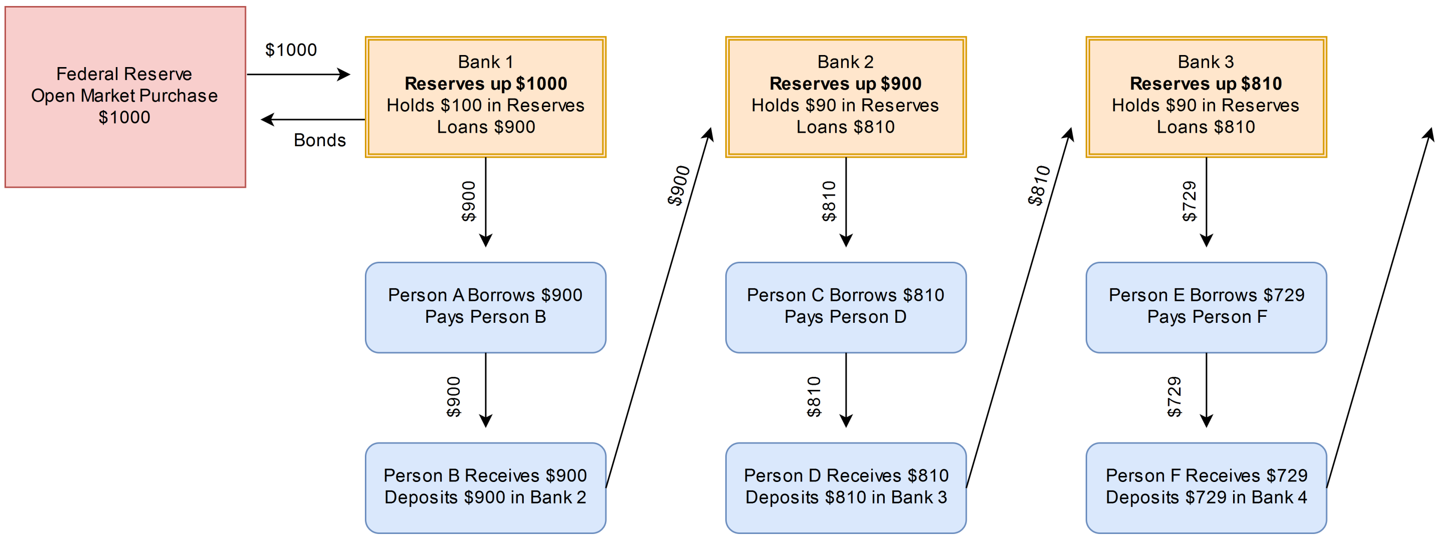
ECN 1B—The Money Multiplier

William M Volckmann II



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.

Suppose banks are fully lent out and will continue to lend as much as they are allowed.

Step 1. The Fed makes an open market purchase—it buys a bond from Bank 1 for $1000. This instantly increases the money supply by $1000 since that $1000 is now in circulation.

Step 2. Bank 1 is required to hold 10% of those new reserves, so $100. They lend out the remaining $900 to Person A. Person A borrowed the money presumably to spend it on something, and they buy Person B's goods. Person B then deposits the $900 in Bank 2. Since Bank 2 now has $900 more reserves, *the money supply has now increased by another $900.*

Step 3. Bank 2 is required to hold 10% of those new reserves, so $90. They lend out the remaining $810 to Person C. Person C borrowed the money presumably to spend it on something, and they buy Person D's goods. Person D then deposits the $810 in Bank 2. Since Bank 2 now has $810 more reserves, *the money supply has now increased by another $810.*

Step 4. Bank 3 is required to hold 10% of those new reserves, so \$81. They lend out the remaining \$729 to Person E. Person E borrowed the money presumably to spend it on something, and they buy Person F's goods. Person F then deposits the \$729 in Bank 3. Since Bank 3 now has \$729 more reserves, *the money supply has now increased by another \$729.*

Step ∞. This process will repeat itself indefinitely. Do you see the pattern? Each iteration increases the money supply as follows:

$$\begin{array}{rccccc}
\$1000+ & \$900+ & \$810+ & \$729+ & \$656.10+ & \dots \\
= \$1000+ & \$1000(0.90)+ & \$1000(0.90)^2+ & \$1000(0.90)^3+ & \$1000(0.90)^4+ & \dots \\
= \$1000+ & \$1000(1-R)+ & \$1000(1-R)^2+ & \$1000(1-R)^3+ & \$1000(1-R)^4+ & \dots
\end{array}$$

Since $0 < R \leq 1$, we can actually evaluate this sum (a *geometric series*), even though it has infinitely many terms added. 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

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

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

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

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

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