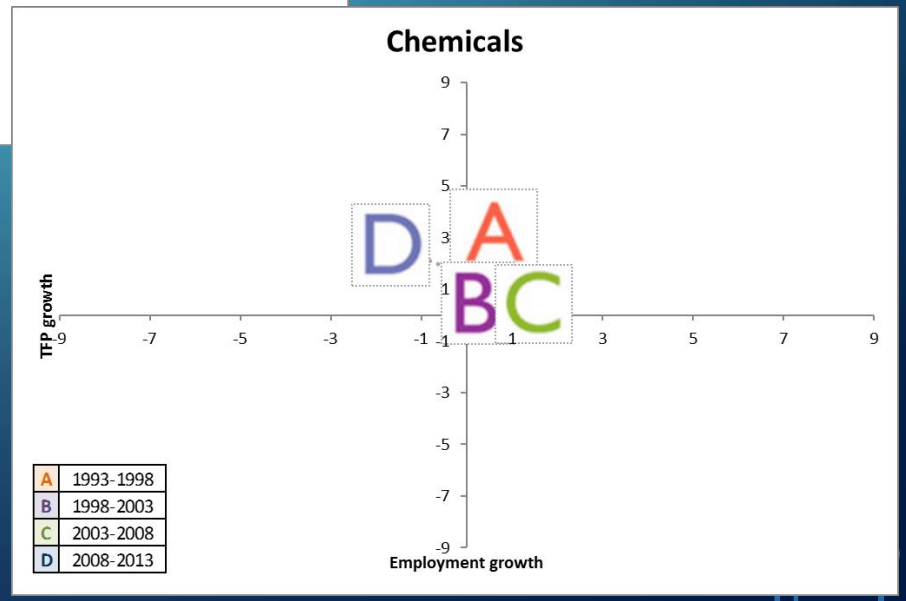



# RESULTS: SECTORAL

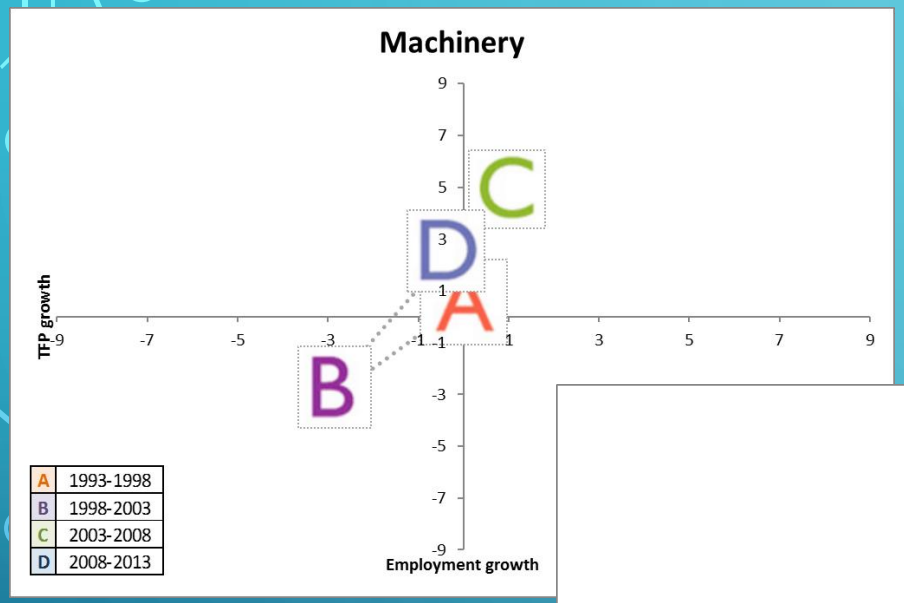


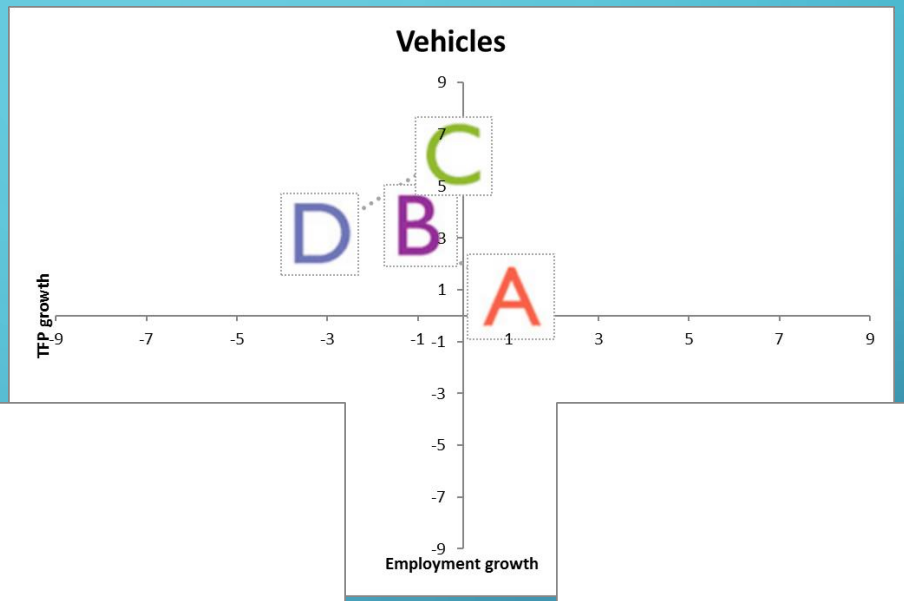



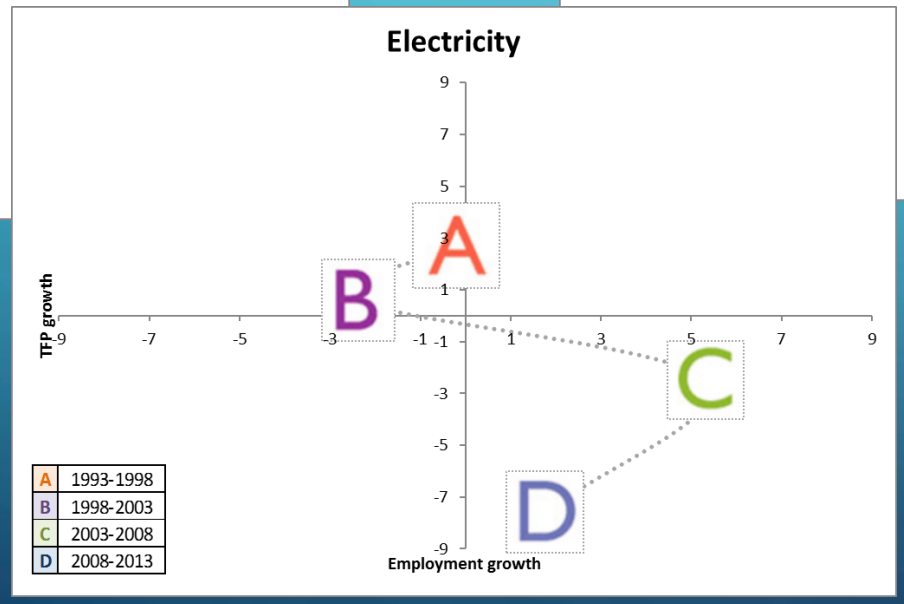



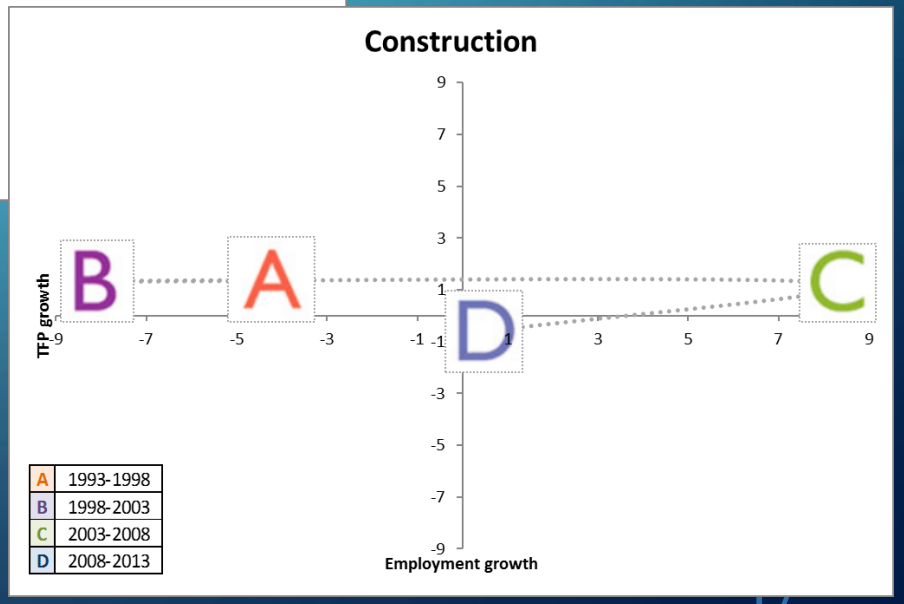



# RESULTS: SECTORAL

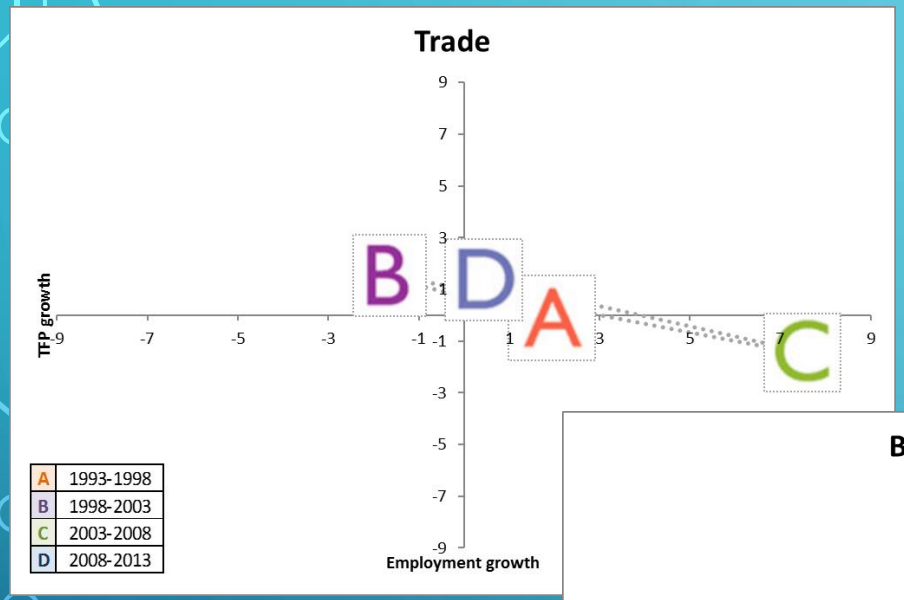


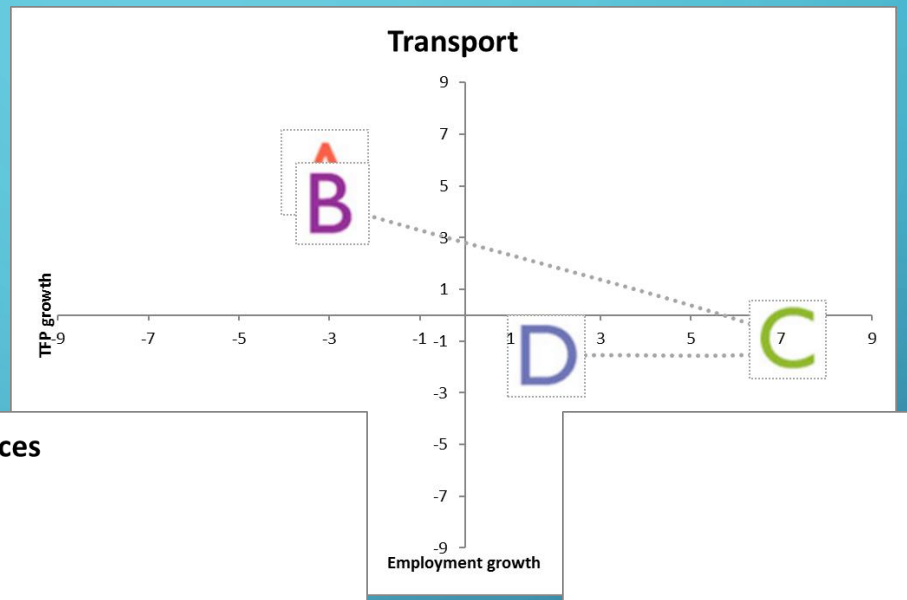



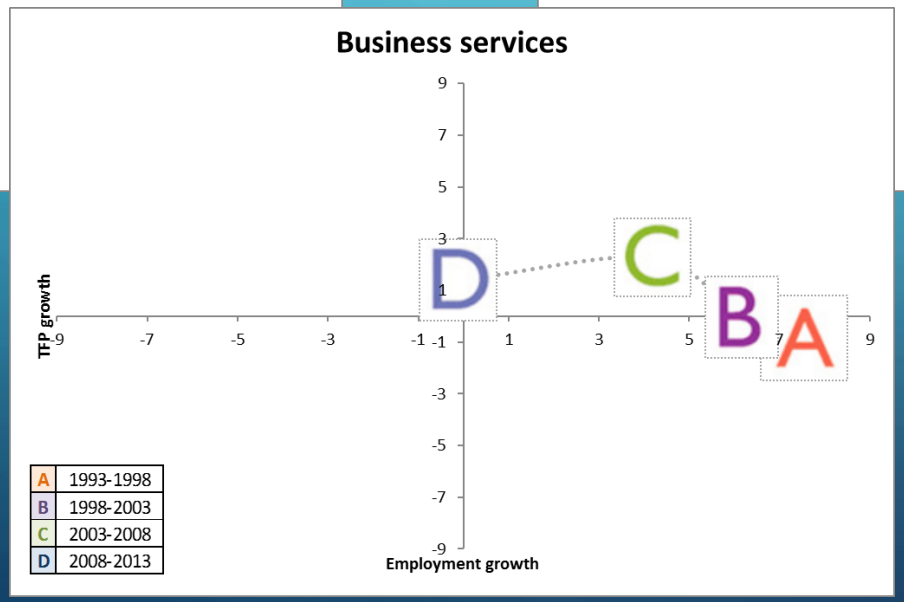



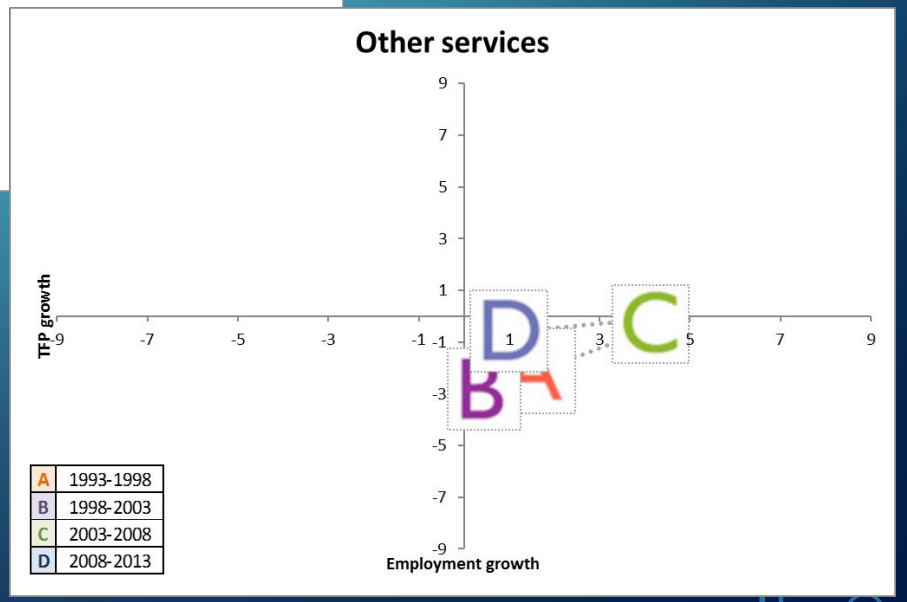



# RESULTS: SECTORAL



# CONCLUDING REMARKS

- The aggregate estimates from the backcasting method are consistent with a number of estimates of long-run TFP growth for South Africa
- However, we find large variation in the sectoral estimates between different types of activities. Even in manufacturing, the range of TFP estimates is diverse. Findings from firm-level studies also find variations by type of firms.
- TFP growth is very difficult to target, as it is an unobserved variable. However, sector- and firm-level disaggregation do provide helpful insights when considering policy interventions
- From a modelling perspective, especially when doing economy-wide analysis such as CGE modelling, it is important to be aware of sector differences when making long-term assumptions of productivity growth.