

Introducing “A Decomposition of US
Business Sector TFP Growth into
Technical Progress and Cost Efficiency
Components”
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Context

We consider a single production unit, and the KL-VA input-output model.

In levels, TFP is real value added divided by real input; that is, using the notation of Balk (2016),

$$TFPROD_{VA}(t, b) \equiv \frac{RVA(t, b)}{X_{KL}(t, b)} = \frac{RVA(t, b)}{C_{KL}^t / P_{KL}(t, b)}$$

where $RVA(t, b)$ is deflated nominal value added, and $X_{KL}(t, b)$ is deflated nominal KL input cost (C_{KL}^t). The deflator $P_{KL}(t, b)$ is a KL-specific price index for period t relative to some reference period b .

Efficiency

Notice that $C_{KL}^t/RVA(t, b)$ can be interpreted as cost per (quantity) unit of output (and $TFPROD_{VA}(t, b)$ as input price over unit cost).

Let best practice (minimum) unit cost, at the period t technology and under input prices w , be given by a function $C_{KL}(w, t)$.

Then period t unit cost efficiency is naturally defined by

$$UCE(t, b) \equiv \frac{C_{KL}(w^t, t)}{C_{KL}^t/RVA(t, b)} .$$

Choice of the input cost deflator $P_{KL}(t, b)$

- Conventional; that is, some empirical, direct or chained, price index (for example Fisher).
- Diewert and Fox propose to use a price index based on the unit cost function; that is,

$$P_{KL}(t, t'; s) \equiv \frac{C_{KL}(w^t, s)}{C_{KL}(w^{t'}, s)}.$$

The central Diewert & Fox result

If one selects $P_{KL}(t, b) = P_{KL}(t, b; t)$ then it appears immediately that

$$TFPROD_{VA}(t, b) = \frac{UCE(t, b)}{C_{KL}(w^b, t)}.$$

TFP change, from period $t-1$ to period t , is then measured as

$$\frac{TFPROD_{VA}(t, b)}{TFPROD_{VA}(t-1, b)} = \frac{UCE(t, b)}{UCE(t-1, b)} \times \frac{C_{KL}(w^b, t-1)}{C_{KL}(w^b, t)},$$

that is, efficiency change times technological change.

Specifics

- The unit cost function $C_{KL}(w, t)$ is defined as the (convex) conical free disposal hull (FDH) of all the observations up to and including period t (no technological regress).
- Application on US corporate and noncorporate nonfinancial sector 1960-2014.
- Both approaches yield approximately the same results for TFP (change).