

‘Burn the Mathematics’

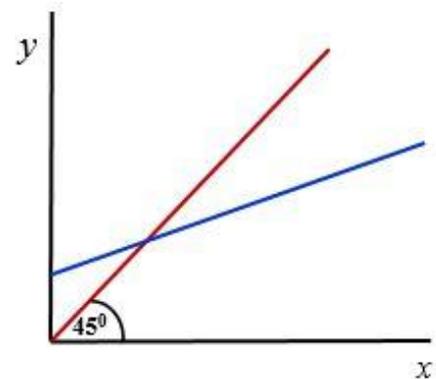
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The trade-off between comprehension and calculation has diminished the role of economic thought. Mathematical prowess is now *de rigueur* in gaining advancement, both with student assessment and with academic careers. Though frequently cited, Alfred Marshall’s strictures - on the use of mathematics in economics - are ‘more honoured in the breach’:

- (1) Use mathematics as a short-hand language, rather than as an engine of inquiry.
- (2) Keep to them till you have done.
- (3) Translate into English.
- (4) Then illustrate by examples that are important in real life.
- (5) Burn the mathematics.
- (6) If you can’t succeed in 4, burn 3. This last I did often. (Marshall, 1906)

The simplest model and geometry that is embedded in most (if not all) macroeconomics textbooks is referenced, by *Wikipedia* and many sources besides, as the Keynesian forty-five degree line diagram. That rudimentary presentation of the income and expenditure model (see, for example, Blanchard, *et al.*, 2013, p. 49), has recently been set within a new context, where it purports to show the ‘evolution’ of the sovereign ‘debt-to-GDP ratio’ (*ibid.*, p. 478). Here, readers are advised to ‘make a small (but very useful) investment by learning the basics of a difference equation’; *i.e.*, ‘the simplest mathematical tool to study the dynamics of a variable’, as represented ‘graphically on a Cartesian plane’ (*ibid.*).



With the more familiar presentation, the respective x , y variables are those for income (Y) and expenditure (C). With the more recent deployment of that same geometry, the x , y variables respectively depict ratios of ‘debt-to-GDP’ (B/Y) at time $t - 1$ and time t . With both presentations, system equilibrium is at the intersection of the behavioural relationship and the 45° line.

As an initial criticism, the ideas that define the more recent presentation are so straightforward that the advice relating to difference-equations is unwarranted. No formal mathematics is needed to understand that debt (B) rises with borrowing (X) and with the accrual of interest (r). In keeping with Marshall’s step 1, the new presentation *is* tantamount to ‘short-hand language’:

$$B_t = X_t + B_{t-1}(1+r)$$

In defining the respective *ratios* of ‘debt-to-GDP’ and ‘borrowing-to-GDP’, this becomes

$$B_t/Y_t = X_t/Y_t + B_{t-1}(1+r)/Y_t$$

and, with the added assumption that GDP grows at the annual rate g ,

$$B_t/Y_t = X_t/Y_t + B_{t-1}(1+r)/Y_{t-1}(1+g)$$

Thus, the exact form of the forty-five degree line and the expenditure/income relationship is retained:

$$C = a + bY$$

With that original equation, the extrapolation from any macroeconomic data set to the y -axis intercept holds no interest. Rather, the b coefficient takes all the attention by its relevance to Keynes's income-multiplier. With the more recent presentation, the connotation is radically different, because the intercept holds a key theoretical feature; *i.e.*, the annual fiscal-deficit or surplus:

$$X/Y = (G - T)/Y$$

By its status within the model as an intercept constant, that fiscal stance-to-GDP ratio can have no relevance as a policy instrument. Nevertheless, the model is extended by additional forty-five degree line diagrams that purport to show the 'dynamics of the debt-to-GDP ratio in the long run' (*ibid.*, p. 480), where the extensions exhaust the combinations of any two determinants from four:

$$g < r; G - T > 0 \quad g < r; G - T < 0 \quad g > r; G - T > 0 \quad g > r; G - T < 0$$

Although it is inexcusable for there to be no discussion of the periodic experience of unsustainable credit-led growth, there is merit elsewhere. Merit lies: (i) in the thoughtful commentaries upon the history of sovereign debt within the European Union and (in earlier times) in Germany, France, the UK and the USA (*ibid.*, p. 482 *ff*); and (ii) in the sensible decision to burn the geometry in respect of the third edition of *Macroeconomics. A European Perspective*.

References

- Blanchard, O., A. Amighini and F. Giavazzi (2013) *Macroeconomics. A European Perspective*, Second edition, (Pearson Education Ltd., Edinburgh)
- Marsall, A. (1906) letter to Arthur Bowley, February 27th 1906, in Pigou, 1925, pp. 427-28
- Pigou, A. C. (1925) ed., *Memorials of Alfred Marshall*, (MacMillan, London)