Total factor productivity in South African manufacturing firms

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Introduction

- The manufacturing sector is an important source of productivity growth and exports.
- Manufacturing firms are generally more productive than firms in the agricultural or services sectors and are an important source of job creation.
- Little is known about the productivity performance of the sector and its drivers in South Africa.
- The recent availability of firm-level tax administration data has made it possible to measure and analyse the productivity of manufacturing firms in South Africa for the first time.
- Using firm-level data for the period 2010–13 we estimate total factor productivity (TFP) in the South African manufacturing sector.
- We examine differences in the level and growth of productivity across manufacturing sub-sectors and the heterogeneity in productivity levels within sectors.
- Analysis paves the way for future research into the factors driving productivity growth of manufacturing firms that will contribute to understanding significant heterogeneity in measured firm performance, even within narrowly defined sectors and size groups.

Productivity estimation

- We first estimate a production function for each 2-digit manufacturing sector and use the estimated parameters to back out a firm-specific measure of productivity.
- Since the estimation assumes that all firms share a common technology, we estimate the production function within 2-digit sub-sectors rather than for the whole manufacturing sector.
- Simultaneity between productivity shocks and input choices leads to a bias in OLS estimates of these inputs in a standard production function.
- We use Ackerberg et al.'s (2006) modification of the Levinsohn and Petrin (2003) approach to deal with this bias.
- The model is estimated using a two-step GMM estimator (Wooldridge 2009). Tests for underidentification, weak identification, and first-stage F-tests confirm the validity of the instruments.
- We consider both weighted and unweighted estimates of productivity.
- In the weighted specification, for each industry *j*, we weight output (value added), capital, labour, and intermediates (cost of sales) by the proportion of sales that firm *i* in time *t* contributes to total sales of all firms in industry *j* for the entire period in question.
- This ensures that the TFP estimates give more weight to larger firms (in terms of sales) and so are a better representation of the manufacturing output of the sector.

TFP in SA manufacturing

- Elasticity estimates from regression analysis are used to estimate productivity for each firm in each sub-sector as follows:

$$\hat{\omega}_{ijt} = y_{itj} - \hat{\beta}_{lj} l_{ijt} - \hat{\beta}_{kj} k_{ijt}$$

- where ω_{ijt} is the estimated (log) of TFP for firm *i* in sector *j* in time *t*, *y* is log value added, *l* is the log of labour, *k* is the log of capital, β_{lj} is the estimated labour elasticity for sector *j*, and β_{kj} is the estimated capital elasticity for sector *j*.
- Firms in different sectors use different technologies so we can compare the growth trajectory of productivity not the level of productivity across sectors.

TFP growth and growth of firms by industry share in total value added

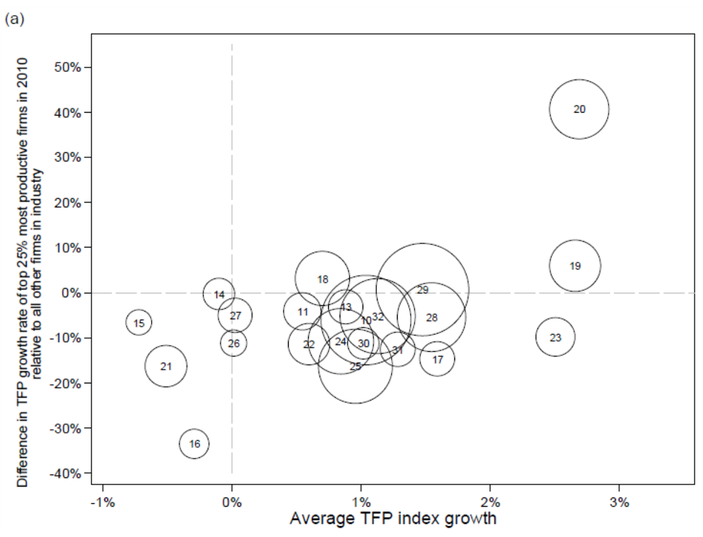
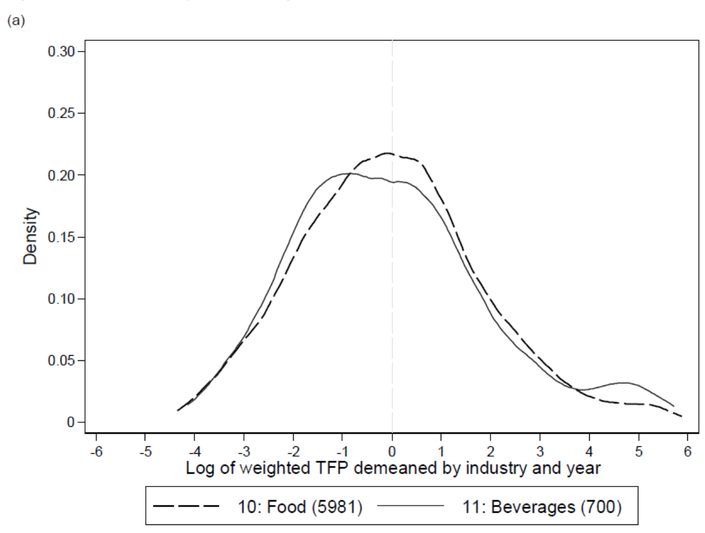
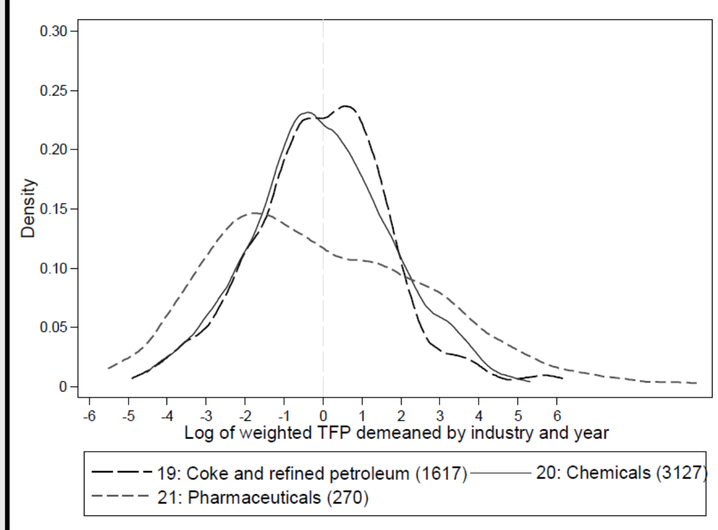


Figure 3: TFP distribution by manufacturing sub-sector





Productivity and its correlates

- Positive and significant correlation between R&D expenditure and productivity.
- R&D tax allowances are also shown to be positively correlated with TFP (even after controlling for actual R&D expenditure).
- More capital-intensive firms are more productive.
- Significant productivity premiums exist for firms involved in international trade.
- TFP increases relative to 2010 levels in 2011 and 2012 but experiences a statistically significant decline in 2013.

Figure 4: TFP demeaned by industry and year by employment category

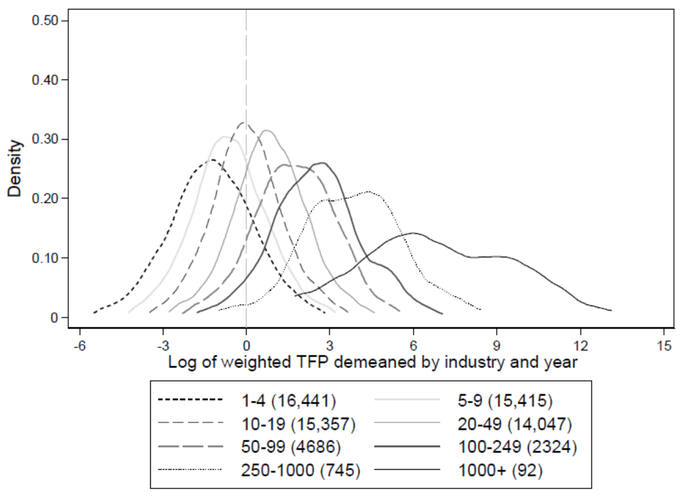
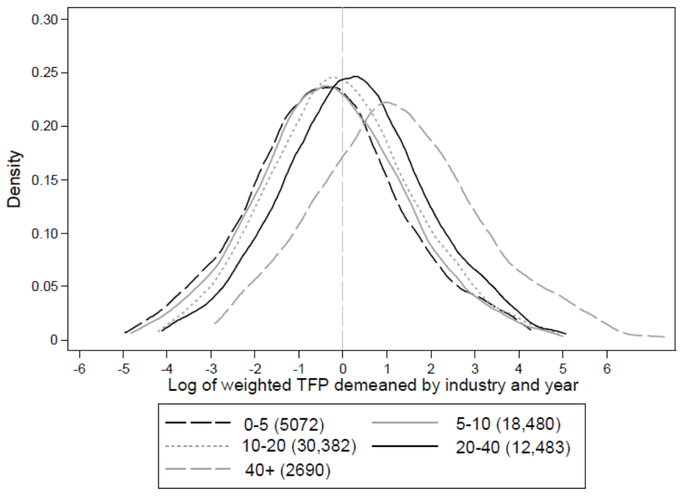


Figure 5: TFP demeaned by industry and year by age category of firm



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Concluding remarks

- Understanding the drivers of firm performance is crucial in designing policies aimed at promoting and expanding the private sector – a key driver of productivity, job creation, and exports in the economy.
- Analysis paves the way for future research into the factors driving productivity growth of manufacturing firms that can provide causal explanations for the significant heterogeneity in measured firm performance.
- This research will play an important role in shaping future industrial policy for the South African economy.