Money and Banking

Jesus Bueren

Exercise 1. From Gold Coins to Bank Balance Sheets

Consider a modern version of the economy from the previous money chapter. Households still need money to buy goods and services, but now they can hold either currency or demand deposits. Banks hold reserves at the central bank and make loans to households and firms.

Initially, the economy has:

$$c = 200, \qquad d = 800, \qquad \rho = 0.10,$$

where c is currency held by households, d is demand deposits, and ρ is the reserve requirement. The private bank initially holds exactly the required amount of reserves. Its other assets are bonds and loans:

$$B = 300, \qquad L = 420.$$

(a) Compute required reserves. Then write the balance sheet of the private bank. Verify that assets equal liabilities plus net worth.

(b) Compute the monetary base,

$$MB = c + \text{reserves},$$

and the money supply measured by M1,

$$M1 = c + d.$$

Explain why M1 is larger than the monetary base.

(c) The central bank buys $\Delta = 100$ of government bonds from the private bank. It pays by increasing the bank's reserves. Write the private bank's balance sheet immediately after the open market operation, before the bank makes any new loans.

(d) Immediately after the open market operation, what happens to MB and $M1$? Explain why the monetary base changes but M1 does not yet change.

(e) The bank does not want to hold excess reserves. It makes the largest new loan consistent with the reserve requirement, and the loan proceeds are deposited back into the banking system. Compute the new level of deposits, loans, and reserves.

(f) After the lending process is complete, compute the new values of MB and $M1$. Compare the change in M1 with the original change in the monetary base.

(g) In the gold-coin economy from the previous chapter, the money supply changed only when the stock of gold changed. Explain why, in the banking economy, M1 can change even when currency held by households is unchanged.

Exercise 2. The Money Multiplier and the Quantity Equation

Assume that banks hold no excess reserves, households do not change their currency holdings, and all new loans are redeposited in the banking system. The reserve requirement is ρ.

The money multiplier is

$$m = \frac{1}{\rho}.$$

Therefore, a change in the monetary base caused by new reserves changes M1 by

$$\Delta M1 = \frac{1}{\rho}\Delta MB.$$

Suppose the economy begins in a steady state:

$$M_0 = M1_0 = 1000, \qquad V = 5, \qquad Y^* = 5000, \qquad P_0 = 1.$$

Prices for period 0 were chosen in advance, as in the previous chapter, so P_0 does not respond immediately to an unexpected monetary shock. Firms update prices according to

$$P_{t+1} = P_t \left(\frac{Y_t}{Y^*}\right)^{\theta}, \qquad 0 < \theta < 1.$$

At the start of period 0, the central bank purchases bonds and increases bank reserves by

$$\Delta MB = 50.$$

(a) If $\rho = 0.10$, compute the money multiplier and the maximum increase in M1. What is the new money supply M_0' after the banking system finishes expanding deposits?

(b) Using the quantity equation and the fixed price level $P_0 = 1$, compute output in period 0 after the monetary expansion. Express your answer as Y_0/Y^*.

(c) Is the economy above or below desired output in period 0? Explain the economic mechanism using the language of the previous chapter: money, spending, sticky prices, and production.

(d) Compute inflation between period 0 and period 1:

$$\pi_1 = \ln P_1 - \ln P_0 = \theta \ln\left(\frac{Y_0}{Y^*}\right).$$

What is π_1 if $\theta = 0.5$?

(e) Suppose the central bank makes the same open market purchase, but the reserve requirement is instead $\rho = 0.20$. Compute the new money multiplier, the increase in M1, and Y_0/Y^*.

(f) Compare the cases $\rho = 0.10$ and $\rho = 0.20$. Why does a higher reserve requirement weaken the effect of the same change in central bank reserves?

(g) In the long run, output returns to Y^*. In the case $\rho = 0.10$, compute the new long-run price level $\hat{P}$ implied by the quantity equation. Compare this with the initial price level $P_0 = 1$.

(h) Briefly discuss one reason why the simple multiplier formula might overstate the effect of central bank reserve creation on M1 in a real-world banking system.