A New Keynesian and Post-Keynesian Model in a Unified Framework

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Outline

Key principles of Post-Keynesian economics

Key principles of Post-Keynesian economics

Lavoie (2014, p. 33) lists four key principles as the foundation of Post-Keynesian economics.

I will focus on two principles and show that models which incorporate them are fundamentally different:

(2) **Principle of effective demand**: aggregate demand determines output and employment in the short and long run

(3) **Historical time**: economies are path dependent

A simple New Keynesian model

What do I mean by New Keynesian?

- Main point of reference: New Keynesian Dynamic Stochastic General Equilibrium Model (DSGE) as in Clarida et al. (1999) for the standard (graduate) textbook see Woodford (2003).
- I will actually use Carlin & Soskice (2014) as it require much less math while retaining the main arguments and conclusions.
- Carlin & Soskice (2014) claims to be stepping stone to NK-DSGE models as does Mankiw (2016) in Chapter 15 with identical framework
- We will come back to this.

Our baseline NK model

- Carlin & Soskice's (2014) 3 equation model will serve as our New Keynesian baseline
- Consists of main building blocks (equations):
  (1) demand side (IS equation)
  (2) supply side (Philips curve, PC)
  (3) monetary policy (central bank reaction function, CB)

The demand side: IS equation

- "IS" refers to investment and saving
  (goods market equilibrium in closed economy)

$$Y_t = A - cr_{t-1} \tag{IS}$$

where Y_t is real GDP in period t and r_{t-1} is the real interest rate in period t-1

- A represents all factors which affect aggregate demand other than the interest rate
- c: the interest rate sensitivity of consumption and investment and depends on size of multiplier (larger multiplier, larger c, economy more interest sensitive)
- time lag: households and firms need time to react

→ IS: Higher real interest rates reduce output.
→ IS: Expansionary fiscal policy corresponds to increase in A.

The supply side: The Philips curve

Carlin & Soskice (2014) specify the Phillips curve as:

$$\Pi_t = \Pi_{t-1} + \alpha(Y_t - Y^p) \quad \text{(PC)}$$

$$\Delta\Pi_t = \alpha(Y_t - Y^p) \quad \text{(PC')}$$

where Π_t is the rate of inflation in period t and Y^p is potential output, α: is a parameter capturing the sensitivity of inflation to the output gap

- Potential output is maximum amount of production with current state of technology without triggering inflation
- Inflation is result of excess demand.
- The **change** in inflation depends on the output gap

$\rightarrow$ PC: If actual output (Y_t) is above potential output (Y^p) inflation increases each period.

Monetary Policy: The CB reaction function

The central bank sets interest rates according to:

$$r_t = r^n + \frac{\alpha\beta}{c}\left(E[\Pi_{t+1}] - \Pi^T\right) \tag{CB}$$

and $E[\Pi_{t+1}] = \Pi_{t+1}$ and r^n is the natural interest rate.

- r^n is the real interest rate compatible with potential output Y^p, autonomous demand A and stable inflation at the inflation target: $\Pi_t = \Pi_{t-1} = \Pi^T$. We assume the CB has a fixed estimate of r^n.
- The CB is forward looking and has rational expectations (it correctly anticipates future inflation: $E[\Pi_{t+1}] = \Pi_{t+1}$)
- It sets interest rates based on deviation of future inflation from target (Π^T)

$\rightarrow$ CB: Central bank raises interest rates when it expects inflation above target.
$\rightarrow$ CB: Expansionary monetary policy corresponds to reduction in r^n.

Using the model

- We have discussed the three building blocks of our New Keynesian baseline model, let's use it.
- We will do two things:
  - Assess impact of fiscal and monetary policy on the (medium-run) equilibrium.
  - Simulate impact of COVID-type recession.

Solving the model

How can we solve the closed economy baseline model?

The fastest way to do it with these stationary models is to make use of the fact that ...

in equilibrium the value of the endogenous variables does not change.

Which means that in equilibrium we have for example $Y_t = Y_{t+1} = Y_{t+2} = Y^*$
We can apply this reasoning to all three endogenous variables and obtain:
(see Appendix for full detail)

- $Y^* = Y^p$
- $r^* = \frac{A - Y^p}{c}$
- $\Pi^* = \frac{c}{\alpha\beta}\left(\frac{A - Y^p}{c} - r^n\right) + \Pi^T$

Fiscal and monetary policy in the New Keynesian Model

- We are interested in the effect of a (permanent) fiscal expansion (increase in A)
- and a (permanent) monetary easing (reduction in r^n).
- Let's compute the effect on our equilibrium values:
- effect on equilibrium output $Y^* = Y^p$:

$$\frac{\partial Y^*}{\partial A} = 0 \qquad \text{and} \qquad \frac{\partial Y^*}{\partial r^n} = 0$$

- effect on equilibrium inflation $\Pi^* = \frac{c}{\alpha\beta}\left(\frac{A - Y^p}{c} - r^n\right) + \Pi^T$:

$$\frac{\partial \Pi^*}{\partial A} = \frac{1}{\alpha\beta} \qquad \text{and} \qquad \frac{\partial \Pi^*}{\partial r^n} = -\frac{c}{\alpha\beta}$$

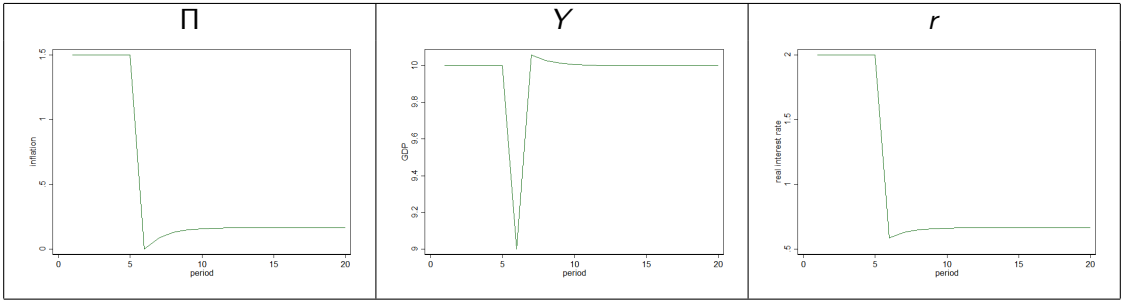
- effect on equilibrium real interest rate $r^* = \frac{A - Y^p}{c}$:

$$\frac{\partial r^*}{\partial A} = 1/c \qquad \text{and} \qquad \frac{\partial r^*}{\partial r^n} = 0$$

Simulating the COVID-19 recession

We start from equilibrium: $Y^* = Y^p = 10$, $\Pi^* = 1.5$ and $r^* = 2$

Then COVID-19 outbreak in period 6 permanently reduces aggregate demand:



Summing up: New Keynesian Baseline model

(1) Fiscal and monetary policy have no effect on output in the medium run ...

(2) .. and can have an effect on inflation and the real interest rate.

(3) A long lasting reduction in aggregate demand due to a COVID-19 recession, would have no impact on output in the medium term. The economy would fully recover (due to monetary stimulus).

A Post-Keynesian Alternative Model

A Post-Keynesian Alternative

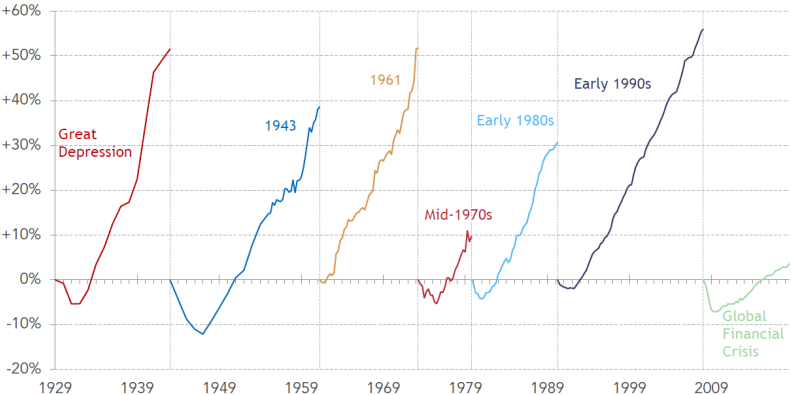
- In this section we will see that introducing a small extension, fundamentally changes the model's behaviour.
- We are going to introduce an **endogenous productivity** mechanism.
- Remember: Potential output (Y^p) was defined as "maximum possible level of output without triggering inflation **with current technology/productivity**".
- So technology/productivity is exogenous in our NK baseline model
- What if (labour) productivity depends on the current or actual state of the economy, most importantly current output (Y_t)?

Endogenous productivity

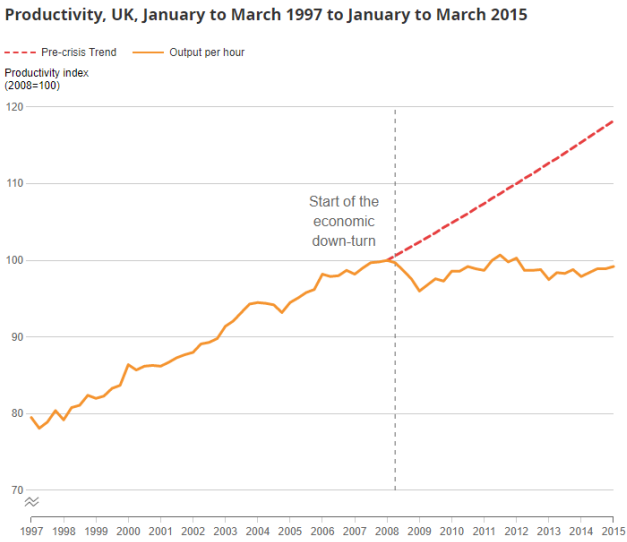
- What if (labour) productivity depends on the current or actual state of the economy, most importantly current output (Y_t)?
- How would that work?
- **Mechanism I**: Low levels of output (i.e. recessions) are associated with low levels of investment and thus installation of new machinery and equipment (technological upgrading). Firm productivity (growth) decreases. Bankruptcies lead to know how loss.
- **Mechanism II**: Deskilling of the work force. If workers stay unemployed for a long time, they loose their skills. The workforce becomes less productive.
- Does that happen in the real world?

Figure 5: Recessions always result in falling GDP and rising unemployment

Cumulative growth in real-terms GDP over successive economic cycles (per cent), UK



Source: https://www.resolutionfoundation.org/publications/failing-to-plan-planning-to-fail-



Source:
https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/labourproductivity/articles/whatistheproductivitypuzzle/2015-07-07 and ONS' Labour Productivity Bulletin Q1 2015.

- This is known as the UK's **productivity puzzle**.
- It refers to the fact that after the financial crisis productivity growth collapsed.
- How can we incorporate these ideas into our framework?
- We will follow the example of Lavoie (2006)

Amending the baseline model

Lavoie (2006) proposes to add one equation to the baseline model:

- IS: $Y_t = A - cr_{t-1}$
- Phillips curve: $\Pi_t = \Pi_{t-1} + \alpha(Y_t - Y_t^p)$
- Taylor rule: $r_t = r^n + \frac{\alpha\beta}{c}\left(\Pi_{t+1} - \Pi^T\right)$

And the new equation:

$$Y_t^p = Y_{t-1}^p + \phi(Y_t - Y_t^p)$$

Endogenous productivity

$$Y_t^p = Y_{t-1}^p + \phi(Y_t - Y_t^p)$$

- The change in potential output is now directly proportional to the output gap
- If $Y_t < Y_t^p$ then Y_t^p adjusts towards Y_t
- One possible mechanism is endogenous productivity: deep recessions lead to a productivity slowdown
- The implication: The medium run is a sequence of short runs. So the medium run depends on the adjustment path (hence the economy is **path-dependent**)

Using the model

- Let's use this amended model.
- As with the baseline model, we will do two things:
  - Assess impact of fiscal and monetary policy on the (medium-run) equilibrium.
  - Simulate impact of COVID-type recession.

Solving the model

The fastest way to solve these stationary models is to make use of the fact that ...

in equilibrium the value of the endogenous variables does not change.
(for example $Y_t = Y_{t+1} = Y_{t+2} = Y^*$)

We can apply this reasoning to all four endogenous variables and obtain:
(see Appendix for full detail)

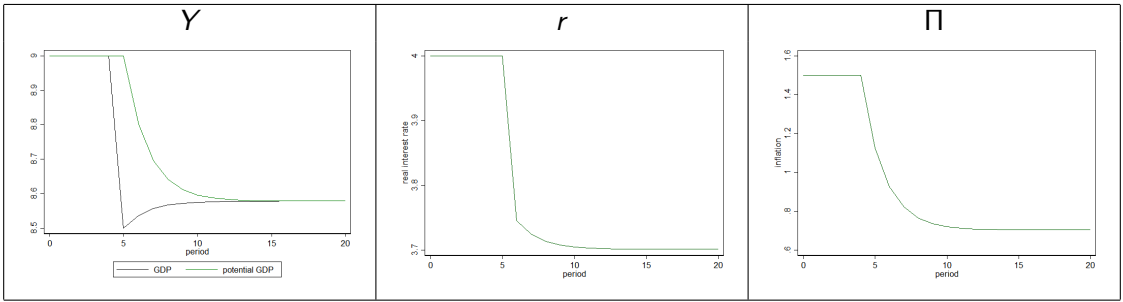
- $Y^* = Y$
- $Y^{p*} = Y$
- $r^* = \frac{A-Y}{c}$
- $\Pi^* = \frac{c}{\alpha\beta}\left(\frac{A-Y}{c} - r^n\right) + \Pi^T$

It means that these equilibrium values are not unique anymore (depend on the initial condition), they depend on economic policy. Let's look at that via a simulation.

Simulating the COVID-19 recession

We start from equilibrium: $Y^* = Y^{p*} = 9$, $\Pi^* = 1.5$ and $r^* = 4$

Then COVID-19 outbreak in period 5 permanently reduces aggregate demand:



Summing up: Amended model

- A long lasting reduction in demand has negative productivity effects ...
- and thus reduces equilibrium output permanently.
- The principle of effective demand also holds in the medium run.
- The implication for economic policy making is that preventing recessions is crucial ...
- and without strong enough support the economy might remain in a low output/low employment equilibrium

Conclusion

- In our baseline New Keynesian model the principle of effective demand does not hold
  - even a permanent demand shock has no impact on output
  - the economy always returns to it's (supply determined) potential output equilibrium
  - policy implications: 1) You don't need to worry too much about long term problems after deep recessions 2) austerity will not hurt the economy and successful in reducing debt to GDP ratios
- In our Post Keynesian alternative model the principle of effective demand holds
  - a permanent demand shock has a permanent impact on output
  - economic policy influences the equilibrium/path of the economy
  - policy implications: 1) Policy intervention needed to prevent low output/low employment equilibrium after deep recession 2) austerity will reduce growth and ineffective in reducing debt to GDP ratios

- Technically the difference between the two models is the Post Keynesian alternative is pathdependent (has unit root)
- There are New Keynesian models with that feature: but it is about what is our baseline
- It matters how does the textbook model look like

References I

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Appendix

Appendix

Solving the NK Baseline Model

In equilibrium the value of the endogenous variables does not change!

Let's apply this reasoning to the Phillips curve: $\Pi_t = \Pi_{t-1} + \alpha(Y_t - Y^e)$

We can use: $\Pi_t = \Pi_{t-1} = \Pi^*$ and $Y_t = Y_{t+1} = Y_{t+2} = Y^*$, plug that into the Phillips curve

What we get is: $\Pi^* = \Pi^* + \alpha(Y^* - Y^e)$ and we can simplify that

and obtain:

$$Y^* = Y^e$$

So we have our first solution.

Let's use the solution for output $Y^* = Y^p$ to derive the other solutions

First we can formulate the IS curve with equilibrium values:

$Y^* = A - cr^*$

and we know already that $Y^* = Y^p$ and thus our IS curve becomes:

$Y^e = A - cr^*$ which we can use to express r^* as

$r^* = \frac{A - Y^p}{c}$

So we have the second solution: $r^* = \frac{A - Y^p}{c}$

Now we can make use of the second solution $r^* = \frac{A - Y^p}{c}$ and $\Pi_t = \Pi_{t+1} = \Pi^*$ and plug them into the monetary policy rule:

$r^* = r^n + \frac{\alpha\beta}{c}(\Pi^* - \Pi^T)$

$\frac{A - Y^p}{c} = r^n + \frac{\alpha\beta}{c}(\Pi^* - \Pi^T)$ which we can simplify to:

$$\Pi^* = \frac{c}{\alpha\beta}\left(\frac{A - Y^p}{c} - r^n\right) + \Pi^T$$

which is our third and final solution.

Now we know that in the closed economy baseline model in equilibrium the three endogenous variables take on the following values:

- $Y^* = Y^p$
- $r^* = \frac{A - Y^p}{c}$
- $\Pi^* = \frac{c}{\alpha\beta}\left(\frac{A - Y^p}{c} - r^n\right) + \Pi^T$

Each equilibrium value is equal to an expression consisting only of exogenous variables (Y^p, Π^T, r^n) or exogenous parameters (A, c, α, β) or both.

Only if we assume that the central bank is fully rational and can always correctly set $r^n = \frac{A - Y^p}{c} = r^*$ will it be able to hit its inflation target.
Because if $r^n = \frac{A - Y^p}{c} = r^*$ then $\Pi^* = \frac{c}{\alpha\beta}\left(\frac{A - Y^p}{c} - \frac{A - Y^p}{c}\right) + \Pi^T = \Pi^T$