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LAND ECONOMY WORKING PAPER SERIES

Number 2. A Total Factor Productivity Index for Scottish Agriculture 1973-2004

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A Total Factor Productivity Index for Scottish Agriculture 1973-2004

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Abstract: *Thirtle et al (2003) have provided a Total Factor Productivity (TFP) index for UK agriculture. This note follows a similar methodology to construct a TFP index for Scottish agriculture beginning in 1973 and ending in 2004. Essentially, Scottish agricultural growth grew strongly during the 1970s but then fell to negative levels over the period 1984-2004. In comparison to the UK Index, Scotland has performed poorly and is only showing signs of a positive recovery from 2000 onwards.*

1. Introduction

Sustainable growth is a key policy concern for the agricultural industry. The Scottish Executive Environment and Rural Affairs Department's forward strategy (SEERAD, 2001) outlines a commitment to 'multi-functionality', i.e. economic, social and environmental development within agriculture. This development would be brought about, in part, by improvements in agricultural productivity. Productivity, the rate at which inputs are converted into outputs, is an underlying indicator of sustainable resource use.

Productivity can be measured either partially or totally. The most common partial indicator is labour productivity, which can be measured as either output per annual hours worked, or per full-time employee. Total Factor Productivity (TFP), which has

more data requirements, offers a more comprehensive picture of growth as it accounts for most of the major inputs within the production process, such as capital, labour and intermediate purchases. Given the imperative for constructing a comprehensive indicator of sustainable growth Total Factor Productivity (TFP) has to be adopted.

Thirtle *et al.* (2003), hereinafter referred to as TUK, have presented a TFP index for the UK. This note reports the results from the application of a similar methodology to Scottish agriculture. Consequently, what follows is a brief outline of the differences in methodology and data adopted, followed by the results and some comparison with the TUK index.

2. Methodology

TUK provide a comprehensive review of the methodology used. Predominantly, there are four main issues when constructing a TFP index, namely i) choice of index, ii) appropriate measurement units for labour, iii) generation of a capital stock series, and iv) data collection issues. Where possible this study has mimicked the TUK study for the first three issues. The major differences between the TUK and this series are data collection and are the main topic of discussion here¹.

The main source for TUK were the Agriculture in the UK series published by Defra and before that the Annual Review of Agriculture. Similar reports are published at the Scottish level, specifically the publication ‘Output, Input and Income of Scottish Agriculture’ (known as the Blue Book) which provides account information in both current and constant prices which is projected back to 1973 in calendar years.

¹ The full methodology is available from the author.

Previous to this information is collected in crop years. This caused some problems for the TUK series as a somewhat rough adjustment had to be calculated to make both series consistent (Thirtle and Bottomley, 1992). They admit themselves that this is an inadequate means of measuring TFP and, consequently, this has been avoided here by fixing the starting point to 1973.

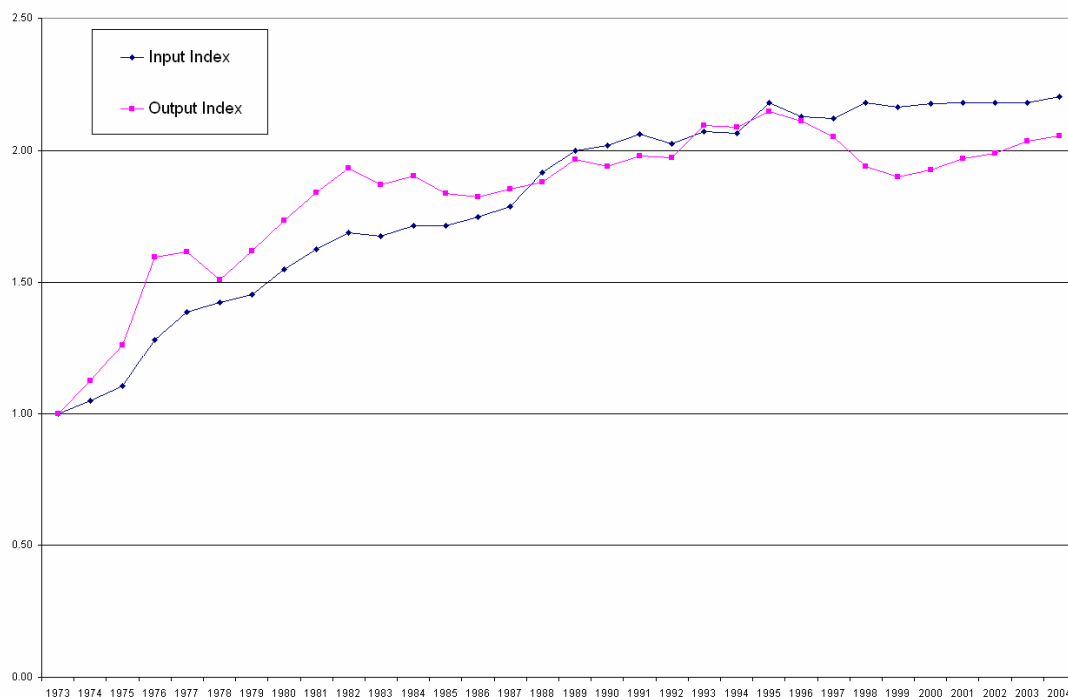
The main problem for this study was a switch between 1997 and 1998 in data collection methods, mainly to bring the Scottish accounts in line with the ONS system of national accounts and EUROSTAT accounting procedures. This affected several data items, most prominently rent, which fell substantially between the two periods. In order to provide a consistent index the items affected from older series were projected forward using average shares for the 5-year period 1999 to 2004. Hence, it has to be accepted that growth rates in this latter period are distorted by these limitations in the data.

Another difference between this study and TUK was the non-inclusion of livestock expenses within the Scottish input series. This proved quite an erratic series and suggests a number of reclassification issues of these data items throughout the period of study. However, the factor share of total inputs is minimal. Accordingly, this was removed from the final input index. This study adopted four outputs, namely i) total crops, consisting of cereals, potatoes and other crops, ii) horticulture, iii) livestock, and iv) livestock products, consisting of eggs, milk and other livestock products. Eight inputs were also adopted namely i) feed, ii) seed, iii) fertilisers and lime, iv) plant and mechanical costs, v) buildings and land improvements, vi) miscellaneous expenditure, vii) labour, and viii) land.

3. Results

Figure 1 shows the Input and Output Tornqvist-Theil Indexes for Scottish agriculture. A period of strong growth in both series emerges from 1973 until the mid-1980s. This seems to be very much in line with the UK picture of early post-entry into the CAP. The strong output growth recorded over the years 1974 to 1976 represents the importance of potatoes to the Scottish economy. During this period the value of potatoes grew substantially, mostly driven by fluctuations in the weather.

Figure 1. Input and Output Indexes for Scottish Agriculture, 1973 to 2004, 1973 = 100

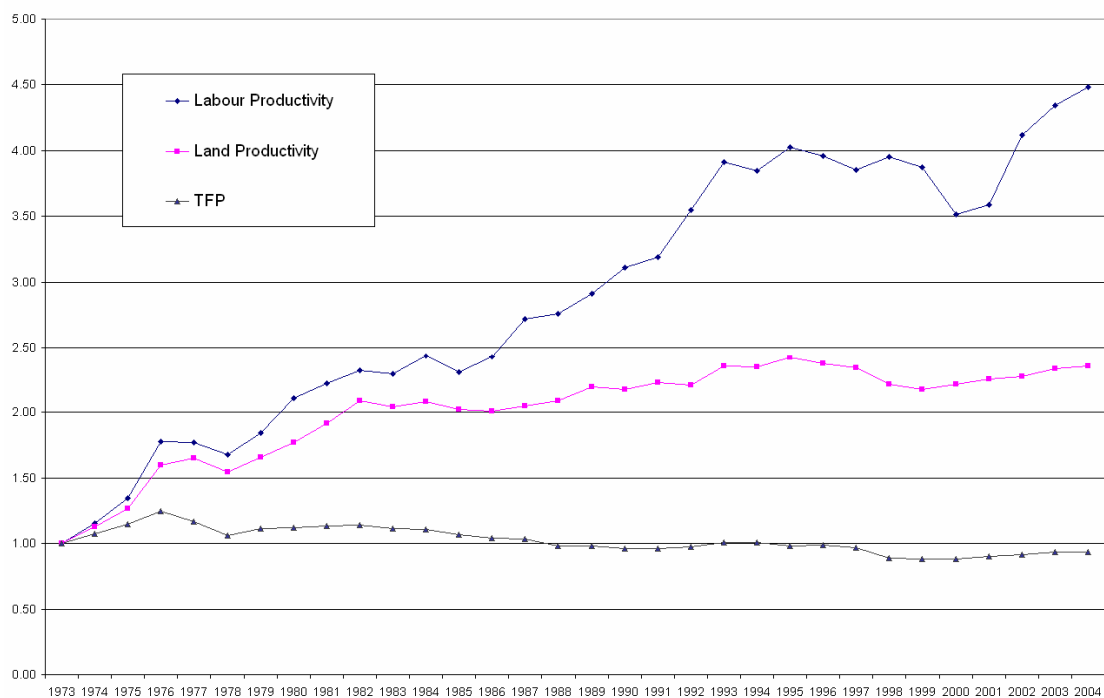


From the mid 1980s to the mid-1990s, inputs started to grow slightly higher than outputs. From a policy perspective, possible drivers of these changes such as the introduction of milk quotas and the MacSharry Reforms may have had a detrimental impact on TFP. However, from 1987 onwards structural change was occurring in the research and advisory sectors of Scotland, coupled with broader UK based changes,

such as the removal of ‘near-market’ research from the late-1980s. From 1997 onwards, whilst inputs remain relatively constant over the period, outputs drop substantially until 2000 and then begin to grow again.

Figure 2 shows the Total Factor Productivity index, alongside partial productivity indexes for Land Productivity (Output per unit of Land) and Labour Productivity (Output per unit of Labour).

Figure 2. Total Factor Productivity, Land and Labour Productivity for Scottish Agriculture, 1973 to 2004, 1973 = 100



Labour and Land Productivity shows strong positive growth. Both quantity series for these indexes decline over this period, in particular full-time regular labour almost halves in size. Consequently, when coupled with output growth, land and labour productivity show strong upward trends. The TFP index grows with a prominent

increase in the 1970s, but then slowly declines as input growth exceeded output growth. Growth rates are presented in Table 1 below.

Table 1. Average (Compound) Rates of Growth for Scottish Agriculture, 1973-2004

	Out	Inp	TFP	Land	Labour
1973-1984	6.02%	5.03%	0.94%	6.90%	8.43%
1984-2004	0.41%	1.32%	-0.90%	0.64%	3.26%
1973-2004	2.35%	2.58%	-0.22%	2.80%	4.96%

Until 1984 strong growth in both outputs and inputs are recorded. Essentially TFP growth rates are just under 1% for the first period, this compares with an average (compound) growth rate of 1.33% for the TUK series over the same period. A definite break is seen from 1984 onwards when output growth falls substantially and inputs, whilst also drastically reduced, are much higher than output growth. This leads to a TFP growth rate of -0.90% over the period. This corresponds with a dramatic fall in the TUK series from 1984 to 2000, with a compound growth rate of 0.15% . Consequently, whilst there are some distortions with the differences in data source, for both sets of years it seems that Scottish agriculture has under-performed compared to the UK index.

4. Conclusions

This note has presented a Total Factor Productivity Index for Scottish Agriculture and compared results with the Thirtle et al. (2003) study. Essentially, Scotland has demonstrated lower growth rates than the UK as a whole. This is predominantly caused by significant reductions in output growth during the 1980s. This phenomena is also reported by TUK and a number of reasons are offered for this fall in TFP

growth, predominantly reductions in agricultural R&D expenditure and advisory work. In addition to this, Scotland has a high proportion of land classified as Less Favoured Area which possibly contributes to lower rates of performance.

References

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