Quantitative Easing in Joseph's Egypt with Keynesian Producers

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Motivation and Mnemonic

> "Accordingly, let Pharaoh find a man of discernment and wisdom, and set him over the land of Egypt. And let Pharaoh take steps to appoint overseers over the land and organize the land of Egypt in the seven years of plenty. Let all the food of these good years that are coming be gathered, and let the grain be collected under Pharaoh's authority as food to be stored in the cities. Let that food be a reserve for the land for the seven years of famine which will come upon the land of Egypt, so that the land may not perish in the famine."

Genesis 41:33-36 in Berlin and Brettler (2004)

- *Egyptian Scenario:* Anticipated famine ↑ desired savings.
- Storage removes the *fallacy of composition.* (Krugman, 1998)
- Does setting the natural interest rate equal to the return from storage eliminate all recessions?

Results

- The flexible-price allocation stores the aggregate good from year 0 to year 1.
- Implementing the flexible-price allocation requires equating bonds' real return with that of storage.
- Even with such appropriate monetary policy, the economy can enter a *confidence recession*.

$$1 = \beta \frac{C_0}{C_1} \frac{1 + i_0}{\pi_1}$$

- *Josephean Quantitative Easing (JQE)* ≡ purchases of *real* assets by monetary or fiscal authority.
- JQE puts a lower bound on year 1 consumption, which in turn bounds year 0 consumption and output from below.
- In an open economy, JQE resembles the monetary mechanics of a competitive devaluation.
- Volatile international capital flows are not an undesirable side-effect of JQE, they are its point.

JQE and Forward Guidance

- ▶ Eggertsson and Woodford (2003) "argue that the possibility of expanding the monetary base through central bank purchases of a variety of types of assets does little if anything to expand the set of feasible paths for inflation and real activity that are consistent with equilibrium under some (fully credible) policy commitment."

- ▶ Eggertsson and Woodford (2003) and Werning (2012) advocate lifting expectations of future consumption by committing to low future interest rates which lead consumption to overshoot its long-run level.

- ▶ Krugman (1998) dismissed Japan exporting its way out of its liquidity trap based on a "shortcut" (his word) ""that one can ignore the effect of the current account on the future investment income of the country."

Road Map

Primitives

- Preferences and Technology

$$U = \sum_{t=0}^{\infty} \beta^t \left(\ln C_t - \theta N_t \right), \text{ with } N_t \geq 0$$

$$Y_t(j) = A_t N_t(j) \text{ for } j \in [0,1] \text{ with } \int_0^1 N_t(j)dj = N_t$$

$$Y_t = \left(\int_0^1 Y_t(j)^{\frac{\varepsilon-1}{\varepsilon}} dj \right)^{\frac{\varepsilon}{\varepsilon-1}}$$
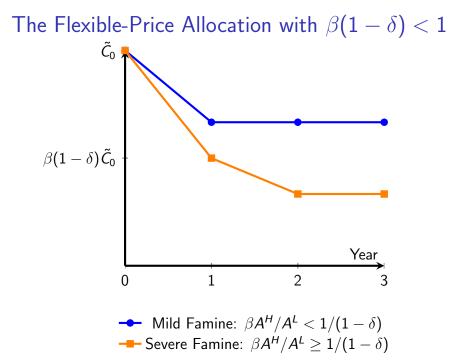
$$S_{t+1} + Q_{t+1} = (1-\delta)(Y_t + S_t + Q_t - C_t) \geq 0$$

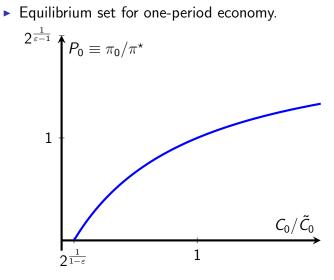$$A_0 = A^H \text{ and } A_t = A^L < A^H \; \forall t \geq 1$$

- Monopolists set two-period price *plans*, $P_t^0(j)$ and $P_{t+1}^1(j)$.
- Households earn a competitive nominal wage W_t.
- Bond Market: Joseph sets B_{t+1}, Q_{t+1}, and i_t subject to

$$Q_{t+1} = (1-\delta) \left(\left(\frac{B_{t+1}}{1+i_t} - B_t \right) / P_t + Q_t \right)$$

The Flexible-Price Allocation with $\beta(1-\delta) < 1$

Mild Famine: $\beta A^H/A^L < 1/(1-\delta)$
Severe Famine: $\beta A^H/A^L \geq 1/(1-\delta)$

The Phillips Curve

- Equilibrium set for one-period economy.

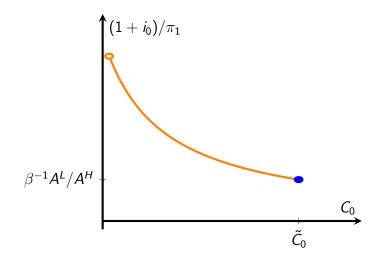- Resolve multiplicity with $1 = \beta \frac{1+i_0}{\pi_1} \frac{C_0}{C_1}$.

Liquidity Traps with Mild Famines

- Presume that $C_t = \tilde{C}_t$, $S_t = \tilde{S}_t$, and $N_t = \tilde{N}_t$ for $t \geq 1$.
- Set $\pi^\star \in [\beta, \beta 2^{\frac{1}{\varepsilon-1}})$.
- Select $\pi_1 \in [\beta, \beta A^H / A^L)$
- Implicitly define C_0 with

$$C_0 = \frac{\pi_1 \tilde{C}_1}{\beta \max\left\{ 1, \pi^\star \beta^{-1} \left(\frac{A^L}{A^H} \right) P_0(C_0)^\phi \right\}} < \tilde{C}_0$$

- Assume that $A^L / A^H > 2^{\frac{1}{1-\varepsilon}}$ to ensure that $C_0 > 2^{\frac{1}{1-\varepsilon}}$.
- The assumption of a "discretionary" equilibrium outcome (Eggertsson and Woodford, 2003) combined with low inflation expectations select a point on the Phillips Curve.
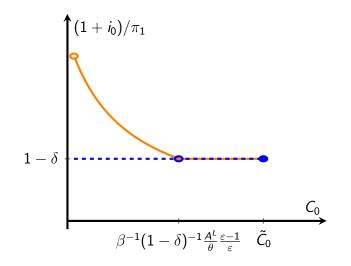
The Standard IS Curve

Recessions with Severe Famines

- Any *liquidity trap* equilibrium from the case with $\delta = 1$ continues to exist with $\delta < 1$ if its $\pi_1 < 1/(1-\delta)$.
- Construct an equilibrium with $\pi_1 \geq 1/(1-\delta)$.
- Set $S_t = 0$, $C_t = \tilde{C}_t$, and $N_t = \tilde{N}_t$ for $t \geq 2$.
- Select

$$C_1 \in \left[\frac{A^L}{\theta} \frac{\varepsilon - 1}{\varepsilon}, \tilde{C}_1 \right).$$

- Set $C_0 = \beta^{-1}(1-\delta)^{-1}C_1$
- Complete the equilibrium construction using the Phillips Curve, the aggregate resource constraint, the optimal pricing conditions, and the interest-rate rule.
- The resulting equilibrium is a *confidence recession*.

The IS Curve with Storage

Josephean Quantitative Easing

$$\underline{C}_0 \equiv (1-\delta)^{-1}\beta^{-1}\frac{A^L}{\theta}\frac{\varepsilon-1}{\varepsilon}$$

$$\underline{B}_1 \equiv \beta\underline{C}_0 P_0(\underline{C}_0)\max\{1, \pi^\star(1-\delta)P_0(\underline{C}_0)^\phi\}.$$

Proposition

For each $B_1 \in [\underline{B}_1, \pi^\star\tilde{C}_1]$, $\exists$ a threshold $\bar{C}_0(B_1)$ such that

1. there is no equilibrium with $C_0 < \bar{C}_0(B_1)$;

2. any confidence recession with $C_0 \geq \bar{C}_0(B_1)$ has a corresponding equilibrium with the given value of B_1 and the same sequences for C_t and N_t;

3. $\bar{C}_0(\bar{B}_1) = \underline{C}_0$;

4. $\bar{C}_0(B_1)$ is strictly increasing in B_1; and

5. $\bar{C}_0(\pi^\star\tilde{C}_1) = \tilde{C}_0$.

An Open Economy Interpretation

- Interpret storage as international trade.

$$\delta \equiv 1 - (1 - \tau)^2 (1 + r^f)$$

- Quantitative External Easing

> *Indeed, some advanced economy central bankers have privately expressed their worry to me that QE "works" primarily by altering exchange rates, which makes it different from QEE only in degree rather than in kind.* (Page 6 of Rajan (2014))

JQE at the BOJ and ECB

- BOJ's "Quantitative and Qualitative Easing"
  - Purchase ¥60 to ¥70 Trillion per month of securities.
  - ¥50 Trillion of these are Japanese sovereigns.
  - The remainder consists of a wide variety of *private* assets.
  - This paper suggests that reversing these shares would be beneficial.
- ECB's LTRO and ABSPP purchase privately-issued assets backed by real wealth.

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