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),

\[ TFP_{VAR}(t, b) \equiv \frac{RVA(t, b)}{X_{KL}(t, b)} = \frac{RVA(t, b)}{C_{KL}^t/P_{KL}(t, b)} \]

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).