

Financial Markets: Part I

BUSS254 Investments

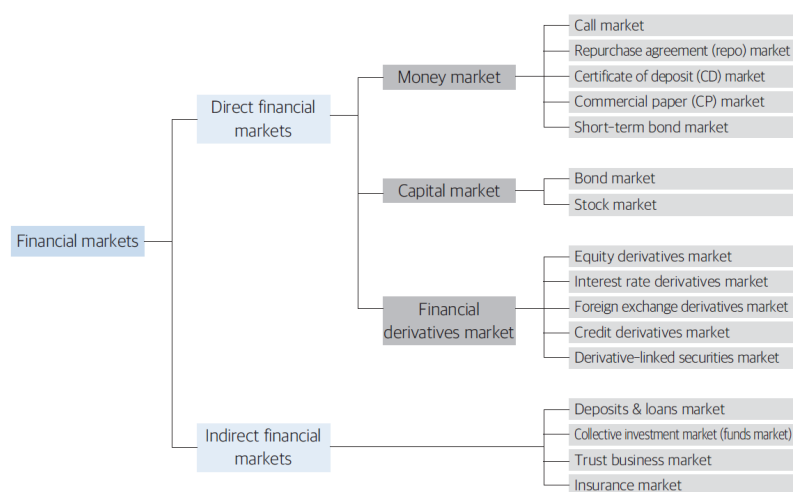
Prof. Ji-Woong Chung

Lecture Outline

- Money markets: Call, Repo, CD, CP, etc.
- Capital markets: Bond, Equity
- Derivatives markets: Futures, options etc.
- Trading mechanisms
- Investment Companies
- Reading: BKM Ch. 1 and 2, “Financial Markets in Korea” Bank of Korea (2022)

Money Markets

Financial Instruments



Financial Market Size in Korea

	1990(A)	2000	2010	2020	2021.6(B)	B/A
Money market ²⁾	44.3	138.8	264.8	522.9	585.1	13.2
Capital market	114.0	638.8	2,401.1	4,576.0	5,077.1	44.5
Bonds ³⁾	35.0	423.6	1,161.2	2,209.9	2,338.7	66.8
Stocks ⁴⁾	79.0	215.2	1,239.9	2,366.1	2,738.4	34.7
TOTAL (C)	158.3	777.6	2,665.9	5,098.9	5,662.3	35.8
C/Nominal GDP ⁵⁾ (%)	82.7	124.5	201.6	263.8	284.5	-
C/Lf ⁶⁾ (%)	79.9	82.4	124.7	113.9	120.5	-
C/Loans ⁷⁾ (%)	86.9	110.9	145.9	140.6	148.2	-

Notes : 1) Based on outstanding balances at period-ends.

2) Call, repo, CD, CP short-term bonds, cover bills, MSBs (one-year maturity or less) and T-bills.

3) Based on figures for bonds deposited in the Korea Securities Depository (excluding short-term MSBs with maturities of one year or less and T-bills).

4) Market capitalization of listed stocks on Korea Exchange's KOSPI and KOSDAQ markets.

5) Nominal GDP at the end of June 2021 has been applied as the sum of the previous four quarters.

6) Liquidity aggregates of financial institutions (= M2 + savings products with maturities of two years or longer of depository institutions + deposits in Korea Securities Finance Corp., etc. + insurance reserves of life insurance companies, etc.).

7) Loans in Flow of Funds Tables (excluding Bank of Korea loans).

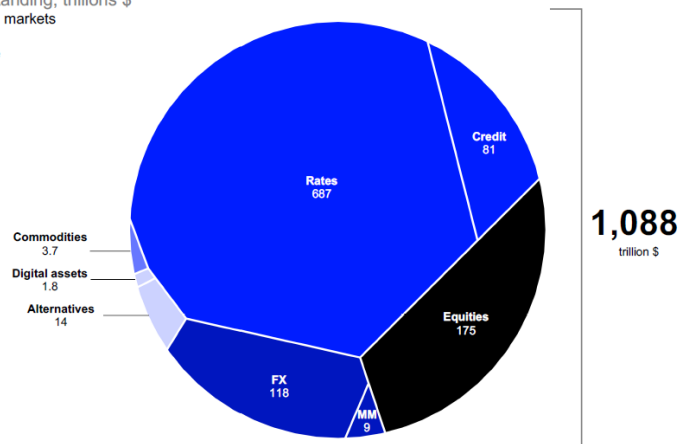
Sources: Bank of Korea, Korea Securities Depository, Korea Credit Information Service, Korea Financial Investment Association, YONHAP INFOMAX, Financial Supervisory Service, KOSCOM, Ministry of Economy and Finance.

Financial Market Size: Global

Global market size 2023 EOY

notional outstanding, trillions \$

■ Equity capital markets
■ FX/MM
■ Fixed income
■ Commodities
■ Other



Source: LSEG

What Are Money Markets?

- Provide **short-term liquidity** to financial institutions, corporations, and investors.
- Instruments have **maturities ranging from one day to one year**.
- A **vital part of the financial system**, ensuring short-term funding.
- Heavily regulated by governments and central banks due to its importance.
- Regulations of money markets vary widely over time and across jurisdictions.
 - Individuals typically access the instruments via a mutual fund (money market mutual fund).
- Typical characteristics

- Short maturity (overnight ~ 1 year), high liquidity, Low risk, Low return, Large denomination: typically large institutions, Dealer market

Money Markets: Size

Table 2		Money market size ¹⁾						Units: trillion won, %	
	2000		2010		2020		2021.6		
	Volume	Share	Volume	Share	Volume	Share	Volume	Share	
Call ²⁾	16.1	15.9	22.5	10.1	6.9	1.4	6.9	1.3	
Repo ³⁾	26.1	25.8	78.8	35.5	219.0	44.9	236.7	43.7	
CD	14.2	14.1	44.5	20.0	19.3	4.0	31.0	5.7	
CP ⁴⁾	44.7	44.2	76.4	34.4	193.2	39.6	211.3	39.0	
Short-term bond ⁵⁾	-	-	-	-	49.2	10.1	56.2	10.4	
Total	101.1	100.0	222.1	100.0	487.6	100.0	542.1	100.0	

Notes: 1) Based on outstanding balances at period-ends.

2) Brokered deals.

3) Customer repos and OTC institutional repos.

4) Based on Flow of Funds Tables for 2000, Korea Credit Information Services for 2010, and on YONHAP INFOMAX after 2020.

5) Introduced in Jan. 2013.

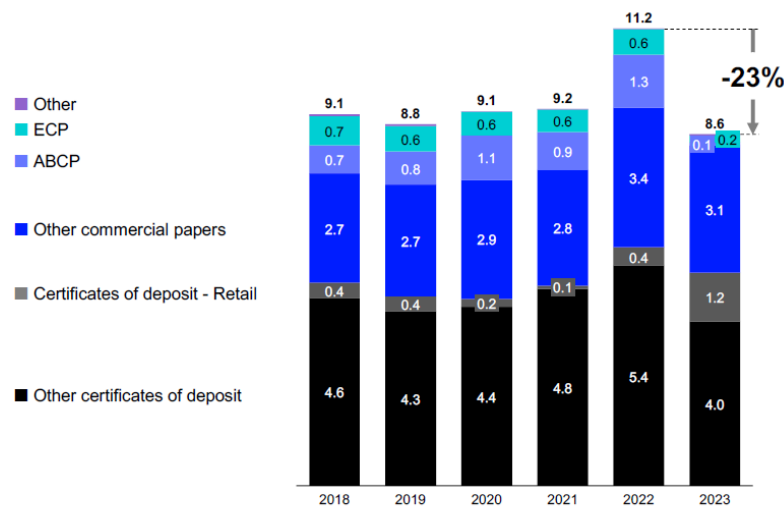
Sources: Bank of Korea, Korea Securities Depository, Korea Credit Information Services, Korea Financial Investment Association, YONHAP INFOMAX.

- Developed in the 1960s–1970s, expanded in the 1990s due to interest rate liberalization and financial sector reforms (the Asian crisis).
- Since the late 2000s, restructuring efforts aimed at improving efficiency
- Korea's money markets have shifted towards repos, CPs, and short-term bonds, reflecting regulatory changes and financial innovation (discuss later).

Money Markets: Global

Money market structure

notional outstanding, trillions \$



Source: LSEG, BIS, IMF

Call Market

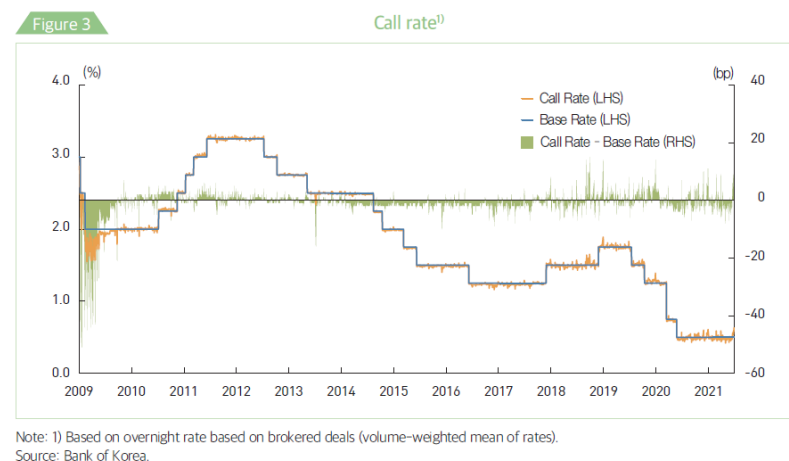
- A marketplace where financial institutions borrow (lend) money on a very short-term basis to resolve their temporary surpluses or shortages of funds (interbank loans).¹
 - Mostly, uncollateralized, brokered, and overnight.
- For banks that must hold reserve requirements, the call market helps them to smooth shortages or excesses in their reserve balances.
- The call market is also important in the implementation of monetary policy.
 - Before 2008, BOK directly set call rate as the Base Rate

¹In Korea, there are 3 brokers: the Korea Money Brokerage Corporation, Seoul Money Brokerage Services, and the KIDB Money Brokerage Corporation.

- Now, call rates are closely linked to BOK repo rate (via open market operations).
- Known as the Federal funds market in the U.S., the Call market in Japan, and the Unsecured market in Europe.

Call Market: Open Market Operations

- The BOK targets the call rate (Base Rate) in its monetary policy, announcing it after regular policy meetings.
- By buying government securities, the BOK increases bank reserves and the money supply, lowering the call rate. Selling securities has the opposite effect. These actions are known as open market operations.



Call Market: Regulations

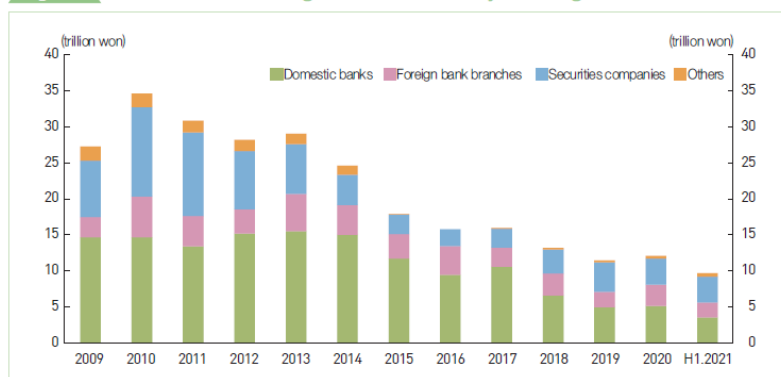
- The Korean government restricted securities firms' borrowing in 2010 and excluded non-banks from the call market in 2015 to enhance financial stability and reduce systemic risk.

- Reducing Short-Term Funding Risks – Heavy reliance on call markets made financial institutions vulnerable to liquidity shocks.
- Preventing Excessive Leverage & Arbitrage – Some non-banks used call market funds for high-risk investments, increasing systemic risk.
- Strengthening Monetary Policy Transmission – Non-bank participation distorted Bank of Korea’s interest rate policies.
- Promoting the Repo Market – The government encouraged secured repo transactions, reducing counterparty risk and making repos the dominant funding source.

Call Market: Evolution

Figure 2

Outstanding balances¹⁾ of call money borrowing



Note: 1) Based on daily average outstanding balances of brokered trades during the periods.
Source: Bank of Korea.

- Impact:
 - Call market share dropped from 10.1% (2010) to 1.3% (2016).
 - Repo market expanded, replacing the call market as the primary short-term funding mechanism.

- These measures aligned with global post-2008 financial reforms, ensuring a more resilient financial system

Repurchase Agreement (RP)

A **repurchase agreement (repo)** is a short-term secured loan where securities serve as collateral.

- **Mechanism:**
 - One party sells securities (ownership transfer) and agrees to repurchase them later at a higher price.
 - Securities serve as **high-credit-quality collateral**.
 - From the **buyer's perspective**, this is called a **reverse repo**.
 - The **repo rate** is the implied interest rate based on the price difference.

RP: Types of Repos

By Participants

- **Customer repos:** Between financial institutions and their clients.
- **Institutional repos:** Among financial institutions.
- **Bank of Korea (BOK) repos:** Between the BOK and institutions.

By Maturity

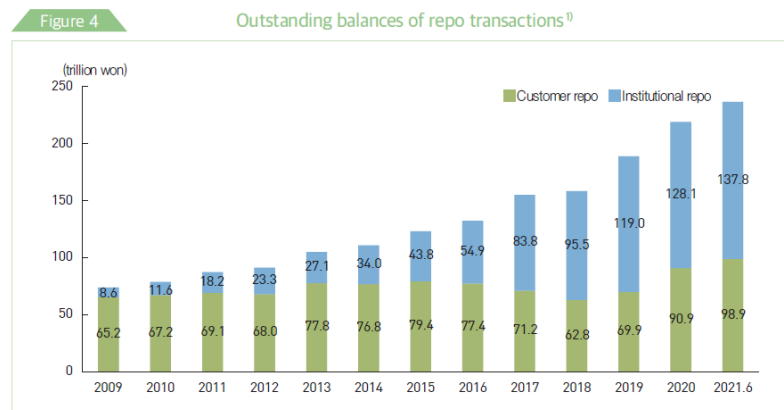
- **Overnight repo:** Expires the next day.

- **Term repo:** Fixed maturity beyond overnight.
- **Open repo:** No fixed maturity; can be rolled over.

By Collateral Management

- **Delivery repo:** Collateral is transferred to the buyer.
- **Tri-party repo:** A third party (custodian) holds collateral.
- **Hold-in-custody repo:** Seller retains collateral (common in customer repos).

RP: Market Size



Notes: 1) At the end of period, except exchange-traded repos.
 Sources: Korea Financial Investment Association, Bank of Korea, Korea Securities Depository.

- As of 2020, €8.3 trillion in Euro, \$2.7 trillion in U.S.
- Alternative to deposits or MMFs.
- Tighter regulation on the call market drove non-bank financial institutions to the repo market.

Role of the Repo Market

- Enables financial institutions (e.g., banks, broker-dealers, hedge funds*) to borrow **cheaply** using securities as collateral.
- Provides cash-rich entities (e.g., money market mutual funds, corporations) with a **low-risk** return.
- Supports **market liquidity** and **efficient collateralized borrowing**.

Repos and Monetary Policy

- **Central banks** use **repos** and **reverse repos** to manage liquidity and control short-term rates.
 - **Injecting liquidity:** A repo transaction (**central bank buys securities**) adds reserves to the system.
 - **Draining liquidity:** A reverse repo (**central bank sells securities**) absorbs reserves, reducing money supply.
 - **Repo rates influence** credit conditions, inflation, and economic growth.

Significance of the Repo Market

- Ensures **efficient money markets** and short-term funding.
- Facilitates **monetary policy transmission** and **interest rate stability**.
- Plays a key role in **financial system stability** through collateralized lending.

BOK Repo

- BOK holds regular auctions of seven-day maturity repo sales every Thursday in order to control short-term liquidity.
 - Flexibly controls timing and collateral securities

Table 8		Repo sales performance of the Bank of Korea ¹⁾				
	2017	2018	2019	2020	2021.1~8	
Repo (trillion won)	14.4 (67.5)	12.8 (76.3)	10.6 (94.9)	13.0 (92.9)	17.1 (100.0)	
Reverse Repo (billion won)	16.8	2.3	85.2	5,017.8	-	

Note: 1) Based on average outstanding balance, numbers in parentheses refer to the proportion (%) of seven-day maturities.

- Repo: liquidity absorption
- Reverse repo: liquidation provision

Certificate of Deposits (CD)

- A **Certificate of Deposit (CD)** is a **time deposit** issued by banks with a **fixed maturity and interest rate**.
- **Negotiable CDs** can be **transferred or traded** in the secondary market, unlike non-negotiable CDs.

Key Features of CDs

- **Subject to reserve requirements**, similar to regular deposits.
- **Not covered by deposit insurance** since 2001 (unlike U.S. CDs).
- **Issued at a discount** (investors receive face value at maturity).

CD Rate Determination in Korea

- The **CD rate** is published **twice daily** (12:00 and 16:30) by the **Korea Financial Investment Association**.
- Based on **91-day CDs issued by AAA-rated nationwide banks**.
- Calculated as a **simple average** of rates from **10 securities companies**, excluding the highest and lowest quotes, rounded to the third decimal place.

CD Rate and Its Role

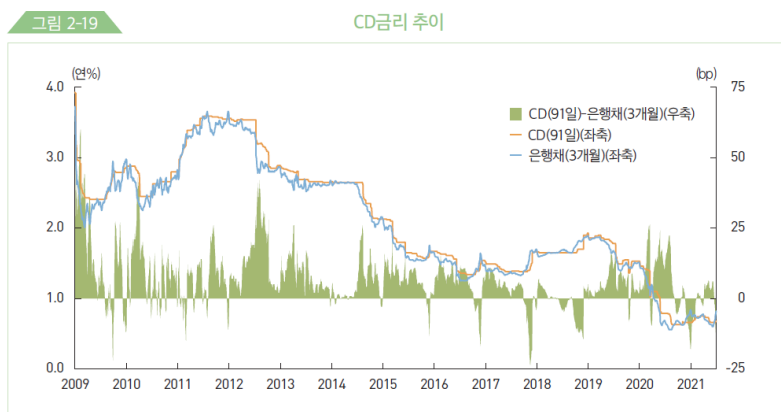
- The **CD rate** serves as a key **reference rate** for:
 - **Floating-rate loans** and **interest rate swaps**.
 - Influencing **bank loan** and **deposit rates**.
- However, **91-day CDs** lack liquidity and may be **unrepresentative**, leading to potential volatility.

Alternative Short-Term Reference Rates

To address CD rate limitations, several alternative benchmarks have been introduced:

- **KORIBOR** (Korea Inter-Bank Offered Rate) – Established in **July 2004**.
 - **COFIX** (Cost of Funds Index) – Introduced in **February 2010**.
 - **KOFR** (Korea Overnight Financing Reference Rate) – Launched in **February 2021**, based on **repo rates** for government bonds and **Monetary Stabilization Bonds (MSB)**.
-

Certificate of Deposits: Rates



- CD rates are sometimes “sticky.”

Commercial Paper (CP)

- A short-term **unsecured** debt instrument issued by corporations with strong **credit ratings** to raise funds (e.g., for working capital).
- **Key Features:**
 - **Faster and easier** to issue than bonds or stocks.
 - **Not backed by collateral**, except for **asset-backed CPs (ABCPs)**.
 - **Lower interest rates** compared to bank loans.
 - Must be **rated by at least two rating agencies**.
 - **Issued at a discount** (investors receive face value at maturity).

CP Rate Determination in Korea

- The **CP rate** is published **twice daily** (12:00 and 16:30) by the **Korea Financial Investment Association**.
- Based on **A1-rated CPs (highest grade)** from eight financial institutions.
- Computed as a **simple average** of the six middle values after removing the highest and lowest rates.

Asset-Backed Commercial Paper (ABCP)

- **Backed by underlying assets** such as:
 - Term deposits, loans, corporate bonds, trade receivables, real estate, etc.
- Typically issued through a **Special Purpose Company (SPC)** via **securitization**.



- Credit Enhancement Providers reduce default risk by, e.g., providing guarantees.
 - Liquidity Providers cover maturing ABCPs, e.g., if investors don't roll over.
 - Placement agents are intermediaries promoting ABCPs, helping determine competitive pricing.
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Commercial Paper: Evolution

Figure 11 CP outstanding balances by issuer¹⁾



Note: 1) At period-ends
Source: YONHAP INFOMAX.

- Rapid CP market expansion since the mid-2000s due to the convenience of ABCP issuance.
- Surge in PF ABCP issuance driven by:
 - Booming construction market.
 - Regulatory changes shifting real estate PF ABS to PF ABCP.

Commercial Paper: Rates



- The CP market in Korea occasionally experiences periods of stress.

Recent Developments: Gangwon-do Default

- **Background:** Gangwon-do province's real-estate developer (GJC) issued an ABCP for the Legoland project, guaranteed by the province.
- **Default Event:** GJC missed a principal payment; the province filed for rehabilitation instead of honoring the guarantee.
- **Immediate Impact:** Credit rating agencies downgraded the ABCP from A1 to D within five days.
- **Government Response:** Special Purpose Vehicle (SPV) created to purchase up to ₩1.8 trillion (\$1.33 billion) of PF-ABCP. Purchases to continue until May 30, 2023.

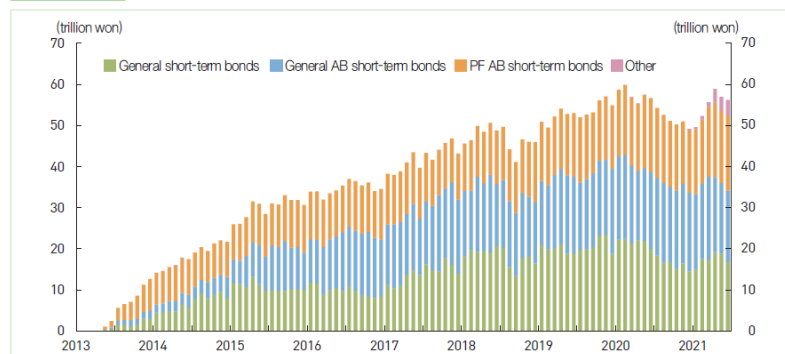
Source: [ING Think](#) / [Reuters](#)

Short-Term Bonds

- Corporate bonds issued and distributed electronically
 - Though legally a bond, it works like CPs.
 - Unlike CPs, physical certificates are not issued.
 - CPs are electronically issued and traded in U.S. (since 2000)
 - Introduced in January 2013 in Korea
 - To replace CP: improve transparency, require board's approval
 - To diversify short-term funding for non-bank institutions away from CP and Call markets.
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Short-Term Bonds: Evolution

Figure 14 Outstanding balance of short-term bond issuance¹⁾

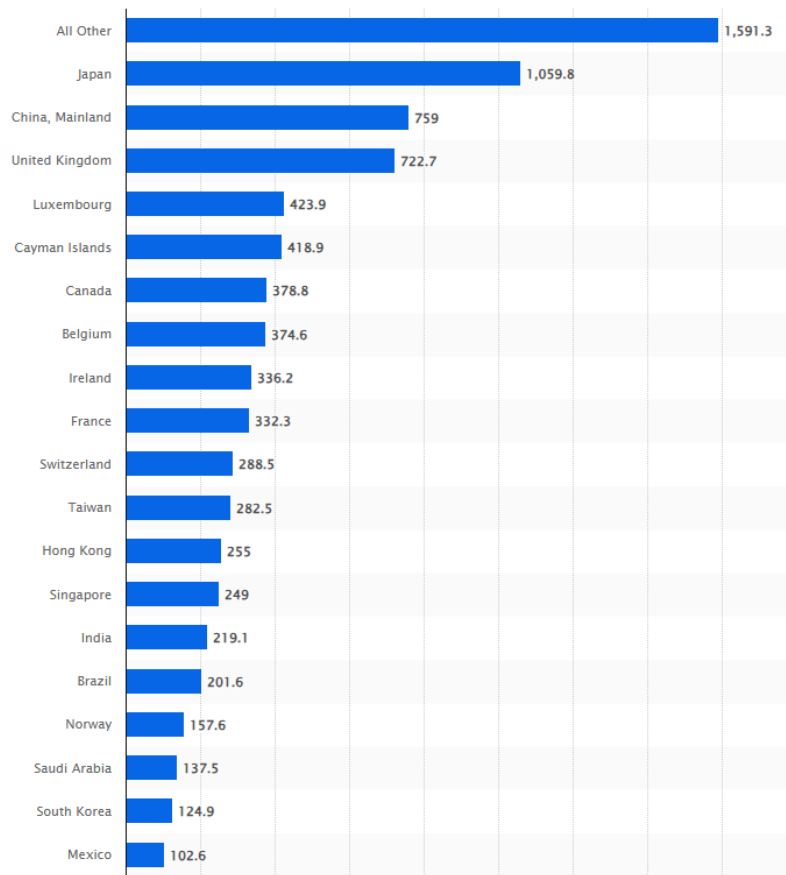


Note: 1) At period-ends
Source: YONHAP INFOMAX.

U.S. Treasury Bills

- Debt issued by the US Treasury with maturities under one year.
 - Maturities: 4, 8, 13, 26, or 52 weeks.
 - Issued at a discount, highly liquid, denominations of $\geq \$100$, exempt from state and local taxes, but subject to federal tax.
 - The most marketable money market instrument.
- The Federal Reserve is a major purchaser of these securities.
 - Federal Reserve's monetary policy, through the federal funds rate, significantly impacts T-Bill prices.
 - Higher federal funds rates tend to reduce demand for Treasuries, and vice versa.

U.S. Treasury: Foreign Holders



- As of December 2024, Source: U.S. Treasury

U.S. Treasury Bills: Roles

- **Largest & Most Essential Bond Market:** Due to U.S. creditworthiness and economic dominance, Treasuries (bills, notes, and bonds) form the deepest and most liquid bond market globally.
- **Low-Cost Borrowing:** The U.S. government benefits from relatively low financing costs over time.

- Safe-Haven Asset: Treasuries are seen as risk-free, near-cash assets, easily liquidated during market stress.
 - Benchmark for Fixed-Income Markets: Treasury yields influence borrowing costs for consumers, businesses, and governments worldwide.
 - Foundation of Global Finance: Treasury markets are critical to financial stability, serving as the bedrock of the global financial system.
-

Eurodollars

- US Dollar-denominated deposits held at foreign banks or at foreign branches of American banks (outside the U.S.).
 - These deposits are not regulated by the Federal Reserve, often resulting in higher interest rates compared to domestic rates.
 - Most Eurodollar deposits are for large sums and typically have maturities of less than six months.
 - The interest rate on overnight Eurodollars tends to closely track the federal funds rate.
 - For a U.S. bank with a reserve deficiency, borrowing Eurodollars is an alternative to purchasing federal funds.
 - Conversely, for a U.S. bank with excess funds, placing dollars in the Euromarket (Europlacement) is an alternative to selling federal funds.
 - Similar instruments exist for other currencies, such as Euroyen, Eurosterling, and Eurofranc.
-

Eurodollars: Roles

- Global Liquidity and Funding Source
 - Provides U.S. dollar-denominated funding to banks, corporations, and governments outside the U.S.
 - Facilitates global trade and investment, as the U.S. dollar is the world's primary reserve currency.
 - Supports the Offshore Dollar System
 - Enables non-U.S. banks and financial institutions to operate in dollars, strengthening dollar-based global finance.
 - Reduces reliance on U.S. domestic banks for dollar liquidity.
 - Critical for Corporate and Sovereign Borrowing
 - Many multinational corporations and governments issue Eurodollar bonds to raise capital efficiently.
 - Provides an alternative to domestic debt markets with favorable interest rates.
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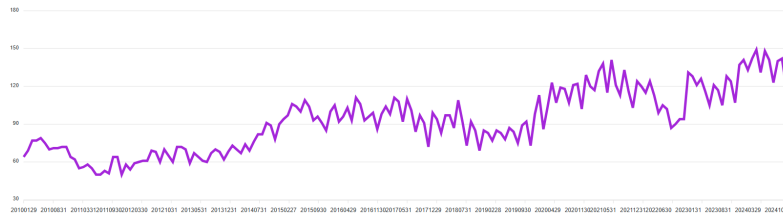
Money Market Mutual Funds (MMMF)

- **Investment funds** that invest in **short-term, highly liquid, low-risk securities**.
- Designed to offer **stability, liquidity, and competitive yields** compared to savings accounts.

Key Features

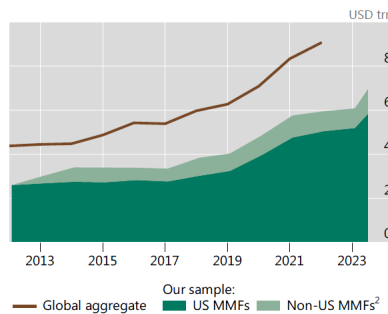
- **Stable Net Asset Value (NAV)**: Many funds maintain a **\$1 per share NAV**.
- **Liquidity**: Investors can **redeem funds quickly**, making them a cash-like investment.

- **Regulation:** Tightly regulated, which limits risk exposure.
- **Yields & Returns:** Typically offer **higher returns than savings accounts** but lower than riskier investments.

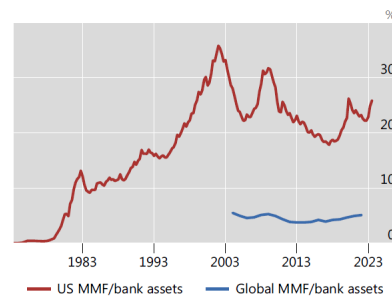


Source: [KFIA](#)

A. MMF assets have seen remarkable growth



B. MMF assets relative to total bank assets



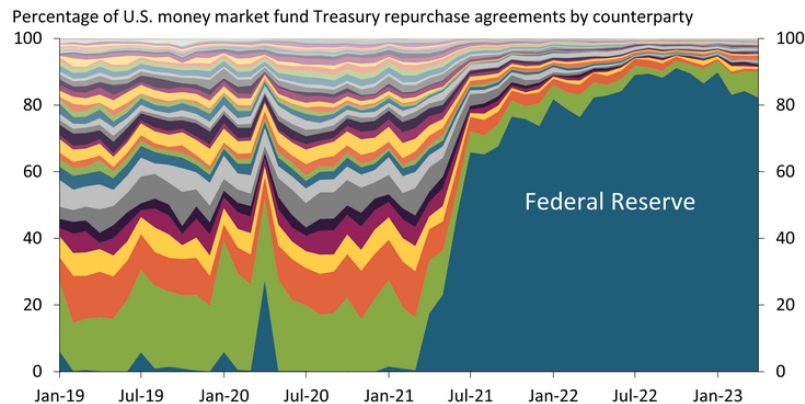
Source: [BIS](#)

MMMF: Risks

Potential Risks

- **Interest Rate Risk:** MMMFs may experience **declining yields** when interest rates drop.
- **Liquidity Risk:** Heavy redemptions can **strain fund liquidity**.

- **Credit Risk:** Default risk exists, especially for **prime MMMFs investing in CP**.
- **Regulatory Changes:** Stricter rules may **impact fund structure and returns**.



Source: [FRB](#)

Pricing Money Market Securities

Alternative Ways of Quoting Prices

- (Bond Equivalent) Yield (y) vs. Discount (d)
- Depending on the jurisdiction/instruments, prices are quoted as y or d.
 - CDs and CPs issued at a discount, but quoted in yield in Korea
 - T-bills and CPs (but not CDs) are issued at a discount and quoted as discount in the U.S.
- Example: Pay \$90 for a \$100 zero that matures in 90 days.

$$y = \left(\frac{100 - 90}{90} \right) \left(\frac{365}{90} \right) = 0.4506$$

$$d = \left(\frac{100 - 90}{100} \right) \left(\frac{365}{90} \right) = 0.4055$$

Alternative Ways of Quoting Prices (cont'd)

Consider a zero coupon bond with price P and face value M

$$P = \frac{1}{\left(1 + y \times \frac{days}{365}\right)} M \quad \text{and} \quad P = \left(1 - d \times \frac{days}{365}\right) M$$

$$\Rightarrow \frac{1}{\left(1 + y \times \frac{days}{365}\right)} = \left(1 - d \times \frac{days}{365}\right)$$

$$\Rightarrow d = \frac{y}{\left(1 + y \times \frac{days}{365}\right)} \quad \text{and} \quad y = \frac{d}{\left(1 - d \times \frac{days}{365}\right)}$$

$$\Rightarrow y > d$$

Example

- What is the 180-day discount “factor” of 7% per year?

$$\frac{1}{\left(1 + 0.07 \times \frac{180}{365}\right)} = 0.9666$$

- What is the price of a \$500 180-day zero coupon bond if the yield is 7%?

$$0.9666 \times \$500 = \$483.31$$

- What is the discount on the face value of the bond?

$$\left(1 - d \times \frac{180}{365}\right) = 0.9666$$

$$d = 6.7728\%, \text{ which is the same as } \left(\frac{500 - 483.31}{500}\right) \left(\frac{365}{180}\right)$$

Day Count Conventions

- Pricing in financial markets started long before computers...
 - People in different countries took different strategies to ease the calculation of accrued interests over time
 - 30 days per month? 360 or 365 days per year?
- Conventions vary from country to country and from instrument to instrument
 - Actual/Actual: US treasury bonds, Australia
 - 30/360 method: US corporate/municipal bonds, Eurobonds
 - Actual/360: US money market
 - Actual/365: Korea, UK, Japan
 - X/Y , where X is the number of days in a month, and Y is the number of days in a year.

Source:

<https://www.rbcits.com/en/gmi/global-custody/market-profiles.page>

Example

- Consider a Treasury bond and a corporate bond both have the same annual coupon payment dates (Principal: \$100, coupon rate: 8%).
 - Their last coupon payment date is March 1, 2018, and the next coupon date is September 1, 2018.
 - How much interest is accrued for the period from March 1, 2018 to July 3, 2018, for the two bonds, respectively?
 - Act/Act: $\frac{124}{184} \times \$4 = 2.6957$
 - 30/360: $\frac{122}{180} \times \$4 = 2.7111$
 - How about from October 3, 2018 to January 1, 2019?
 - Act/Act: $\frac{90}{184} \times \$4 = 1.9889$
 - 30/360: $\frac{88}{180} \times \$4 = 1.9555$
 - Excel functions: Days and Days360
-

Example (cont'd)

- What if we use Actual/365?
 - Divide 8% by 365 = 0.02191
 - Multiply by # of days from March 1 to July 3, 2018 (124) = 2.7178
- Actual/360?
 - Divide 8% by 360 = 0.02222
 - Multiply by # of days from March 1 to July 3, 2018 (124) = 2.7555
- [NB] Therefore, 8% in Actual/360 is equivalent to $8\% \times \frac{365}{360} = 8.1111\%$
 - Divide 8.1111% by 365 = 0.02222

- Multiply by # of days from March 1 to July 3, 2018
 $(124) = 2.7555$
 - [NB] 1% in Actual/360 would earn $1\% \times 365/360$ of interest in 365 days.
-

Pricing CDs

- A 90-day CD with \$100,000 face value was issued on March 17, 2015 in the U.S., offering a 6% yield (under ACT/360 day convention) with a market rate of 7 %.
 - [NB] Unlike US, CDs are issued at a discount in Korea.
1. Compute the payoff.
 2. Compute the price of the CD on March 17, 2015
 3. On April 10, 2015, the market rate dropped to 5.5 percent.
 Compute the price of the CD in the secondary market
 4. On May 10, the market rate further dropped to 5 percent.
 Compute the return of an investor that purchased the CD on April 10 and sold it on May 10 (30 days)
-

Pricing CDs (cont'd)

1. Compute the payoff.
 - $\text{Payoff} = 100,000 \times \left(1 + 6\% \times \frac{90}{360}\right) = 101,500$
 2. Compute the price of the CD on March 17, 2015
 - $PV = \frac{101,500}{\left(1 + 7\% \times \frac{90}{360}\right)} = 99,754$
 3. On April 10, 2015, the market rate dropped to 5.5 percent.
 Compute the price of the CD in the secondary market
 - $\text{Days}(\text{Date}(2015, 4, 10), \text{Date}(2015, 3, 17)) = 24$
 - $PV = \frac{101,500}{\left(1 + 5.5\% \times \frac{90-24}{360}\right)} = 100,487$
-

Pricing CDs (cont'd)

4. On May 10, the market rate further dropped to 5 percent. Compute the return of an investor that purchased the CD on April 10 and sold it on May 10 (30 days)

- $\text{Days}(\text{Date}(2015, 5, 10), \text{Date}(2015, 3, 17)) = 54$
 - $PV = \frac{101,500}{(1 + 5.0\% \times \frac{90-54}{360})} = 100,995$
 - $\text{Days}(\text{Date}(2015, 5, 10), \text{Date}(2015, 4, 10)) = 30$
 - $\text{Return} = \left(\frac{100,995}{100,487} - 1 \right) \times \frac{360}{30} = 6.07\%$
-

Commercial Paper Yields

- Yields on commercial paper are quoted on a discount basis (like Treasury bills) in the U.S.
- A 60-day CP has a nominal (face) value of \$100,000. It is issued at a discount of 7.5% per annum (Act/360). The discount is calculated as:

$$d = 0.075 \times \frac{60}{360} \times \$100,000 = \$1,250$$

- The issue price for the CP is therefore \$100,000 - \$1,250 = \$98,750.
- The yield is:

$$y = \frac{d}{\left(1 - d \times \frac{\text{days}}{360}\right)} = \frac{0.075}{\left(1 - 0.075 \times \frac{60}{360}\right)} = 7.59\%$$

$$\text{or } y = \frac{\$1,250}{\$98,750} \times \frac{360}{90} = 7.59\%$$

U.S. Treasury Bill Quotes

- US T-bills are quoted on a discount basis (reference price is face value) using Act/360 method.

U.S. Treasury Quotes	Thursday, December 15, 2022
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Treasury Notes & Bonds | Treasury Bills

Treasury bill bid and ask data are representative over-the-counter quotations as of 3pm Eastern time quoted as a discount to face value. Treasury bill yields are to maturity and based on the asked quote.

MATURITY	BID	ASKED	CHG	ASKED YIELD
12/20/2022	3.695	3.685	+0.150	3.738
12/22/2022	3.738	3.728	+0.155	3.782

- $\text{Days360}(\text{Date}(2022, 12, 15), \text{date}(2022, 12, 20)) = 5$ days

$$P = \left(1 - d \times \frac{5}{360}\right) \times 100 = \left(1 - 3.685\% \times \frac{5}{360}\right) \times 100 = 99.9488$$

$$y = \left(\frac{100 - 99.9488}{99.9488} \times \frac{365}{5}\right) = 3.738\%, \text{ which is ASKED YIELD}$$

Pricing Repo

- X sells \$9,876,000 worth of T-bills and agrees to repurchase them in 14 days at \$9,895,000 in the U.S. What is the repo rate?

$$y = \left(\frac{9,895,000}{9,876,000} - 1\right) \times \frac{360}{14} = 4.9470\%$$

- If the overnight repo rate is 4.5% what is the payment tomorrow for a repo of \$10,000,000

$$10,000,000 \times \left(1 + 0.045 \times \frac{1}{360}\right) = 10,001,250$$