

Book review

Jesús Felipe and John S.L. McCombie, *The Aggregate Production Function and the Measurement of Technical Change: Not Even Wrong* (Edward Elgar, Cheltenham, UK and Northampton, MA, USA 2013) 400 pp.

Javier López Bernardo

PhD Candidate, Kingston University, Kingston upon Thames, UK

The Aggregate Production Function and the Measurement of Technical Change is the final outcome of several years of joint collaboration between the economists Jesús Felipe and John McCombie. For followers who have been reading their contributions for more than a decade (Felipe and McCombie 2003; 2006; 2013), this long-awaited book is a definitive critique of the foundations of the empirical neoclassical theory of production.

I say the ‘empirical theory’ because the book is not intended to address the theoretical criticisms of the neoclassical framework, although they do so briefly in the first chapter. Rather, the book tries to show why the neoclassical framework seems to work empirically (in an instrumentalist, Friedman sense), even when the previous theoretical literature had demonstrated why the concept of a production function is logically flawed and should not be used in applied analysis. By theoretical literature, the authors mean the Cambridge Capital Controversies on the one hand, and the aggregation literature on the other. The Cambridge Capital Controversies showed that it was impossible to find a measure of capital that could be measured independently of distribution and prices and that the simple ‘parables’ told by the neoclassical theory (such as an inversely monotonic relationship between quantity of capital and rate of profit) could not be generalised to models with heterogeneous capital goods. The aggregation literature showed that the conditions under which micro production functions can be aggregated into a single macro production function are so restrictive as to ‘make the existence of aggregate production functions in real economies a non-event’ (Fisher 2005, p. 490). However, the empirical analysis has usually showed a good fit between a hypothetical production function and the economic data. For neoclassical economists, this constitutes a ‘proof’ that their theory works. Felipe and McCombie show throughout the book that the reason why the empirical analysis usually delivers such a good fit is deceptively simple and is because of the presence of the accounting identity that relates (in monetary terms) value added with wages and profits; in other words, what neoclassical economists are simply doing is regressing an accounting identity – which, by definition, will give a perfect fit to the data. Therefore, the results of these analyses cannot be a proof of the validity of the neoclassical theory – the theory is ‘not even wrong’ in the sense that it cannot be tested empirically using value data.

In this sense, the essence of the book can be found in chapters 2 and 3, where the accounting identity critique and its consequences for applied neoclassical work are explained. In chapter 2, Felipe and McCombie present the argument in all of its

varieties: for cross-sectional data, for time-series data, for Cobb–Douglas production functions and then (in the appendix) for CES and translog production functions. As they readily note, the argument can be applied to any production function. Chapter 3 digs more into this intuition through a series of simulation exercises. In one of these exercises – one that was already put forward in Felipe and McCombie (2006) – two sets of data are constructed: one set that deals with physical quantities that are produced through well-behaved micro Cobb–Douglas production functions (the authors assume that no aggregation problems arise) and another set of monetary values that are generated through a mark-up on unit labour costs. The hypothetical researcher would have access to the value dataset, but not to the former, which is unknown for him. The output elasticities (in the first data-set) are set in such a way that they are precisely the opposite of the income shares: the output elasticity of labour is set to be equal to 0.25 (and capital 0.75) while its income share (generated by the mark-up and the only information available to the researcher) is 0.75 (0.25 for capital). The use of regressions on monetary values will lead the researcher to conclude that (s)he is picking up in the regressions the underlying technology of the economy, while in fact the approximation will be very poor. In this way, the use of value data when testing the validity of the neoclassical theory does not give any evidence at all.

Felipe and McCombie make clear throughout the book that the fact that some studies do not find a perfect fit between the data and the chosen functional form is not a refutation of the critique, but rather is due to the way the rate of technical change is modelled. They show that for a Cobb–Douglas production function, the necessary condition for a perfect fit is constancy in the income shares (one of Kaldor's stylised facts) and that the weighted growth rate of wages and of the profit rate can be approached by a linear trend. Of course, the accounting identity critique does not depend on these assumptions and is not restricted to a particular type of function (that is, Cobb–Douglas), although the functional form for the technical change that delivers a good fit is easier to find for a Cobb–Douglas function than for other functions.

The fourth and fifth chapters are historical summaries on the seminal contributions of Cobb and Douglas, and those of Solow. Throughout the fourth chapter the reader learns about the poor reception to Cobb and Douglas's initial work and the misgivings of the latter about his own work. Felipe and McCombie also summarise the original criticisms of the Cobb and Douglas empirical work, emphasising especially Phelps Brown's critique (Phelps Brown 1957), the first paper where the accounting identity critique was formally proposed – for cross-section data. By contrast, chapter 5 starts by highlighting the enduring impact of Solow's 1957 paper and the good reception it received. As is well-known, Solow (1957) was the first paper where the concept of total factor productivity growth was incorporated into an aggregate production function. This contribution, together with the empirical evidence presented there, helped to launch a plethora of studies trying to determine the 'sources' of economic growth. A large part of the fifth chapter is devoted, then, to Shaikh's critiques of Solow's 1957 paper and Solow's subsequent rejoinders. Shaikh's initial critique (Shaikh 1974) plays a crucial role in the book, because it was the first time that a generalisation of the Phelps Brown identity critique to a time-series framework was put forward. Shaikh showed how the whole exercise performed by Solow was simply algebraic manipulations of an accounting identity ('laws of algebra' as he put it), without any meaning for the 'real' underlying technology. Felipe and McCombie then review Solow's reply (Solow 1974), concluding that it was not compelling and that it precluded Shaikh's

paper from reaching a wider audience. In fact, if one had used Solow's data set to test the existence of a Cobb–Douglas production function, very poor results would have been obtained; '[w]e can only speculate whether Solow's (1957) paper would have had such a dramatic impact if these regressions had also been reported' (p. 174, italics in the original). The reason for such a poor fit, as the reader can imagine, is the use of a linear trend for the rate of technical change when the weighted sums of the logarithms of the wage and profit rates show large pro-cyclical fluctuations.

Chapter 6 is the first one in which the accounting identity critique is applied to specific neoclassical empirical work. The target of this chapter is the concept of *total factor productivity growth* (TFP), which plays a central role in the neoclassical growth theory for explaining differences in the levels of productivity across countries – given that differences in the savings ratios and human capital only account for a small portion. Felipe and McCombie show that the adjustment made in the neoclassical literature for international differences in technology will deliver a better fit to the data not because the researcher is picking up correctly the differences in technology, but because the approximation to the accounting identity will improve.

The next five chapters are again applications of the critique to specific neoclassical literature. This sort of game of finding out where the accounting identity is hidden in the plot of these papers has been christened by the authors as 'Where's Waldo?', alluding to the famous game where one had to find Waldo within a crowd of people. Felipe and McCombie show that the econometric results of these papers will depend on how close the data are to some 'stylised facts': 'it is possible to determine the outcome of a regression analysis before a single regression has been run' (Felipe and McCombie 2013, p. 221). Chapter 7 deals with the argument put forward in Mankiw et al. (1992) to explain international differences in growth rates across countries using an augmented Solow model – that is, to what extent can the differences be boiled down to variations in saving rates and population growth. Felipe and McCombie show that the most disappointing econometric results achieved by Mankiw et al. (those associated with OECD countries) can be improved once differences in the rate of technical change are allowed across countries, but at the same time this improvement is due to the accounting identity, so no economic implication can be drawn in general from their study. Chapter 8 deals with the critique of neoclassical multi-sector growth models, and more specifically with those models that aim to explain the decisive impact of the export sector or the government sector on the rest of the economy in both developed and less developed countries, although in the literature the emphasis is usually upon the latter. Chapter 9 deals with the mainstream literature that tries to prove whether capital is 'special' or not, in the sense of whether its aggregate output elasticity is greater than its factor share (due to externality effects). Chapter 10 discusses the studies (pioneered by Hall in the 1980s) that try to estimate the degree of market competition through a mark-up parameter. Felipe and McCombie explain that the 'misspecification' of the accounting identity will yield estimations of the mark-up consistently above one, but that this result cannot be interpreted as empirical evidence in favour of oligopolistic markets because of the 'hidden' presence of the identity. Chapter 11 is a bit different in comparison to the previous ones, in the sense that now the focus is on neoclassical labour market theory, rather than on growth theory. They show that the usual estimations of labour demand functions, where the level of employment is inversely related to the level of real wages, will always exhibit a downward slope, but not by virtue of any theory, but because they are manipulations of the accounting identity. The conclusion is that 'no reliance can be placed on estimates of the wage elasticities in formulating economic policy' (p. 307).

Finally, the last chapter deals with the reactions to the implications of the accounting identity critique. They consider why the critique has had such a poor reception, and after enumerating some facts (such as the difficulty of the first presentation of the critique by Phelps Brown or the harsh rejoinder by Solow to Shaikh (1974)), they move on to address the only meditated response the critique has received, advanced in papers by Temple (2006; 2010). Felipe and McCombie show why Temple's criticisms are not convincing, then conclude with a summary of the main arguments of the book.

Although this book is a decisive contribution to the critique of neoclassical theory, some aspects could be improved. Beyond some necessary repetition of the fundamental argument, there are some parts that could be shortened (the conclusions of the second chapter appear again in the last chapter) while some long appendixes (such as 2A2) deserve a separate chapter due to the richness of the detail they contain. On the other hand, some chapters are difficult to follow and some additional background (such as longer literature reviews) would be needed for those readers not coming from growth theory, especially from chapter 6 onwards. The implications of the critique for the neoclassical literature are extremely serious and should be accessible to the broadest possible audience; moreover, no indication is made by the authors that the book is aimed exclusively at growth theorists. Finally, although the authors admit explicitly in the introduction that no attempt is made to present alternative theories of growth and distribution, some brief guidelines would have still been advisable. This is even more the case when one is aware that both authors have forcefully presented alternative and coherent views of growth and distribution elsewhere (McCombie and Thirlwall 1994; Felipe 2010).

Due to the importance of the issue at hand and the thorough and encyclopaedic treatment of the critique of applied neoclassical production theory created by the authors, I strongly recommend this book to every economist, regardless of his or her provenance (applied or theoretician, mainstream or heterodox). It is a book that is bound to be a classic and an obligatory reference in the future.

REFERENCES

- Felipe, J. (2010), *Inclusive Growth, Full Employment and Structural Change: Implications and Policies for Developing Asia*, 1st edn. London and Manila: Anthem Press and Asian Development Bank.
- Felipe, J. and McCombie, J. (2003), Some Methodological Problems with the Neoclassical Analysis of the East Asian Miracle. *Cambridge Journal of Economics*, 27(5), 695–721. Retrieved from <http://cje.oxfordjournals.org/content/27/5/695.short>.
- Felipe, J. and McCombie, J. (2006), The Tyranny of the Identity: Growth Accounting Revisited. *International Review of Applied Economics*, 20(3), 283–299, doi:10.1080/02692170600735963.
- Felipe, J. and McCombie, J. (2013), How Sound are the Foundations of the Aggregate Production Function? In G.C. Harcourt and P. Kriesler (eds), *The Oxford Handbook of Post-Keynesian Economics, Volume 2: Critiques and Methodology*. Oxford: Oxford University Press, pp. 202–230.
- Fisher, F. (2005), Aggregate Production Functions – A Pervasive, but Unpersuasive, Fairytale. *Eastern Economic Journal*, 31(3), 489–491.
- Mankiw, N.G., Romer, D. and Weil, D.N. (1992), A Contribution to the Empirics of Economic Growth. *Quarterly Journal of Economics*, 107(2), 407–437.
- McCombie, J. and Thirlwall, A.P. (1994), *Economic Growth and the Balance-of-Payments Constraint*. London: Macmillan.

- Phelps Brown, E.H. (1957), The Meaning of the Fitted Cobb–Douglas Function. *Quarterly Journal of Economics*, 71(4), 546–560.
- Shaikh, A. (1974), Laws of Production and Laws of Algebra: The Humbug Production Function. *Review of Economics and Statistics*, 56(1), 115–120.
- Solow, R. (1957), Technical Change and the Aggregate Production Function. *Review of Economics and Statistics*, 39(3), 312–320.
- Solow, R. (1974), Laws of Production and Laws of Algebra: The Humbug Production Function: A Comment. *Review of Economics and Statistics*, 56(1), 121.
- Temple, J.R.W. (2006), Aggregate Production Functions and Growth Economics. *International Review of Applied Economics*, 20(3), 301–317.
- Temple, J.R.W. (2010), Aggregate Production Functions, Growth Economics, and the Part-time Tyranny of the Identity: A Reply to Felipe and McCombie. *International Review of Applied Economics*, 24(6), 685–692.