ECON 815

"Keynesian Supply Shocks"

Winter 2020

Question

What are the effects on output and the natural rate of interest when parts of the economy are shut off?

Can supply shocks lead to shocks in demand that are *greater* than the initial supply shock?

If so, **supply creates excess demand!**

We will see that – under certain circumstances – the current **negative supply shock** leads to a **fall in the natural rate of interest**.

Discuss briefly policy implications.

Simple Environment

Preferences are given by

$$\frac{c_0^{1-\sigma}}{1-\sigma} + \beta \frac{c_1^{1-\sigma}}{1-\sigma} + 1$$

with production being linear $y = n$.

We assume the following budget constraints

$$c_0 + a_1 \leq wn + a_0$$
$$c_1 \leq wn + a_1$$
$$a_0 = 0$$

and for a fraction μ of people that they cannot borrow

$$a_1 \geq 0$$

MIT Shock: Fraction ϕ of labour is turned off in period 0.

No borrowing constraints ($\mu = 0$)

Without a shock, we have that the long-run natural rate of interest is given by $(1 + r) = \frac{1}{\beta}$.

The Euler equation with market clearing and equal consumption across agents is given by

$$1 + r_0 = \frac{1}{\beta} \left(\frac{c_{t+1}}{c_t} \right) = \frac{1}{\beta} \left(\frac{1}{1 - \phi} \right)^\sigma > \frac{1}{\beta}$$

Implications:

1) The natural rate of interest increases.

2) If wages are downwardly rigid and interest rates do not move, we have $c_0 = n$ and, hence, excess demand.

3) Policy would have to move up (!) interest rates to avoid inflation.

$\implies$ standard, negative supply shock

Borrowing constraints ($\mu > 0$)

We have two types of agents.

1) Constrained <u>and</u> shut off work
$\implies$ they consume $c_{\mu 0} = 0$ & their Euler equation is irrelevant!

2) Not shut off work <u>or</u> unconstrained
$\implies$ they can work or borrow & Euler equation holds

We can aggregate their consumption.

Market clearing implies then

$$c_0 = (1 - \phi)n$$
$$c_1 + c_{\mu 1} = c_1 + \mu \phi n = n$$

Hence, the natural interest rate increases again, since for the second group we have

$$1 + r_0 = \frac{1}{\beta} \left(\frac{c_{t+1}}{c_t} \right)^\sigma = \frac{1}{\beta} \left(\frac{(1-\phi)n}{(1-\mu\phi)n} \right)^\sigma \geq \frac{1}{\beta}$$

Note that the effect is decreasing in μ.

For $\mu = 1$, there is no effect on the natural interest rate.

Why?

Each agent that is shut off work reduces his consumption by exactly n.

Labour supply and labor demand drop both by ϕn and there is no effect on the natural rate.

Two Sectors

Sector 1: fraction ϕ of workers; turned off **(CoVid-19!)**

Sector 2: fraction $1 - \phi$ of workers

Preferences are given by

$$u(c_{10}, c_{20}) + \beta u(c_{11}, c_{21})$$

where

$$u(c_t^1, c_t^2) = \left(\frac{1}{1 - \sigma}\right)\left(\phi^\rho c_{1t}^{1-\rho} + (1 - \phi)^\rho c_{2t}^{1-\rho}\right)^{\frac{1-\sigma}{1-\rho}}$$

$1/\sigma$ – intertemporal elasticity of substitution

$1/\rho$ – elasticity of substitution between goods

Note that without shocks we have that $p_1 = p_2 = 1$.

Main Insight – "Unobtainium" Matters!

We define the Euler equation in terms of good 2. Then, we have

$$(1 + r) = \frac{1}{\beta} \frac{u_{c2}(c_{10}, c_{20})}{u_{c2}(c_{11}, c_{21})}$$

Market clearing with the shock to sector 1 requires that

$$c_{10} = 0 \text{ and } c_{20} = (1 - \phi)n$$
$$c_{11} = \phi n \text{ and } c_{21} = (1 - \phi)n$$

We thus have for the Euler equation

$$(1 + r_0) = \frac{1}{\beta} \left(\frac{(1 - \phi)^\rho c_{20}^{1-\rho}}{\phi^\rho c_{11}^{1-\rho} + (1 - \phi)^\rho c_{21}^{1-\rho}} \right)^{\frac{\rho - \sigma}{1 - \rho}} \left(\frac{c_{21}}{c_{20}} \right)^\rho$$

Using the market clearing conditions, we obtain

$$(1 + r_0) = \frac{1}{\beta} \left(1 - \phi\right)^{\frac{\rho - \sigma}{1 - \rho}} < \frac{1}{\beta}$$

if and only if

$$\frac{1}{\rho} < \frac{1}{\sigma}$$

Result:

1) The natural rate of interest **falls** if the "intratemporal elasticity" is smaller than the intertemporal elasticity.

2) The goods are then complements. Having nothing to eat of good 1 causes me to eat less also of good 2 and save for the future.

3) This requires a drop in interest rates by the central bank. If not, there is amplification through a drop in labour demand equal to

$$\frac{n_{20}}{n} = \left(1 - \phi\right)^{\frac{\rho - \sigma}{\sigma(1 - \rho)}} < (1 - \phi)$$

Discussion – Borrowing Constraints Matter, too!

We should expect $1/\rho >> 1$, i.e.; goods are substitutes.

Borrowing constraints help! Why? Additional demand shock is generated by the fact that all income is lost for workers in sector 1.
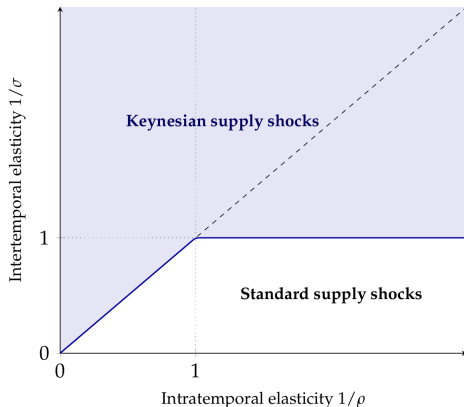
What about Current Policy Measures?

1) BoC interest rate cuts? Great if μ close to 1.

2) Fiscal policy with constrained agents? Less effective. Why? No multiplier effects! Why? Sector 1 and its workers do not benefit since sector shut down.

3) Contagion of shutdowns? Suppose extra businesses are also closing due to shutdown in sector 1. Employer-side payroll tax cuts or profit subsidies may work as they require firms to stay open. Lump-sum grants (bailouts) do not.

4) Wage subsidies? Yes, they help. But needs to be aided by low interest rates to increase long-term profit considerations to not destroy firm-worker matches.