THE PRODUCTIVITY PUZZLE IN NETWORK INDUSTRIES: Evidence from electricity, gas and water sectors

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Overview

Productivity growth is defined as the change in output over input and can be estimated using single figures (i.e. labour productivity) or a set of figures (i.e. total factor productivity or multi-factor productivity). Total factor productivity (TFP) involves the consideration of multiple inputs and outputs and combines all them in a single ratio. The productivity puzzle relates to the observation that productivity is flatlining (and in some cases falling) in many advanced economies after decades of steady growth.

This paper examines the existence of a productivity puzzle in energy and water sectors. It looks at the value added total productivity growth of the combined electricity, gas and water sectors using the EU KLEMS database[1] for the period 1995-2015. We compare the trend of UK productivity growth with its peers (France, Germany, Italy, Netherlands, USA) for the different network industries and analyse the different factors that may have contributed to a lower or higher trend of TFP in specific periods (i.e. sector reform, privatisation, economic downturns, others).

Methods

The method used for the estimation of TFP is the Growth Accounting (GA) method (Solow, 1957; Jorgenson et al., 1987), in agreement with the one used by EU KLEMS. The production function (*f*) can be represented as follows:

$$Y_{i=} fi\,(Ki, Li, Mi, T) \qquad Eq.\ 1$$

Where *Y: output, K: capital services, L: labour services, M: intermediate inputs and T: technology indexed by time.*

Under the GA method, the productivity growth is represented by the unaccounted or unexplained growth (called residual) of the output (i.e. value added, gross output) that cannot be explained by the growth of the different inputs (capital, labour, intermediate inputs). According to Timmer et al. (2007) the output growth can be represented as follows:

$$\Delta lnY_t = \bar{v}^M \Delta lnM + \bar{v}^K \Delta lnK + \bar{v}^L \Delta lnL + \Delta lnA \qquad Eq.2$$

Where Δ denotes changes between periods (t, t+1) for all the inputs, $\bar{v}^{M,K,L}$ represents average value shares between periods (two period average of the share of input related to the nominal value of output) and A is the TFP. If we want to estimate the value added growth[2], Eq. 2 can be expressed as follows:

$$\Delta lnVA_t = \bar{e}^K \Delta lnK + \bar{e}^L \Delta lnL + \Delta lnA \qquad Eq.3$$

Where $\bar{e}^K, \bar{e}^L$ are average value shares between periods and $\bar{e}^K + \bar{e}^L = 1$ (constant return to scale assumption).

Results

The initial results suggest that[3]:

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[1] EU KLEMS is an initiative founded by the European Commission. EU KLEMS stands for capital (K), labour (L), energy (E), materials (M) and service (S). For futher details see: www.euklems.net/

[2] Value added growth involves capital and labour while gross output involves these two plus intermediate inputs.

[3] The initial study includes only four countries: Germany, USA, UK and the Netherlands.

UK is among the countries with the lowest valued added TFP growth, with an average value of -2.3 p.a. (percentage points) over the whole period (1995-2015) with a much lower value after the economic downturn in 2008.

Germany is among the ones with highest value added TFP growth along with Netherlands in comparision with the ones from the USA and the UK.

Economic downturns have impacted negatively the value added TFP growth. However, the level of impact varies across countries, being Netherlands among the ones less affected.

Conclusions

The productivity puzzle is present is the individual countries, especially in the UK. There are different reasons that may explain the weakness of the value added TFP growth, including lower levels of investments, unemployment, financial crisis, etc. However productivity growth in electricity, gas and water sectors may have been negatively effected by the energy transition which has required higher levels of inputs at the same time as competition, regulation and falling demand have limited the ability to raise revenues and hence value added. We find that capital rather than labour has driven the trend TFP growth across the four countries and identify differing drivers related to the contribution of labour differ across countries (in the USA is driven by labour composition, while in the European countries mainly by hours worked).

References

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