ECN 1B: The Money Multiplier

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Illustrating the Money Multiplier

Suppose the required reserve ratio is 10%, and that banks lend out fully, i.e. will lend as much as they are allowed (90% of deposits).

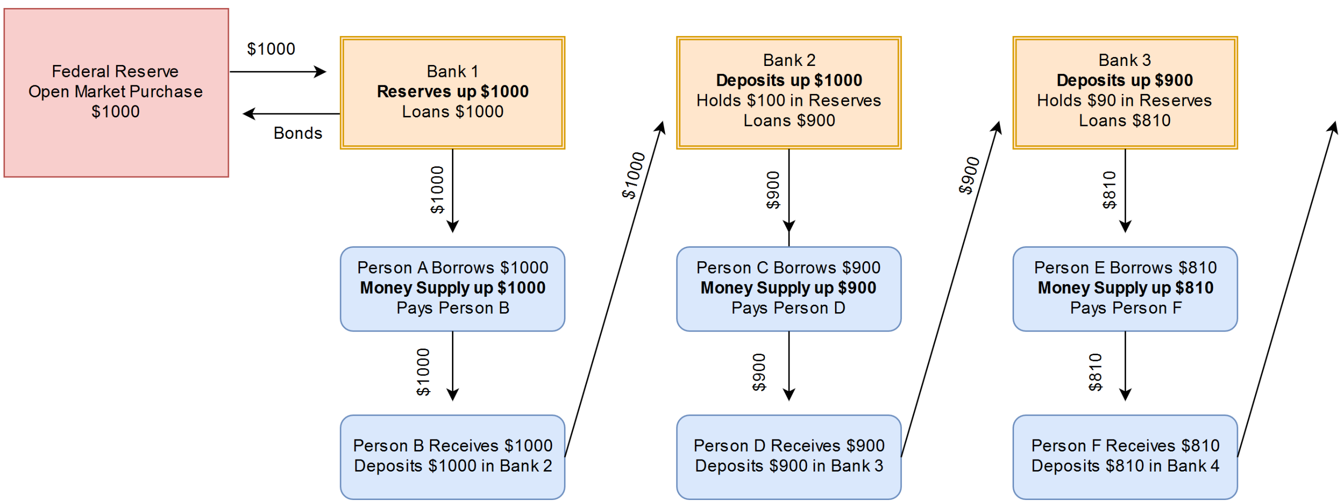

Figure 1: The money multiplier effect when the Federal Reserve injects $1,000 into an economy with a reserve requirement of $R = 10\%$ where banks choose to hold zero excess reserves.

Step 1. The Fed makes an open market purchase—it buys a bond from Bank 1 for $1000. This by itself does not increase the money supply because the money isn't held by the public.

Step 2. Since that $1000 did not enter the bank as deposits, the bank is not required to hold onto any of it. So they lend out all $1000 to Person A. *The act of lending increased the money supply by $1000*, because now that money is held by the public. Person A then spends all $1000 at Person B's shop. Person B deposits the $1000 in Bank 2.

Step 3. Bank 2 must hold on to 10% of their new deposits, i.e. $100 of it. They lend out the remaining $900 to Person C, *which increases the money supply by $900.* Person C spends the $900 at Person D's shop. Person D then deposits the $900 in Bank 3.

Step 4. Bank 3 now has $900 more deposits, they loan keep 10% of it as reserves and loan out the remaining $810 to Person E, *which increases the money supply by $810.* Person E spends the $810 at Person F's shop. Person F then deposits the $810 in Bank 4.

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

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

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 $1/0.125 = 8$. So the fraction of *actual lending* is what determines the money multiplier.

Appendix: Deriving the Money Multiplier

This is optional and a bit mathematical. It explains numerically 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. (As seen above, similar terms can be seen diagonal to each other.) 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 $S - S + S \times R = S \times R$. Therefore

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