

Formula for GDP: $Y = C + I + G + (X - I)$, expenditure demand view

Consumer spending: Durables, non-durables, services, biggest component

Investment: Business + residential fixed investment, inventories. NOT STOCK

Government: NO social security, stimulus payments, bond purchase, transfer

Three ways to measure: production = expenditure = income

• Production: market values of all final goods and services. GDP is flow, wealth is stock

• Expenditure: market value of expenditures; sold to person, business, or gov

• Income: payment received by sellers, income factors of production

Real GDP = $\frac{\text{Nominal GDP}}{\text{GDP Price Index}} \times 100$ GDP per capita = GDP / population

Includes negative things (crime prevention, pollution) and not positive (home, health,)

CPI: avg price; CPI in 2022 w/ 2021 base = $(\text{Cost}_{2021} \text{ in } 2022 / \text{Cost}_{2021} \text{ in } 2021) \times 100$

Bananas		Coconuts		CPI in 2021 w 2020 as base year	
Year	Price	Quantity	Price	Quantity	
2020	\$4	2	\$3	4	$\text{CPI}_{2021} = \frac{\$5 \times 2 + \$5 \times 4}{\$4 \times 2 + \$3 \times 4} \times 100 = 150$
2021	\$5	4	\$5	6	

Inflation rate = $\frac{\text{CPI}_{2021} - \text{CPI}_{2020}}{\text{CPI}_{2020}}$
GDP price index includes all. CPI only consumer goods
%change in consumption spending just use pure values for each year

AGGREGATE INCOME

• Global inequality due to differences across countries, not inequality within countries. In 1000, everyone had low GDP per capita, so relative position is more important.

• 2 ways to compare countries: market rates & purchasing power parity (PPP) - compares cost to buy fixed basket of consumer goods in one country to another.

• If per cap income in India = 147k rupees, market exchange of 71 for \$1 = 147,000/71 = 2070; \$1 with 21 rupees = 147,000/21 = 7,000. Thus things cost less.

Aggregate production function: $Y = A * f(K, H)$, K = capital equipment, H = human capital, A = tech/TFP (R&D and efficiency). K & H subject to diminishing returns, A isn't.

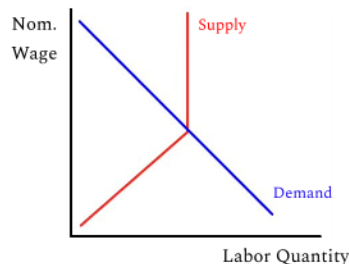
Labor Productivity: $Y/L = A * f(K/L, h)$, K/L = capital intensity, h = avg human capital

TRADEOFFS INVOLVING TIME

- **Intertemporal transformation:** move resources between time periods; Z (principal) * $(1 + i)^T$; i = annual nominal interest rate
- **Fisher Equation:** Real rate of return = i (nominal rate of return) - π (inflation rate)
- **Real interest rate** = nominal interest rate - inflation rate
- **Present Value:** measures how much money needed today to produce future payment; PV = payment T periods from now / $(1 + \text{interest rate})^T$
- **Quantity Theory of Money:** $M \times V = P \times Y$ // Money: cash in circulation plus highly liquid accounts like checking // Velocity of Money: num times avg unit of money changes. Assume LONG-TERM is 0 // Price level // Y = Real GDP.
 - $m + v = \pi + y$; y = real GDP growth, $v = 0$; $\pi = m - y$ (inflation = money supply growth rate - real GDP growth rate)

THE LABOR MARKET

- **Unemployed:** Actively looking for work in past 4 wks, currently available to work
 - Frictional: time takes to search for jobs / switching between; structural: imbalance in labor supply/demand; cyclical = current unemployment - natural rate: transitory, imbalance with wage rigidity (recession)
 - **Natural Rate (frictional + structural):** can't be lowered w/ policy w/o inflation
 - **Labor Force Participation Rate** = Labor force (employed + unemployed) / work age pop
 - **Unemployment** = number unemployed / labor force
 - **Okun's Law:** 3.3 - 2.1 (change in unemployment rate) = GDP growth; effect of lower unemployment + longer hours, greater work intensity, higher capital utilization
- Labor market links downturn in economy: K & H decrease (unemployment + idle factories) OR C & I decrease (people + business spend less)
- If C, I, G, or (X-M) decrease, labor demand decrease, so L in production function decrease



Supply line vertical bcz no more eligible workers.

If labor demand falls, wages fall. Some businesses wage rigidity and won't pay lower, so unemployment.
If labor demand rises, wages rise. At max employment, causes inflation.

FINANCIAL MARKETS/BANKS

- **Uses: Intermediation** (matching savers and borrowers), **Payments** (facilitating exchange), **Maturity transformation** (short term lending to long term borrowing), **Risk Reduction** (hedging and diversification), **Price Discovery** (market trading determine company value)
- **Asset:** something bank owns. Includes: **Bank Reserves** (vault cash, mostly liquid); **Cash** Equivalents (riskless liquid access immediately), **Long-term investments** (loans to others, value of bank properties, not liquid)
- **Liability:** something owed to another. Includes: **Demand deposit** (funds depositors get on demand), **short-term borrowing** (loans from other financial institutions), **long term debt**
- **Stockholder's equity:** assets - liabilities; estimated value of company
- **Bank Runs:** can reduce frequency by requiring banks to hold more stockholder's equity, more reserves, expand deposit insurance.

Suppose Allston Bank has a balance sheet as follows.

	Assets		Liabilities + Shareholder's Equity
Cash reserves	\$1,000	Short-term borrowing/ demand deposits	\$2,500
Long term bonds	\$2,000	Shareholder's equity	\$500
Total	\$3,000	Total Liabilities plus shareholder's equity	\$3,000

If long term bonds lose 10% of value:

	Assets		Liabilities + Shareholder's Equity
Cash reserves	\$1,000	Short-term borrowing/ demand deposits	\$2,500
Long term bonds	\$1,800	Shareholder's equity	\$300
Total	\$2,800	Total Liabilities plus shareholder's equity	\$2,800

FDIC Involvement: shut down bank, 250k to depositors or transfer ownership

SIFI: systematically important fin insit; must pass annual stress test, less risk, +stockholder equity

The Fed: Central bank, monetary policy, Supervise and regulate SIFI
Controls short run int, infl long-run
quantity of bank reserve
Dual mandate: max employ, stable prices

FUNDAMENTAL DRIVERS OF GROWTH

Growth Rate: $(y_2 / y_1) - 1$ **Compounding:** $(1 + g)^T - 1$; **Annualized:** $(y_2/y_1)^{(1/T)} - 1$

Growth A X B = Growth of A + Growth of B; GR of A / GR of B = growth A - Growth B

Rule of 72: If growth rate = g, then variable will double in X yrs; $X = 72/g$

- **Sustained Growth:** advanced countries slow steady growth 2%
- **Catch-up/Convergence:** economies will have same income from adopt. ideas of rich (leapfrog) and diminishing returns to capital

In the US, K & K/L grow, K/Y constant. K slower in advanced economy

Geography: Resources, temp, climate, disease. Bad to use: **reversal of fortune:** European colonialism in good regions, those areas have had long-run growth, tech

Culture: hard work, trust, saving ethic. Hard to define, racist use, culture shaped by institutions, limited in ability to explain growth rates

Institutions: frameworks det by society; shape behavior w/ incentives + constraints.

Trust in institutions for tech; system needs to allow **creative destruction**. Extractive: protect minority at expense of majority, Inclusive: innov, constraints on politicians, enforce prop. rights + competi. Things can still be diff in countries w same institu.

Policies: institutions (market regu, property rights), openness to new ideas (foreign direct investment), physical capital (high savings, early accumulation, R&D), human capital and inclusion (edu), macro policies (not tm debt or high inflation)

BONDS!!

- **Financial Securities:** contracts value from future promised payments, exchangeable
- **Bond:** contract promises creditors with known schedule of fixed, nominal payments
- **Face Value:** value of bond's last payment; **Coupon:** intermediate payment made by bond;
- **Coupon Rate:** fraction of face value that bond pays until maturity; **Primary market:** firms or govt issue bonds & sells to bondholders; **Secondary market:** bondholders sell bonds to other bondholders, receive all remaining payments
- **Yield to Maturity:** constant annual rate of return investors earn from buying bonds and holding till maturity, equates current price w/ present value of future payment streams.
 - **Bond prices + yield/rate of return move in opposite directions.** When bond prices increase, get same face value and coupon payments. When rate on return investment goes down since costs same to buy same future payment stream.
 - $p = \frac{F}{(1+y)^T}$; market price = Face value / $(1 + \text{yield to maturity})^T$; NO COUPONS!

Three-year maturity bond with face value \$F and coupon rate c, trades for \$p

$$p = \frac{cF}{1+y} + \frac{cF}{(1+y)^2} + \frac{cF}{(1+y)^3} + \frac{F}{(1+y)^3}$$

Valuing a 3-year bond with $p = \$100$, $F = \$100$, $c = 5\%$:

$$100 = \frac{5}{1+y} + \frac{5}{(1+y)^2} + \frac{5}{(1+y)^3} + \frac{100}{(1+y)^3}$$
$$y = 0.05 = 5\%$$

If $p = F$, then $y = c$

Federal Funds Rate: interest rate banks pay others when borrowing reserves from each other.

Y-axis = FFR, quantity of reserves = x-axis. **Shift Supply Reserves Right:** buy securities, **Left:** sell securities; **Shift Demand Reserves:** Banks get more deposits (want to hold more reserves) or central bank raise/lower interest on reserves. Lower interest on reserve = lower FFR.

CREDIT MARKET

Credit Demand Shifts: expectation on future business + policy, income, changes to gov't tax/spending **Credit Supply Sources:** econ agents who save. slopes upward, 2 competing effects: 1) high interest rate as reward for saving, 2) increase purchasing power in future increase present consumption. 1st effect dominates. comes from households (retirement, saving, future purchase) and firms (cheaper to fin invst using retained earnings)

Credit Supply Shifts: expect abt future income, demographic shifts (retirement), expectation of future credit avail

Gov't Budget Deficits: increased gov't borrowing can "crowd out" private investment, rising interest reduces credit demand from firms and households; reduce rate of investment.

INFLATION

Problems: complicates long-range financial planning, irritation on sellers (print new prices), arbitrary redistribution of purchasing power (winners and losers - some get inflation-adjusted salaries, some don't), people don't like inflation

Benefits: makes real wage more flexible, raises money for gov (*seignorage*) by printing more money, facilitates price adjustment, return economy to equilibrium in recession, central bank more power to use countercyclical monetary policy.

Hyperinflation: 2x prices in 3 years, huge increase in money supply from overprinting.

Misunderstanding on printing consequences, tight labor market, can't borrow anymore. **Ways to Combat:** Fix quantity of \$ to commodity (etc gold). this is old and country can experience inflation if commodity value falls or ppl might melt /// Fix exchange rate - adopt low inflation rate of country fixing against, but reduce flexibility and crisis if can't maintain.

PHILLIPS CURVE

Inflation = expected inflation - f(unemployment rate - natural rate) + supply shock

f(unemployment rate - natural rate) is an increasing function where $f(0) = 0$; shows demand

1. in a healthy economy w/ no supply shock, inflation = expected inflation
2. **When unemployment falls below the natural rate, there is inflationary pressure** (inflation > expected)

$$Y^D = C(Y-T, r) + I(r, Y) + G + NX(Y, Y^F, \epsilon)$$

Holding the credit demand curve fixed, in which of these scenarios would the quantity of credit demanded be largest?

- a. nominal interest rate = 4%, inflation = -2%
- b. nominal interest rate = 6%, inflation = 2%
- c. nominal interest rate = 10%, inflation = 4%
- d. nominal interest rate = 10%, inflation = 2%

The credit demand curve = quantity of credit demanded as a function of the real interest rate = nominal interest rate - the inflation rate. The lower the real interest rate, the greater the quantity of credit demanded. B has the lowest real interest rate (6% - 2% = 4%).

MACROECONOMIC FLUCTUATIONS

- Recessions:** negative growth with high unemployment; financial crisis, trade wars, expectations, is amplified by multipliers. **Expansion** is period of sustained growth.
- For the long run, it's an increase in **supply** where $Y = A \times F(K, H)$
- For the short run, it's demand with all K and H :

$$Y = ((Y - T, r) + I(r, Y) + G + (X - M))$$

$Y - T$ = disposable income, r = interest rate, g = gov't spending, $X - M$ = exports - imports
Labor market links demand and supply sides of the economy

C, I, G or $(X - M) \downarrow$ <- demand

Labor demand \downarrow

$H \downarrow$

$Y \downarrow = A * F(K \downarrow, H \downarrow)$ <- supply

Types of exogenous economic shocks

- Supply (Technology / Productivity)**, such as technological ability to produce in Dustbowl / COVID
- Demand (Keynesian)**, such as **expectations / animal spirits** when consumers or businesses become more/less confident. Monetary, fiscal, and exchange rate policies
- Financial (Financial markets/institutions)** fluctuations in asset prices and failures of financial institutions)
- Global (real or financial shocks)** emanating from other countries)

The net export equation

$$NX = f(Y, Y^{foreign}, e)$$

If $Y \uparrow$ then purchase more imports so $NX \downarrow$

If $Y^{foreign} \uparrow$ then they purchase more of our exports so $NX \uparrow$

If e up then it becomes cheaper for home to buy foreign goods and is more costly for foreign to buy domestic goods, so $NX \downarrow$

This is really, really important!

RECESSIONS

2007 - 2009: Fall in housing prices, 50% collapse in new residential construction. Drop in C (job, wealth loss and saving), spiraling mortgage defaults causing bank failures)

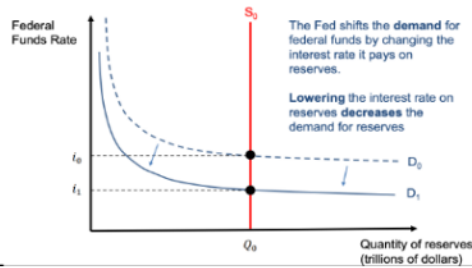
2020: COVID-19; labor demand shifts to left (C down since consumers stay home, lose jobs, cut down on spending; I down since firms stop buying since can't sell). Supply chains also broken.

Banking Crisis 2023: Silvergate, SVB, mid-sized banks experiencing runs, Credit Suisse. Failing since value of bank assets lowered from interest rates rising, bank runs, fire sales, reduction in stockholder equity.

MONETARY POLICY

Expansionary:

- Lowers interest rate, increases demand for borrowing for C & I
- Firms hire more labor to produce C, I , so labor curve shifts right
- Do when labor demand is low
 - HOW: have gov't buy bonds, supplying credit (long term) // Pay lower interest rate on bank reserves (Fed Policy Rate), lowering FFR



The general case when the primary balance is not zero just adds one more term to this

$$\text{Debt}_t - \text{Debt}_{t-1} = i_t * \text{Debt}_{t-1}$$

$$\left(\frac{\text{Debt}}{\text{GDP}} \right)_t - \left(\frac{\text{Debt}}{\text{GDP}} \right)_{t-1} = (i_t - g_t) \left(\frac{\text{Debt}}{\text{GDP}} \right)_{t-1} + \left(\frac{\text{Primary Deficit}}{\text{GDP}} \right)_t$$

Primary deficit = gov't spending excluding interest - taxes
Deficit = PD + interest // Deficit = gov't spending - tax

Concerns of low IR: harder for banks to do monetary policy, risky behavior by investors, increased borrowing (can cause rates to rise), erodes profit and capital.

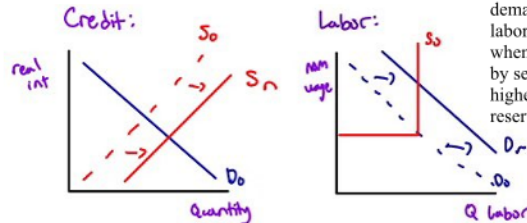
Monetary Policy at Zero bound (lowering IR):

- Forward guidance: promise to keep rates lower for longer and future short-term rates will stay low -> can inc long-term rates
- Quantitative Easing: Central bank creates large quantity of bank reserves to buy long-term bonds -> inc Q / supply of reserves and push down IR on long term bonds -> raise wealth, inc C
- Negative Nominal Interest Rates: borrows repay less than initially borrow; banks higher return in vaults than in lending.

Deflationary Spiral: lower Q credit -> lower output & inflation -> real interest inc to $r = -\pi$. Avoid by: (1) raise inflation target, (2) flexible avg inflation targeting lower RIR by raising expected inflation, (3) countercyclical fiscal policy

Expansionary Monetary:

r dec -> i dec -> e dec -> NX dec (changes credit supply)



Real interest dec, Q credit inc

Labor demand shift right -> firms need more workers

Debt

Debt sustainability

When debt is stable:

$$\frac{\text{Primary Deficit}}{\text{GDP}} = (g - i) \frac{\text{Debt}}{\text{GDP}}$$

Larger primary deficits increase the debt faster

The higher the growth rate of GDP relative to the interest rate paid on debt, the more a country can "grow out" of its debt over time.

A government can sustain persistent budget deficits as long as the economy is growing fast enough relative to its interest payments.

But high levels of debt may drive up borrowing costs, crowd out private investment, and increase the risk of a fiscal crisis

EXCHANGE RATES

and **Nominal exchange rate** (e) = units of foreign / 1 unit of domestic

- Absolute Purchasing Power Parity (PPP):** average prices same across countries, but can fail b/c of (1) transportation costs, (2) taxes and tariffs, (3) informational limitations
- Relative PPP:** assumes fixed deviation from absolute PPP: $P_{\text{domestic}} * e = D * P_{\text{foreign}}$; P is average across all goods, D is constant.

Growth in e = inflation foreign - inflation domestic: assuming growth rate of $D = 0$; works well over long periods of time.

KEY: if domestic IR rises relative to foreign IR, then nominal ER appreciates since dollar is more attractive to investors. Stronger ER today means investors expect it to weaken more when it returns to normal in the future, making up for higher IR, thus NX decreases.

In short run, determined by **supply/demand in foreign exchange market**. **In long run**, determined by **relative PPP**.

- Central banks (not investors) use **international reserve** funds to move money to change exchange rates and accumulate funds to increase resiliency against future shocks.
 - Ex. to prevent currency from depreciation, buy domestic currency (strengthens it) with intl reserves. To prevent appreciation, buy foreign currency in exchange for domestic.
- Currency Crisis:** depreciation of 25% or more; causes by fixing exchange rate to wrong value, self-fulfilling speculative attack, investor worry, political event. **Consequences:** gov't loses foreign currency by trying to defend exchange rates; higher interest rates to defend exchange rate -> recessions; difficulty repaying debt

NET EXPORTS

- Increase NX :** exchange rate depreciation; increase exports by making it cheaper to buy domestic goods, decrease imports since cheaper to buy foreign goods. Value effect (pay more for foreign goods than country imports, but volume > value)
- GDP:** increase export when GDP increases in foreign countries and decrease imports when GDP decreases domestically.

	Flexible/Float Rates	Fixed Rates
Advantages	Exchange rate automatically adjusts, stabilizing monetary policy, lower risk of currency crashes	Reduces frequent large fluctuations, constraints gov't from monetary policy and inc credibility
Monetary Policy	Esp effective (currency depreciation strengthens); weaker exchange rates boost net exports (reduced by multiplier) Effect on r: $r \downarrow \Rightarrow i \downarrow \Rightarrow e \downarrow \Rightarrow NX \uparrow$	n/a < - All effect on R is expands.
Fiscal Policy	Reduced effectiveness (crowd out thru currency appreciation) Effect on r: $r \uparrow \Rightarrow i \uparrow \Rightarrow e \uparrow \Rightarrow NX \downarrow$	Especially effective (no crowding out b/c IR no change, NX decrease b/c higher domestic income = inc import)
Exchange Rate	N/A monetary and fiscal policy have opposite effects on r	Potentially effective, devaluation (depreciate exchange rate, boost NX) and revelation (appreciate EX, reduce NX) Often forced. Effect on r: $r \downarrow \Rightarrow i \downarrow \Rightarrow e \downarrow \Rightarrow C, I, NX \uparrow$

Fiscal Policy

Countercyclical / Expansionary:

- Raise gov't purchases, lower tax / increase transfer. This boosts demand directly.
- More spending -> higher inflation + output -> raise interest rate, gives central bank more room to maneuver. Esp effective when economy well below potential w/ 0 interest rate, reduces investment through crowd out // shifts labor demand to right // lowers inflation.

Effects:

- Crowding out when rising interest rates**, more credit demand -> high i -> low C, I
- Keynesian multiplier:** money is spent and respent

If G increases, y inc -> C inc, I inc, NX dec // r inc -> e inc -> c dec, i dec, NX dec, but to lesser extent
If T dec -> C inc, y inc, then the multiplier amplifies. this inc r , which inc e .

Fiscal Policy Multiplier: $\Delta Y / \Delta G$ or $\Delta Y / \Delta T$, but can differ b/c key multiplier (higher for households who consume more) or crowding out.

- Central bank likely to offset what it perceives as undesired fiscal policy, aggregate supply constraint, and costs of deficit / debt.

WHEN TO DO BOTH:

- Expansionary** when labor demand is too far to the left, **contractionary** when labor demand is too far to the right. If expansionary when economy is at full employment, then wage inflation -> inflation. If contractionary when at full employment, then there will be a recession.

Expansionary Fiscal

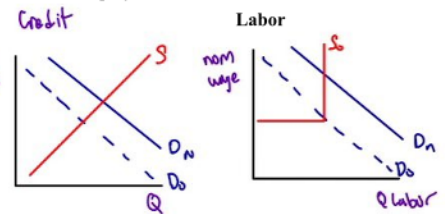
Since gov't spend more -> demand for credit rises since need to borrow more

thus, needs more labor.

CONTRACTIONARY

IS OPPOSITE:

lower gov't purchase, increase tax/lower transfer



Stocks

Purpose: intermediation (cash from investor to business), payments, maturity transformation, Risk reduction, price discovery

Stock Return: bond return + risk premium (lower risk premium -> lower return -> stock price rise)

Market capitalization = share price * num shares

Why do stock prices increase? Expected future earnings higher, rate of return on alt assets lower, risk falls

Efficient Markets Hypothesis: stock prices alr include all available public info, so can't consistently beat

Stock prices reflect present discounted value of future dividend payments

$$\text{share price} = \sum_{t=1}^{\infty} \frac{\text{Dividend}_t}{(1 + \text{discount rate})^t}$$

$$\text{Annualized return} = (\text{closing price} / \text{beginning price})^{1/t} - 1$$

Overview

Macroeconomics: Study of why GDP/capita fluctuates and vary across countries; what causes recessions?

GDP / Income

GDP = production, expenditure, income. Omits non market activity, final goods, and within borders. GDP is flow, wealth is stock

GDP includes negative (crime prevention, pollution) but not positive (home, health)

Production = market value (MV) of final goods inside borders; sold to person, business, or gov (unsold count as inventory)

Expenditure: MV on expend on final goods, to the buyer

Income: payments received by sellers; income of factors of production

Fund. Drivers of Growth

Geography: Access to resources, temp, climate, disease. Often bad to use

Reversal of Fortune: European settlers established colonialism in wealthy regions, those areas have lower long-run growth now

Culture: hard work, trust, saving ethic. Hard to define, racist use, culture shaped by institutions, limited in ability to explain GR

Institutions: frameworks det by society; shape behavior w/ incentives + constraints. Trust in institutions for tech; system needs to allow creative destruction, Extractive: protect minority at expense of majority, Inclusive: innov, constraints on politicians, enforce prop. rights + competi. Things can still be diff in countries w same institu.

Policies: institutions (market regu, property rights), openness to new ideas (foreign direct investment), physical capital (high savings, early accumulation, R&D), human capital and inclusion (edu), macro policies (not tm debt or high inflation)

Convergence



Tradeoffs w/ Time

Intertemporal transf: Move resources between time periods. See: annual nom interest rate formula

Future Value of Payment Streams: amt money accumulate by some time in future

Discount Factor: How much u have to discount 20k to turn into current dollars

Net Present Value (NPV): sum of costs and benefits associated using present values to make costs and benefits comparable. Pursue proj w/ + NPV, not - NPV

Financial Interm. & Banks

Financial System Roles: financial intermediation, payments, maturity transf., risk reduction (hfr, insurance), price discov

Asset: smth bank owns, **bank reserves** (vault cash), **cash equivalents** (riskless liquid assets), **long-term invest** (loans to others, properties, not liquid)

Liability: \$ owed to another instit, includes **demand deposit** (depositors can get on demand), **short-term borrowing** (<1yr loans from other fin insti.), **long-term debt**

Stockholder's equity: asset liabilities, est. value of company by stock mkt

Role of Banks: identify profitable lending opp, maturity transformation (deposit -> long term invst), manage and transfer risk (diversified portfolio + stockholders), residual risk to FDIC / gov't

Insolvent: assets < liabilities

Limited Liability: stockholder eq low o

FDIC Involvement: shut down bank, 250k to depositors or transfer ownership

SIFI: systematically important fin instit; must pass annual stress test, less risk, +stockholder equity

The Fed: Central bank, monetary policy

- Supervise and regulate SIFI
- Controls short run int, infl long-run
- quantity of bank reserve
- Dual mandate: max employ, stable prices.

Aggregate Incomes

Global income inequality falling, income within countries is flat or rising
Market exchange less accurate than **Purchasing Power Parity (PPP)**: compares to cost to buy a fixed basket of good from 1 country to another
See: Aggregate production function
Diff in country GDP comes in tech

CPI/ Nominal + Real GDP

Nominal GDP: current market price
Real GDP: changes in quantity

CPI measures avg price for consumer goods, **Nominal GDP / GDP Price Index x 100**

Inflation Rate: rate of change (RoC) of avg prices over time. 2% for dev, 5-10% for not

GDP Price Index: All components of GDP (invst + govt expend)

Consumer Price Index: What typical consumer buys

Prox. Drivers of Growth

In the US, K and K/L grown, K/Y constant
Economies grow by accumulating capital

Depreciation = machinery wears out
Investment = Amt of equip. produ per unit of time [FLOW]

Capital: total amt of equip. [STOCK]
TFP has been slower in all advced

economies: takes time to incorporate new innovations + hard to have new ideas

Slowdowns reflect **slower capital intensity (K) increases**

Labor productivity growth (Y / L) is around half due to increased capital intensity (K/L), h only small contribution. vari due to TFP.

Convergence: economies will have same income. Caused by diminsh. returns in capi't + poor adopt ideas of rich.

2% annual growth = f(Y/L), each country moves 2% of distance between current income and frontier country income.

Ex: SK, taiwan, myanmar, singapore, jpn

The Labor Market

Employed = working for pay
Unemployed = not working, looking for work within 4wks

Not in labor force = not working or look

Unemployment rate: unemp / labor force
Employed-population ratio: employed / pop.

To raise employment, lower unemployment or LFPR goes up

Frictional: imperfect info on available jobs, time in between jobs

Structural: labor supplied > labor demanded; wage rigidity is big factor

• tm labor regulations, no supportive labor reg, less effective edu, high min wage, inflexible unions

Natural Equilibrium: 3.8-3.5%; can't be lowered with macroec policy w/o neg inflat

Cyclical: current unemployment - natural

Labor Demand Shifts: price/demand for goods rises, changing tech

Labor Supply Shifts: workers pfer working, falling opp. cost of time working, increased population

Real Wage: adjusted for inflation, can lower by reducing someone's paycheck or keeping paycheck same under inflation.

Links Production & Expend: Downward turn in econ: K & H decrease (unemp + idle factories) or C and I go down (ppl + business spend less).

• When C, I, G, or (X-M) decrease, labor demand go down, L in production decre.

Okun's Law: 3.3 - 2.1(unemployment) = GDP growth

• less unemploy & +hrs, +LFPR, +work, +work intensity, +capital utilization

Supply/Demand for Credit

Credit Supply: Funds offered as loans
Principal: initial value loaned

Interest Rate: Cost of borrowing for debtor; rate of return for creditor

Maturity: Time when loan is repaid in full
Credit Demand: real interest rate = price of credit, from

• **firms**: costs incurred before revenue, finance for invst

• **households**: buying expensive goods, smoothing consumption over temp income shocks (ie. losing job)

• **gov't**: budget deficit, credit demand inelastic. +tax = -borrow; +spending, no tax+

Equations

National Income Accounting Identity

Y = C + I + G + (X - M)

C = consumer spending, I = business + residential invst, inventories, NOT STOCK MARKET, G = govt expend + invst, NO transfers, (X - M) = exports - imports

Note: Buying house is investment. Purchase of imported goods counted twice and removed in imports. Imports no count GDP

Real GDP = Nominal / GDP PI x 100

Comparing real GDP in diff yrs keeps prices constant, diffn due to quantity

Year	Bananas		Coconuts	
	Price	Quantity	Price	Quantity
2021	\$4	2	\$2	6
2022	\$5	4	\$4	5

What is the increase in nominal GDP?

Nominal GDP₂₀₂₁ = \$4 x 2 + \$2 x 6 = \$20
Nominal GDP₂₀₂₂ = \$5 x 4 + \$4 x 5 = \$40
% growth = $\frac{\$40 - \$20}{\$20} \times 100 = 100\%$

$Real\ GDP_{2021} = \frac{\$20}{100} \times 100 = \$20$
 $Real\ GDP_{2022} = \frac{\$40}{170} \times 100 = \$23.53$

Consumer Price Index (CPI)

$CPI_{2022} = \frac{Cost\ of\ 2021\ Consumption\ Basket\ in\ 2022}{Cost\ of\ 2021\ Consumption\ Basket\ in\ 2021} \times 100$

Year	Bananas		Coconuts	
	Price	Quantity	Price	Quantity
2021	\$4	2	\$2	6
2022	\$5	4	\$4	5

What is the CPI for the economy as a whole in 2022 (with 2021 as the base year)?

$CPI_{2022} = \frac{\$5 \times 2 + \$4 \times 6}{\$4 \times 2 + \$2 \times 6} \times 100 = \frac{\$34}{\$20} \times 100 = 170$

Capital Accumulation

K_{t+1} = K_t + i_t - depreciation_t
K_{2021} = capital at beginning of 2021
Invst and deprec. during 2021 results in new amt of capital at beginning of 2022

Savings

Savings = S = Y - C - G
Saving Rate = S / Years
I = S - (X - M) // from natl acct. identity
C = consumption, G = Govt

Annual Nominal Interest Rate

$Z \times (1 + i)^T$
Z = amt saved today
i = interest rate
T = yrs
Saving money today, then spending it T years from now.

Fisher Equation / Real Rate of Return

Real Rate of Return = i - pi
i = nominal rate of return
pi = inflation rate
Tells us how buying power of savings grows over time.

Bond Prices (no coupon)

$X = \frac{F}{(1 + i)^T}$
X = present val; F = face val; T = maturity; i = interest

Quantity Identity of Money

$M + V \equiv \pi + Y$
m = gr of M (Money; cash + liquid; no bank reserves), v = gr of V (velocity, # times avg unit of money changes hands in period), pi = inflation, y = gr of Y, or real gdp growth. Nominal = pi + y
v is constant, so always o for long-run

Credit Demand Shifts: expectation on future business + macroec, income, changes to gov't tax/spending

Credit Supply Sources: econ agents who save. slopes upward, 2 compeeting effects: 1) high interest rate as reward for saving, 2) increase purchasing power in future increase present consumption. 1st effect dominates. comes from households (retirement, saving, future purchase) and firms (cheaper to fin invst using retained earnings)

Credit Supply Shifts: expect abt future income, demographic shifts (retirement), expectation of future credit avail

Bonds and Bond Mkt

Bond: Contract promises creditors schedule of fixed, nominal payments. Seller gets money now

Face Value: Value of bond's past payment.
Coupon: Intermediate payment by bond

Primary market: firms or gov't issue bonds, sell them to bondholders

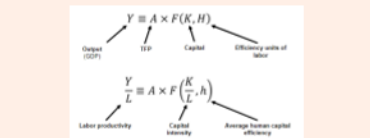
Secondary market: bondholders sell bonds to others, get remaining payments from issuers.

Bond prices & yields move in oppos. direc
If interest rate increase, yield increase. If interest rate falls, price goes up.

Yield to maturity: constant annual rate of return investor earns from holding bond till maturity; = price w/ pv of future payment

Long term bond = series of consecutive short term bonds

Aggregate Production Function



K = capital equipment and capital structures, H = human capital (L = # hrs of wk / # workers, h = avg human capital efficiency), A = tech/TFP (R&D, learning by doing, efficiency, like mgmt, culture, alloc of ppl / capt to high value)

Constant returns to capital and labor; **Diminishing to capital and labor**. Misallocation include: license req, limiting laws, protection for existing ineff firms, limits on foreign investment

K/L = capital intensity, h = avg yrs schooling
Note: Buying house is investment. Purchase of imported goods counted twice and removed in imports. Imports don't count as GDP

Growth Rates (GR)

Growth of A x B ≈ growth of A + growth of B
Growth of $\frac{A}{B}$ ≈ growth of A - growth of B

Or, gr x approx = gr A + gr B

Annual Growth Over Time

$Growth_{t,t+T} = (1 + g)^T - 1$

g = annual growth rate, y = variable
Annualized Growth Rate

$Annualized\ growth\ rate_{t,t+T} = \left(\frac{Y_{t+T}}{Y_t}\right)^{\frac{1}{T}} - 1$

How much did U.S. GDP grow between Q3 and Q4 2019?

- GDP in Q3 2019 = \$4,780 trillion
- GDP in Q4 2019 = \$4,805 trillion

$Growth_{Q3,Q4} = \frac{\$4,805}{\$4,780} - 1 = 0.0052 = 0.52\%$

But newspapers reported 2% growth in Q4 2019?

$Annualized\ growth_{Q3,Q4} = (1.0052)^4 - 1 = 0.021 = 2.1\%$

If a variable is growing at a constant annual rate of g% (expressed in percentage points), then the variable will double in approximately X years, where X is given by:

$X \approx \frac{72}{g}$

Net Present Value (NPV)

$Present\ value = \frac{Payment\ T\ periods\ from\ now}{(1 + interest\ rate)^T}$
 $Present\ value = \left[\frac{1}{(1 + interest\ rate)^T}\right] \times (Payment\ T\ periods\ from\ now)$

Present value is discounted value of future.
pi = inflation rate

Bond Prices (with coupon)

Three-year maturity bond with face value \$F and coupon rate c, trades for \$p

$p = \frac{cF}{1+y} + \frac{cF}{(1+y)^2} + \frac{cF}{(1+y)^3} + \frac{F}{(1+y)^3}$

Valuing a 3-year bond with p = \$100, F = \$100, c = 5%:

$100 = \frac{5}{1+y} + \frac{5}{(1+y)^2} + \frac{5}{(1+y)^3} + \frac{100}{(1+y)^3}$
 $y = 0.05 = 5\%$

General property: if p = F, then y = c

Money, Price, Inflation

Money: Make and receive payments when buy/selling service. **Medium of exchange facilitates trade**. **Store of value** = transfer purchasing power in future. **Unit of acct**: universal yardstick

M2: highly liquid, currency in circulation, checking / saving acct

Neg of Inflation: complicates long-term planning, irritation on sell side (new prices), redistrib of purchasing power (long term contracts based on expt inflat), ppl hate it

Pos of Inflation: raise \$ for gov't (seignorage) by printing money, facilitate price adj, return econ to equil after recession, fed more power to use countercyclical monetary policy by lowering real interest -> increases borrowing.

Check quantity theory of money
Hyperinflation: price 2x in 3yr, misunderstanding on conseq of printing money, increase in spending or collapse in tax, loss ability to borrow

anchors to pin price/infl:

- Fix quantity of \$ to commodity (etc gold)
- old tech, experience inflation if commodity value falls or ppl might melt. If worth more can't do countercycle policy
- Fix exchange rate
- adopt low inflation rate of country fixing against, but reduce flexibility and crisis if can't maintain.
- Primary: inflation targeting
- target what matters

Things to Remember

On Inflation:

Higher inflation leads to higher interest rates. Thus, higher inflation means purchasing power of the dollar goes down. Mortgages are similar to bonds, so if interest rates go up, the bond price decrease

Okun's Law:

3.3 - 2.1(unemployment) = GDP growth

Quantity Theory of Money

Inflation = growth rate of money - growth rate of real GDP
Works well over long periods, not well over short periods since hard to predict. etc toilet paper during covid

Real v. Nominal:

Nominal is always before taking inflation into acct, real is after taking it into acct.

Real GDP = Nominal / GDP Price Index x 100

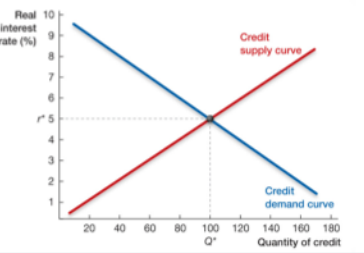
Bonds & Maturity

Expectations for long-run inflation rise increases nominal yield for 20-yr treasury bonds. Nominal Yield = real yield + inflation, if real yield is unchanging, then nominal will increase to acct for inflat.

Growth in GDP Per Capita

Growth = growth in GDP - growth in popu.

Credit Supply Curve



Who would benefit from unexpected increase in inflation

The borrower paying down mortgage loan at fixed nominal interest rate. Borrows money to get house, if money worth more, house worth way more. Real return to the lender from making loan will be lower. Inflation reduces the value of cash and of a fixed nominal income.

Country experiencing deflation, according to Quantity Theory of Money, what's true?

Money supply grew at faster rate than real GDP. Quantity theory: inflation = growth rate of the money supply - growth rate of real GDP

For inflation = -1%, the growth rate of money supply must be slower than the growth rate of real GDP.

Worldwide crisis leads consumers to cut back on spending, reduing demand. Employers can freely adjust nominal wages,

Thus, reduction in employment, not involuntary unemployment.

If employers can't reduce nominal wage, then:

larger reduction in employment and increase in unemployment.

General Q's

Which of the following would be measured as an expenditure in the G component of GDP?

The cost of a new fleet of air rescue helicopters; not 20yr treasury bonds or stimulus payments.

Home production not counted in GDP
key limitation of GDP is that w/o a market transaction or another reliable way of estimating this value, home production doesn't appear in our national accounts.

What matters more to where a person stands in the global distribu of income in 1000 / 2022:

Relative position in their country / What country they live in

Any GDP Per Capita Qs

No statements can be necessarily true, etc. higher marginal product, faster growth, larger total GDP, etc

All equal, increase in real interest will

Cause quantity of credit demanded to fall along credit demand curve; not shift demand curve to right/left.

Demand Curve when gov't increased taxes and reduce federal sending

Demand curve shifts left and interest rate decreases, since reduce gov't spending -> reduce gov't borrowing -> decrease credit demand. At interest rate, less demand.

A bank run occurs when then bank's collectively withdraws their funds. Banks are vulnerable bez

It is creditors, rather than borrowers (or debtors), who have funds to withdraw from a bank during a bank run. Banks have illiquid assets.

The credit supply curve

The interest rate gives return to saving, increase in the interest rate makes saving more attractive for households. higher interest rate also makes households richer - can spend more and save less now but still end up with the same amount of money in the future. 1st efft dominates the 2nd and so curve slopes upward. Also +interest rate +cost of borrowing for private investment, so it will decrease rather than increase.

Employment-population ratio increased. What happened?

Unemployment rate went down and labor force participation was unchanged.

Assume households are pessimistic abt future, so they borrow less and save more now. This will equilibrium real interest and equil quantity of credit demanded
Decrease; have ambiguous effect on borrowing less and saving more.

leftward shift in the credit demand curve (borrowing) and a rightward shift in the credit supply curve (saving). shifts will definitely produce a lower real interest rate, but effect on quantity depends on the relative size of the two shifts (is ambiguous).

Calculation Q's

Trusty makes 10-yr business loan, and requires 6% real return. If expected inflation is 4%, what interest rate will Trusty Bank charge to Reliable? Which party benefits?

The nominal interest rate is equal to the real interest rate plus inflation, so if Trusty needs a 6% real return on top of 4% inflation, it will need to charge a 10% nominal interest. If inflation is lower than expected at 2%, the 10% nominal produces 8% real return for Trusty, so they benefit.

Exchange Rate / PPP

A Big Mac meal costs \$5 in the US and 50 pesos in Mexico. The market exchange rate between U.S. dollars and pesos is 20 pesos per \$1. Average income/capita in the United States is \$60k, and average income/capita in Mexico is 200k pesos. Mexican income per capita in U.S. dollars is _____. Adjusted for Purchasing Power Parity (using the Big Mac meal as the basket of goods), Mexican income per capita is ____.

\$10k, \$20k
20 pesos = \$1. Thus, 200,000 pesos / (20 pesos / \$1) = \$10,000.
Because Big Macs are \$5 in the U.S. and 50 pesos in Mexico, the PPP adjustment is 10 pesos per \$1. Consequently, Mexican income per capita is 200k pesos / (10 pesos / \$1) = \$20,000.

Nominal GDP + Inflation

Year	Peanut Butter		Tennis Balls	
	Price per jar	Quantity (jars)	Price per ball	Quantity (balls)
2020	\$4	2	\$1	12
2021	\$5	3	\$1	15

3. What was Dogtown's nominal GDP in 2021?

$$\text{\$30} = 5 * 3 + 1 * 15$$

4. What was inflation in Dogtown between 2020 and 2021 (using 2020 as the base year for the CPI)?

$$CPI_{2021} = \frac{\$5 \times 2 + \$1 \times 12}{\$4 \times 2 + \$1 \times 12} \times 100 = \frac{22}{20} \times 100 = 110$$

$$CPI_{2020} = 100$$
$$[110 - 100] / 100 = 0.1 = 10\% \text{ inflation}$$