ECN 1B—The Money Multiplier

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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 to 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

$$\$1,000 + \$900$$
$$= \$1,000 + \$1,000(0.90)$$
$$= \$1,000 + \$1,000(1 - R).$$

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. So now, overall, the money supply has increased by

$$\$1,000 + \$900 + \$810$$
$$= \$1,000 + \$1,000(0.90) + \$1,000(0.90)^2$$
$$= \$1,000 + \$1,000(1 - R) + \$1,000(1 - R)^2.$$

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

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

Since $0 < R \le 1$, 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

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

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

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