This document accompanies EXCEL implementation of two variants of a Keynesian model (attached together in the e-mail). In order to link the model parameters to the EXCEL implementation, I did not use Greek letter but cell references to the EXCEL file. For example, the parameter named as b8 means that the value of this parameter can be set on cell B8 of the EXCEL file.

This is a demand driven model thus GDP is determined by demand which is determined by the multiplier equation

(0)

Where b8 is the marginal propensity to consume (out of labor income) and *σ=w/a* is the share of labor income in GDP. As I did with the EXCEL implementation, for simplicity, let us ignore for now (or forever) autonomous household and government spending (Ht=0 and Gt=0), thus (1)

We assume that income distribution is determined by firms’ aggregate mark-up rate M. Since, for P being the price level, , by definition, we have

(2)

The markup rate dynamics is determined by the aggregate excess demand as

(3)

Question is what we consider as aggregate supply. I build in three alternative assumptions: Labor constrained output level, capital-constrained output level and a Cobb-Douglas production function. The cell value B1 in the EXCEL sheets is a switch that sets the underlying assumption, respectively by the values 1,2, and 3:

(4)

where is the constant labor supply and parameter b14 is the capital-output ratio.

Under the labor-constrained supply assumption (i.e., b1=1), equation 3 turns into a reverse Phillips curve relation. This is a naïve formulation which is built in just for experimentation

(3\_1) =

Where e is clearly the employment rate.

Under the capital-constrained supply assumption (i.e., b1=2), equation 3 turns into an equation that makes the mark-up rate a function of capacity utilization rate ut:

(3\_2) =

where *Kemp* is the capital employed/used (which in case of over-utilization can be larger than K). Obviously *Kemp/K* is the capacity utilization rate *u*.

Here I must already emphasize that equation 3 (be it, 3\_1 or 3\_2) is a very key one: The system we have here can be at a steady state only at a unique income distribution state (i.e., labor income share or equivalently aggregate mark-up rate) and equation 3 gives the system the ability to find/reach that unique level endogenously.

In the rest of this document, I will focus on the capital-constrained supply assumption (i.e., eq 3b), mainly because analytical convenience (not to mention that the results do not change qualitatively much under the Cobb-Douglas assumption…

Labor productivity dynamics closely follow that of Palley (2013 or 2019)

(4)

where b3 is an autonomous/exogenous growth element, while b6 is the threshold employment level above (below) which there is a positive (negative) labor productivity effect.

The (gross) investment function mainly follows the various Keynesian growth models we considered so far, but I also build in two options to make investment propensity also a function of labor productivity growth at the top of capacity utilization.

(5a)

(5b)

where b16 is the depreciation rate and as mentioned before b3 is an exogenously given labor productivity element.

According to the former equation (if b12>0) firms observe the recent labor productivity growth achieved and increase their investment rate accordingly. In the latter formulation, what the firms observe (and respond to by higher investments) is the exogenous gains in productivity, which is say…, achieved by R&D etc. Clearly both formulations can be considered as ‘cheating’ as long as they are not micro-founded by at least a convincing story, but let’s forget that for now. As will be made clear soon, the model works independently of whether b12>0. But when that is the case, which equation we adopt has major implications on the results, which is why I have an EXCEL sheet for each.

And finally and obviously,

(6)

Let’s find out about the steady-state levels of the interesting variables, separately for the two alternative formulations of equation 5.

Common to both cases is the steady-state condition , which, given eq 3b, requires that

(7)

And since , the steady state condition requires , and since and , together with equation 3, which requires at the steady state, we need

(8)

Equations 5a,6,7 and 8 together imply

(9a)

while for the alternative formulation 5b (again, together with 6,7, and 8)

(9b)

Of course, these are the most interesting (and possibly controversial) outcomes of the model. In case we would write a paper on some variant of this model, a great deal of text will be required to justify this. Let’s break them down:

Remember that b12 determines the investment response of firms to labor productivity growth, while b13 determines the investment response of firms to capacity utilization. Let’s first set b12=0 and observe that the growth rate of the economy is merely determined then by the discrepancy between the two (capacity utilization related) threshold values we have in the model: one capturing a price response, the other a quantity response. Parameter b22 (according to eq 3b) is the threshold capacity utilization level above (below) which firms increase their mark-up rate (i.e., price relative to the wage rate), while b15 (according to eq 5a or 5b) is the threshold capacity utilization level above (below) which firms keep their investment rate above (below) the depreciation rate.

Interestingly, while the actual (steady-state) capacity utilization rate is uniquely determined by b22 (see eq7), that is, the threshold value for price response to over/under capacity utilization, the growth rate of the economy is determined by the discrepancy between the two threshold values. In cases where firms do not translate labor productivity growth into investments (i.e., where b12=0), the only way in which the economy can grow is having b22>b15. Can we think of a story that justifies this? Let’s keep thinking about that.

(9a)

(9b)

Interestingly, in model (a) (i.e., the variant that draws on eq 5a), the exogenous labor productivity growth (captured by parameter b3) has no effect on the steady state growth. As we will see below, in this version, an exogenous productivity growth element achieves nothing but decrease employment!

However, in model (b) (i.e., the variant that draws on eq 5b), thinks are different: Even when b22=b15 or b13=0 (i.e., the case where investments do not respond to over/under capacity utilization), model (b) is still able to grow only due to exogenous labor productivity growth. Furthermore, as we will see shortly, in model (b), exogenous productivity growth, not only has a negative impact on the employment rate, but also on the labor’s income share…

Let’s take a look at employment. Equations 9a and 9b, alternatively plugged in equation 4 yields the steady-state employment rate respectively as

(4)

(9a)

(9b)

(10a)

(10b)

Apparently, in both models, the main factor that increases the growth rate of the economy (i.e., the discrepancy between the two capacity-utilization-related threshold values b22 and b15) also increase the employment rate! And in both models, exogenous productivity growth has a negative impact on employment.

And finally income distribution: Considering equation 1

which can be rewritten as , eq 3 which requires and that , we have , which, together with equations 5a and 9a imply that the steady-state income share of labor is

(11a)

(11b)

Clearly anything that contributes to higher economic growth is bad news in terms of labor’s share in income! A high marginal propensity to consume (i.e., b8) and a higher capital output ratio (i.e., b14) also seem to have a negative impact on labor’s income share.