International Money and Banking: 9. The Money Supply

Karl Whelan

School of Economics, UCD

Autumn 2023

Monetary Policy

Over the next few weeks, we will cover a number of topics related to monetary policy. The plan is to cover the following:

1. The money supply
2. Monetarism
3. How central banks control interest rates: The Federal Reserve
4. How central banks control interest rates: The ECB
5. Long-term interest rates: Bonds and the yield curve
6. Default premia for private sector interest rates
7. Quantitative easing
8. The Phillips curve and central bank institutions
9. Real interest rates and monetary policy rules

What Is the Money Supply?

- Economists tend to use the term "money" differently than most people.
- While people may say a rich person "has a lot of money", economists define money to mean only the most liquid part of a person's assets, i.e. that part that can most quickly and easily be to fund purchases of goods and services.
- Liquidity varies widely across assets from the most liquid asset (cash) to assets that are illiquid because selling them involves all sorts of transactions costs (e.g. a house).
- For this reason, economists have different definitions of money ranging from definitions including only the most liquid to others including things that can be sold reasonably quickly and turned into cash.
- The **monetary base**, also known as M0 ("M zero") is defined as the sum of currency in circulation and reserves held at the Central Bank.
- The M1 definition of the money supply includes only currency and checking deposits: Both of these can be used directly to pay for goods and services.
- M2 equals M1 plus other assets such as savings deposits and money market mutual funds

Central Banks and the Monetary Base

- Central banks can control the monetary base.
- The base has two components, currency and reserves. One might imagine that currency is the component Central Banks have the most control over. Central Banks are the sole providers of currency and when they supply it to a bank they deduct the same amount from the bank's reserve account.
- However, in a modern economy, the amount of currency in circulation is driven by the public demand: The Fed or ECB are not going to refuse to provide currency to banks to keep their ATM machines running (provided the banks have sufficient credit in their reserve accounts).
- So the way that modern Central Banks control the monetary base is via controlling the quantity of reserves. These can be controlled via open market operations. By buying securities, they can increase the amount of bank reserves and by selling securities, they can decrease reserves.

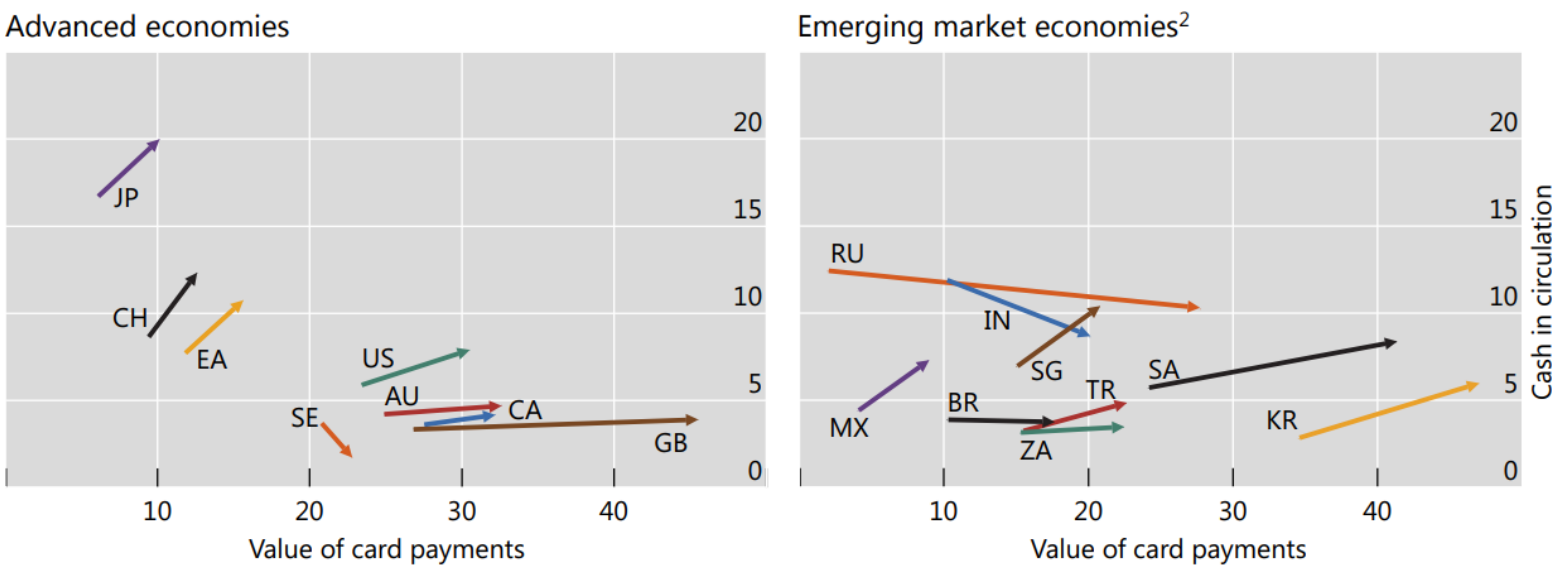
Transaction Usage Does Not Explain Amount of Banknotes in Circulation

- Some maths: €1,610,000 million in banknotes in circulation. Euro Area population is estimated at 343 million. That's an average amount of banknotes per person of €4,693.
- Pretty clearly, people are not keeping that amount of money on hand for everyday transaction purposes.
- And large notes (€100 or more) play a much greater role in the supply than you might imagine, accounting for about half the total value in circulation.
- ECB research (based on using information on how often notes are returned to the central bank) estimates that only a quarter of the total value of banknotes in circulation are being held for transactional purposes.
- They also estimate that around 30% of the total value of banknotes in circulation was held outside the euro area.
- Given these, ECB estimate that up to 45% of the value of euro bank notes are held as a "store of value" (i.e. "mattress money").

Increasing Usage of Cards Worldwide Hasn't Killed Off Cash

Card payments and cash demand have generally increased since 2007[1]

As a percentage of GDP Graph 1



[1] 2007–16 changes. The start/end of an arrow represents 2007/2016, respectively. [2] For South Africa, 2009–16 change. Data for China are not comparable with other jurisdictions and thus are not shown. Data are not available for Hong Kong SAR.

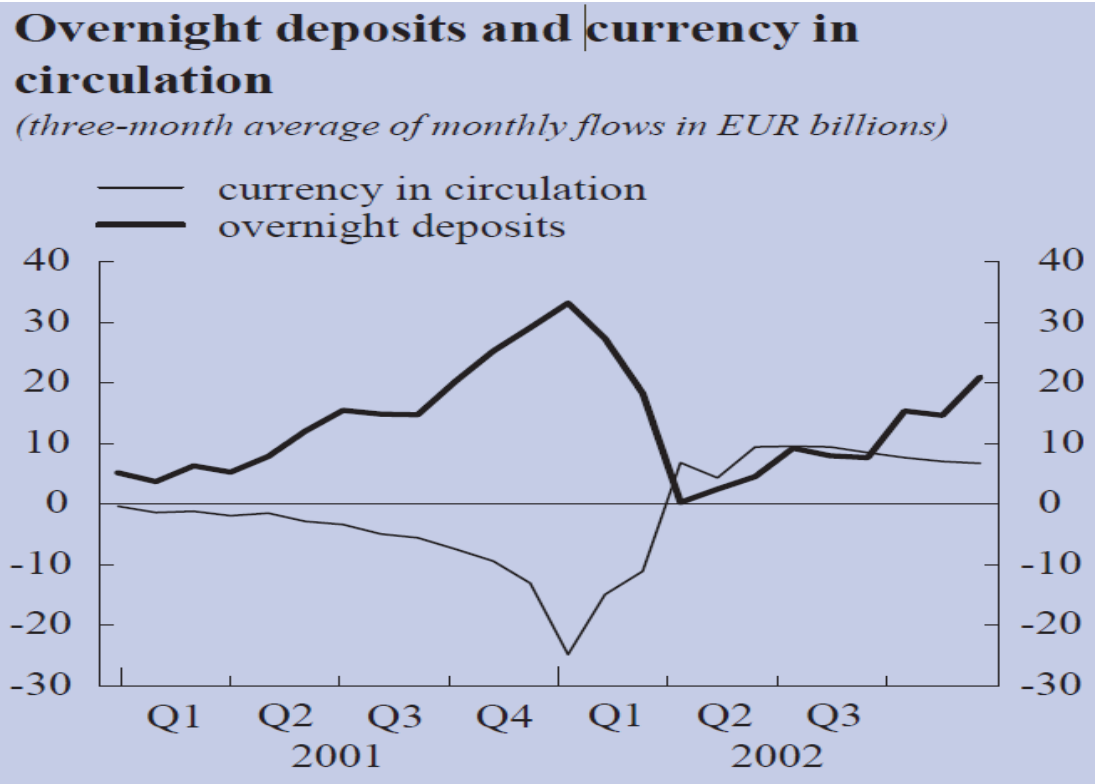
Source: BIS Quarterly Review, March 2018.

The Euro Changeover

- An interesting incident occurred in the run-up to the euro changeover in 2002. It is well known that most of cash in circulation reflects "hoarded" cash that is generally of high denominations.
- Imagine yourself in 2001, with a huge pile of 500 Deutsche Mark notes because you run what we might call "an informal business." Would you have fancied walking into a bank with in early 2002 to get the whole pile changed into euros?
- Hence, currency in circulation in the euro area gradually fell from €340 billion in January 2001 to €234 billion in December 2001 and then gradually recovered. Most of the cash taken out of circulation was deposited in banks.
- There was a big decline and then a big increase in the average value of banknotes in circulation. (See the article on the ECB webpage). The €500 note has been very popular with "informal" businesses.

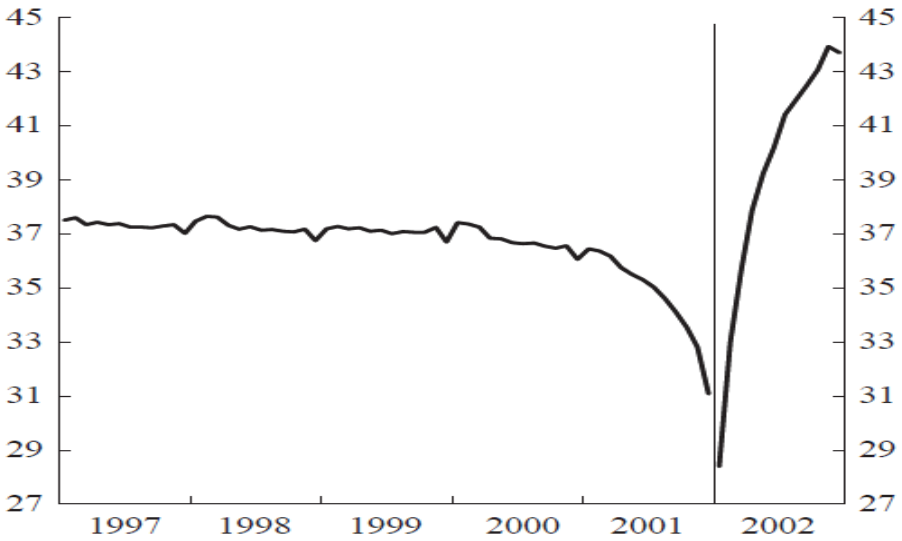
Decline in Currency Prior to Euro Changeover (Millions of Euros)

And a Big Increase in Bank Deposits



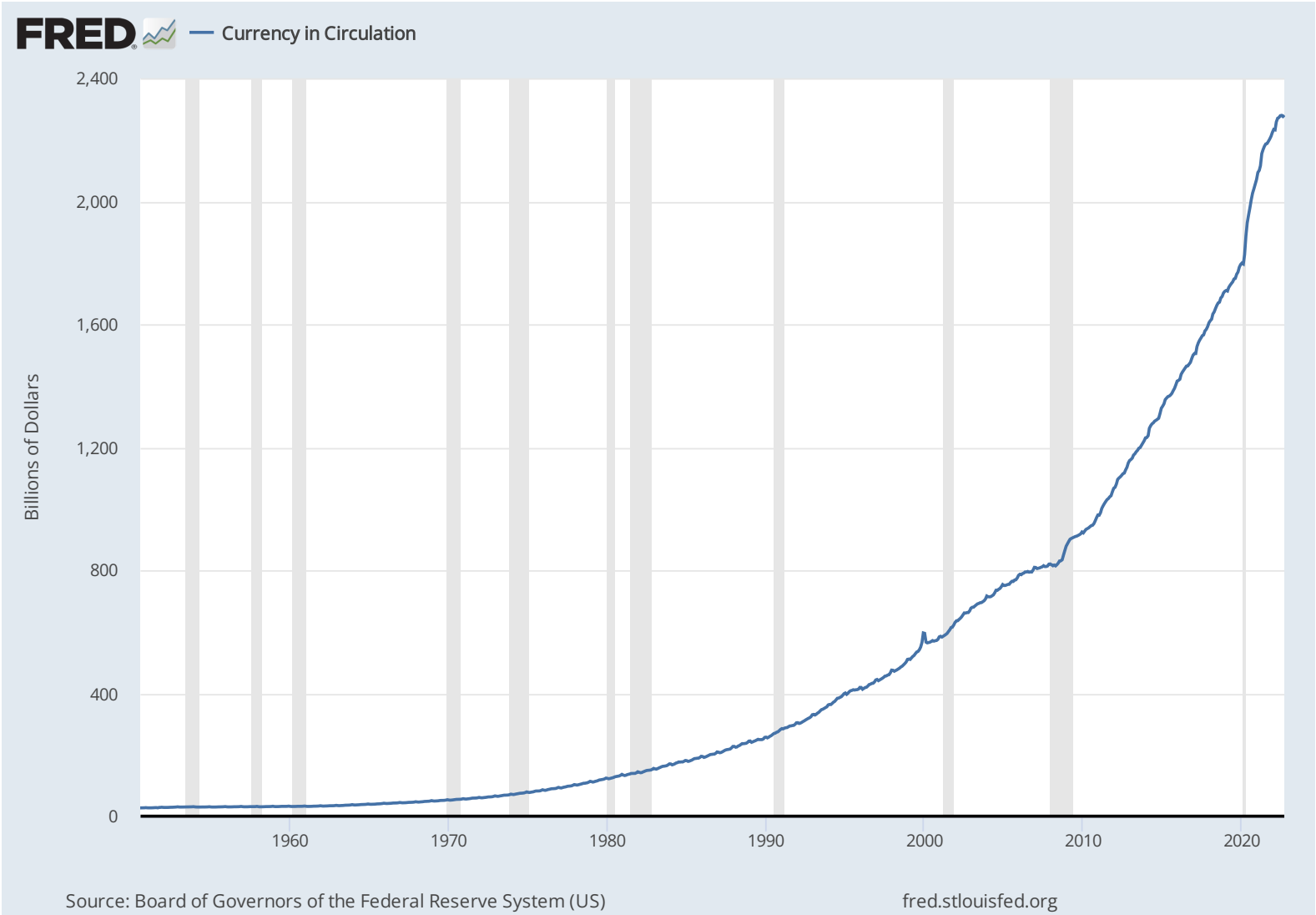
Big Swings in Average Value of Banknotes

Average banknote value in the euro area
(in EUR)

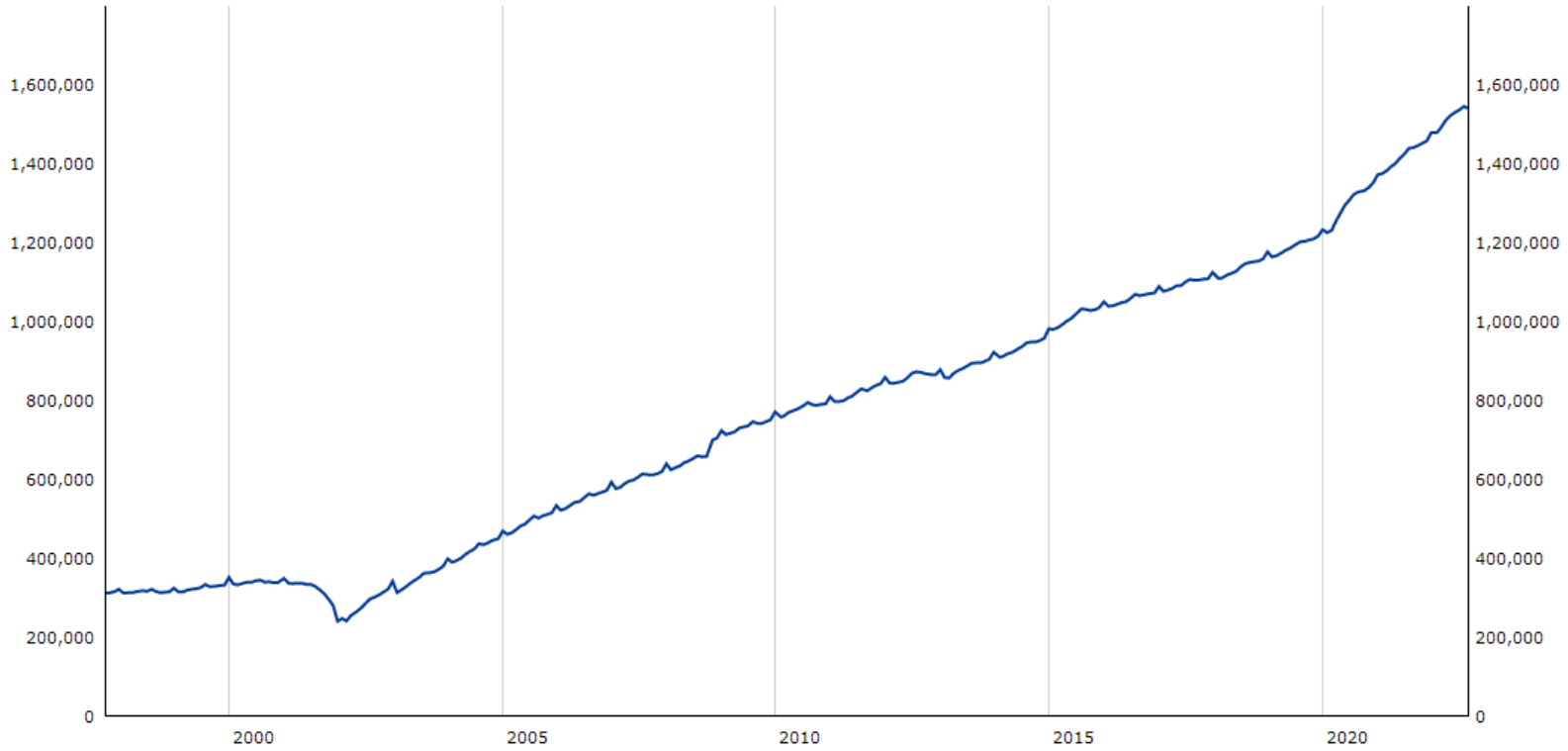


Source: ECB; partly estimated.
Note: For the period before 2002, euro legacy banknotes have been converted into euro (with the fixed conversion rates) and aggregated. From 1 January 2002 onwards, only EUR banknotes are taken into account.

Large Increase in US Currency in Circulation During the Pandemic

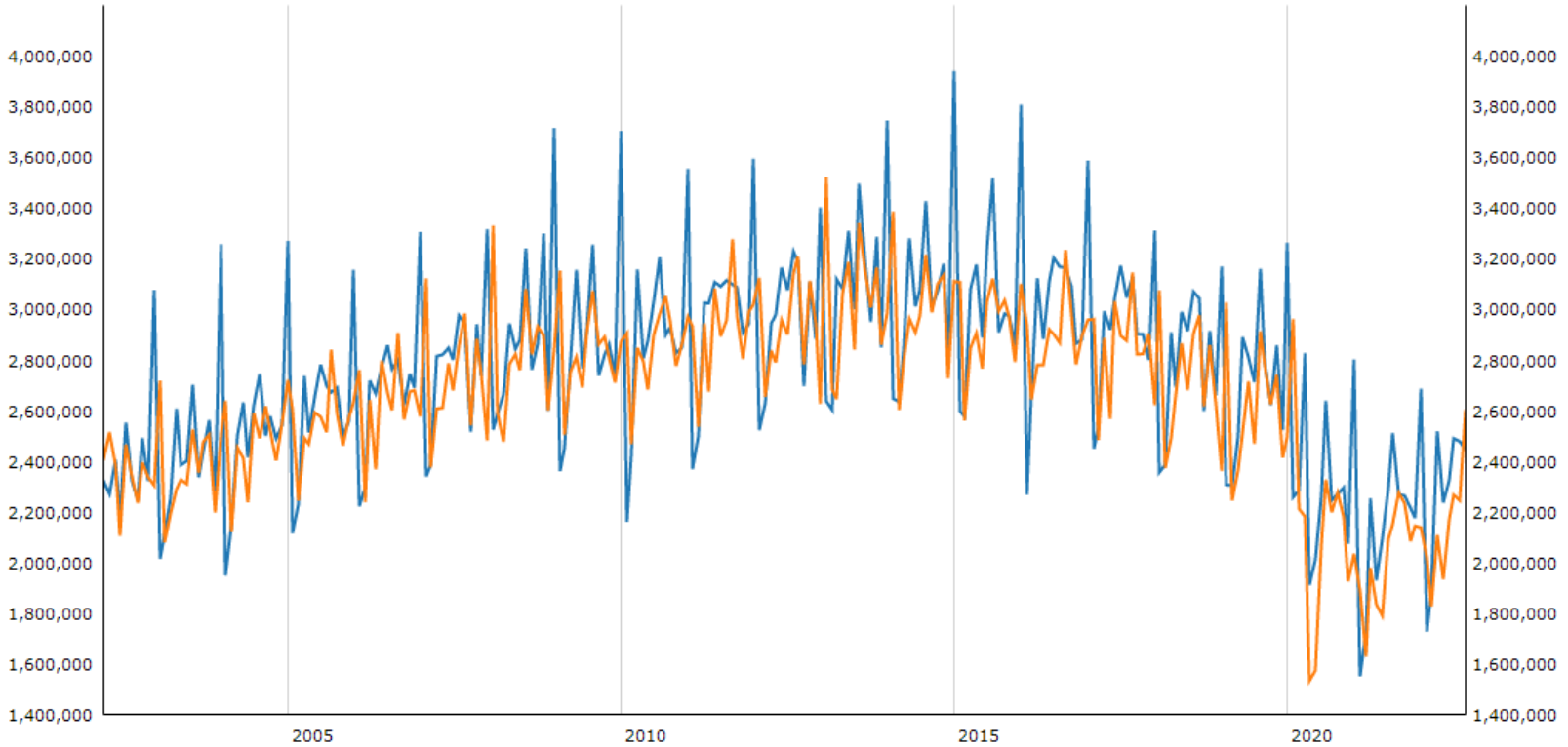


And Also in the Euro Area



Source: ECB Statistical Data Warehouse.

Caused By Fewer Returns of Banknotes, Not Increased Issuance (Issuance Was Down)



Source: ECB Statistical Data Warehouse.

Central Banks and the Money Supply

- We will now describe a simple model of how the central bank can control measures of the money supply such as M1, via controlling the monetary base. (We will point out problems with this model in the next lecture).
- Central Banks do not have a direct control over these aggregates. Here we will describe how monetarists saw the relationship between the quantity of reserves and the M1 measure of the money supply.
- Let's start by considering a very simple world where all banks are just starting up in business and don't yet have any sources of funds.
- Now suppose the Central Bank conducts an open market operation, buying a security so that deposits rise by \$100. When the cheque is deposited, the Central Bank increases the bank's reserves by \$100.
- The bank's balance sheet looks like this

First Bank's Balance Sheet			
Assets		**Liabilities**	
Reserves	100	Deposits	100
Loans	0		

Introducing Reserve Requirements

- Suppose also that reserve requirements are 10% of deposits.
- Let's assume the bank only wants to keep the minimum required level of reserves and uses the rest of its available funds to make loans, which earn a higher rate of return.
- The bank lends out \$90 and keeps the remaining \$10 in reserves.
- The bank's balance sheet now looks like this

First Bank's Balance Sheet			
Assets		**Liabilities**	
Reserves	10	Deposits	100
Loans	90		

Second Bank

- The person that received the \$90 loan from the first bank deposits the funds at a second bank, which sees their deposits and reserves both credited by \$90.
- This bank now starts life with a balance sheet that looks like this.

Second Bank's Balance Sheet			
Assets		**Liabilities**	
Reserves	90	Deposits	90
Loans	0		

- Note now that there are still \$100 of reserves in the system: \$10 at Bank A and \$90 at Bank B. Then Bank B decides to keep 10 percent of its deposits on reserves and loan out the rest, so its balance sheet looks like.

Second Bank's Balance Sheet			
Assets		**Liabilities**	
Reserves	9	Deposits	90
Loans	81		

Third Bank

- You can probably see what's coming next. The person that received the \$81 loan from the second bank deposits these funds at a third bank, which sees their deposits and reserves both credited by \$81.
- This bank now starts life with a balance sheet that looks like this.

Third Bank's Balance Sheet			
Assets		**Liabilities**	
Reserves	81	Deposits	81
Loans	0		

- Note again there are still \$100 of reserves in the system: \$10 at Bank A, \$9 at Bank B and \$81 at Bank C. Then Bank C decides to keep 10 percent of its deposits on reserves and loan out the rest, so its balance sheet looks like

Third Bank's Balance Sheet			
Assets		**Liabilities**	
Reserves	8.1	Deposits	81
Loans	72.9		

Multiple Deposit Creation: The Final Outcome

- And so on. When the process is finished, the addition of \$100 of reserves (remember the increase in reserves was always \$100) has been associated with an increase in deposits of

$$\$100 + \$90 + \$81 + ... = \$1000$$

- How did I do that sum? How do I know the sequence adds to \$1000?
- Let r be the reserve requirement ratio. After an initial increase of 1 in the monetary base, the subsequent increases are $1 - r$, $(1 - r)^2$, $(1 - r)^3$ and so on. So the total increase in the money supply is

$$1 + (1 - r) + (1 - r)^2 + (1 - r)^3 + ...$$

- Recall the multiplier formula. If $|c| < 1$ then $1 + c + c^2 + c^3 + ... = \frac{1}{1-c}$.
- So, the increase in deposits is $\frac{1}{1-(1-r)} = \frac{1}{r}$ times the initial increase.
- We shouldn't be too surprised. The Central Bank added \$100 in reserves and each bank sets reserves equal to ten percent of deposits. The equilibrium involves an increase in deposits that is ten times the increase in reserves.

The Money Multiplier

- The **money multiplier** is the ratio of the money supply to the monetary base. In this simple example, it equals $\frac{1}{r}$.
- The money multiplier is often mis-interpreted.
- In our example, the central bank starts by increasing deposits by \$100 and the actions of the banking system end up increasing deposits by \$1000.
- People sometimes think that individual banks are somehow able to take in \$100 and then make an additional \$900 in loans from this, creating funds out of nowhere. This would be fraud—lending funds they didn't have.
- That is not what happens. Go back and look at the example: In each case, banks lend 90 percent of their deposits and retain the rest. They don't lend out amounts above those provided to them by depositors, which is their role as financial intermediaries.
- When a person deposits \$100 in cash in a bank, that bank can lend at most an additional \$100. However, the fact that we have a fractional-reserve system means that with a reserve requirement of 10 percent, reserves of \$100 are consistent with total deposits of \$1000. Remember, you knew this even before you saw the money multiplier.

Lending via Crediting Deposits Within the Institution

- In our example, the money the bank loans to people is directly deposited in a different bank.
- This is how some of the most important types of loans usually work.
  - **Mortgages**: When banks provide a mortgage loan to purchase a property, the money is usually sent to a third party who then ensures the seller obtains the funds and that the buyer obtains the legal deeds for the property. The terminology for this third party differs across the world: In Ireland or the UK it is a solicitor representing the buyer in the US it as an "escrow agent."
  - **Car Loans** are commonly issued directly to dealerships selling the cars with the bank obtaining a title deed for the car.
- However, in some cases, such as personal loans, banks often issue the loans by crediting an account the borrower has with the bank issuing the loan.
- There has been some discussion—including a relatively well-known Bank of England paper—of whether this means the money multiplier story that we have just described is somehow invalidated by this. In reality, however, this point makes no real difference.

Balance Sheet with Deposits Staying Within the Bank

- In our previous example, the money the bank loans to people is directly deposited in a different bank. If the Bank A credited an account the borrower had with the bank, their balance sheet would become.

First Bank's Balance Sheet			
Assets		**Liabilities**	
Reserves	100	Deposits	190
Loans	90		

- This looks different from before but the end outcome would be the same.
  - Most loans that are issued are for the purposes of spending on particular things: Why take out a loan just to leave it sitting in the bank on deposit, since this will lose you money? So the money gets spent and ends up in deposit accounts with other banks.
  - And if, for whatever reason, the loaned money remained in the bank as deposits, then a bank choosing to meet the minimum reserve requirement (as is assumed here) can use these reserves to make new loans, just as we assumed other banks did in the example.

Banks Are Financial Intermediaries

- Some claim the fact that banks can issue loans by crediting an account the borrower has with the same bank is a radical one which overturns the idea that banks are financial intermediaries.
- People who adopt this position say "Banks don't need to get funds from depositors or elsewhere to make loans, they can simply create the money from nowhere. So they are not really financial intermediaries."
- This thinking misses the next thing that happens after the customer gets the funds deposited in their account. They spend it on a car or house or whatever, so the money comes out of the bank reducing its stock of reserves. Only the original customer deposits remain with the bank.
- An important question for those who believe banks can just create as much credit as they want: Why do banks sometimes go to great effort to issue interest-bearing bonds to obtain funding for their activities? This line of thinking suggests there is no need for that.
- Credits to customers for the purposes of providing them with a loan will only ever be a small percentage of bank's funding. And this funding is not stable – people take out the loans to spend them on stuff.

Incorporating Currency and Excess Reserves

- The previous example did not allow for the possibility that some of the loan proceeds would be withdrawn as currency rather than just re-deposited in the banking system. Now assume currency is a constant fraction c of deposits, $C = cD$.
- It also assumed banks would maintain a reserve ratio of r. Banks may want to hold more reserves for precautionary reasons. Assume now that reserves are $R = (r + e)D$.
- The monetary base is

$$MB = R + C = (r + e + c)D$$

- The M1 money supply is

$$M1 = D + C = (1 + c)D$$

- The money multiplier is thus

$$m = \frac{M1}{MB} = \frac{1 + c}{r + e + c}$$

- The money multiplier gets smaller as get bigger. It also gets smaller as c gets bigger provided $r + e < 1$ (which it will be).

Friedman and Schwartz on the Great Depression

- Through careful collection of data that had not been previously available, Friedman and Schwartz's famous 1963 study "A Monetary History of the United States, 1867-1960" showed that e and c had increased during the Great Depression and that there had been a sharp decline in the money multiplier.
- The underlying cause was a banking crisis which lead to a lack of confidence in banks.
- Depositors withdrew money from banks they viewed as perhaps not being safe, preferring to keep it as cash, and banks needed to keep large stocks of reserves, in case they were hit by a bank run.
- The Federal Reserve during the 1930s did not collect detailed monetary statistics and had not been aware that the money supply was sharply contracting.
- Friedman and Schwartz attributed the decline in activity to the sharp contraction of the money supply.

Why the Money Multiplier Contracted During the Great Depression

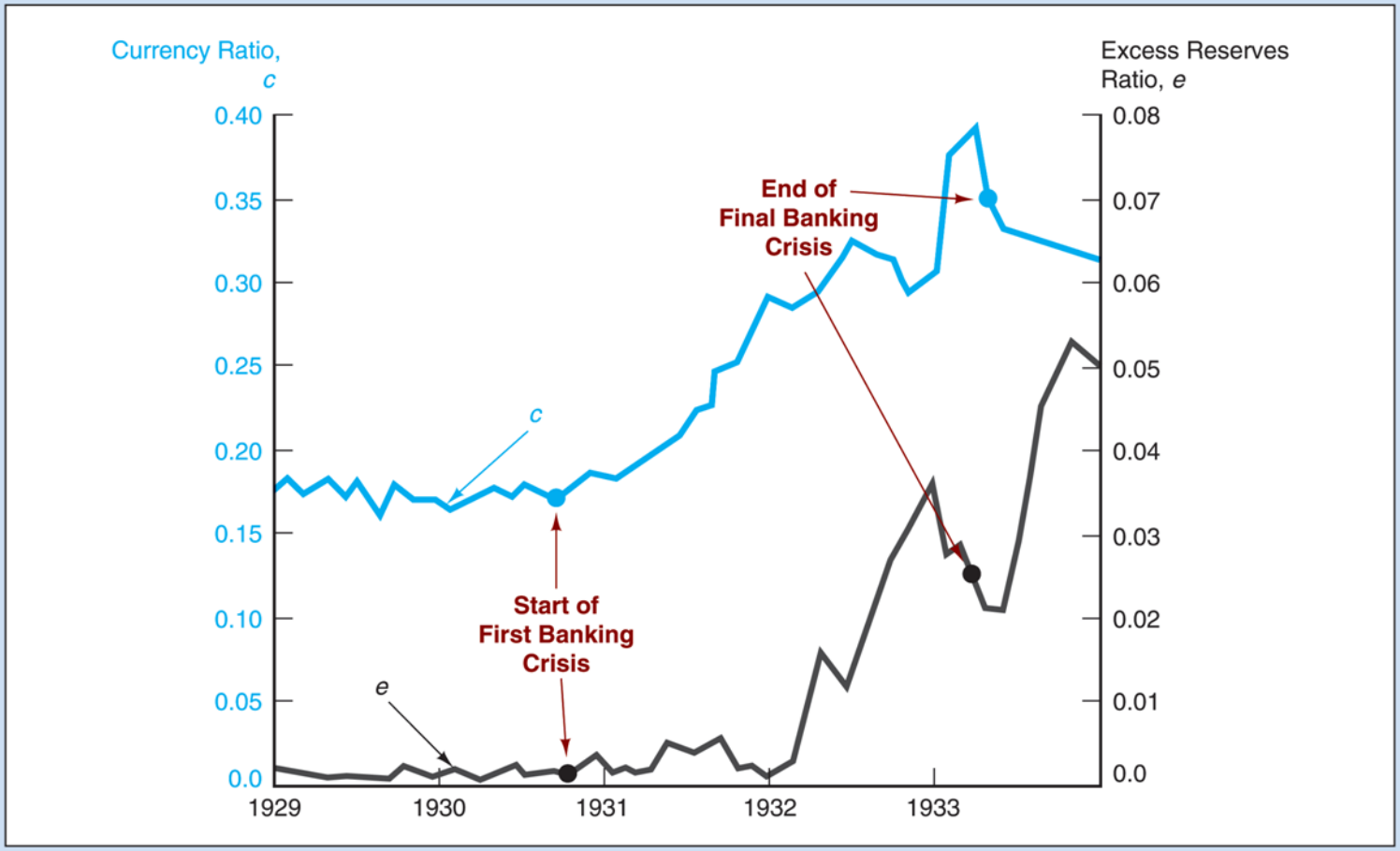


FIGURE 5 **Excess Reserves Ratio and Currency Ratio, 1929–1933**

Sources: Federal Reserve *Bulletin*; Milton Friedman and Anna Jacobson Schwartz, *A Monetary History of the United States, 1867–1960* (Princeton, N.J.: Princeton University Press, 1963), p. 333.

Section 3 Example: The Money Multiplier

Consider an economy where the ratio of required reserves to bank deposits is $r = 0.15$, *the ratio of currency holdings to deposits is* $c = 0.2$ *and the ratio of bank excess reserves to deposits is* $e = 0.25$. *Show how to calculate the value of the M1 money multiplier predicted by the money multiplier model.*

- The money multiplier is given by

$$m = \frac{M1}{MB} = \frac{1 + c}{r + e + c}$$

- Plugging in $r = 0.15$, $c = 0.2$ and $e = 0.25$, we get

$$m = \frac{M1}{MB} = \frac{1.2}{0.15 + 0.25 + 0.2} = \frac{1.2}{0.6} = 2$$

Section 3 Example: Calculating the Money Supply

Consider an economy where the ratio of required reserves to bank deposits is $r = 0.15$, *the ratio of currency holdings to deposits is* $c = 0.2$, *the ratio of bank excess reserves to deposits is* $e = 0.25$ *and the monetary base is 100. Show how to calculate the value of the M1 measure of the money supply.*

- Plugging in $r = 0.15$, $c = 0.2$ and $e = 0.25$ into the money multiplier formula, we get

$$m = \frac{M1}{MB} = \frac{1+c}{r+e+c} = \frac{1.2}{0.15+0.25+0.2} = \frac{1.2}{0.6} = 2$$

- The M1 money supply is

$$M1 = m * MB = 2 * 100 = 200$$

Key Points

1. Definitions of M0 (monetary base) and M1.
2. Events in which demand for currency changed.
3. Determinants of the demand for currency.
4. Trends in the use of cash and cards for payment.
5. Basic and expanded models of the money multiplier.
6. Procedures banks use to issue loans.
7. How banks creating deposits within their own bank affects the money multiplier.
8. The behaviour of the money multiplier during the Great Depression.