

The background features a dark blue color with several light blue circular patterns. On the left side, there is a large circular scale with tick marks and numbers ranging from 140 to 260. Other smaller circles with arrows and dashed lines are scattered across the background, creating a technical or scientific aesthetic.

MONETARY POLICY AND THEORY

KITTICHAISAELEE
FACULTY OF ECONOMICS
THAMMASAT UNIVERSITY

MEASURING MONEY AGGREGATE

- What is money?
 - Medium of exchange / means of payment
 - **Store of value**
 - Unit of value
 - Legal tender (lawfully mean of payment)
- Money serves as an **asset**; many assets **are closely resemble** to money. (near-money-asset)

MEASURING MONEY AGGREGATE

- How do we measure money? Which **particular assets** can be called “**money**”?
- What are the **criteria** used to justify **their moneyness**?

MEASURING MONEY AGGREGATE

- Whilst varies across countries, the construction of monetary aggregates mostly hinges on the concept of **liquidity***:
 - **M1 (most liquid assets)** = currency + traveler's checks + demand deposits + other checkable deposits = **outside money + highly liquid inside money****.

*Yueh-Yun C. O'Brien (2007) "*Measurement of Monetary Aggregates across Countries*" FED working paper

** **Outside money** = Money created by state (legal tender!)

Inside money = asset that is closely resemble to money created by financial innovations, e.g. Bank deposits.

MEASURING MONEY AGGREGATE

- Possible criteria used for classifying money – e.g. see details in Yueh-Yun C. O'Brien
 - **Degree of liquidity**
 - The size of the denomination or minimum deposits
 - The original maturity of the deposits
 - The characteristics of the asset holders
 - Foreign currency denominated deposits
 - The types of money issuers
 - The types of financial institutions
 - The scope of money holders
 - Location of depository institutions

MEASURING MONEY AGGREGATE

- **M2** (adds to M1 other assets that are not so liquid) = M1 + small denomination time deposits + savings deposits and money market deposit accounts + money market mutual fund shares

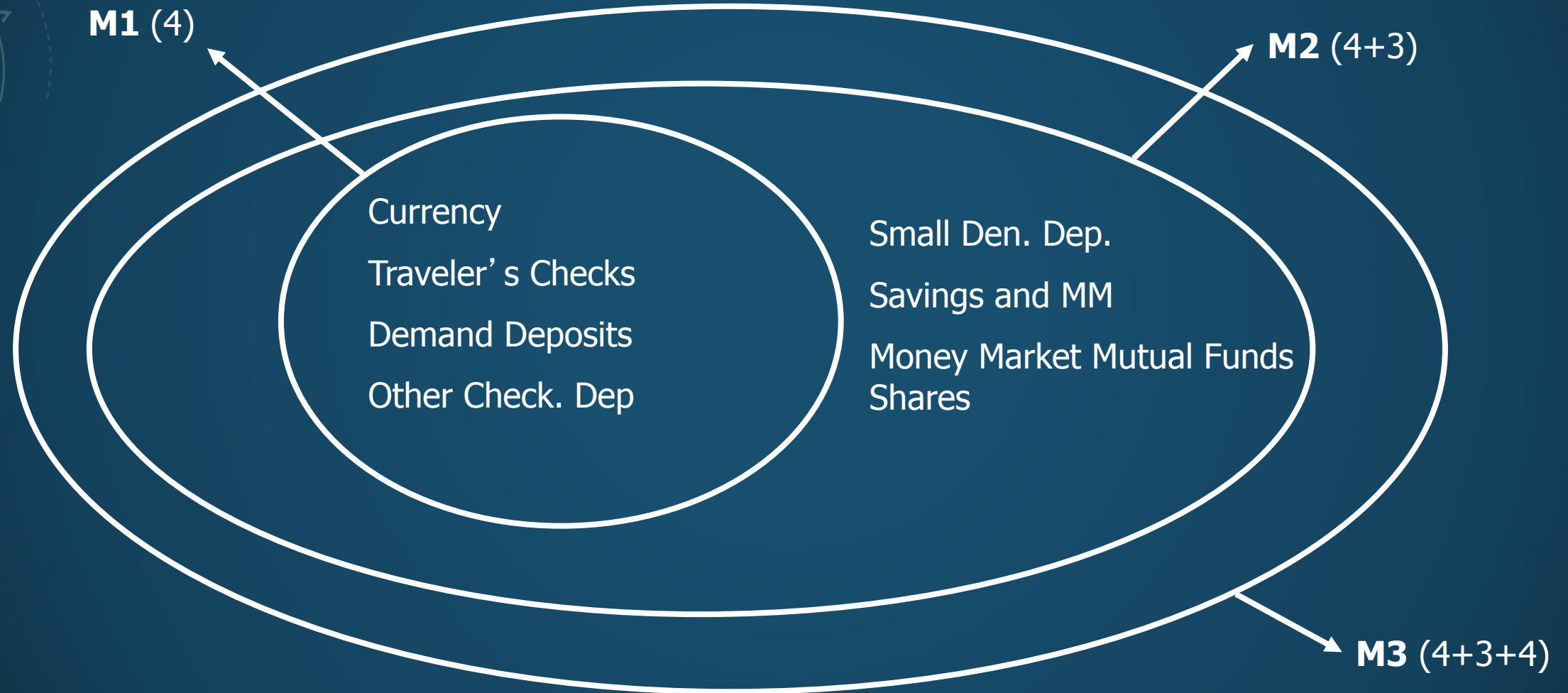
THE FEDERAL RESERVE'S MONETARY AGGREGATES

TABLE 1 Measures of the Monetary Aggregates

	Value as of August 18, 2014, (\$ billions)
M1 = Currency	1,206.1
+ Traveler's checks	3.3
+ Demand deposits	1,089.9
+ Other checkable deposits	<u>477.4</u>
Total M1	2,776.7
M2 = M1	
+ Small-denomination time deposits	533.0
+ Savings deposits and money market deposit accounts	7,338.2
+ Money market mutual fund shares (retail)	<u>642.5</u>
Total M2	11,290.4

Source: <http://www.federalreserve.gov/releases/h6/hist>.

THE FEDERAL RESERVE'S MONETARY AGGREGATES



THE BANK OF THAILAND MONETARY AGGREGATES

- Narrow Money (M₁):
 - Currency outside Depository Corporations and Central Government = banknotes in circulation and coin in circulation less currency held by depository corporations and central government.
 - **Demand Deposits** at Depository Corporations refer to transferable deposits or current deposits in national currency of money holders placed at depository corporations.

THE BANK OF THAILAND MONETARY AGGREGATES

- Quasi Money comprises:
 - Foreign Currency Deposits placed at depository corporations. i.e. commercial and specialized banks, as well as promissory notes issued by finance companies, inclusive of accrued interests.
 - Other Deposits at Depository Corporations in national currency, net asset value of money market mutual fund of money holders placed at depository corporations, i.e. commercial and specialized banks, as well as promissory notes issued by finance companies, inclusive of accrued interests.
 - Securities other than Shares refer to negotiated certificate of deposit issued by **depository corporations** and bill of exchange issued by **commercial banks** that are held by money holders, inclusive of accrued interests.

THE BANK OF THAILAND MONETARY AGGREGATES

- Broad Money M₂

Broad Money comprises of the sum of narrow money and quasi money

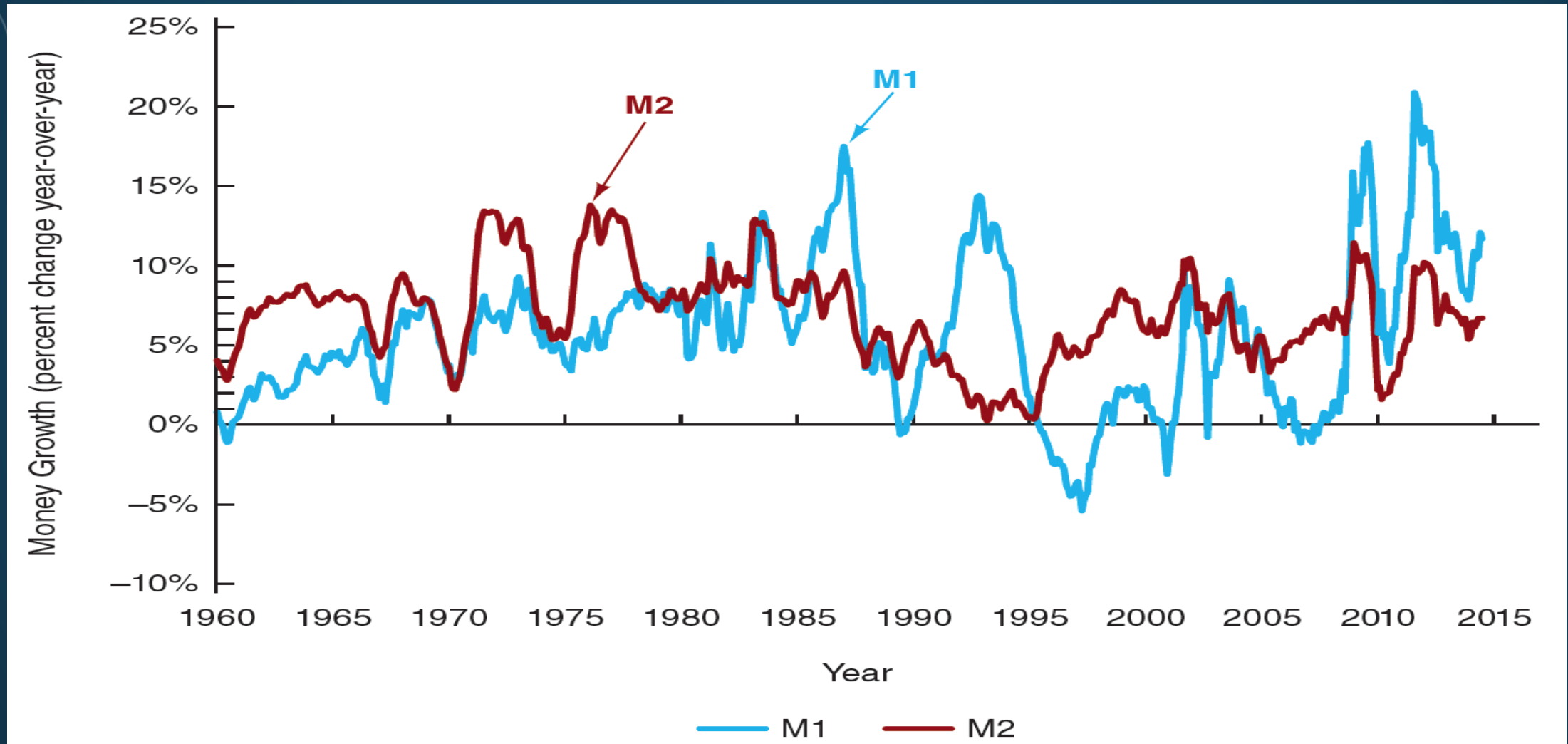
ECB MONETARY AGGREGATE

Components of Major Aggregates	Definition of Each Component
M1 (Narrow Money)	Sum of the following two components.
(1) Currency in Circulation	Notes and coins issued by money issuers held by private non-MFI residents located in and outside the EMU.
(2) Overnight and Similar Deposits	Deposits which can be converted into currency or used for cashless payments.
M2 (Intermediate Money)	M1 plus non-M1 component of M2.
Non-M1 Component of M2	Sum of the following two components.
(1) Short-term Saving Deposits	Deposits redeemable at a period of notice up to 3 months.
(2) Short-term Time Deposits	Deposits with an agreeable maturity of up to 2 years.
M3 (Broad Money)	M2 plus marketable instruments issued by MFIs.
Marketable Instruments Issued by Monetary Financial Institutions (MFIs)	Sum of the following three components.
(1) Money market fund shares and units (MMMFs)	Excluding shares and units held by MFIs, CGs, and non-euro area residents.
(2) Repurchase Agreements (RPs)	RP liabilities of the MFIs with the money-holding sector
(3) Debt securities with an original maturity of up to 2 years	Liabilities of MFIs held by the money-holding sector

WHY DO WE NEED VARIOUS MEASUREMENTS OF MONETARY AGGREGATES

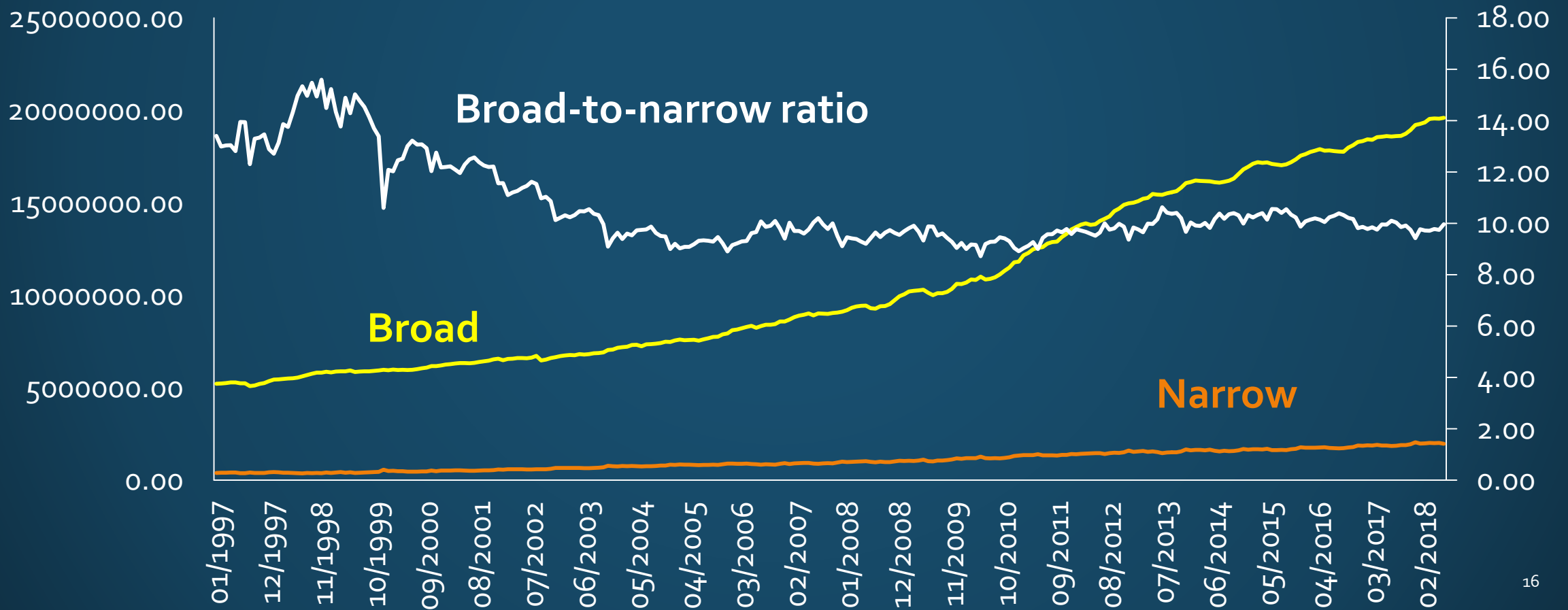
- M₁ versus M₂: Does it matter which measure of money is considered?
 - M₁ and M₂ can move in **different directions** in the short run (see figure).
 - Some choices of monetary aggregate can be **a better leading indicator** than the other – e.g. containing more useful information.
- Conclusion: **the choice of monetary aggregate is important for policymakers.**

FIGURE 1 GROWTH RATES OF THE M₁ AND M₂ AGGREGATES, 1960–2014

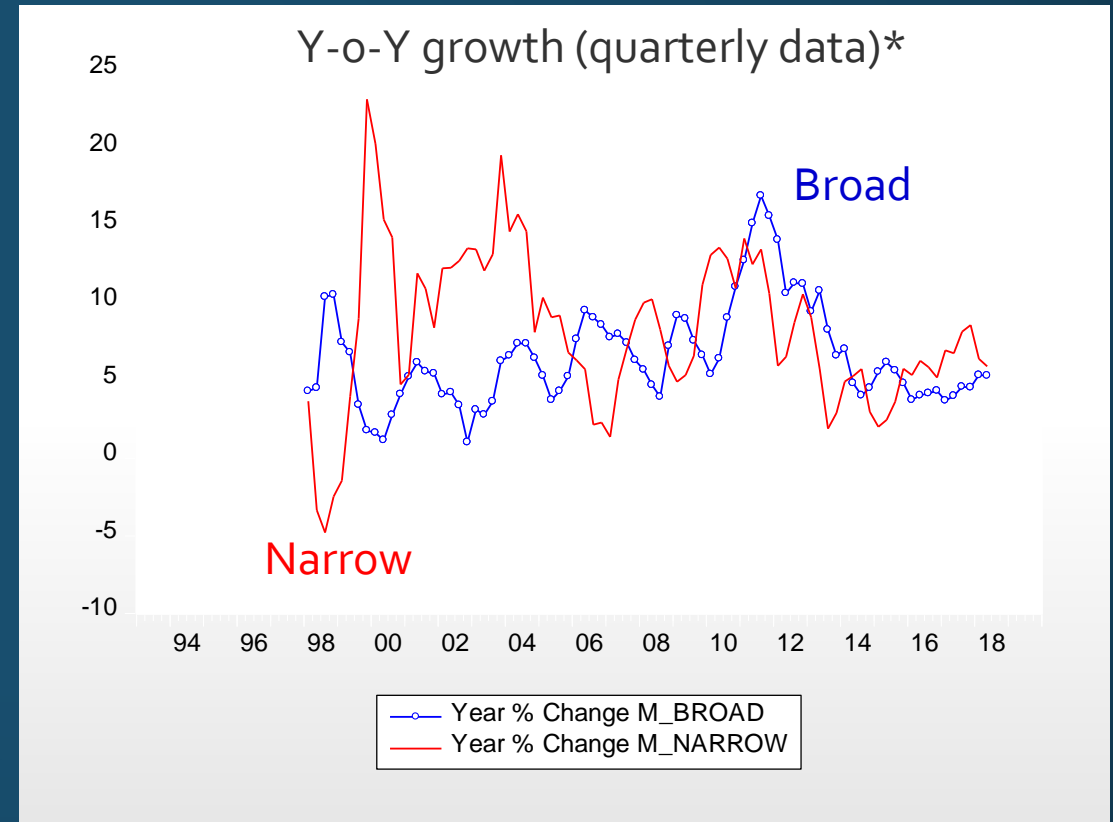


THAILAND MONETARY AGGREGATES

Thailand Monetary aggregates (monthly)



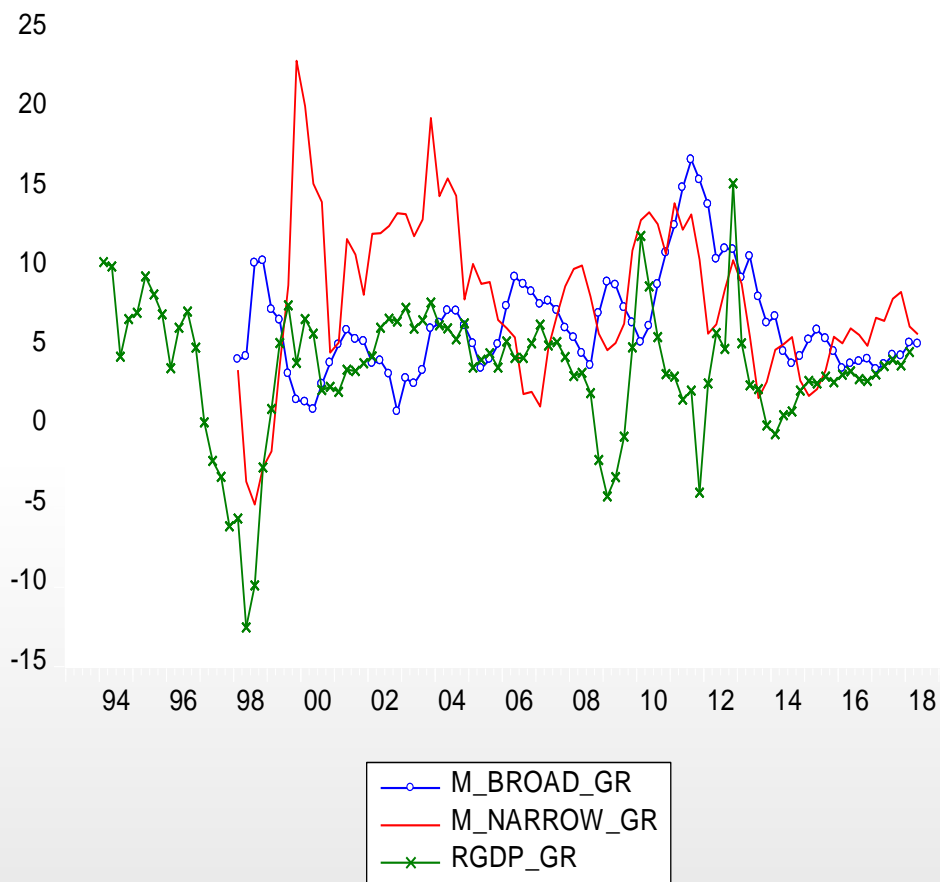
THAILAND MONETARY AGGREGATES



* Quarterly = average monthly series in the quarter.

	Full-sample	2000 onwards
Correlation	-0.17139	-0.08699

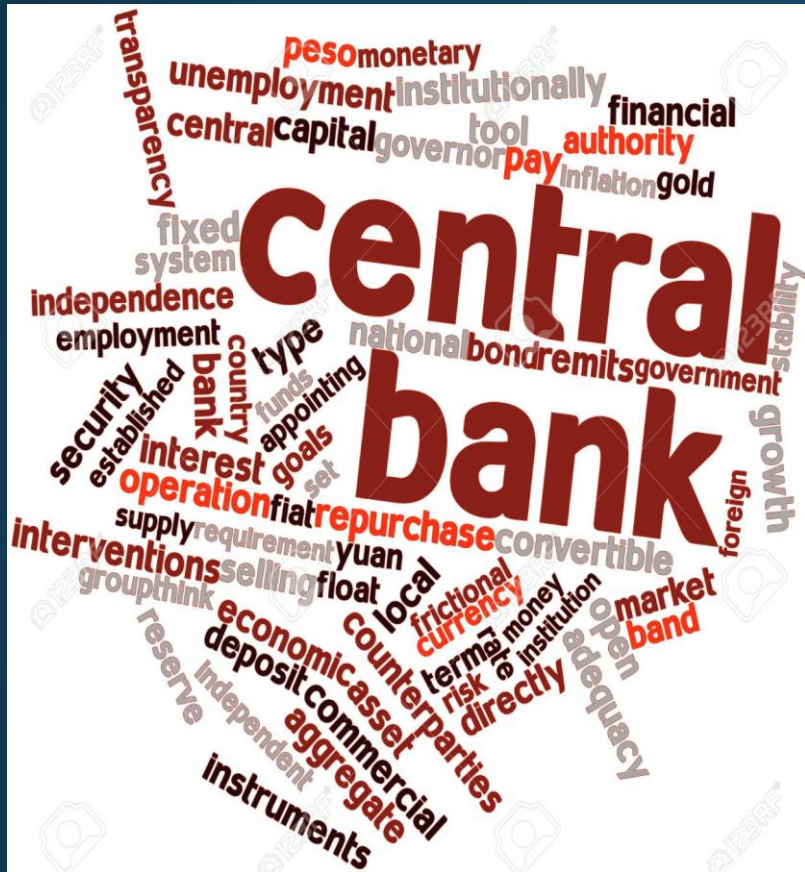
THAILAND MONETARY AGGREGATE: STATISTICAL BEHAVIOR



	GDP growth	
	broad	narrow
Full-sample	-0.1755 p-value = 0.1171	0.560125 p-value = 0
2000 onwards	-0.20014 p-value = 0.0896	0.432183 p-value = 0.0001

Date: 08/20/18 Time: 14:09 Sample: 2000Q1 2018Q1 Included observations: 73 Correlations are asymptotically consistent approximations					Date: 08/20/18 Time: 14:06 Sample: 2000Q1 2018Q1 Included observations: 73 Correlations are asymptotically consistent approximations				
M_BROAD_GR,RGDP_...	M_BROAD_GR,RGDP_...	i	lag	lead	M_NARROW_GR,RGDP_...	M_NARROW_GR,RGDP_...	i	lag	lead
		0	-0.2001	-0.2001			0	0.4322	0.4322
		1	-0.1537	-0.1585			1	0.4262	0.2973
		2	0.0007	-0.0765			2	0.2866	0.1221
		3	0.0456	0.0401			3	0.1350	0.0153
		4	0.0867	0.0693			4	0.0818	0.0621
		5	0.1223	0.0153			5	0.0907	0.0927
		6	0.0432	-0.0979			6	0.0533	0.1543
		7	-0.0207	-0.2180			7	-0.0232	0.2953
		8	-0.0973	-0.3271			8	-0.1338	0.3295
		9	-0.1643	-0.3917			9	-0.1775	0.4062
		10	-0.1678	-0.4422			10	-0.1340	0.3762
		11	-0.1485	-0.4183			11	-0.0793	0.2403
		12	-0.1229	-0.2995			12	-0.0407	0.1020
		13	-0.1054	-0.1615			13	-0.0866	-0.0316

Which one is better is to be discussed in the later chapter.¹⁸



AGENDA

- Measuring money aggregate
- **Interplay of agents and Central bank's balance sheet**
- Deposit creation and money multiplier
- Case study: QEs

Reading: Chapter 15. This chapter provides an overview of how commercial banks create deposits and describes the basic principles of the money supply creation process

THREE PLAYERS IN THE MONEY SUPPLY PROCESS

- **Money supply process:** central bank's intervention that procedurally causes the change in money supply level.
- This involves three players:
 1. **The Central bank:** Federal Reserve System, BOT, and etc.
 2. **Banks:** depository institutions; financial intermediaries
 3. **Depositors:** individuals and non-financial institutions

CENTRAL BANK'S BALANCE SHEET: SIMPLIFIED

Central bank	
Assets	Liabilities
Securities	Currency in circulation
Loans to Financial Institutions	Reserves

- **Liabilities**

- **Currency in circulation:** in the hands of the public
- **Reserves:** bank deposits at the Fed and vault cash

- **Assets**

- **Government securities:** holdings by the Fed that affect money supply and earn interest
- **Discount loans:** provide reserves to banks and earn the discount rate

CONTROL OF THE MONETARY BASE

- **Monetary base (high-powered money) =**

Currency + Bank reserve = $C + R =$ *Central bank's liabilities*

- **High controllability**
- Change in the level of money is **always associated** with the change in monetary base.
 - **High predictability**

OPEN MARKET PURCHASE FROM A BANK

Banking System		Federal Reserve System	
Assets	Liabilities	Assets	Liabilities
Securities	-\$100m	Securities	+\$100m
Reserves	+\$100m	Reserves	+\$100m

- Suppose Central bank (CB) initiates an **OMO purchase**
- Net result is that reserves have increased by \$100
- No change in currency
- **Monetary base has risen by \$100**

OPEN MARKET PURCHASE FROM THE NONBANK PUBLIC

Banking System			
Assets		Liabilities	
Reserves	+\$100m	Checkable deposits	+\$100m

Federal Reserve System			
Assets		Liabilities	
Securities	+\$100m	Reserves	+\$100m

- Person selling bonds to the Fed deposits the Fed's check in the bank
- Identical result as the purchase from a bank

OPEN MARKET PURCHASE FROM THE NONBANK PUBLIC

Nonbank Public	
Assets	Liabilities
Securities -\$100m	
Currency +\$100m	

Federal Reserve System			
Assets		Liabilities	
Securities +\$100m		Currency in circulation	+\$100m

- The person selling the bonds cashes the Fed's check
- Reserves are unchanged
- Currency in circulation increases by the amount of the open market purchase
- **Monetary base increases by the amount of the open market purchase**

OPEN MARKET PURCHASE: SUMMARY

- The effect of an open market purchase on reserves depends on whether the seller of the bonds **keeps** the proceeds from the sale in **currency** or in **deposits**.
- The effect of an open market purchase on the **monetary base** **always** increases the monetary base by the amount of the purchase.
 - **Highly controllable...**

OPEN MARKET SALE

Nonbank Public	
Assets	Liabilities
Securities +\$100m	
Currency -\$100m	

Federal Reserve System	
Assets	Liabilities
Securities -\$100m	Currency in circulation -\$100m

- Reduces the monetary base by the amount of the sale
- Reserves remain unchanged
- The effect of open market operations on the monetary base is much more certain than the effect on reserves.

SHIFTS FROM DEPOSITS INTO CURRENCY

Nonbank Public	
Assets	Liabilities
Checkable deposits	-\$100m
Currency	+\$100m

Banking System			
Assets		Liabilities	
Reserves	-\$100m	Checkable deposits	-\$100m

Federal Reserve System		
Assets	Liabilities	
	Currency in circulation	+\$100m
	Reserves	-\$100m

- Net effect on monetary liabilities is zero
- Reserves are changed by random fluctuations
- **Monetary base is a relatively stable variable**

LOANS TO FINANCIAL INSTITUTIONS

Banking System	
Assets	Liabilities
Reserves +\$100m	Loans +\$100m
	(borrowing from Fed)

Federal Reserve System	
Assets	Liabilities
Loans +\$100m	Reserves +\$100m
(borrowing from Fed)	

- Monetary liabilities of the Fed have increased by \$100
- Monetary base also increases by this amount

OTHER FACTORS THAT AFFECT THE MONETARY BASE

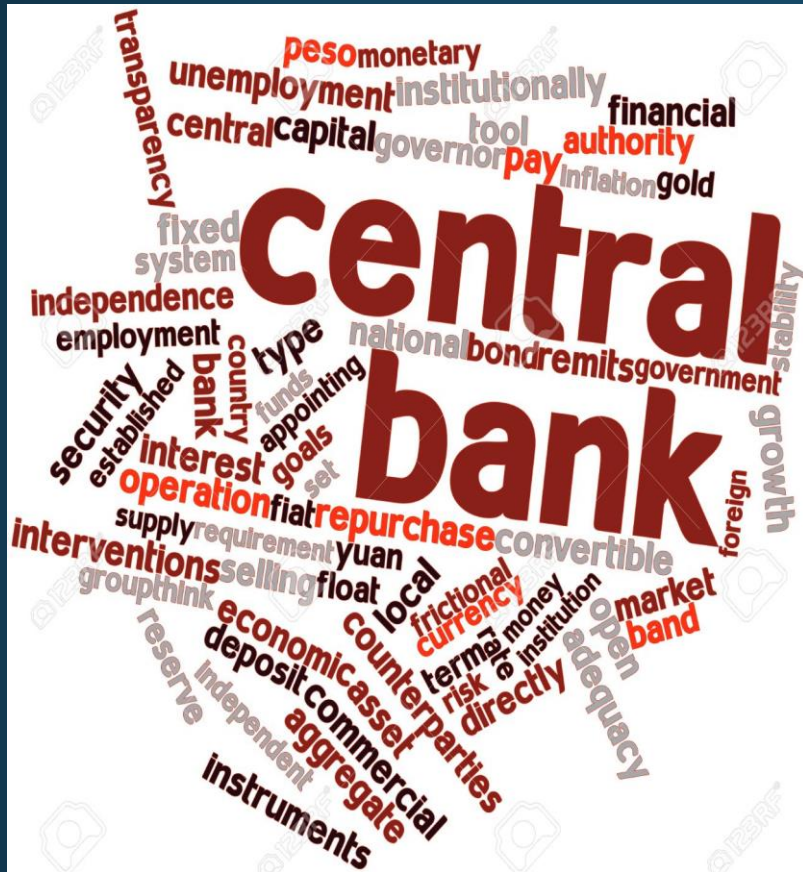
- Float
- Treasury deposits at the Federal Reserve
- **Interventions in the foreign exchange market**

EMERGING MARKET CENTRAL BANKS' BALANCE SHEET: SIMPLIFIED

Central bank	
Assets	Liabilities
Domestic Securities	Currency in circulation
Loans to Financial Institutions	Reserves
Foreign reserves - Gold / IMF SDR - Foreign currency-denominated assets.	

- Foreign market interventions might be of little important item in the balance sheet of FED
- **Foreign reserves item is very important for most emerging countries**
- $MB = C + R (= \text{liabilities})$
 $= DS + \text{Loans} + FR (= \text{assets})$

Rank ↕	Country ↕	Forex reserves (ex. gold) (in million of US\$) ↕	As of ↕
1	 China	3,142,820	Mar 2018 ^{[2][1]}
2	 Japan	1,268,300	Mar 2018 ^{[3][1]}
3	 Switzerland	737,806	Mar 2018 ^[4]
4	 Saudi Arabia	487,259	Feb 2018 ^[1]
5	 Russia	463,800	April 2018 ^{[5][1]}
6	 Taiwan ^[6]	457,190	Mar 2018 ^[7]
7	 Hong Kong	440,300	Mar 2018 ^{[8][1]}
8	 India	423,580	April 2018 ^{[9][10][1][11]}
9	 South Korea	396,750	Mar 2018 ^{[12][1]}
10	 Brazil	379,577	Mar 2018 ^{[13][1]}
24	 Eurozone	63,120	Mar 2018 ^[1]
11	 Singapore	282,921	Mar 2018 ^{[14][1]}
12	 Thailand	215,614	Mar 2018 ^{[15][1]}
13	 Mexico	177,615	Feb 2018 ^{[16][1]}
14	 United Kingdom	164,209	Mar 2018 ^[1]



AGENDA

- Measuring money aggregate
- Interplay of agents and Central bank's balance sheet
- **Deposit creation and money multiplier**
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Reading: Chapter 15. This chapter provides an overview of how commercial banks create deposits and describes the basic principles of the money supply creation process

OVERVIEW OF THE FED'S ABILITY TO CONTROL THE MONETARY BASE

- Accounting principle suggests that

$$\begin{aligned} \text{MB} &= \text{C} + \text{R} (= \text{liabilities}) \\ &= \text{DS} + \text{Loans} + \text{FR} (= \text{assets}) \end{aligned}$$

- **DS**: Open market operations are controlled by the Fed (central bank).
- **FR**: Foreign market operations (buy and sell foreign currency/assets)
- **Loans**: The Fed cannot determine the amount of borrowing by banks from the Fed.

OVERVIEW OF THE FED'S ABILITY TO CONTROL THE MONETARY BASE

- Split the monetary base into two components:

$$MB_n = MB - BR$$

- The money supply is positively related to both the **non-borrowed monetary base** MB_n and to the level of **borrowed reserves**, BR , from the Fed.

MULTIPLE DEPOSIT CREATION: A SIMPLE MODEL

Deposit Creation: **Single Bank**

First National Bank	
Assets	Liabilities
Securities -\$100m	
Reserves +\$100m	

First National Bank	
Assets	Liabilities
Securities -\$100m	Checkable +\$100m deposits
Reserves +\$100m	
Loans +\$100m	

- Excess reserves increase
- Bank loans out the excess reserves
- Creates a checking account
- Borrower makes purchases
- The Money supply has increased

First National Bank	
Assets	Liabilities
Securities -\$100m	
Loans +\$100m	

MULTIPLE DEPOSIT CREATION: A SIMPLE MODEL

Deposit Creation: **The Banking System**

Bank A				Bank A			
Assets		Liabilities		Assets		Liabilities	
Reserves	+\$100m	Checkable deposits	+\$100m	Reserves	+\$10	Checkable deposits	+\$100m
				Loans	+\$90		

Bank B				Bank B			
Assets		Liabilities		Assets		Liabilities	
Reserves	+\$90	Checkable deposits	+\$90	Reserves	+\$9	Checkable deposits	+\$90
				Loans	+\$81		

TABLE 1 CREATION OF DEPOSITS (ASSUMING 10% RESERVE REQUIREMENT AND A \$100 INCREASE IN RESERVES)

TABLE 1 Creation of Deposits (assuming 10% reserve requirement and a \$100 million increase in reserves)

Bank	Increase in Deposits (\$)	Increase in Loans (\$)	Increase in Reserves (\$)
First National	0.00	100.00 m	0.00
A	100.00 m	90.00 m	10.00 m
B	90.00 m	81.00 m	9.00 m
C	81.00 m	72.90 m	8.10 m
D	72.90 m	65.61 m	7.29 m
E	65.61 m	59.05 m	6.56 m
F	59.05 m	53.14 m	5.91 m
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
Total for all banks	1,000.00 m	1,000.00 m	100.00 m

DERIVING THE FORMULA FOR MULTIPLE DEPOSIT CREATION

- Assuming banks do not hold excess reserves
 - Required Reserves (RR) = Total Reserve (R)

$$(1) \quad RR = R = r * D$$

$$(2) \quad D = \frac{1}{r} * R$$

$$(3) \quad \Delta D = \frac{1}{r} * \Delta R$$

CRITIQUE OF THE SIMPLE MODEL

- Holding cash stops the process
 - Currency has no multiple deposit expansion
- Banks may not use all of their excess reserves to buy securities or make loans.
- Depositors' decisions (**how much currency to hold**) and bank's decisions (**amount of excess reserves to hold**) also cause the money supply to change.

FACTORS THAT DETERMINE THE MONEY SUPPLY

- Changes in the nonborrowed monetary base MB_n
 - The money supply is positively related to the non-borrowed monetary base MB_n
- Changes in borrowed reserves from the Fed
 - The money supply is positively related to the level of borrowed reserves, BR , from the Fed

FACTORS THAT DETERMINE THE MONEY SUPPLY

- **Changes in the required reserves ratio**
 - The money supply is negatively related to the required reserve ratio.
- **Changes in currency holdings**
 - The money supply is negatively related to currency holdings.
- **Changes in excess reserves**
 - The money supply is negatively related to the amount of excess reserves.

OVERVIEW OF THE MONEY SUPPLY PROCESS

SUMMARY TABLE 1

Money Supply Response

Player	Variable	Change in Variable	Money Supply Response	Reason
Federal Reserve System	Nonborrowed monetary base, MB_n	↑	↑	More MB for deposit creation
	Required reserve ratio, rr	↑	↓	Less multiple deposit expansion
Banks	Borrowed reserves, BR	↑	↑	More MB for deposit creation
	Excess reserves	↑	↓	Less loans and deposit creation
Depositors	Currency holdings	↑	↓	Less multiple deposit expansion

Note: Only increases (↑) in the variables are shown. The effects of decreases on the money supply would be the opposite of those indicated in the “Money Supply Response” column.

THE MONEY MULTIPLIER

- Define money as currency plus checkable deposits: M_1
- Link the money supply (M) to the monetary base (MB) and let m be the money multiplier

$$M = m \times MB$$

DERIVING THE MONEY MULTIPLIER

- Assume that the desired holdings of currency C and excess reserves ER grow proportionally with checkable deposits D .

- Then,

$$c = \{C/D\} = \text{currency ratio}$$

$$e = \{ER/D\} = \text{excess reserves ratio}$$

DERIVING THE MONEY MULTIPLIER

- Total reserve (R) equals the sum of required reserves (RR) and excess reserves (ER)

$$R = RR + ER$$

- The total amount of required reserves equals to the required reserve ratio time the amount of checkable deposit (D)

$$RR = r * D$$

- As a result, total reserve equals to $R = r * D + ER$

DERIVING THE MONEY MULTIPLIER

- The monetary base MB equals currency (C) plus reserves (R):

$$MB = C + R = C + (r \times D) + ER$$

- Equation reveals the **amount of the monetary base** needed to support the existing amounts of checkable deposits, currency and excess reserves.

DERIVING THE MONEY MULTIPLIER

- Given that $c = \frac{C}{D}$ and $e = \frac{ER}{D}$, we yield that

$$MB = C + R = C + (r \times D) + ER = c * D + r * D + e * D$$

- So, the amount of total deposit equals to

$$D = \frac{MB}{c + r + e}$$

DERIVING THE MONEY MULTIPLIER

- Because money supply is the sum between currency and deposit, this implies that

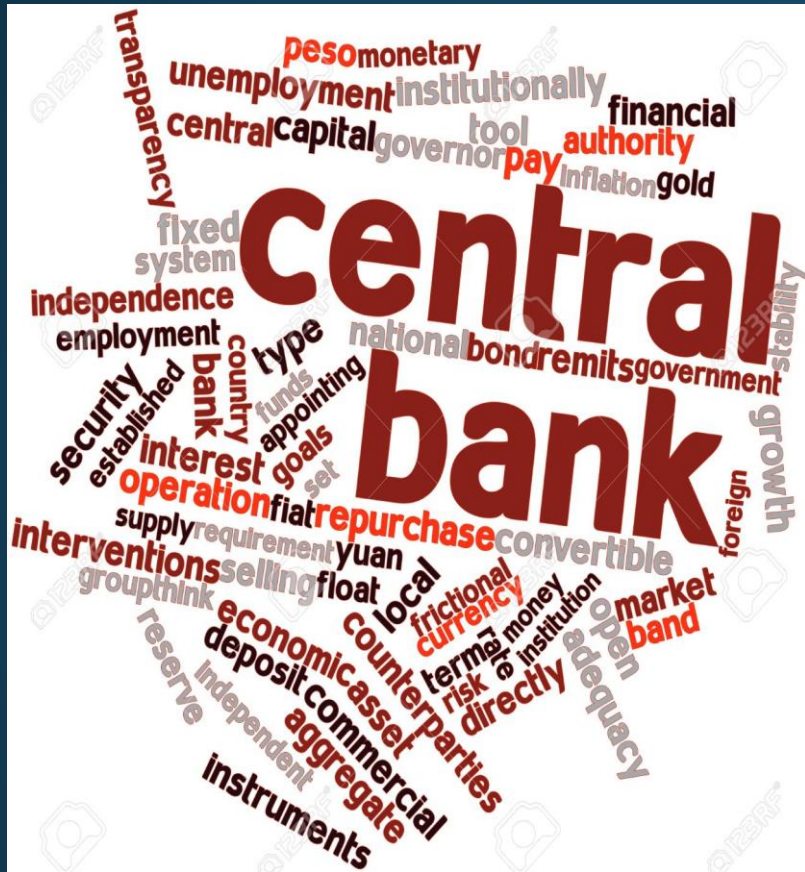
$$M = C + D = c * D + D = (1 + c) * D$$

- Using the deposit equation, we yield that

$$D = \frac{MB}{c + r + e} \quad M = \frac{1 + c}{c + r + e} MB$$

DERIVING THE MONEY MULTIPLIER

- $\frac{1+c}{c+r+e}$ is called “money multiplier”
- The equation links between “monetary base” and “money supply”
- The multiplier concept is a generalized version of deposit creation multiplier.



AGENDA

- Measuring money aggregate
- Interplay of agents and Central bank's balance sheet
- Deposit creation and money multiplier
- **Case study: QEs**

Reading: Chapter 15. This chapter provides an overview of how commercial banks create deposits and describes the basic principles of the money supply creation process

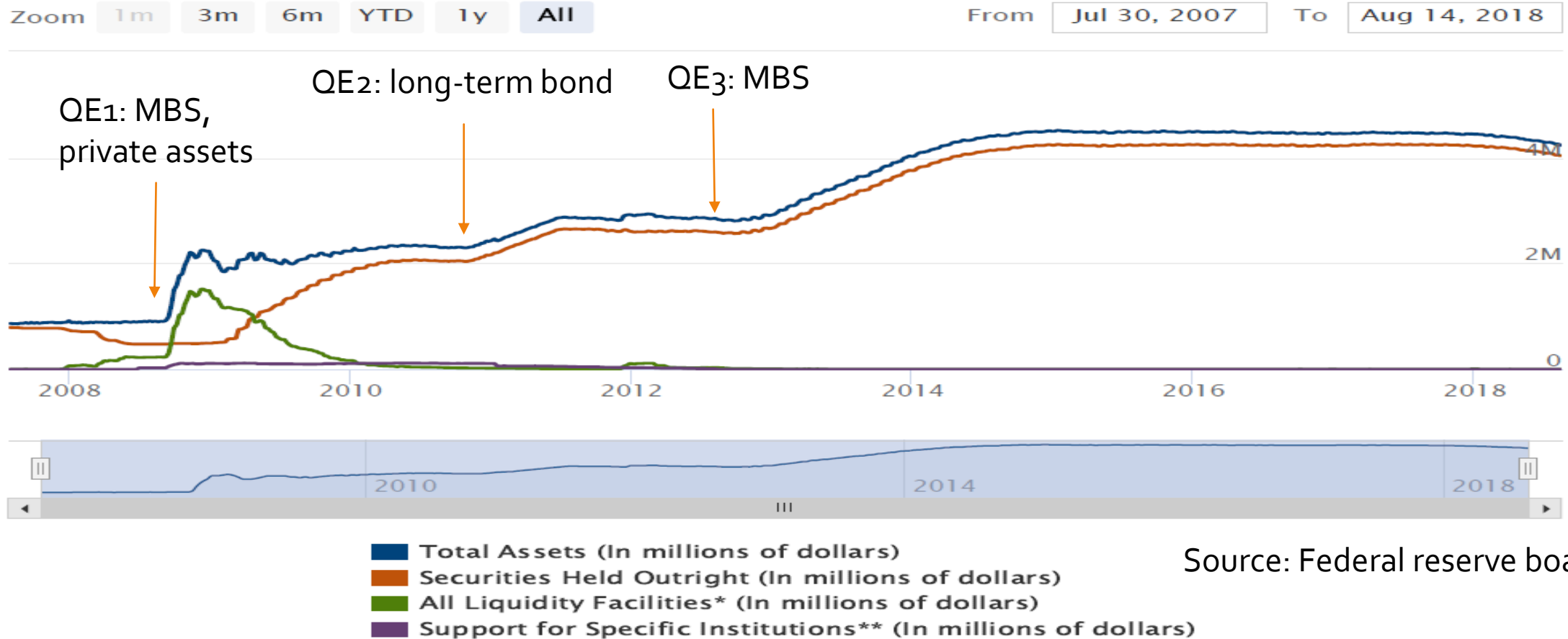
CASE STUDIES: SLOW TO RECOVER AFTER THE GFC

- GFC in 2007 marked as one of the worst economic downturn in the USA, as well as the global economy.
- Lot of things happened, many of which will be a heritage to future monetary policy
- One is how central bank responds to the crisis – e.g. **conventional v.s. unconventional policies**

QUANTITATIVE EASING AND THE MONEY SUPPLY, 2007-2014

- When the global financial crisis began in the fall of 2007, the Fed initiated **lending programs and large-scale asset-purchase programs (LSAPP)** in an attempt to bolster the economy.
- By June 2014, these purchases of securities had led to a **quintupling** of the Fed's balance sheet and **a 377% increase in the monetary base**.
- These lending and asset-purchase programs resulted in a huge expansion of the monetary base and have been given the name **“quantitative easing: QE”**

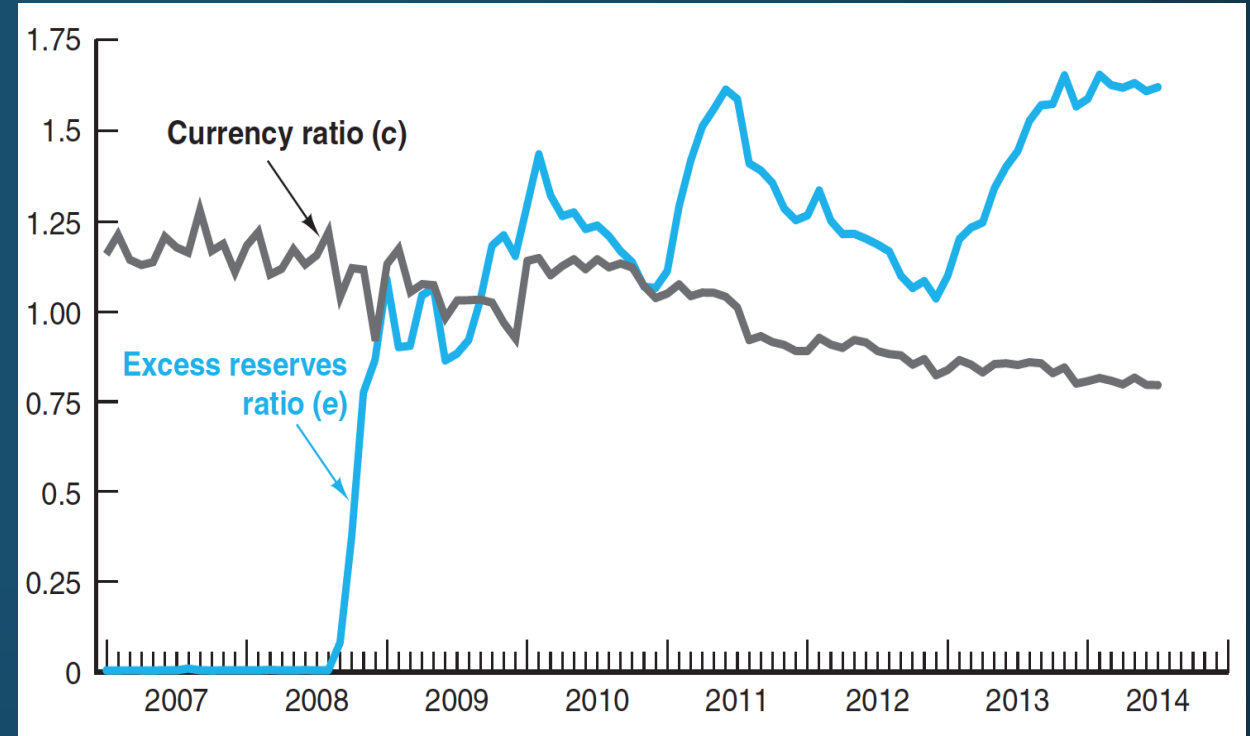
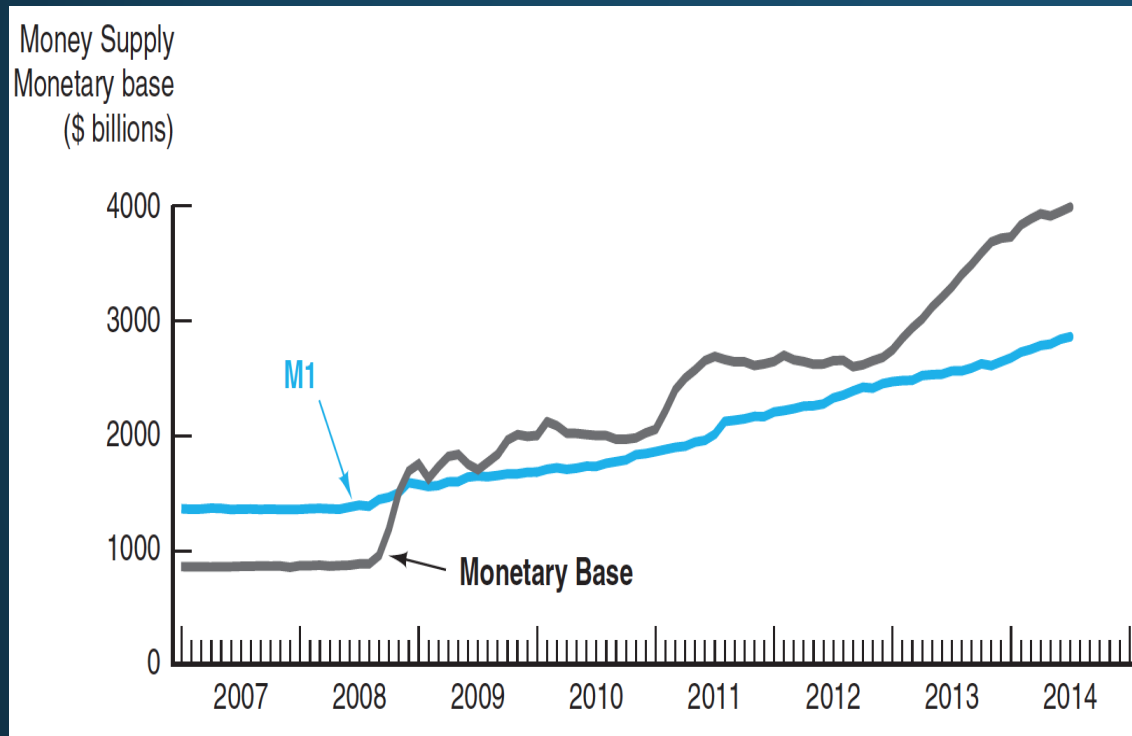
QUANTITATIVE EASING AND THE MONEY SUPPLY, 2007-2014: USA



QUANTITATIVE EASING AND THE MONEY SUPPLY, 2007-2014

- **Observations:** Took so many QEs during the 7 years.
- **Outcome:** Slow to recover..
- Related to our context of lecture, **what could be the possible reason attributed to the slow recovery problem?**

QUANTITATIVE EASING AND THE MONEY SUPPLY, 2007-2014



Source: Federal Reserve Bank of St. Louis, FRED database: <http://research.stlouisfed.org/fred2/>.