ECN 1B—The Money Multiplier

William M Volckmann II

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 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

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

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**.

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

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

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

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