ECN 1B—The Money Multiplier

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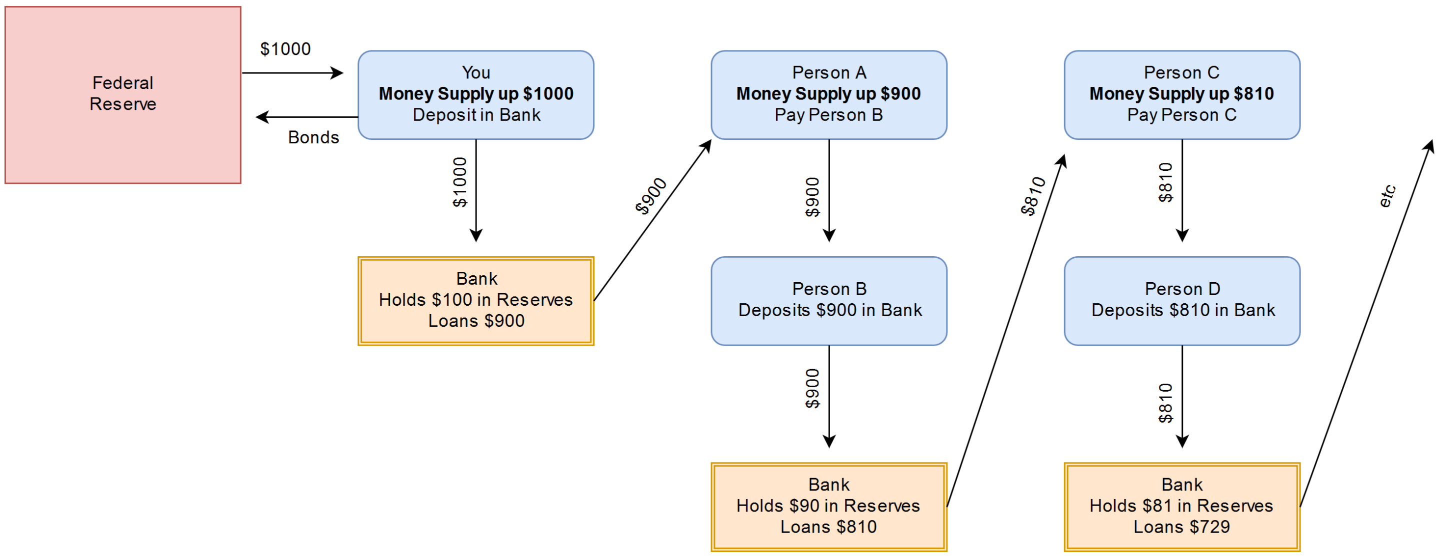

An illustration of the money multiplier effect when the Federal Reserve injects \$1,000 into an economy with a reserve requirement of $R = 10\%$ where banks choose to hold zero excess reserves.

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*—they can spend what they borrowed, and technically you can still spend what you gave to the bank. So when you deposited your \$1,000 in the bank and it got lent out, it had the effect of creating \$900. Overall now, 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 to 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. 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

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

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**.

It might not always be the case that banks lend out the entirety of what they are allowed to lend out—they might choose to hold on to excess reserves. Suppose that the banks decide they want to hold 12.5% of reserves instead of the 10% that they are required. Then the money multiplier would instead be $1/0.125 = 8$.

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

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

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

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

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

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