Introduction to Macroeconomics

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Outline

These slides follow the original slides of Quijano/Quijano that accompany the Blanchard textbook.

Money and bonds

Assumptions within our model:

- Money, which you can use for transactions, pays no interest. There are two types of money: **currency**, coins and bills, and **checkable deposits**, the bank deposits on which you can write checks;
- Bonds pay a positive interest rate, i, but they cannot be used for transactions.

In reality, a wide choice of interest-bearing assets is available. Typically, their interest rates are higher if they have low liquidity (using them for transactions incurs costs: short-term bills have lower interest than long-term bonds) and if the interest rate is uncertain (stocks are riskier than government bonds).

The demand for money

Our rule is that money is needed for any purchase of goods or services. Thus, the demand for money depends on the level of transactions.

Low i on bonds implies that the possibly subjective cost of exchanging bonds into money increases and bonds become less attractive.

The proportions of money and bonds you wish to hold depend mainly on two variables:

- Your level of transactions;
- The interest rate on bonds.

Semantic traps: beware of confusion

- **Income** is what you earn from working plus what you receive in interest and dividends. It is a **flow**: it is expressed per unit of time;
- **Saving** is that part of after-tax income that is not spent. It is also a **flow**. **Savings** is sometimes (not here) used as a synonym for wealth: a stock;
- Your financial wealth, or simply **wealth**, is the value of all your financial assets minus all your financial liabilities: a **stock**;
- **Investment** is a term economists reserve for the purchase of new capital goods: machines, plants, office buildings. The purchase of shares or other financial assets may be referred to as a 'financial investment'.

A money demand function

Here is an equation describing the demand for money:

$$M^d = \$Y \cdot \underset{(-)}{L(i)}$$

The demand for money M^d equals nominal income $\$Y$ times a function of the interest rate i, with the function denoted by $L(i)$.

The demand for money:

- increases in proportion to nominal income ($\$Y$);
- depends negatively on the interest rate ($L(i)$ and the negative sign underneath).

Demand for money and bonds

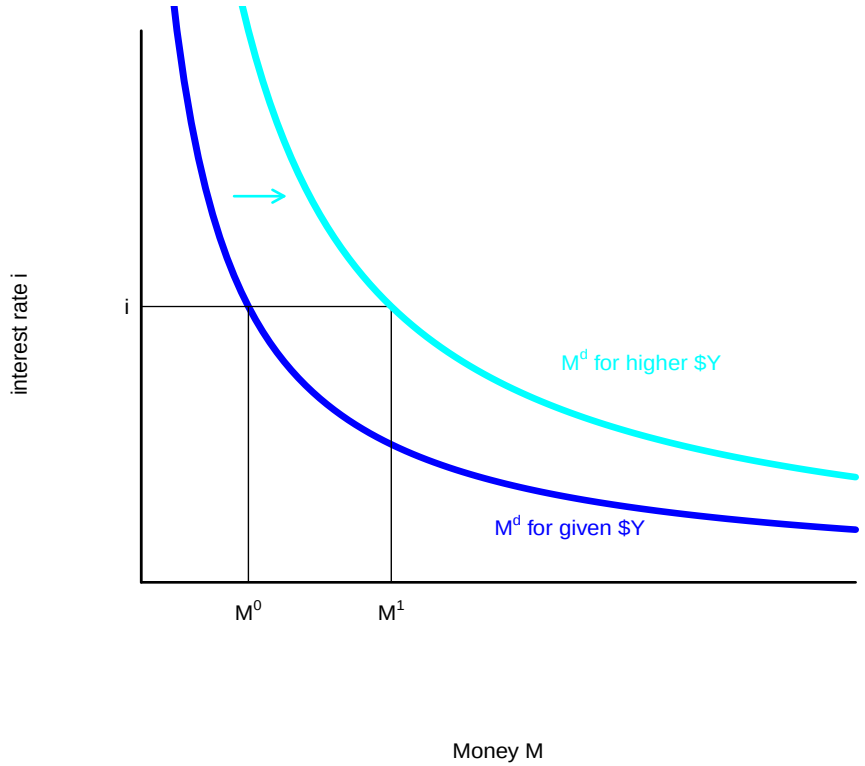
Assume that households hold a given amount of asset wealth HW (a stock). Their task is to distribute their wealth between money M and bonds B:

$$HW = M + B.$$

Here, everything is in nominal terms: we could also write $\$HW$, $\$M$, and $\$B$.

For given HW, increasing M implies reducing B. M bears no interest, and future HW may be lower, as households receive less rent income. This effect is ignored at this level of the model.

Money demand function: graphs



For a given level of nominal income, a lower interest rate increases the demand for money. An increase in $\$Y$ shifts the money demand curve to the right (out). For a given interest rate i, money demand increases from M^0 to M^1.

Money supply

Money supply M^s is set **exogenously** by the central bank. The central bank is supposed to be independent of the government.

$$M^s = M = \bar{M}$$

The U.S. central bank is the Federal Reserve System (Fed). The European central bank is the ECB.

Monetary policy (by central banks) and fiscal policy (by governments) are two independent tools of economic policy.

Equilibrium in the financial market

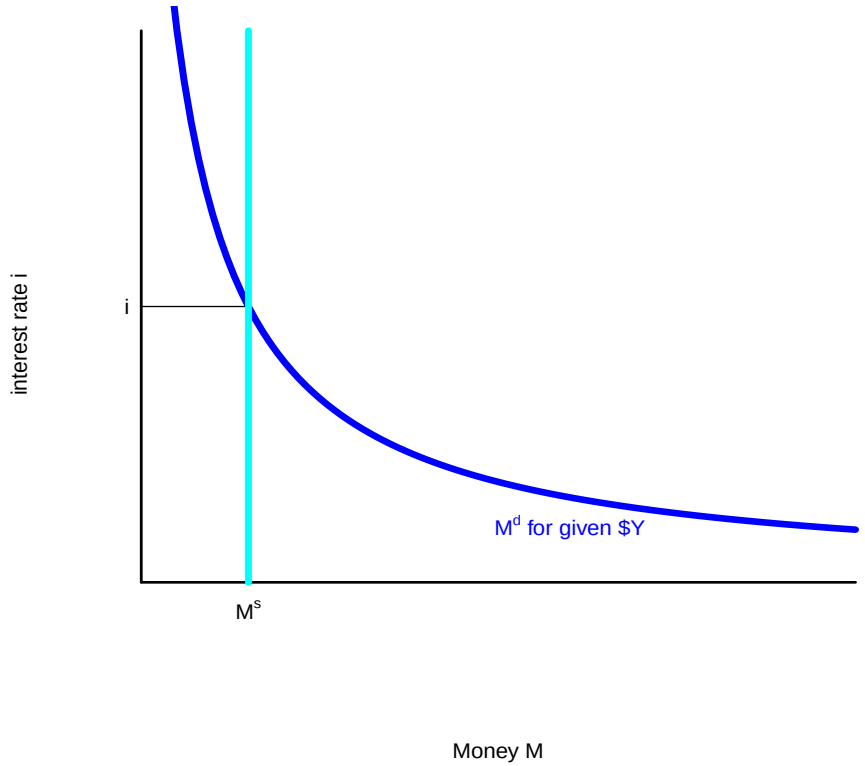
Equilibrium in financial markets requires that money supply be equal to money demand, or that $M^s = M^d$. Using the model equation for money demand, the equilibrium condition is:

$$\text{Money supply} = \text{Money demand}$$

$$M = \$Y \cdot L(i)$$

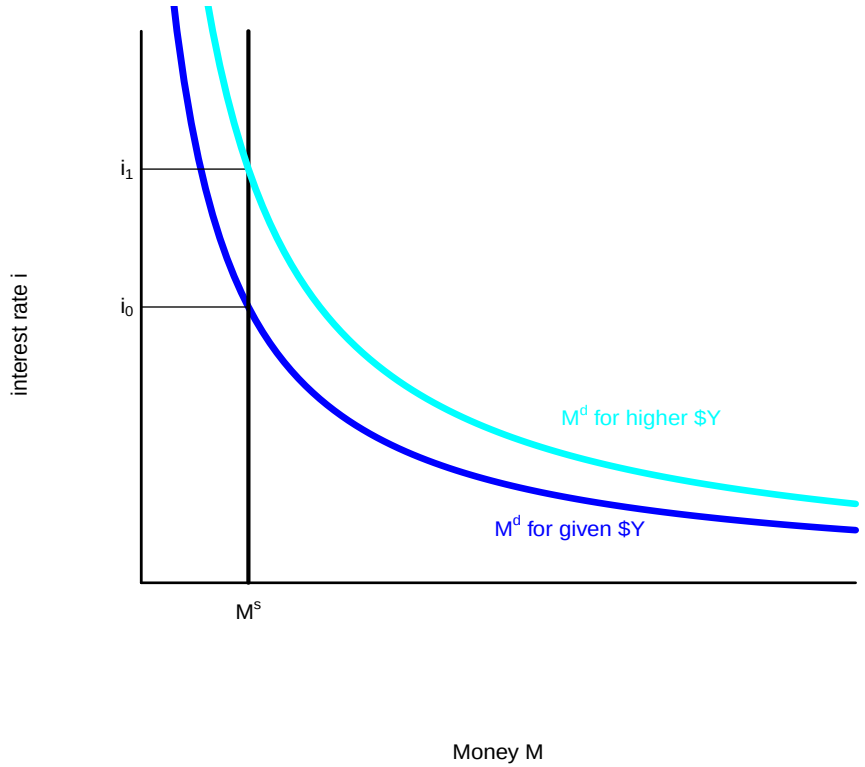
This equilibrium relation is called the **LM relation**. This 'LM' means 'Liquidity equals Money'.

Equilibrium in the financial market: graph



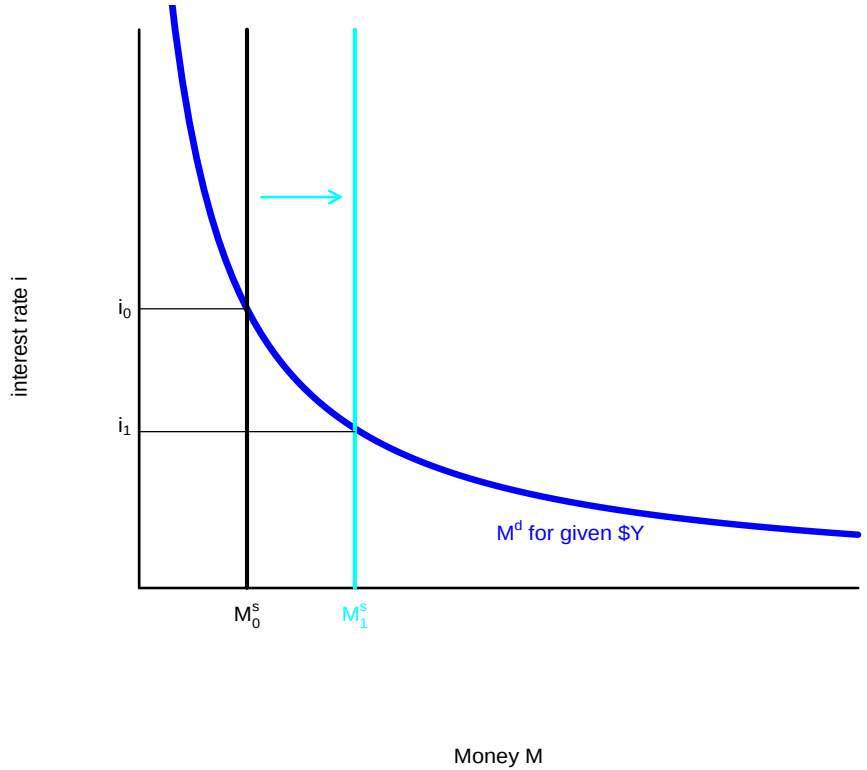
The interest rate must be such that the supply of money (exogenous and independent of the interest rate) equals the demand for money (which does depend on the interest rate).

Higher nominal income implies a higher interest rate



An increase in nominal income leads to an increase in the interest rate. The central bank does not provide more money, so the cost of liquidity rises.

A monetary expansion implies a lower interest rate



An increase in the supply of money leads to a decrease in the interest rate. There is no additional demand to match the additional supply, so the cost of liquidity falls.

Tools of the central bank

In order to increase (or decrease) the money supply the central bank has three instruments:

- Open market operations: the central bank purchases (expansion) or sells (contraction) bonds;
- The central bank increases (contraction) or decreases (expansion) special interest rates under its control (discount rate, not our i which is a market rate);
- The central bank increases (contraction) or decreases (expansion) the minimum reserve requirements of banks. It may also change the (small) interest rate on these reserves.

Open market operations are the most frequently used instrument.

Open market operations and the balance sheet of the central bank

Historically, money originates from banks issuing debt certificates. Money is a **liability** for a central bank.

The **assets** of a central bank are bonds issued by other institutions and (in the actual economy) valuables, e.g. gold.

In a **monetary expansion**, the central bank buys bonds. Its assets increase by the purchased bonds, its liabilities increase by the money transferred into the economy.

In a **monetary contraction**, the central bank sells bonds. Its assets decrease by the sold bonds, its liabilities decrease by the money withdrawn from circulation.

Bond prices and bond yields

Treasury bills (T–bills) are issued by the U.S. government promising payment in a year or less. If you buy the bond today and hold it for a year, the rate of return (interest) on holding a $ 100 bond for a year is

$$\frac{\$100 - \$P_B}{\$P_B}.$$

If the interest rate is given, we can figure out the price of the bond using the same formula

$$i = \frac{\$100 - \$P_B}{\$P_B} \Rightarrow \$P_B = \frac{\$100}{1+i}$$

Note, though, that usually **bonds** are defined as debt certificates issued with a term of a year or more, while **bills** have terms of less than a year. BLANCHARD's model bonds have terms of one year.

Narrow-sense money and other money

In modern economies, the money supply offered by the central bank is only a portion of the circulating money:

- Central bank money or the **monetary base** (currency, 'cash') bears no interest and has unlimited liquidity (in theory: you may not be able to do some transactions in cash money);
- Money **M1** consists of cash and of checkable deposits with banks (financial intermediaries). For these deposits, banks may offer a (small) interest that is ignored here;
- Broad-sense money **M3** consists of cash, checkable deposits, and savings accounts. Savings accounts at banks offer interest, their liquidity is high but restricted.

The following focuses on an economy with money M corresponding to M1, consisting of currency CU and checkable deposits D.

What banks do

Banks or **financial intermediaries** are institutions that receive funds from people and firms, and use these funds to buy bonds or stocks, or to make loans to other people and firms.

- Banks receive funds from people and firms who either deposit funds directly or have funds sent to their checking accounts. The liabilities of the banks are therefore equal to the value of these checkable deposits;
- Banks (must) keep as reserves some of the funds they receive.

Why banks hold reserves

- On any given day, some depositors withdraw cash from their checking accounts, while others deposit cash into their accounts: some buffer is needed;
- In the same way, on any given day, people with accounts at the bank write checks to people with accounts at other banks, and people with accounts at other banks write checks to people with accounts at the bank.
- Banks are subject to reserve requirements. The actual **reserve ratio**—the ratio of bank reserves to bank checkable deposits—is about 10% in many countries: insurance against bank runs, tool for regulating the money supply.

Loans and bonds

In the real world, loans (to customers) represent roughly 70% of banks' non-reserve assets. Bonds count for the remaining 30%. In the following, loans will be ignored, and banks' assets will be assumed to consist of bonds and reserves.

The assets of the central bank are the bonds it holds. The liabilities of the central bank are the money it has issued, central bank money. The new feature is that not all of central bank money is held as currency by the public. Some of it is held as reserves by banks.

Supply and demand for central bank money

Lets think in terms of the supply and the demand for *central bank money* (high-powered money H):

- The demand for central bank money is equal to the demand for currency by people plus the demand for reserves by banks;
- The supply of central bank money is under the direct control of the central bank;
- The equilibrium interest rate is such that the demand and the supply for central bank money are equal.

Demand for currency and checkable deposits

When people can hold both currency and checkable deposits, the demand for money involves *two* decisions:

1. People must decide how much money to hold;
2. They must also decide how much of this money to hold in currency (cash coefficient c) and how much to hold in checkable deposits.

Assume that overall money demand is given by the same equation as before:

$$M^d = \$Y \cdot L(i),$$

while demand for currency (CU) and checkable deposits (D) is given by:

$$CU^d = cM^d \qquad D^d = (1-c)M^d.$$

The demand for reserves

Assume the reserve ratio θ (approximately 10%). Obligatory reserves are a fixed proportion of deposits

$$R = \theta D.$$

Then, the demand for reserves by banks is given by:

$$R^d = \theta D^d = \theta(1 - c)M^d.$$

The demand for central bank money

The demand for central bank money is equal to the sum of the demand for currency and the demand for reserves:

$$H^d = CU^d + R^d.$$

Substituting for CU^d and R^d yields:

$$H^d = cM^d + \theta(1-c)M^d = \{c + \theta(1-c)\}M^d.$$

Finally, substituting for money demand M^d yields:

$$H^d = \{c + \theta(1-c)\}\$Y \cdot L(i)$$

Equilibrium expressed in central bank money

In equilibrium, the supply of central bank money (H^s) equals the demand for central bank money (H^d):

$$H^s = H^d = \{c + \theta(1 - c)\}\$Y \cdot L(i).$$

This relation can be used to determine the equilibrium interest rate for given H^s and $\$Y$.

The money multiplier

Re-write the relation $H = \{c + \theta(1-c)\}M$ that links central bank money and general money:

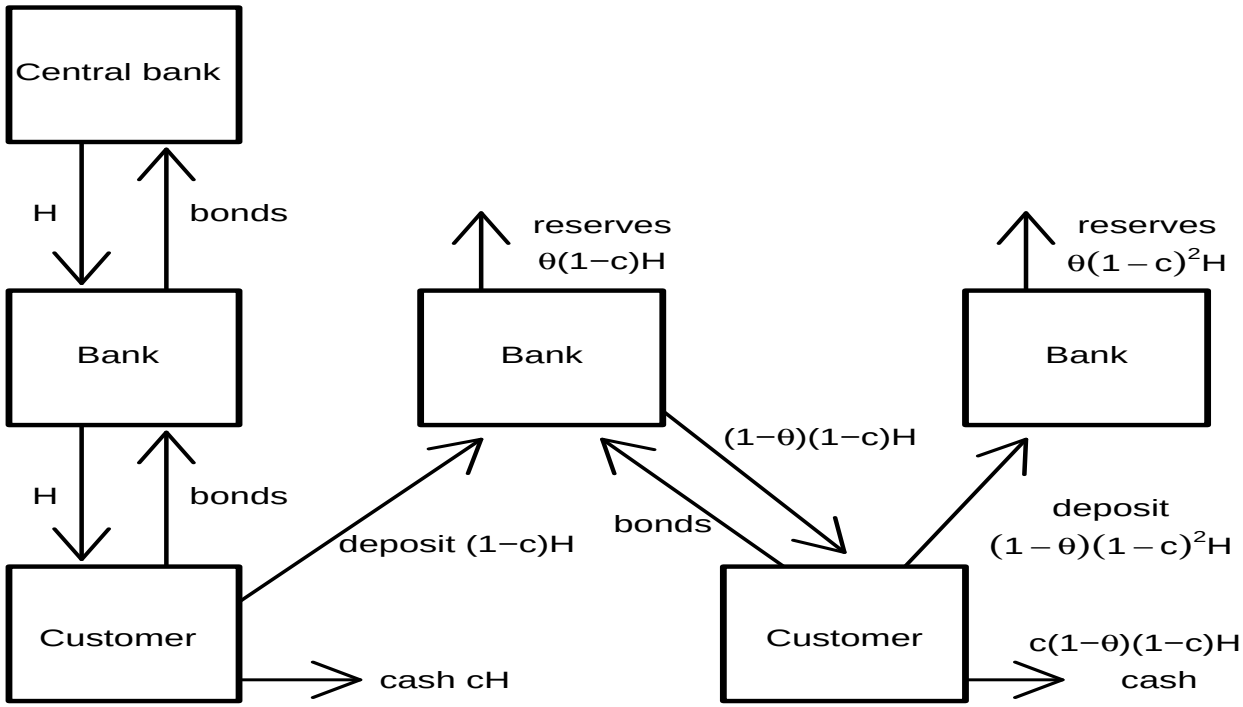
$$M = \frac{1}{c + \theta(1-c)} H.$$

For reasonable c and θ, we have

$$\frac{1}{c + \theta(1-c)} > 1.$$

For example, for $c = 0.3$ and $\theta = 0.1$, the value is 2.7. If the central bank issues an additional euro, the banking sector creates 1.7€ more.

Working of the money multiplier



Money multiplier: mathematics

Both the values of deposits and of cash follow geometric series:

$$CU = Hc\{1+(1-\theta)(1-c)+(1-\theta)^2(1-c)^2+\ldots\} = \frac{cH}{1-(1-\theta)(1-c)}$$

and

$$D = H(1-c)\{1+(1-\theta)(1-c)+(1-\theta)^2(1-c)^2+\ldots\} = \frac{(1-c)H}{1-(1-\theta)(1-c)}$$

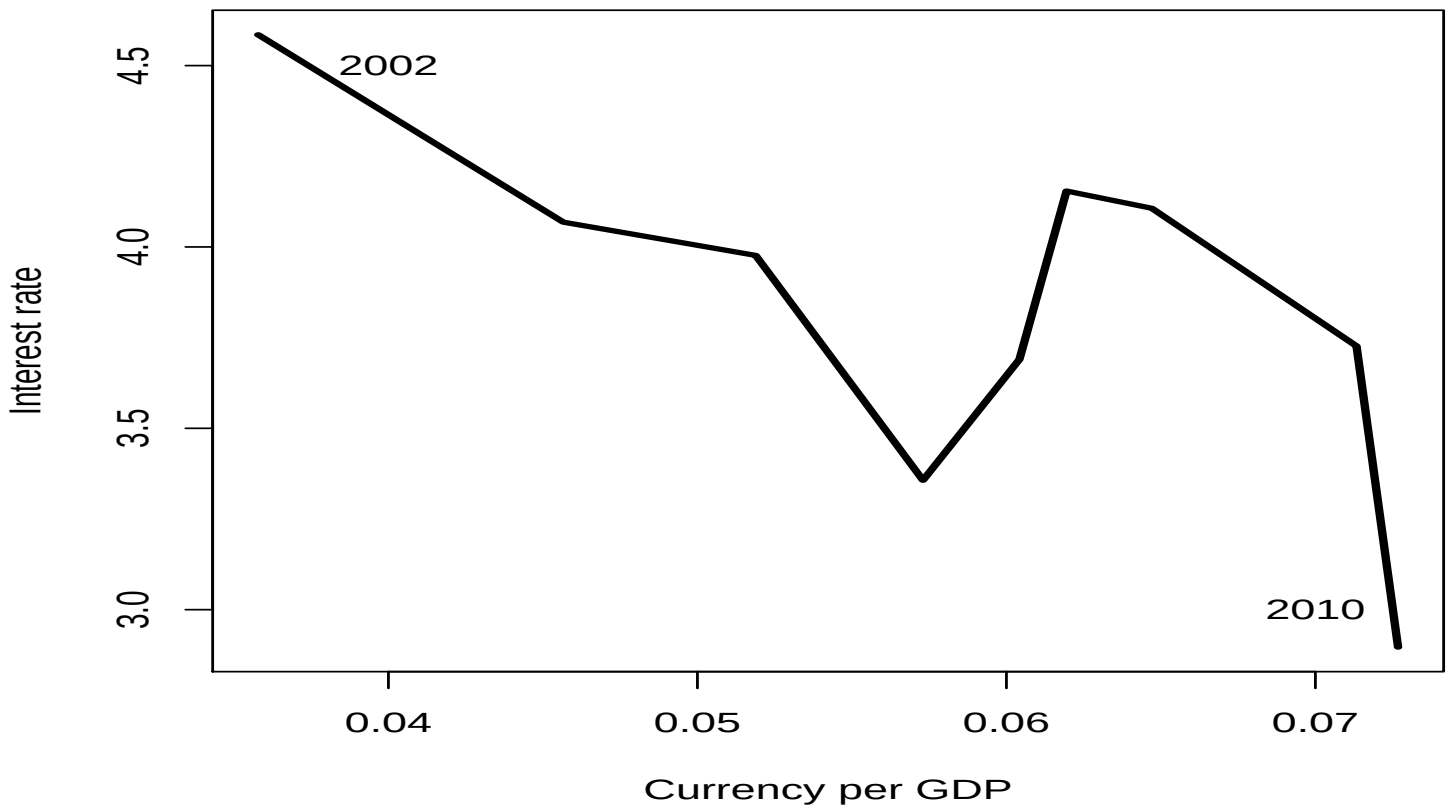
For total money M1:

$$M = CU + D = \frac{H}{1-(1-\theta)(1-c)} = \frac{H}{c+\theta(1-c)},$$

which clearly shows the money multiplier.

The money multiplier does *not* describe the effects of a monetary expansion on *output*, contrary to the fiscal multiplier.

Empirical evidence on the money demand function



Austrian data for 2002–2010: ratio of currency and nominal GDP and a bond rate.

The velocity of money

The function

$$M^d = \$Y \cdot L(i)$$

implies that the ratio $M/\$Y$ depends on i only. Its inverse, $\$Y/M$, is called the *velocity of money*. Our model assumes that the velocity of money is constant, given the interest rate.

Some economists maintain that the velocity has increased over time, following new technology for transactions, credit cards and debit cards. Recent evidence, however, fails to support this trend.