Supplementary Notes on Chapter 6 of D. Romer's Advanced Macroeconomics Textbook (4th Edition)

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Question: How are y_t, r_t and π_t mutually determined?

$$(6.8) \qquad \ln Y_t = E[\ln Y_{t+1}] - \frac{1}{\theta} r_t$$

$$(6.10) \qquad \frac{M_t}{P_t} = Y_t^{\theta/v}[(1+i_t)/i_t]^{1/v} = Y_t^{\theta/v}\left[\frac{1+r_t+\pi_t^e}{r_t+\pi_t^e}\right]$$

- Two equations to solve three variables we are interested in?
- Solvable if $\pi \equiv 0$. Rigid prices?
- However, $P_t \equiv \bar{P}$ obviously is unrealistic assumptions.
- An additional equation (with inflation in it) is called for.

Option 1: Phillips (1958) Curve

$$W_t = AP_{t-1} \tag{6.20}$$

$$F'(L_t) = \frac{A}{1+\pi_t} \tag{6.21}$$

- Unemployment-inflation trade-offs.
- Works for 1960s, but can not explain other periods in Figure 6.7 of textbook.
- Limitation: The government can always improve employment simply by keeping increasing the price level? How will workers accept rule (6.20) to determine their wage if they know that the government is pursuing an ever-continuing inflation policy?
- This leads us to option 2 below.

Option2: Friedman (1968) and Phelps (1968)

$$(6.22) \qquad \pi_t = \pi_t^* + \lambda(\ln Y_t - \ln \bar{Y}_t) + \epsilon_t^S, \quad \lambda > 0$$

$$(6.24) \qquad \pi_t = \pi_t^e + \lambda(\ln Y_t - \ln \bar{Y}_t) + \epsilon_t^S,$$

$$(6.25) \qquad \pi_t = \phi\pi_t^e + (1-\phi)\pi_{t-1} + \lambda(\ln Y_t - \ln \bar{Y}_t) + \epsilon_t^S, \;\; 0 \leq \phi \leq 1.$$

- π^* is the core inflation, it denotes the inflation level when output is equal to its natural rate ($\bar{Y}_t$) and there are no supply shocks.
- $\pi_t^* = \pi_{t-1}$ is often adopted. Or instead use a weighted average of inflation over the previous several periods.
- No permanent tradeoff between output and inflation exhibits in (6.22). (What if $\pi_t \equiv \bar{\pi}$? Compared to the original Phillips curve?)
- (6.22) – expectations-augmented Phillips curve.

Option2: Friedman (1968) and Phelps (1968) (Continued)

(6.22) $$\pi_t = \pi_t^* + \lambda(\ln Y_t - \ln \bar{Y}_t) + \epsilon_t^S, \quad \lambda > 0$$

(6.24) $$\pi_t = \pi_t^e + \lambda(\ln Y_t - \ln \bar{Y}_t) + \epsilon_t^S,$$

(6.25) $$\pi_t = \phi\pi_t^e + (1-\phi)\pi_{t-1} + \lambda(\ln Y_t - \ln \bar{Y}_t) + \epsilon_t^S, \quad 0 \le \phi \le 1.$$

- (6.22) explains Figure 6.7 better. However, given a government adopting ever-increasing inflations, what happens?
- The ever-increasing inflation will affect π_t^e in (6.24)! Meaning?
- (6.25) is a **hybrid** Phillips curve, reflecting the inertia in inflation.
- Long run - short run debates.

AS-AD diagram

$$(6.26) \qquad r_t = r(\ln Y_t - \ln \bar{Y}_t, \pi_t), \quad r_1(\cdot) > 0, r_2(\cdot) > 0.$$
$$(11.45) \qquad r_t^{target} = \bar{r} + \phi_\pi(\pi_t - \pi^*) + \phi_y(\ln Y_t - \ln \bar{Y}_t).$$

- (6.26) is the MP curve, it replaces the previous LM curve.
- (11.45) is the famous Taylor's interest-rate rule (Taylor (1993)) with $\phi_\pi = 1.5$ and $\phi_y = 0.5$.
- The revised phillips curve, (6.22) gives us the AS curve, IS-MP diagram gives us the AD curve.

Self-fulfilling Equilibriua

$$
\begin{aligned}
(6.31) \qquad & y_t = \phi E_t[y_{t+1}] + \phi \mu_t^{IS} \\
(6.35) \qquad & y_t = \frac{\theta}{\theta + b - \theta \rho_{IS}} \mu_t^{IS} \\
(\textit{bubble solution}) \qquad & y_t = \frac{\theta}{\theta + b - \theta \rho_{IS}} \mu_t^{IS} + \frac{X}{\phi^t}, \quad \forall X \in \mathbf{R} \qquad (1)
\end{aligned}
$$

- In the system depicted in (6.27) – (6.30), if (6.35) is a solution to (6.31), why isn't the bubble solution (2)?
- Infinitely many equilibria!
- Recalling the asset-pricing model you've learned in Finance courses, where y here stands for asset price, μ is next period's dividend?
- Economic intuition. Fundamental, self-fulfilling, sunspot, and correlated equilibria.

Self-fulfilling Equilibriua (Continued)

$$
\begin{aligned}
(6.31) \qquad & y_t = \phi E_t[y_{t+1}] + \phi \mu_t^{IS} \\
(6.35) \qquad & y_t = \frac{\theta}{\theta + b - \theta\rho_{IS}} \mu_t^{IS} \\
(\textit{bubble solution}) \qquad & y_t = \frac{\theta}{\theta + b - \theta\rho_{IS}} \mu_t^{IS} + \frac{X}{\phi^t}, \quad \forall X \in \mathbf{R} \qquad (2)
\end{aligned}
$$

- Economic intuition. Fundamental, self-fulfilling, sunspot, and correlated equilibria.
- World is so complicated that **multiplicity problems** almost always happen, Economists behaves, using their theories, as Equilibrium-Selection devices! (Different schools may find different equilibria in favor.)
- http://v.youku.com/v_show/id_XMjc0MTgwMTgw.html?from=s1.8-1-1.2.

To be continued $\cdots$

References

[1] Milton Friedman. The role of monetary policy," american economic review, 58. *repr. in M. Friedman (1969)*, pages 102–110, 1968.

[2] Edmund S Phelps. Money-wage dynamics and labor-market equilibrium. *The Journal of Political Economy*, pages 678–711, 1968.

[3] WA Phillips. The relationship between unemployment and the rate of change of money wages 1862-1957. *Economica*, 34:254–81, 1958.

[4] John B Taylor. Discretion versus policy rules in practice. In *Carnegie-Rochester conference series on public policy*, volume 39, pages 195–214. Elsevier, 1993.