

COMMENT ON WOLFF

Thijs ten Raa

The initiator of the productivity convergence debate, Ed Wolff, who launched his empirical results early last decade, now takes us with yet another thought-provoking result. The total factor productivity convergence of the 1970s has continued in the 1980s, but the mechanism has changed. It is no longer a technological catch-up by less-developed countries, but the result of specialisation in high-growth sectors. Professor Wolff's diagnosis of convergence is in line with the trade liberalisation that we have witnessed recently.

Professor Wolff's results are still reassuring to the United States. Total factor productivity growth in Japan has not reached American levels yet. To some extent this result may be ascribed to his methodology, however. Total factor productivity growth is measured by the residual between the output growth rate and weighted input growth rates, where the weights are the value shares of the inputs. With an appeal to the theory of international trade, these value shares are equated across countries by taking international means. In this discussion, I am going to examine this methodology and its implication for the result that Japan is still lagging. I shall do so in the context of an example that is favourable to the adoption of the factor price equalisation theorem, namely a world with a common technology.

So let us consider a world economy with a CES production function,

$$F(L, K, \rho) = (\frac{1}{2}L^{-\rho} + \frac{1}{2}K^{-\rho})^{-1/\rho},$$

common to the US and Japan. Note that since the time argument does not appear on the right-hand side, technical change is absent. If factor inputs are valued by their marginal productivities, as they should be in total factor productivity growth analysis, the wage share is

$$\alpha = \frac{1}{2}(Y/L)^{\rho}.$$

For simplicity, let labour and capital grow exponentially in each country: $L = L_0 e^{lt}$ and $K = K_0 e^{kt}$, then the wage share reduces to

$$\alpha = \frac{e^{-\rho lt}}{e^{-\rho lt} + e^{-\rho kt}}.$$

The labour and capital growth rates may be different for the two countries. Professor Wolff pays attention to the higher growth rate of capital in Japan

than in the US. The consequent abundance of capital depresses productivity. Let me stylise this fact by assuming balanced growth for the US ($k = l$), but unbalanced growth for Japan ($k > l$). Then the last expression shows that $\alpha = 1/2$ in the US, but $\alpha \rightarrow 1$ in Japan. In the latter country, capital gets so abundant that not only does its price go down, but even its value share does. (This is possible when the macroeconomic production function is CES rather than Cobb–Douglas.)

By averaging out with the US, Professor Wolff underestimates the wage share in Japan and overestimates the capital share. Since in the total factor productivity growth formula, the growth rate of capital dominates that of labour (and both are subtracted from the output growth rate), he underestimates total factor productivity growth in Japan. In other words, the high growth rate of Japanese capital may suppress total factor productivity growth, but the weight attached to it ought to be smaller than in the US and this off-setting effect is not taken into account when value shares are averaged out across countries. Japan may perform better than Professor Wolff's estimates suggest.

International trade theory may be employed to equate factor prices, but not factor shares, except possibly at the sectoral levels. One might build a case, using neoclassical paradigms, for equalisation of value shares between countries on a sector-by-sector basis. However, it is precisely the process of specialisation in sectors that may invalidate the equality of macroeconomic value shares between labour and capital across countries. It would be interesting to redo Professor Wolff's computations with the shares equalities inserted at the sectoral level, on which he builds his analysis anyway.

I am sceptical, however, as regards any use of the factor prices equalisation theorem. One of its assumptions is that at any point of time countries have access to a common technology. True, technical coefficients will differ, but only in response to scarcity conditions, not the state of technology, the book of blueprints of all conceivable techniques. In such a stylised world, any measure of total factor productivity growth that relates to technical change in Solow residual fashion ought to imply no divergence or convergence between countries, but a zero wedge. In other words, when there is access to a common technology, convergence is no issue.

In the final analysis the measurement of productivity growth and convergence is a matter of choosing factor input prices. Professor Wolff, like all leaders in the field, uses the ones based on market value shares. This may be appropriate for a pure competitive economy, but not for the real world. My preference would be to calculate the shadow prices of labour and capital through an appropriate linear program. There would be no need