MONETARY AND FINANCIAL SYSTEM

Money is not one "of the wheels of trade: It is the oil which renders the motion of the wheels more smooth and easy."

- David Hume in *Political Discourses* (1752)
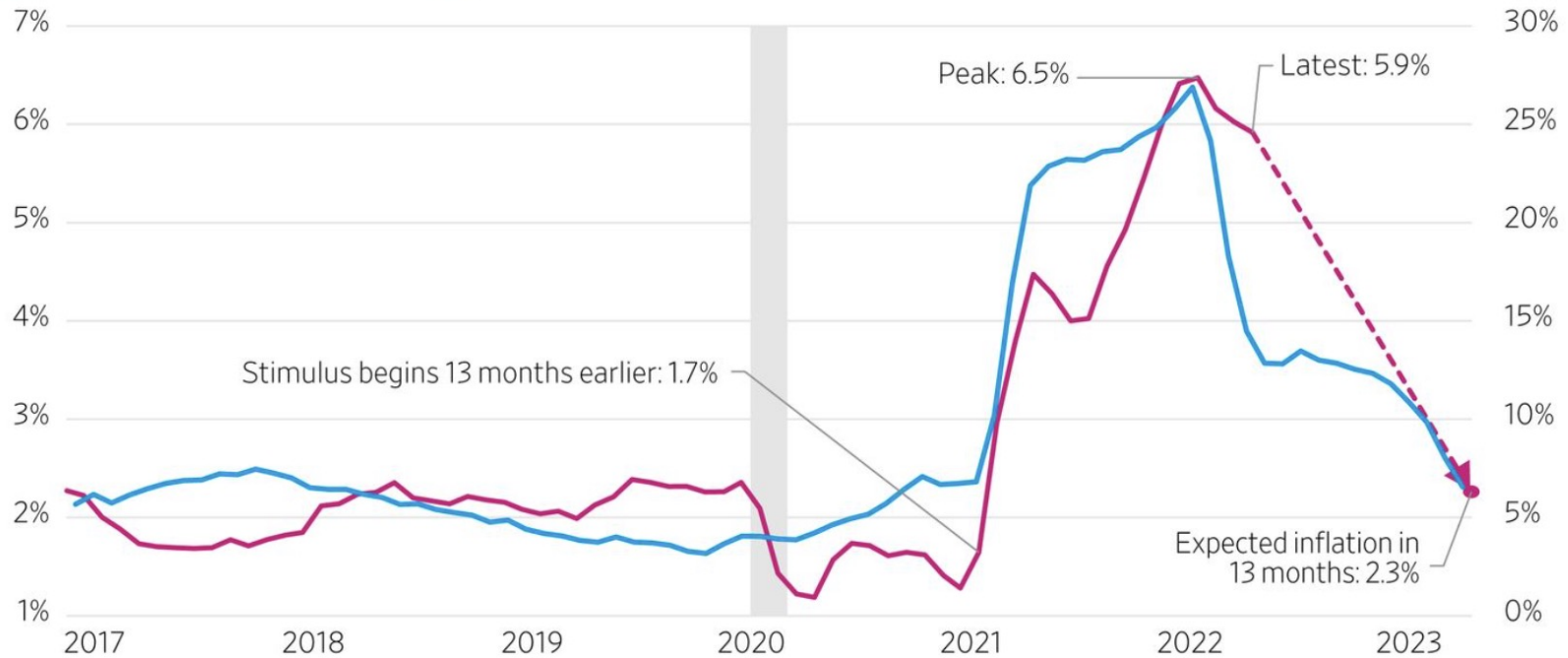
INFLATION

Significant changes in the growth rate of money supply, even small ones, impact the financial markets first. Then, they impact changes in the real economy, usually in six to nine months, but in a range of three to 18 months. Usually in about two years in the US, they correlate with changes in the rate of inflation or deflation."

- Milton Friedman
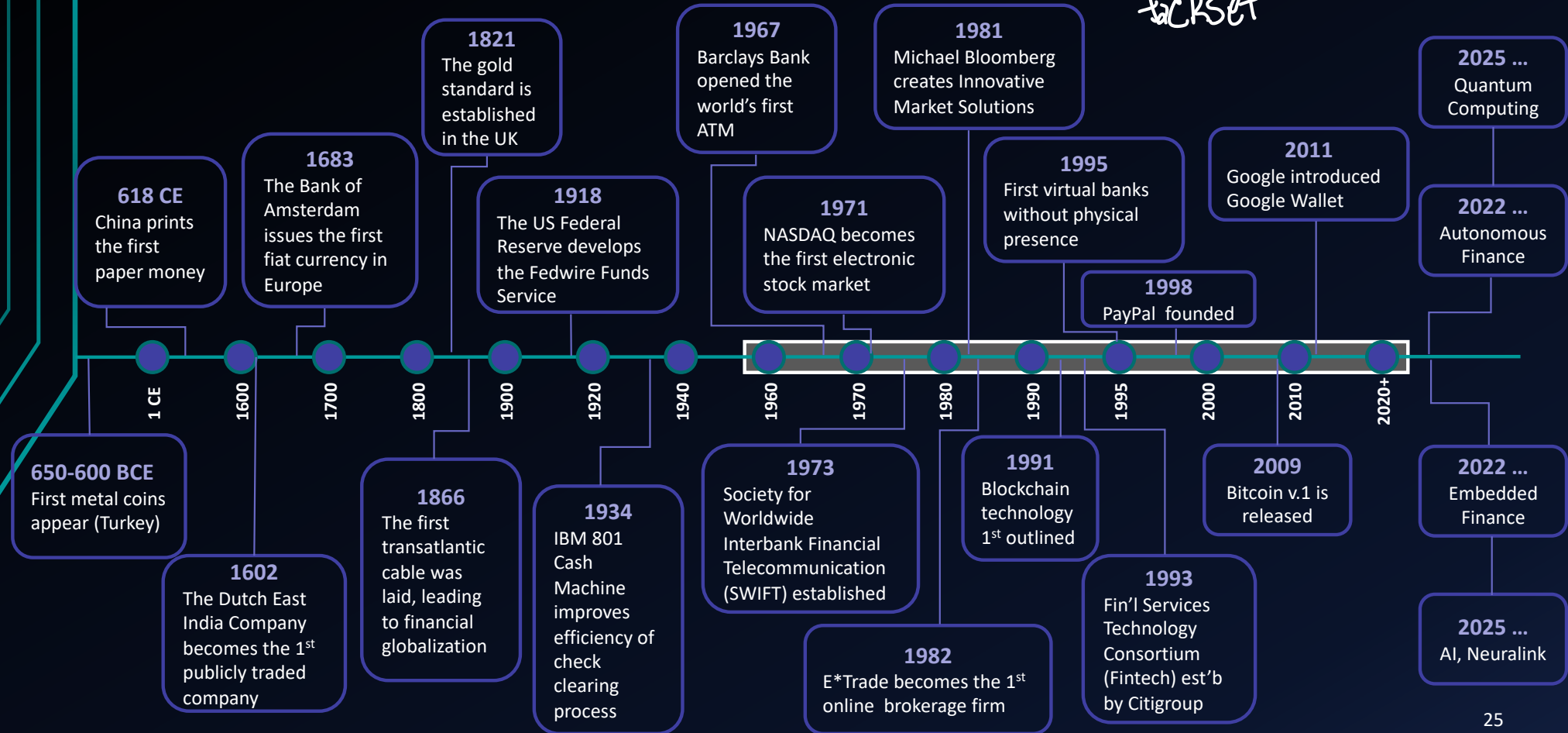
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Inflation Follows the Money

■ Core CPI inflation (left scale)   ■ M2 growth 13 months earlier (right scale)

Peak: 6.5%
Latest: 5.9%
Stimulus begins 13 months earlier: 1.7%
Expected inflation in 13 months: 2.3%

Source: Bureau of Labor Statistics, Federal Reserve

A HISTORY OF FINANCIAL INNOVATION

factset

650-600 BCE
First metal coins appear (Turkey)

618 CE
China prints the first paper money

1602
The Dutch East India Company becomes the 1st publicly traded company

1683
The Bank of Amsterdam issues the first fiat currency in Europe

1821
The gold standard is established in the UK

1866
The first transatlantic cable was laid, leading to financial globalization

1918
The US Federal Reserve develops the Fedwire Funds Service

1934
IBM 801 Cash Machine improves efficiency of check clearing process

1967
Barclays Bank opened the world's first ATM

1971
NASDAQ becomes the first electronic stock market

1973
Society for Worldwide Interbank Financial Telecommunication (SWIFT) established

1981
Michael Bloomberg creates Innovative Market Solutions

1982
E*Trade becomes the 1st online brokerage firm

1991
Blockchain technology 1st outlined

1993
Fin'l Services Technology Consortium (Fintech) est'b by Citigroup

1995
First virtual banks without physical presence

1998
PayPal founded

2009
Bitcoin v.1 is released

2011
Google introduced Google Wallet

2022 ...
Autonomous Finance

2022 ...
Embedded Finance

2025 ...
Quantum Computing

2025 ...
AI, Neuralink

Timeline: 1 CE | 1600 | 1700 | 1800 | 1900 | 1920 | 1940 | 1960 | 1970 | 1980 | 1990 | 1995 | 2000 | 2010 | 2020+

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THE ADVENT OF FRACTIONAL RESERVE BANKING

how money gets moved

- Savers deposited gold and silver at goldsmiths, receiving in exchange a note for their deposit, thus creating an early form of paper money

- Since depositors typically would not redeem all their notes at the same time, the goldsmiths saw the opportunity to invest these "reserves" in interest-bearing loans and bills

- In this system, a bank takes in customer deposits of cash or gold, and then lends out a portion of the money it has on deposit, keeping only a fraction of it as a reserve

- The system is called Fractional-reserve Banking
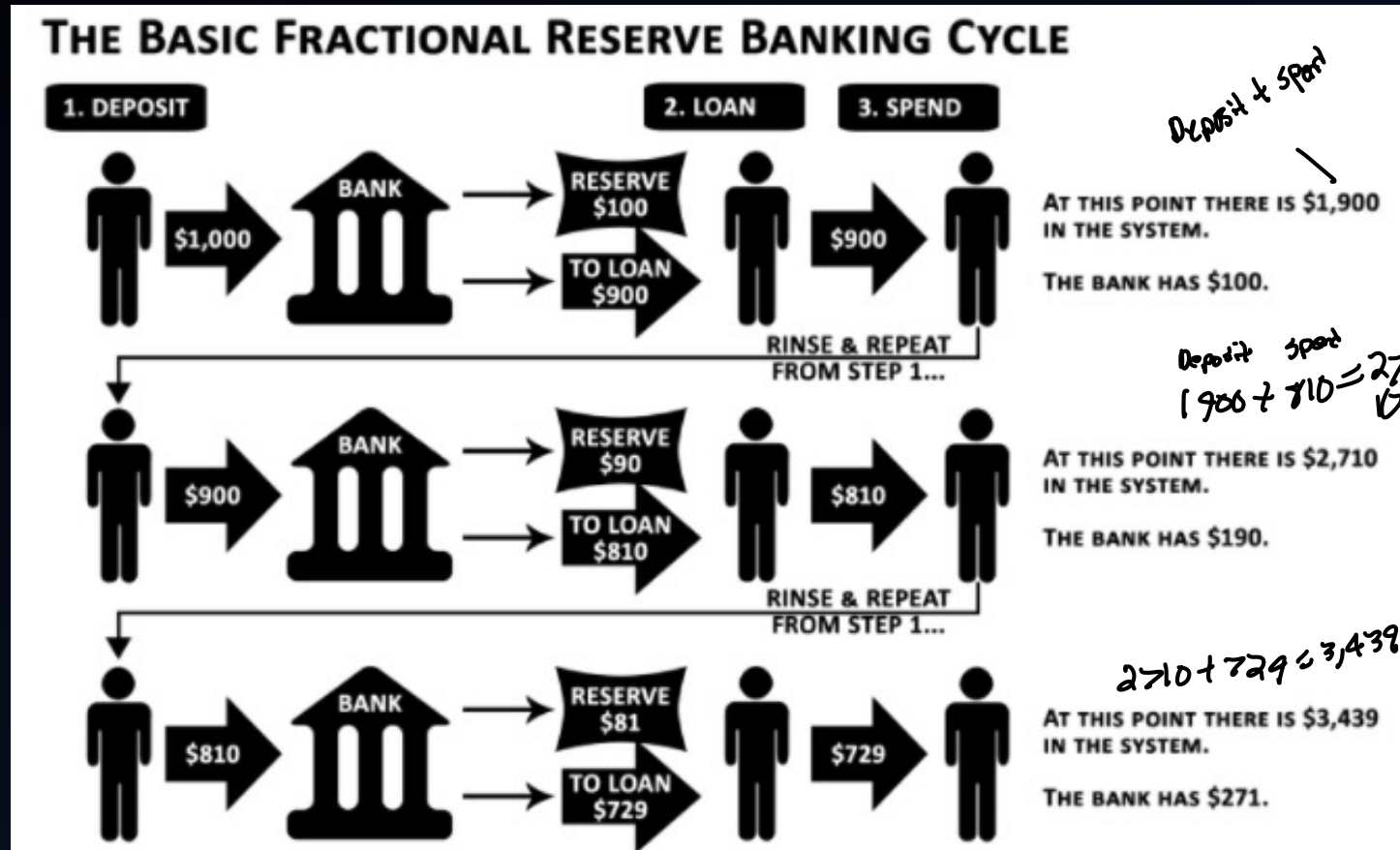
BANK DEPOSITS

- The term deposits can be misleading

- It implies something deposited for safekeeping, like currency in a vault … bank deposits are not like that

- A bank may put a small fraction of currency in the vault as reserves, and lend most of it to someone else, or buy an investment such as a bond or some other security

- An inducement to depositors is that a bank provides facilities for transferring demand deposits from one person to another by check

BANK ASSETS AND LIABILITIES

- *The deposits ~~of~~ (into) commercial banks are* assets to their holders but *liabilities of the banks*

- The assets of the banks consist of "reserves" (currency plus deposits at other banks, including the central bank) and "earning assets" (loans plus investments in the form of bonds and other securities)

- Bank reserves are only a small fraction of aggregate (total) deposits

- Early in the history of banking, each bank determined its own level of reserves by judging the likelihood of demands for withdrawals of deposits. Now *reserve amounts are determined through government regulation*.

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- A bank run occurs when *depositors wish to make large volumes of withdrawals* at once

- *A bank that cannot meet this sudden demand fails* (i.e., it goes out of business!)

  insolvent - liabilities exceed assets

- Even solvent banks — those whose assets exceed the value of their liabilities — fail if they cannot convert their assets into cash rapidly enough to satisfy their clients' demands

  TARP - bailout bills

Something happens to cast doubt on a bank's assets

Savers attempt to remove deposits

Anatomy of a Bank Run

Banks run short of liquidity

Confidence falls causing a panic

More savers want to remove savings

A "REAL-LIFE" EXAMPLE OF A BANK RUN

its a wonderful life

THE TIME VALUE OF MONEY

WHAT IS THE TIME VALUE OF MONEY?

- Money that is available today is worth more than the same amount in the future, since you can immediately put it to use

- The *opportunity cost* (also called an implicit cost) of a decision is the value of what you will lose or miss out on when choosing one possibility over another

- *Time value of money is the building block for many other fundamental topics such as bond valuation, stock valuation, options valuation, and capital budgeting*

COMPOUND INTEREST

"COMPOUND INTEREST IS THE EIGHTH WONDER OF THE WORLD. HE WHO UNDERSTANDS IT, EARNS IT ... HE WHO DOESN'T... PAYS IT." ~ loans

Albert Einstein
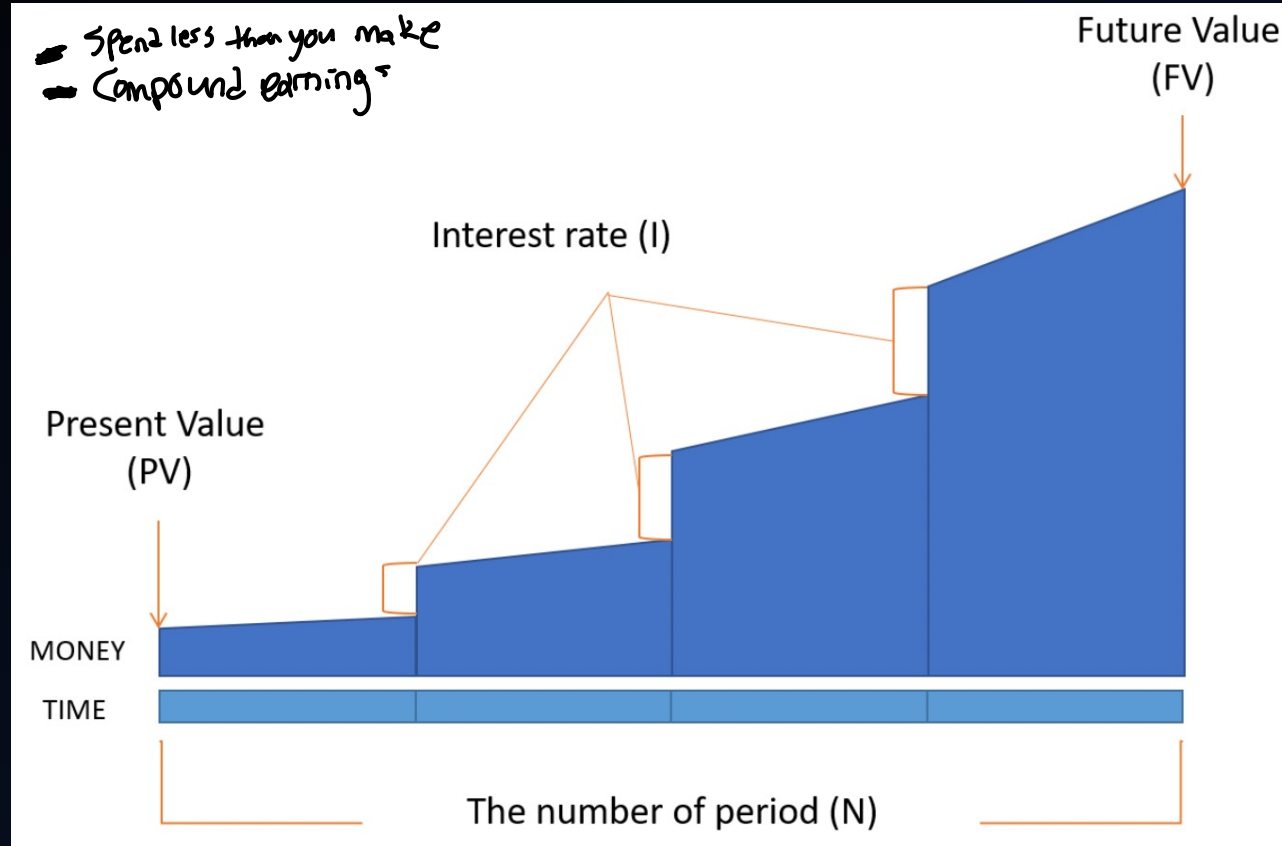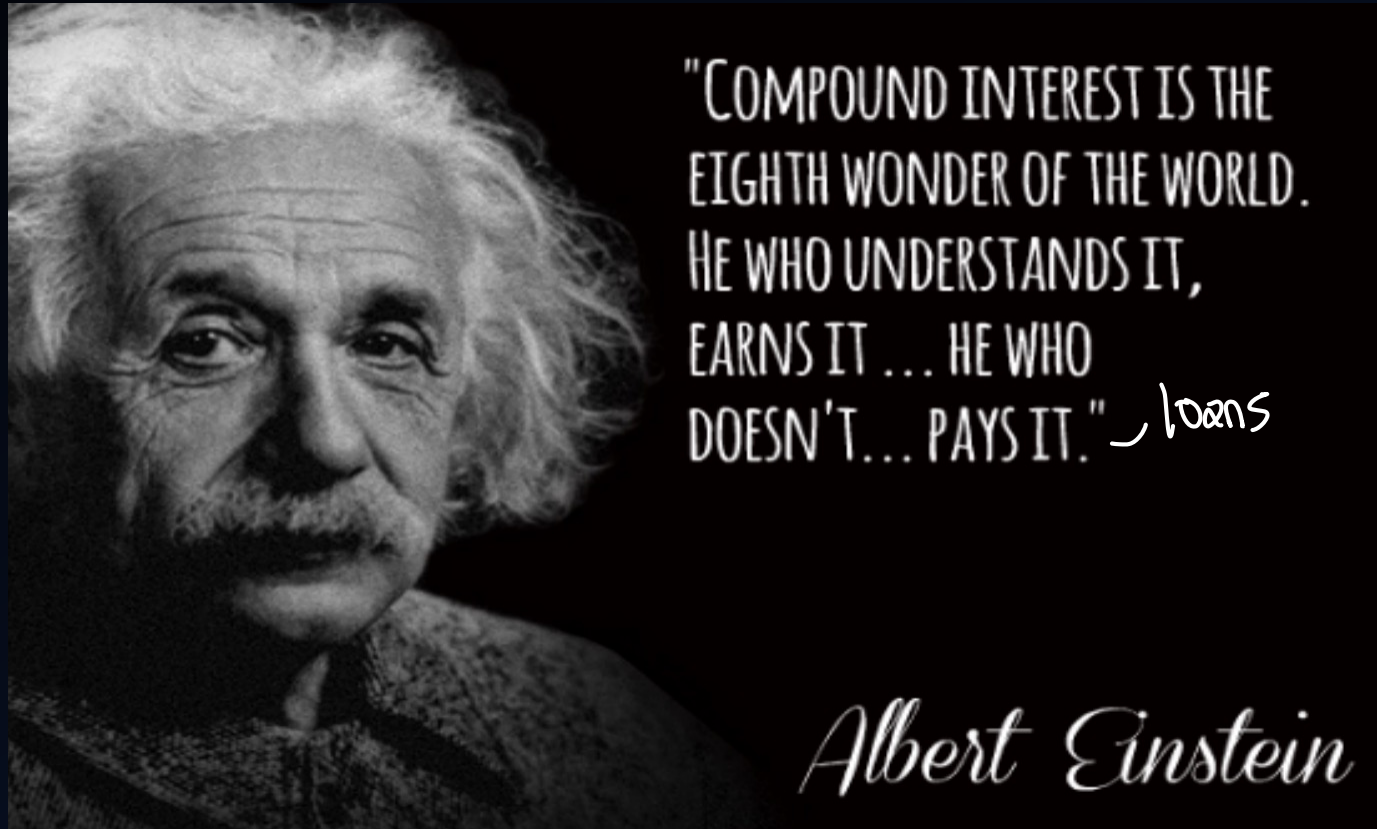
TIMELESS FORMULAS

Dont worry about these for tests

Future value of a lump sum:

$$FV = PV \times (1+i)^n$$

Present value of a lump sum:

$$PV = \frac{FV}{(1+i)^n}$$

Future value of an annuity:

$$FV = \left(\frac{(1+i)^n - 1}{i} \right) \times PMT$$

Present value of an annuity:

$$PV = \left(\frac{1 - \frac{1}{(1+i)^n}}{i} \right) \times PMT$$

Perpetuity:

$$PV = \frac{PMT}{i}$$

Where:

FV = future value

PV = present value

i = interest rate

n = number of time periods

PMT - payment
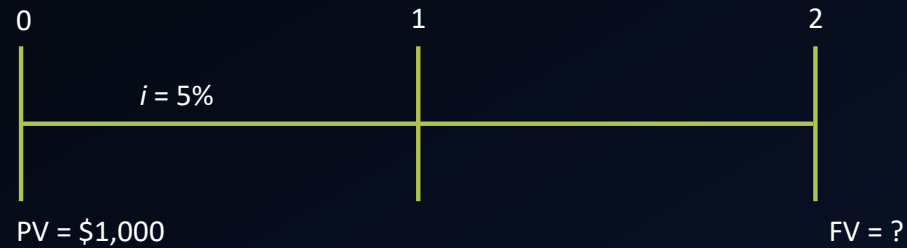
ANNUITIES

Timeline for the Future Value of an Annuity

FV = 200 [(1+.10)^3-1] / .10 = $662

CASH FLOWS

Timeline for the Present Value of a Mixed Stream of Cash Flows

| 0 | 1 | 2 | 3 |

$i = 7\%$

PV = ? CF$_1$ = \$60 CF$_2$ = \$75 CF$_3$ = 100

Solve for PV in any of the following 3 ways:

1. NPV formula on a spreadsheet
2. The Cash Flow function on a financial calculator
3. Treat each cash flow as an individual lump sum and use the lump sum formula

$$PV = (\$60/1.07) + (\$75/1.07^2) + (\$100/1.07^3) = \$203.21$$

RULE OF 72

Calculates the ***number of years*** it takes for principal to double

- Years = 72 divided by interest rate

- **Example:** 72 divided by 8% = 9 years

Calculates the ***interest rate*** it takes for principal to double

- Interest rate = 72 divided by number of years
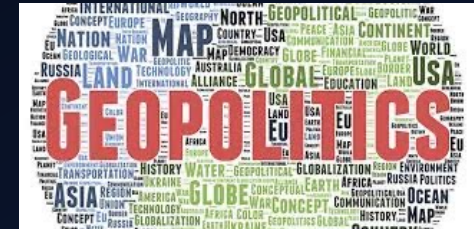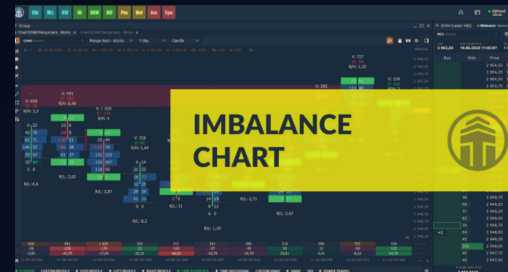
- **Example:** 72 divided by 5 years = 14.4%

72 / rate = yrs to double
72 / yrs = rate it takes to double

VOLATILITY

- We've discussed time and interest rates as important factors – Let's introduce a 3rd Factor … Volatility

- Volatility is defined *as a measure of the variation in the price of an asset over time*
  - Higher volatility is naturally associated with greater potential for larger losses (i.e., Risk)

- *Historical volatility* lets the data predict the future

- *Implied volatility* lets the market predict the future   *More Commonly used*

- Volatility is a factor in many important financial metrics such as the Sharpe Ratio

FACTORS AFFECTING VOLATILITY

Black Swan events

Volatility ↑ prices ↓
Prices ↑ Volatility ↓

Business Cycle

Peak — volatility ↑

Expansion — Recession — Expansion — Recession

Depression — Recovery

Trough

DEMAND   SUPPLY

IMBALANCE CHART

GEOPOLITICS

C BOE ~ White paper ViX

Duke
FinTech

VIX

implied

- *The VIX Index* is a financial benchmark designed to be an up-to-the-minute market *estimate of expected volatility* of the S&P 500 Index

- Provides an instantaneous measure of *how much the market thinks the S&P 500 Index will fluctuate in the 30 days from the time of each tick of the VIX Index*

- Thus, the VIX Index is *a forward-looking measure,* in contrast to realized (or actual) volatility, which measures the variability of historical (or known) prices

VIX ↑ markets↓   derivative

30 or higher = Sell Signal

^VIX	34.62	20%
Prev.Close		28.85
Open		28.2
52 Week	High 37.51	Low 14.1

as of January 24, 2022, 10:39 AM EST

Intraday 1M 3M 6M 1Y   — VIX

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VIX VERSUS S&P 500