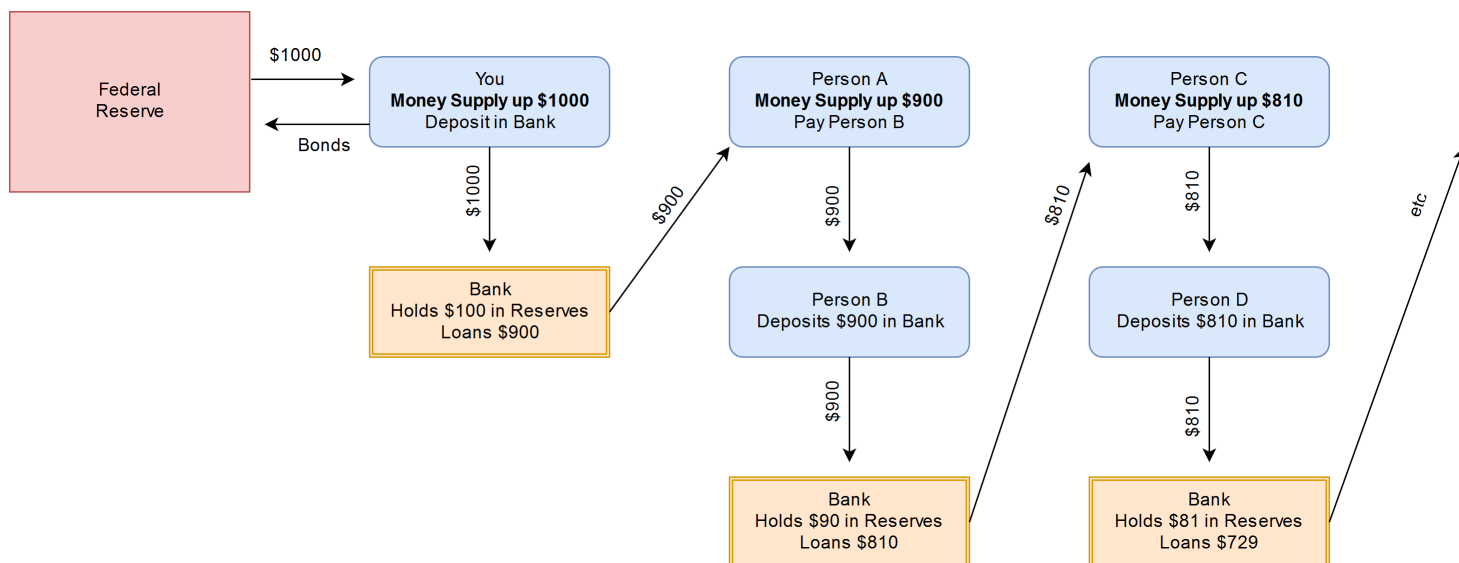


ECN 1B—The Money Multiplier

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An illustration of the money multiplier effect when the Federal Reserve injects \$1,000 into an economy with a reserve requirement of $R = 10\%$.

Step 1. Suppose you sell a bond to the Federal Reserve for \$1,000. Since that \$1,000 is no longer being held by the Federal Reserve, it is now in circulation, and therefore the money supply has increased by \$1,000.

Step 2. You deposit the \$1,000 in your savings account. Your bank faces a reserve requirement of $R = 10\% = 0.10$. This means they have to keep $\$1,000 \times 0.10 = \100 of your deposit at the bank at all times. The remaining $1 - R = 90\% = 0.90$ of your deposit, however, they can loan out. So they'll loan $\$1,000 \times 0.90 = \900 .

The \$1,000 you deposited is still your money. But Person A, who borrows the \$900 from the bank, has currency *that did not exist before*. So when you deposited your \$1,000 in the bank, it had the effect of creating \$900. So now, overall, the money supply has increased by

$$\begin{aligned}
 & \$1,000 + \$900 \\
 &= \$1,000 + \$1,000(0.90) \\
 &= \$1,000 + \$1,000(1 - R).
 \end{aligned}$$

Step 3. Person A borrowed the \$900 presumably because she wanted to spend it on something. So she spends it at Person B's shop. Person B takes the \$900 and deposits it at his bank.

The story is the same as before: his bank faces a reserve requirement of $R = 10\% = 0.10$. This means they have to keep $\$900 \times 0.10 = \90 of his deposit at the bank at all times. The remaining $1 - R = 90\% = 0.90$ of his deposit, however, they can loan out. So they'll loan $\$900 \times 0.90 = \810 .

The \$900 he deposited is still his money. But Person C, who borrows the \$810 from the bank, has currency *that did not exist before*. So when Person B deposited his \$900 in the bank, it had the effect of creating \$810. So now, overall, the money supply has increased by

$$\begin{aligned} & \$1,000 + \$900 + \$810 \\ &= \$1,000 + \$1,000(0.90) + \$1,000(0.90)^2 \\ &= \$1,000 + \$1,000(1 - R) + \$1,000(1 - R)^2. \end{aligned}$$

Step ∞ . This process will repeat itself indefinitely. The pattern that emerges is that, ultimately, the money supply will increase by

$$\begin{aligned} & \$1,000 + \quad \quad \$900 + \quad \quad \quad \$810 + \quad \quad \quad \$729 + \quad \quad \quad \$656.10 + \quad \dots \\ &= \$1,000 + \quad \$1,000(0.90) + \quad \$1,000(0.90)^2 + \quad \$1,000(0.90)^3 + \quad \$1,000(0.90)^4 + \quad \dots \\ &= \$1,000 + \quad \$1,000(1 - R) + \quad \$1,000(1 - R)^2 + \quad \$1,000(1 - R)^3 + \quad \$1,000(1 - R)^4 + \quad \dots \end{aligned}$$

Since $0 < R \leq 1$, we can actually evaluate this sum, even though it has infinitely many terms added. It turns out that the money supply will ultimately increase by

$$\$1,000 \times \frac{1}{R} = \$1,000 \times \frac{1}{0.10} = \$1,000 \times 10 = \$10,000.$$

The term $1/R$ is called the **money multiplier**.

Appendix: Deriving the Money Multiplier. This is optional and is a little bit mathematical, but it explains where the money multiplier comes from. As shown above, when the reserve requirement is R , the money supply will increase by

$$S = \$1,000 + \$1,000(1 - R) + \$1,000(1 - R)^2 + \$1,000(1 - R)^3 + \dots$$

Multiply everything by $(1 - R)$ and we have

$$\begin{aligned} S &= \$1,000 + \$1,000(1 - R) + \$1,000(1 - R)^2 + \$1,000(1 - R)^3 + \dots \\ S(1 - R) &= \$1,000(1 - R) + \$1,000(1 - R)^2 + \$1,000(1 - R)^3 + \$1,000(1 - R)^4 + \dots \end{aligned}$$

Notice that because S is an infinite sum, every term in $S(1 - R)$ is also found in S . So if we take $S - S(1 - R)$, the only thing that won't cancel out will be the \$1,000 term. Therefore

$$S - S(1 - R) = \$1,000.$$

But $S - S(1 - R)$ simplifies into $S - S + SR = SR$. Therefore

$$SR = \$1,000 \implies S = \$1,000 \times \frac{1}{R}.$$