Business cycles

Business cycles and trends.

Business cycle: Short-term fluctuations in economic activity. Business cycle knocks off course from its longer-run trend.

Potential output: The level of output that occurs when all resources are fully employed.

Long-run economic growth reflects growth in the economy's economic growth.

In short-run, the economy may fail to meet its potential. Sometimes GDP is higher than potential output, and sometimes it's lower. These short-term wiggles around potential output make up the business cycle.

The ups and downs of the business cycle are very disruptive (unemployment rate, etc.)

output gap: The difference between actual and potential output, measured as a percentage of potential output.

$$\text{output gap} = \frac{\text{Actual output} - \text{potential output}}{\text{potential output}} \times 100 = \frac{Y^* - Y^{pot}}{Y^{pot}} \times 100$$

- when output gap $< 0 \Rightarrow Y^* < Y^{pot} \Rightarrow$ Recessionary gap.

  When there is a recessionary gap:

  - Actual unemployment > Natural unemployment
  - Low and often decreasing inflation (and sometimes deflation)

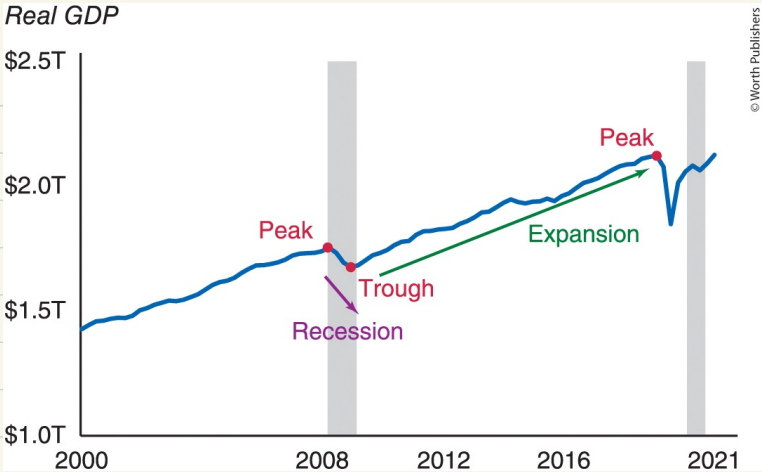
- when output gap $> 0 \Rightarrow Y^* > Y^{pot} \Rightarrow$ Inflationary gap

  When there is a inflationary gap:

  - Low unemployment rate
  - high inflation

Typical stages of business cycle include:

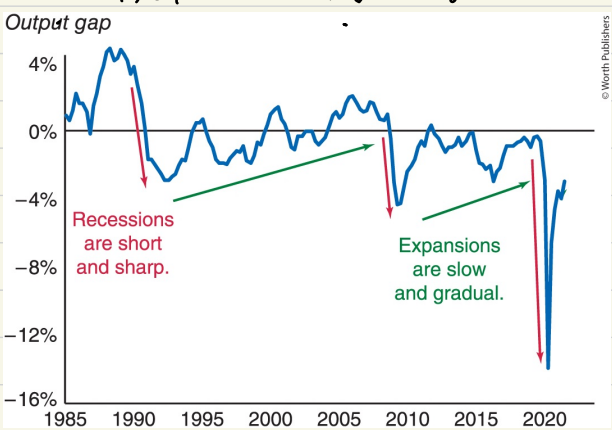
- **Peak**: A high point in economic activity.
- **Trough**: A low point in economic activity.
- **Recession**: A period of declining economic activity.
- **Expansion**: A period of increasing economic activity.



GDP measures the level of output, and thus potential GDP is the highest sustainable level of output. The output gap presents this level another way by scaling GDP relative to the level of potential output. The output gap therefore tells you how well the economy is doing relative to its potential. GDP growth rates are about changes, describing the rate at which the size of the economy is expanding or contracting.

Characteristics of business cycles.

- Recessions are short and sharp, expansions are long and gradual.



- The business cycle is persistent, which means that it is a reasonable bet that current conditions will continue in the near future.
- The business cycle impacts many parts of the economy.
- output gap and the unemployment rate is related by Okun's Rule of thumb.

Okun's rule of thumb: cyclical unemployment rate = $-b \times$ Gap

b = sensitivity of cyclical unemployment to the output gap, usually <1.

Aggregate expenditure and multipliers

Aggregate expenditure and income

Aggregate expenditure (AE): The total amount of goods and services that people want to buy across the whole country.

$$AE = C + I + G + NX.$$

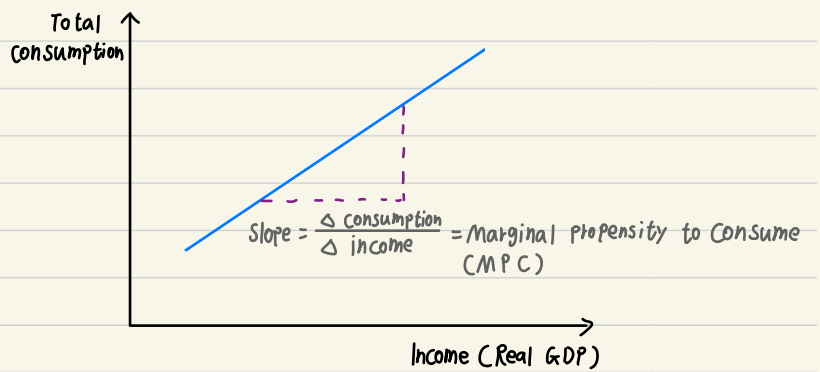
Consumption: when households buy goods and services.

Planned investment: Investments that a business intentionally makes when it buys capital goods, excluding inventories. Purchasing of real estate is also included.

Government purchases: when the government buys goods and services.

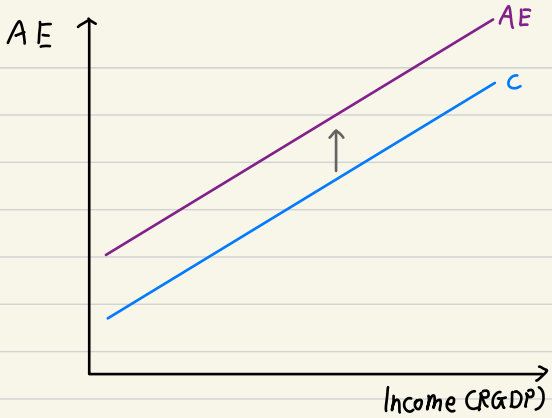
Nx: Spending by foreigners on domestic-made exports, less total spending by domestic on foreign made imports.

Consumption function: A curve plotting the level of consumption associated with each level of income.



Marginal propensity to consume (MPC) is the fraction of each extra dollar of income that households spend on consumption.

Aggregate expenditure has the curve that is always above consumption curve, and it has the same slope as consumption function, the aggregate expenditure also increases as income increases.



Changes and shift to aggregate expenditure

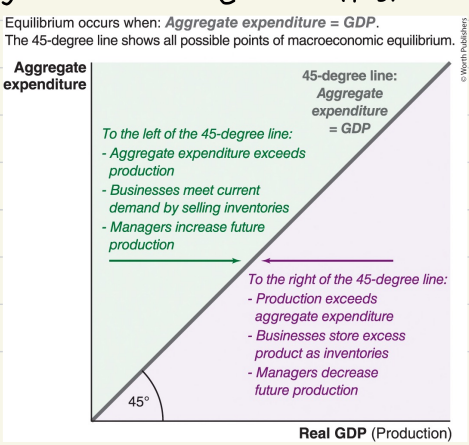
- A change in income causes movement along the aggregate expenditure line.
- A change in factors that change aggregate expenditure at any income level causes the aggregate expenditure line to shift.
  - Spending decrease ⇒ decrease AE ⇒ shift AE line down.
  - positive spending shock ⇒ increase AE ⇒ shift AE line up.

Market equilibrium

Macroeconomic equilibrium: It is a point at which the total quantity of output that buyers collectively want to purchase is equal to the total quantity of output that suppliers collectively produce.

AE at a level of real income Y^* = RGDP.

- If AE > Y : Planned spending > actual income (excess demand)
- If AE < Y : Planned spending < actual income (excess supply).



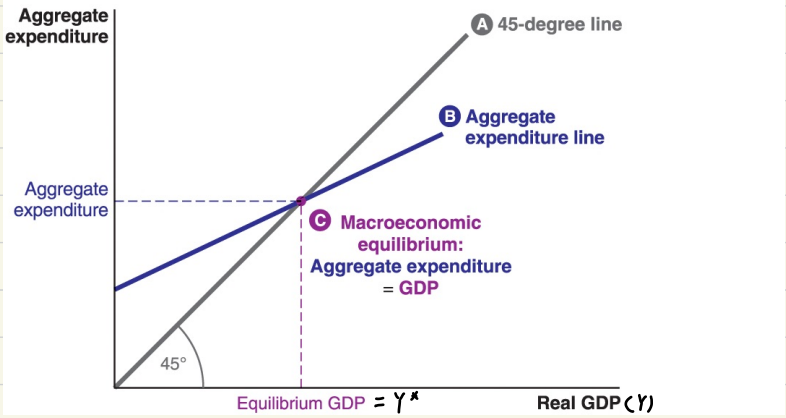
The macroeconomic equilibrium occurs at the cross between aggregate expenditure crosses the 45-degree line, the cross is known as Keynesian cross.

Equilibrium occurs where the aggregate expenditure line meets the 45-degree line.

Ⓐ The **45-degree line** shows the set of possible equilibria where ***aggregate expenditure = GDP***.

Ⓑ The **aggregate expenditure line** shows how total spending varies with the level of GDP.

Ⓒ **Macroeconomic equilibrium** occurs where the **aggregate expenditure line** crosses the **45-degree line**, ensuring that spending and production plans are consistent with each other.



Inventories will let production adjust toward the equilibrium:

- If $Y < Y^*$ $\Rightarrow$ $Y < AE$ (production < planned spending)
  - Unplanned inventories are decreasing
  - Firms increase production
- If $Y > Y^*$ $\Rightarrow$ $Y > AE$ (production > planned spending)
  - Unplanned inventories are increasing.
  - Firms decrease production
- If $Y = Y^*$ $\Rightarrow$ $Y = AE$ (production = planned spending)
  - No change in inventories
  - output remains constant

AE - simple model

Assume there is no government in a closed economy.

At equilibrium : $AE = Y = C + I$

- Consumption function (C) : total planned consumption, which is given by :

$$C = \bar{C} + mpc \times Y^D$$

$\bar{C}$ = autonomous consumption (consumption if income = 0)

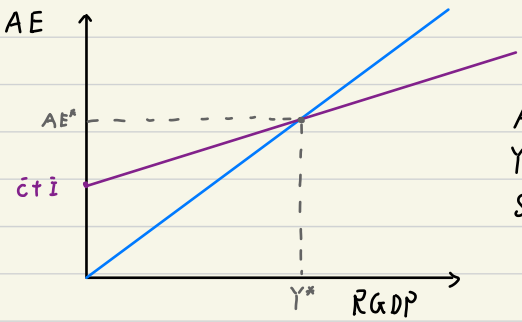
mpc = marginal propensity to consume ($0 < mpc < 1$)

Y^D = Disposable (after tax) income = $Y - T = Y(1-t)$.

MPS (marginal propensity to save) = $1 - mpc$, it is the save per dollar income.

- Investment function (I) : total planned investment

All investment is autonomous : $I = \bar{I}$



$$AE = C + I = \bar{C} + mpc \times Y^D + \bar{I}$$

$$Y^* = (\bar{C} + \bar{I}) \cdot \frac{1}{1-mpc} = \bar{A} \cdot \frac{1}{1-mpc}$$

$$S^* = Y^* - C^*$$

$$= Y^* - \bar{C} - mpc \cdot Y^*$$

$$= -\bar{C} + (1-mpc) \cdot Y^*$$

$$= -\bar{C} + mps \cdot Y^*$$

There are changes to AE and Y^* :

- Changes to autonomous expenditure ($\bar{A}$) :
  - Changes to autonomous consumption ($\bar{C}$) :
    - Increase consumer confidence ⇒ Increase $\bar{C}$ ⇒ AE shift up ⇒ Y^* increases. (Vice versa)
    - Increase income ⇒ increase $\bar{C}$ ⇒ AE shift up ⇒ Y^* increases. (Vice versa)
  - Changes to autonomous investment ($\bar{I}$) :
    - positive shock to investment ⇒ Increase $\bar{A}$ ⇒ AE shift up ⇒ Y^* increases. (Vice versa
- Changes to induced expenditure
  - Changes to mpc ⇒ rotate AE ⇒ increase or decrease Y^*
  - Changes to tax rate ⇒ increase or decrease Y^*

The complete model of AE

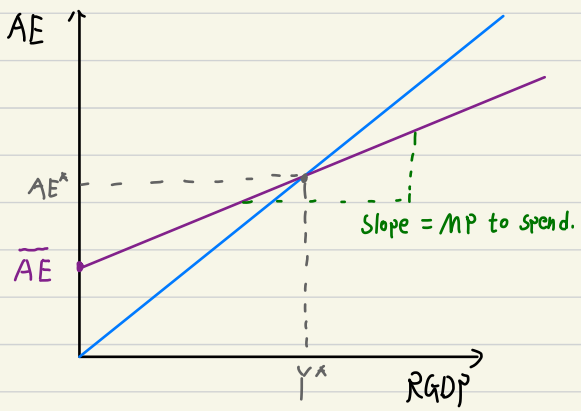
$AE = Y = C + I + G + Nx = C + I + G + X - Im = \bar{C} + \bar{I} + \bar{G} + \bar{X} + (mpc(1-t) - mpIm) \cdot Y$

Induced expenditure.

Autonomous expenditure

$= \bar{AE} + MP \text{ to spend} \cdot Y$

- mpIm (marginal propensity to import): For every unit income, the amount spent on income.
- mp to spend = mpC(1-t) - mpIm (marginal propensity to spend): For every unit income, the amount spent. include investment, consumption, government purchase, and net exports.
- mpC (marginal propensity to consume): For every unit income, the amount spent on consumption.



Spending multiplier

Spending multiplier: It describes how an initial change in autonomous expenditures leads to a more significant change in GDP than the initial spending change alone.

$$\Delta Y = \Delta A \cdot \text{multiplier}.$$

Generally:

$$\frac{\Delta Y}{\Delta A} = \text{multiplier} = \frac{1}{1-z}, \quad z = \text{slope of AE function}$$

Consider $AE = Y = C + I$:

$AE = \bar{C} + mpC \cdot Y^D + \bar{I} = \bar{C} + \bar{I} + mpC \cdot Y^D = \bar{C} + \bar{I} + mpC \cdot (1-t)Y = \bar{AE} + z \cdot Y \Rightarrow z = mpC \cdot (1-t)$.

$\text{Multiplier} = \frac{1}{1-z} = \frac{1}{1-(mpC \cdot (1-t))}$

Consider $Y = AE = C + I + G$:

$AE = \bar{C} + mpc \times Y^D + \bar{I} + \bar{G} = \bar{C} + \bar{I} + \bar{G} + mpc \cdot C(1-t) \cdot Y = \bar{AE} + z \cdot Y \Rightarrow z = mpc \cdot C(1-t)$

multiplier $= \frac{1}{1-z} = \frac{1}{1-mpc \cdot C(1-t)}$

Consider $Y = AE = C + I + G + NX$

$AE = \bar{C} + \bar{I} + \bar{G} + \bar{x} - mpIm \cdot Y + mpc \cdot C(1-t) \cdot Y = \bar{C} + \bar{I} + \bar{G} + \bar{x} + (mpc \cdot C(1-t) - mpIm) \cdot Y \Rightarrow z = mpc \cdot C(1-t) - mpIm$

multiplier $= \frac{1}{1-z} = \frac{1}{1-mpc \cdot C(1-t) + mpIm}$

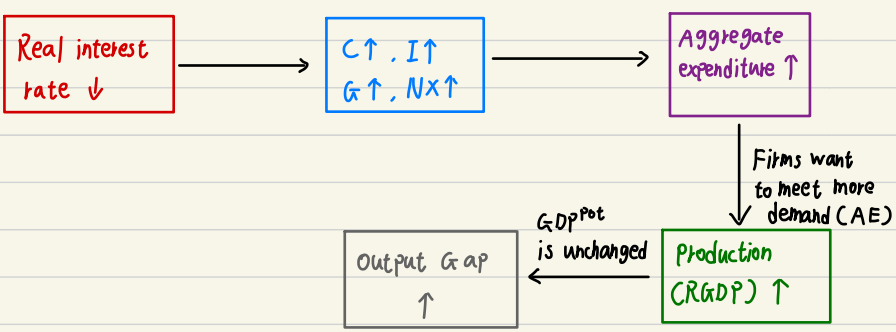
IS-MP-PC model

IS curve

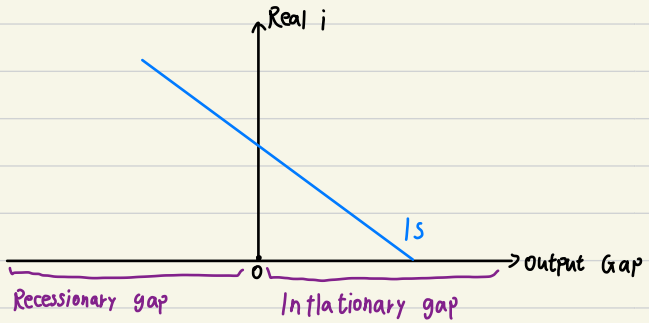
Real interest rate shapes components of aggregate expenditure :

- lower interest rate boost consumption (low I ⇒ less oppo cost from saving ⇒ spend more)
- lower interest rate boost investment (low I ⇒ low investment cost ⇒ invest more)
- lower interest rate boost government purchase. (low I ⇒ low interest payment ⇒ government spend more)
- lower interest rate boost net exports. (low I ⇒ depreciate domestic currency ⇒ more exports ⇒ increase net exports)

Thus :



IS curve: IS curve illustrates that a lower real interest rate leads output to be larger, relative to potential output.



IS curve changes according to:

- Changes to AE ⇒ shift IS curve (AE↑ ⇒ shift to right, AE↓ ⇒ shift to left)
- Changes to real i ⇒ move along IS curve

The MP curve

Monetary policy: The process of setting interest rate in an effort to influence economic conditions by the central bank.

The bank sets nominal interest rate to influence real interest rate indirectly, central bank sets real interest rate.

Nominal policy rate: It is the interest rate set by a central bank as a primary tool for monetary policy.

Real policy rate (Risk-free real interest rate): Nominal policy rate - inflation

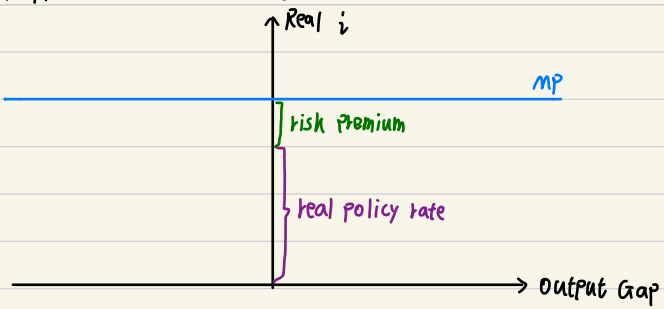
Real interest rate: It is the end result from the nominal policy rate

Risk premium: The extra interest that lenders charge to account for risk of loaning money.

Monetary policy rule of thumb:

- Stage 1: Nominal policy rate = inflation + neutral real interest rate (Loanable fund market) + 0.5·(inflation - target inflation) + output gap.
- Stage 2: Real policy rate = Nominal policy rate - inflation
- Stage 3: Real interest rate (MP) = Real policy rate + risk premium

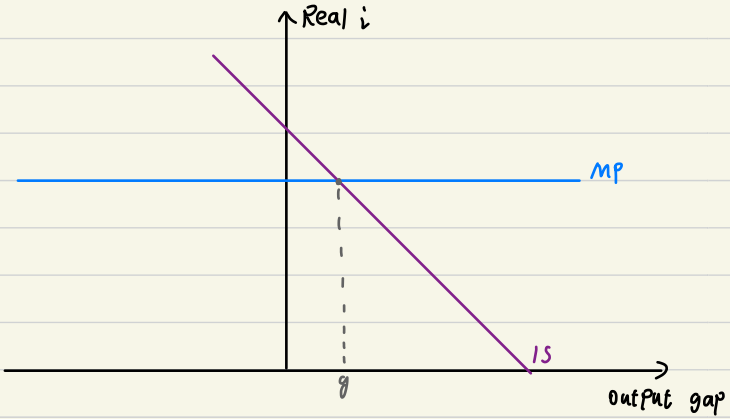
The MP curve reflects this real interest rate:



IS-MP framework

The state of the economy is determined by the intersection of the IS curve and the MP curve.

The economy moves to the point of macroeconomics equilibrium where the two curves intersect.



For government:

Fiscal policy $\xrightarrow{\text{impact}}$ AE $\xrightarrow{\text{shift}}$ IS

Monetary policy $\xrightarrow{\text{impact}}$ policy rate $\xrightarrow{\text{shift}}$ MP

Three forces of inflation

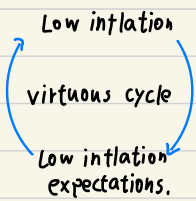
There are three main forces:

- Inflation expectations: The rate at which average prices are anticipated to rise next year.
- Demand-pull inflation: Inflation resulting from excess demand.
- Cost-push inflation: Inflation that result from an unexpected rise in production cost.

Inflation = Expected inflation + Demand-pull inflation + Cost-push inflation

- Expected inflation: inflation expectation ↑ ⇒ inflation ↑
- Demand-pull inflation: Output gap ↑ ⇒ demand > economy can supply ⇒ inflation ↑
- Cost-push inflation: Production cost ↑ caused by supply shock ⇒ Inflation ↑

For expected inflation:



Expected inflation are formed in the combination of four factors:

- Adaptive: history matters
- Anchored: faith in the central bank
- Rational: fully informed
- Sticky: only pay attention when it matters.

In the long run, assume there is no supply shock:

If economy is operating at full capacity (Actual output = Potential output). Thus:

$$\text{inflation} = \text{expected inflation}$$

Mathematically:

$$\text{Inflation} = \text{expected inflation} + a \cdot \text{output gap} + \text{shocks}$$

$$\text{Unexpected inflation} = a \cdot \text{output gap} + \text{shocks}.$$

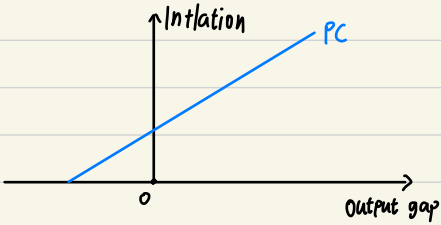
Okun's rule of thumb: Actual unemployment rate − Natural rate of unemployment = Cyclical unemployment rate

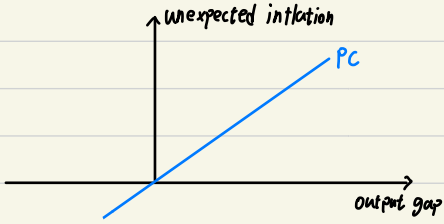
$= -b \times \text{Gap}$. b = sensitivity of cyclical unemployment to the output gap, usually < 1.

Thus, we have:

Inflation = expected inflation $- \frac{a}{b}$ · cyclical unemployment rate + shocks.

Phillipes curve: The relation between output gap and inflation or unexpected inflation.





Phillips curve shifts because of expectations and/or shocks:

- Output gap ↑ ⇒ Excess demand ⇒ Rising prices ⇒ point on phillips curve move upward and to the right.
- output gap ↓ ⇒ Insufficient demand ⇒ Falling prices ⇒ point on phillips curve move downward and to the left.

The change in output gap cause movement along the Phillips curve:

- input costs ↑
  Productivity growth ↑ ⇒ Rising production costs ⇒ Rising prices at each output gap ⇒ Phillips curve shifts up
  Domestic currency ↓

- input costs ↓
  Productivity growth ↑ ⇒ Falling production costs ⇒ Falling prices at each output gap or slower rates of increase ⇒ Phillips curve shifts down
  Canadian dollar ↑

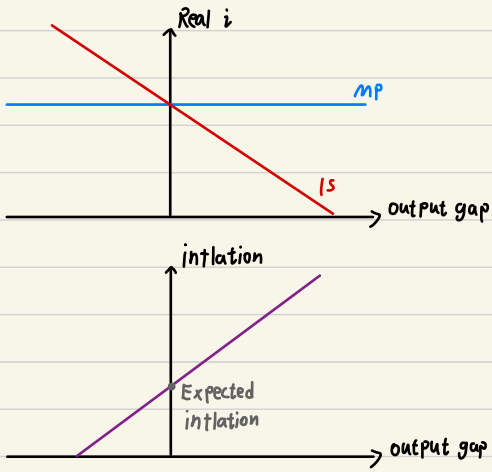
	Short Run Recessionary Gap	Short Run Inflationary Gap	Long Run Output Gap = 0
GDP	$Y < Y^{pot}$	$Y > Y^{pot}$	$Y = Y^{pot}$
Unemployment	$u > u^{natural}$	$u < u^{natural}$	$u = u^{natural}$
Inflation surprise	$\pi < \pi^{expected}$	$\pi > \pi^{expected}$	$\pi = \pi^{expected}$

π: inflation u: unemployment Y: RGDP

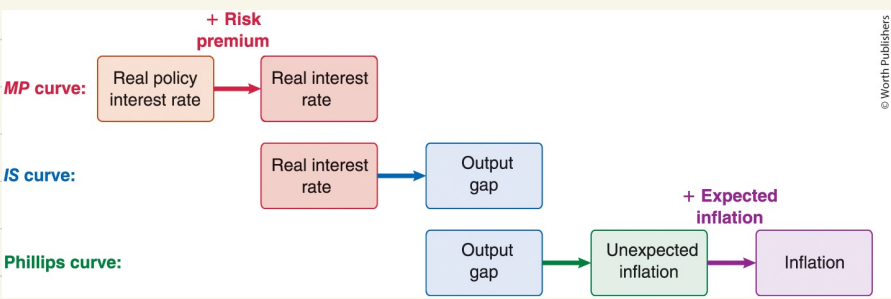
← In long run, output gap = 0.

The full IS-MP-PS model

The full model: The framework that uses the IS curve, the MP curve, and the Phillips curve to link interest rates, the output gap, and inflation.



The connections of three curves are as follows:

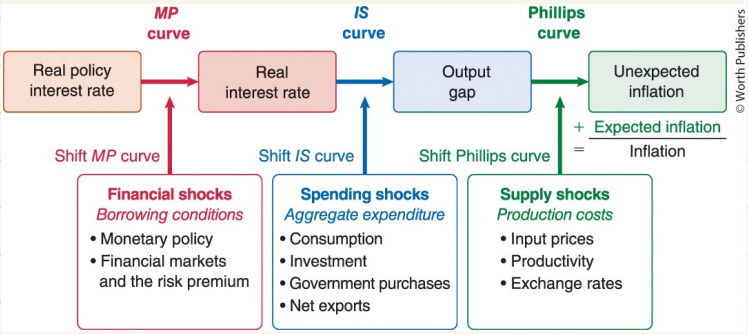


There are three types of financial shocks:

- **Financial shocks:** Any change in borrowing conditions that change the real interest rate at which people can borrow. The central bank shifts the policy interest rate, or changes in financial markets shifting the risk premium - will shift the MP curve.

- **Spending shocks:** Any change in aggregate expenditure at a given real interest rate and level of income - whether due to consumption, planned investment, government expenditure, or net exports - will shift the IS curve.

- Supply shock : Any change in production costs that leads suppliers to change the prices they charge at any given level of output will shift the Phillips curve.



A Recipe for analyzing macroeconomic shocks:

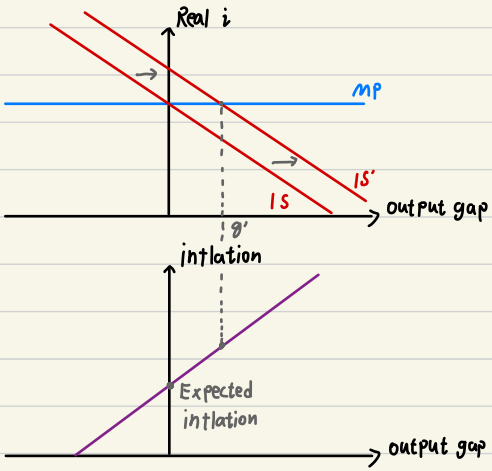
- Identity the shocks so you can shift a curve.
- Find the output gap
- Access inflation and unemployment

	Step one	*Step two*		*Step three*
	Shift the curve	**Real interest rate**	**Find the output gap**	**Assess inflation**
Financial shocks				
↑Real interest rates	*MP* curve shifts up	↑	↓	↓
↓Real interest rates	*MP* curve shifts down	↓	↑	↑
Spending shocks				
↑Spending	*IS* curve shifts right	No change	↑	↑
↓Spending	*IS* curve shifts left	No change	↓	↓
Supply shocks				
↑Production costs	Phillips curve shifts up	No change	No change	↑
↓Production costs	Phillips curve shifts down	No change	No change	↓

For example:

- Consumer confidence rose sharply following the election of a populist government

  ⇒ Increase in consumption ⇒ shift IS curve to the right.



As a result:

- Unchanged real interest
- Cause intlationary gap
- higher intlation
- Low unemployment rate

The economy recover using either two ways:

1: Self - correcting mechanism

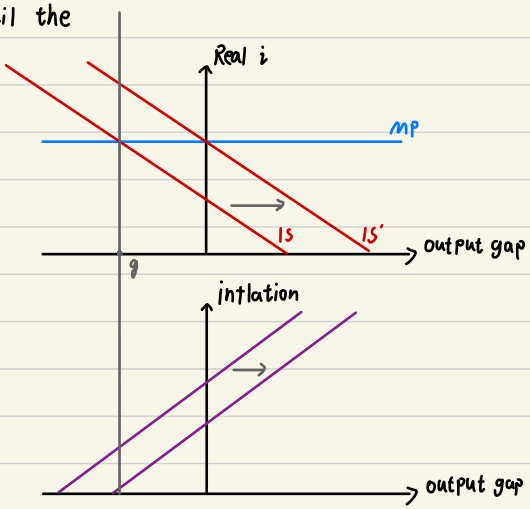
2: Fiscal and/or monetary policy

For a recessionary gap when using self-correcting mechanism:

Recessionary gap ⇒ high unemployment rate ⇒ over time wages fall ⇒ shift PC curve down

lower wages ⇒ firms hire more worker ⇒ output increases ⇒ shift IS curve right

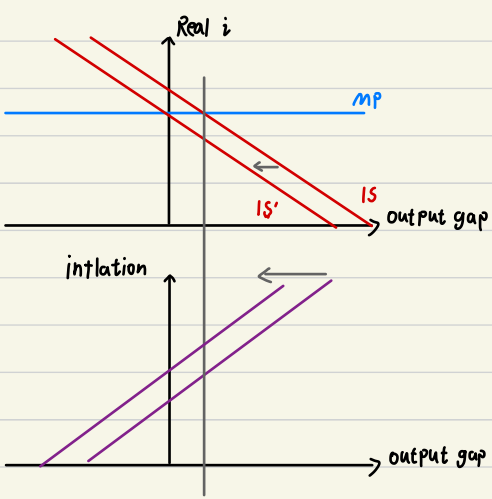
This process continues until the output gap is zero.



For intlationary gap when use self-correcting mechanism:

Intlationary gap ⇒ unemployment is low ⇒ wages rise ⇒ PC shift to the left

wages rise ⇒ output decrease ⇒ IS shift to the left.



Fiscal policy

Fiscal policy: The government's use of spending and tax policies to attempt to influence the economy.

Automatic stabilizer and discretionary fiscal policy

Usually, self-correcting mechanism is always painful and slow, government usually fiscal stabilization policy to speed up the recovery. These policies are called counter-cyclical fiscal policies.

we have two ways to speed up the recovery:

- **Automatic stabilizer:** spending and tax program that adjust as the economy expands and contracts, without policy makes taking any deliberate action.
- **Discretionary fiscal policy:** Policy that temporaliy change government spending or taxes to boost or slow the economy.

we have two possible scenarios:

1: Recessionary gaps ($Y^* < Y^{pot}$)

In this case, expansionary fiscal policy is used to speed up the recovery.

Instruments: Changes in G, Tr, and/or T.

when we have automatic stabilizer, the automatic stabilizers and expansionary fiscal policy would respond:

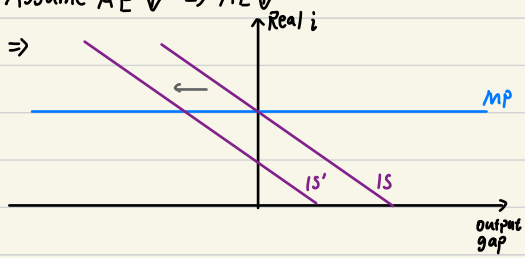
- Unemployment benefits: As unemployment rises due to the recessionary gap, more people quality for unemployment benefits. This leads to increase government spending on these benefits, which helps to boost aggregate demand.

For example:

- when there is no unemployment insurance:

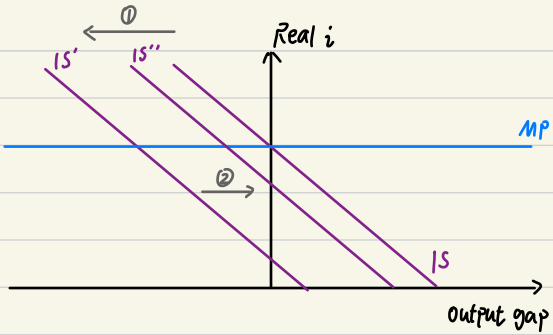
Assume $\overline{AE} \downarrow \Rightarrow AE \downarrow$

$\Rightarrow$



- when there is unemployment insurance:

Assume $\overline{AE} \downarrow \Rightarrow$ IS shifts to the left $\Rightarrow$ unemployment rate $\uparrow \Rightarrow TR \uparrow$ $\Rightarrow \overline{AE} \uparrow \Rightarrow AE \uparrow \Rightarrow$ IS shift to the right.



- Taxes : Decrease the multiplier

when $Y_0^* = 1000$, $mpIm = 0$, $mpC = 0.8$, $0\bar{A}E = -10$

when T = 0.25 Y (Proportion tax)	when T = 250 (Fixed tax)
$Y_0^D = (Y_0^* - T) = (1000 - 0.25 \cdot 1000) = 750$	Disposable income : $Y_0^D = Y_0^* - T = 750$
Multiplier : $\frac{1}{1 - 0.8 \cdot (1 - 0.25)} = 2.5$	Multiplier : $\frac{1}{1 - 0.8} = 5$
$Y_1^* = Y_0^* - 10 \cdot \frac{1}{1 - 0.8 \cdot (1 - 0.25)} = 975$	New GDP : $Y_1^* = Y_0^* - 10 \cdot 5 = 950$
$Y_1^D = 975 - 0.25 \cdot 975 = 731.25$	New disposable income : $Y_1^D = 950 - 250 = 700$

$731.25 > 700 \Rightarrow$ Proportion tax scenario is better in the recessionary gap since it fluctuate less

When there are discretionary fiscal policy for recessionary gap :

- Reduction in taxes and tax rates
- Increase in government spending
- Increase in transfer to household and firms

2 : Inflationary gap ($Y^* > Y^{Pot}$)

For automatic stabilizer:

1 : Use tax

when $Y_0^* = 1000$, $mpIm = 0$, $mpC = 0.8$, $0\bar{A}E = 10$

when T = 0.25 Y (Proportion tax)	when T = 250 (Fixed tax)
$Y_0^D = (Y_0^* - T) = (1000 - 0.25 \cdot 1000) = 750$	Disposable income : $Y_0^D = Y_0^* - T = 750$
Multiplier : $\frac{1}{1 - 0.8 \cdot (1 - 0.25)} = 2.5$	Multiplier : $\frac{1}{1 - 0.8} = 5$
$Y_1^* = Y_0^* + 10 \cdot \frac{1}{1 - 0.8 \cdot (1 - 0.25)} = 1025$	New GDP : $Y_1^* = Y_0^* + 10 \cdot 5 = 1050$
$Y_1^D = 1025 - 0.25 \cdot 1025 = 768.75$	New disposable income : $Y_1^D = 1050 - 250 = 800$.

In the scenario above, using proportion tax is a better option because it fluctuate less.

For discretionary fiscal policy:

- Decrease government spending
- Increase taxes
- Reduce transfer payment

The effectiveness of fiscal policy, whether through automatic stabilizers or discretionary measures, is closely tied to the size of the spending multiplier. The spending multiplier measures the total change in economic activity resulting from an initial change in government spending or taxation. It captures the cascading effects of an initial fiscal stimulus (or contraction) as it ripples through the economy.

Here's how the size of the spending multiplier affects the effectiveness of fiscal policy:

Magnitude of the Multiplier:

If the multiplier is greater than 1, an initial increase in government spending or a tax cut will lead to a more than proportionate increase in aggregate demand. Conversely, a reduction in government spending or a tax hike will lead to a more than proportionate decrease in aggregate demand.
If the multiplier is less than 1, the change in aggregate demand will be less than the initial change in government spending or taxation.

Automatic Stabilizers:

With a large multiplier, automatic stabilizers can be highly effective. For instance, during a recession, an increase in unemployment benefits can lead to a significant boost in aggregate demand as recipients spend most of their additional income, which in turn leads to further rounds of spending in the economy.
If the multiplier is small, the impact of automatic stabilizers will be muted. The economy might not get as much of a boost from increased transfer payments or reduced tax collections during downturns.

Discretionary Fiscal Policy:

A large multiplier amplifies the effects of discretionary fiscal policy. For example, a government spending increase will lead to a substantial rise in aggregate demand, potentially pulling the economy out of a recession more quickly.
With a small multiplier, even significant changes in government spending or taxation might have only a modest impact on aggregate demand. This could mean that very large fiscal interventions are needed to achieve the desired economic outcomes.

limits of discretionary fiscal policy

Discretionary fiscal policy involves deliberate changes in government spending and taxation to influence the level of economic activity. While it can be a powerful tool for stabilizing the economy, there are several limitations and challenges associated with its use:

Time Lags:

Recognition Lag: The time it takes for policymakers to recognize that the economy is in a recession or boom.

Decision Lag: The time it takes for policymakers to decide on the appropriate fiscal policy response.

Implementation Lag: The time it takes to put the chosen policy into effect, especially for large spending projects.

Impact Lag: The time it takes for the policy to affect the economy after being implemented.

Ricardian Equivalence: Some economists argue that when the government increases its debt, households might expect future taxes to rise to pay off that debt. As a result, they might save more now to pay for those future taxes, offsetting the stimulative effect of the current deficit spending.

Precision and Targeting Challenges:

Calibration: It's challenging to determine the exact magnitude of fiscal intervention required. Overestimating or underestimating the required stimulus or contraction can lead to overshooting or undershooting the desired economic outcomes.

Targeting: Ensuring that fiscal measures benefit the intended recipients or sectors can be difficult. For instance, a tax cut intended to stimulate consumer spending might end up being saved or used to pay down debt instead of being spent.

Unintended Consequences: Fiscal measures might have side effects that weren't anticipated. For example, a subsidy intended to boost a particular industry might inadvertently create distortions in related sectors.

Evaluation Difficulties: After implementing a fiscal measure, it can be challenging to assess its effectiveness accurately. Other factors, external to the policy, might influence economic outcomes, making it hard to isolate the policy's direct impact.

Granularity: While fiscal policy can address broad economic trends, it might not be precise enough to tackle specific microeconomic issues or disparities within regions, sectors, or demographic groups.

Increasing Taxes May Cause Disincentives to Work:

Marginal Tax Rates: As marginal tax rates increase, individuals might perceive that they are keeping less of each additional dollar they earn. This could reduce the incentive to work more hours or pursue higher-paying opportunities.

Work-Leisure Trade-off: Higher taxes can alter the trade-off between work and leisure. If individuals feel they are retaining less of their income after taxes, they might value leisure more relative to work, leading to reduced work hours.

Entrepreneurship and Risk-taking: High taxes, especially on capital gains and business income, might deter entrepreneurship and risk-taking. If potential rewards from successful ventures are significantly reduced due to taxes, individuals might be less inclined to start new businesses or invest in innovative projects.

Talent Migration: In a globalized world, highly skilled and high-earning individuals might choose to relocate to jurisdictions with more favorable tax regimes, leading to a brain drain.

Efficiency and Productivity: High taxes can sometimes lead to inefficient economic behavior as individuals and businesses seek ways to minimize their tax liabilities rather than focusing on productive activities.

Government deficits and debt

Flow: A flow variable measures quantities over a specific period.

Budget balance: Budget balance is S_{public} is a flow.

Budget deficit: $S_{public} = \bar{T} - G - Tr < 0$

Budget surplus: $S_{public} = \bar{T} - G - Tr > 0$

Stock: A stock variable measures a quantity at a specific point in time.

Government Debt (D): Government debt represents the total accumulated deficits (and surpluses) up to a particular point.

$$D^{2024} = (1+i) \cdot D^{2023} - S_{public}^{2023} \quad . \ i \text{ is the interest rate.}$$

In essence:

$S_{pub} \approx 0$ if $Y^* = Y^{pot}$

$S_{pub} < 0$ if $Y^* < Y^{pot}$

$S_{pub} > 0$ if $Y^* > Y^{pot}$

Debt-to-GDP ratio: It measures the ratio between its debt and nominal GDP

$$\frac{\text{Total deficits}}{\text{Nominal GDP}} \times 100$$

Deficits impact the GDP as a effect of crowding out.

Crowding out: The decline in private spending, particularly investment, that follows from a rise in government spending.

Here are the process:

Government faces serious deficits $\Rightarrow T<Tr+G \Rightarrow$ Government becomes borrower $\Rightarrow$ Demand for loanable funds increases $\Rightarrow$ real interest rate $\uparrow \Rightarrow$ cost of borrowing for many firms $\uparrow \Rightarrow$ Some firms stop borrowing money $\Rightarrow I \downarrow \Rightarrow$ GDP $\downarrow$

Monetary policy

Central bank and bank of Canada

Monetary Policy: The process of setting interest rate in an effort to influence economic conditions.

The central bank in Canada is bank of Canada:

- It is relatively independent from the central bank.
- Responsible for price stability, which typically means controlling inflation.
- Controls and regulates financial institutions and markets: central banks have regulatory and supervisory roles over commercial banks and other financial institutions in their jurisdiction. They also ensure the stability and integrity of the financial system.
- Bank to the commercial banks: Central banks serve as a lender of last resort to commercial banks. Central banks also store the reserves for commercial banks.
- Bank to the federal government: Central banks manage the government's monetary accounts and facilitate its transactions. Central banks also play a role in issueing and managing the national debt, buy or sell government bonds.
- Organizes market for reserves: Central banks manage the interbank market, where commercial banks lend to and borrow from each other, usually on a short-term basis.
- Monetary policy: Central banks set monetary policies.

The bank of Canada sets:

Reserve Requirements:
Reserve requirements refer to the minimum amount of funds that commercial banks are required to hold in reserve against their deposits. These reserves act as a safety buffer. As mentioned, Canada does not currently use reserve requirements as a primary monetary policy tool. Instead, the BoC relies more on other tools, such as the target overnight rate.

Target Overnight Rate:
The target overnight rate is the interest rate at which major financial institutions borrow and lend one-day (or "overnight") funds among themselves. The BoC sets this rate as a part of its monetary policy.
As stated, the current target overnight rate is 5.00%. This rate influences other interest rates in the economy, including those for consumer loans and mortgages.

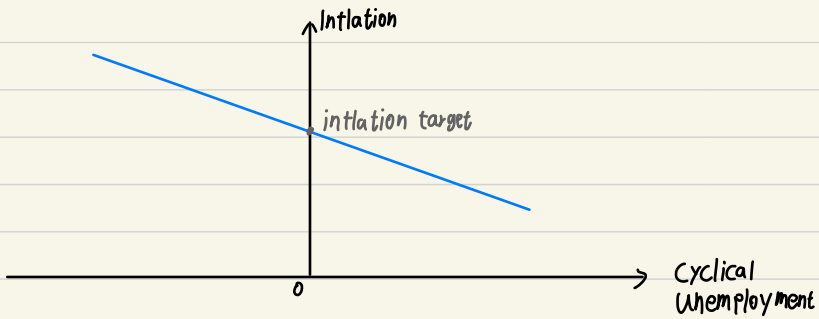
Bank Rates:
The bank rate is the rate at which the central bank (BoC) lends money to commercial banks. It's set at a level slightly above the target overnight rate.
As mentioned, the bank rate is the policy rate plus 0.25 percentage points. So, with a policy rate of 5.00%, the bank rate is currently 5.25%.

Deposit Rate:
The deposit rate is the interest rate the BoC pays on money deposited by commercial banks at the central bank.
Typically, the deposit rate is set at a level slightly below the target overnight rate. However, as mentioned, it's currently the same as the policy rate at 5.00%. This means that commercial banks receive a 5.00% return on funds they deposit at the BoC.

Inflation target: An inflation target is a specific goal or range set by a central bank for the annual rate of inflation in the economy.

The current inflation target is around 2%

When we achieve inflation at target, unemployment is at natural rate.



The inflation target cannot be 0% for the following reasons:

Wage Adjustments: A slight inflation allows firms to adjust real wages without resorting to unpopular nominal wage cuts. For instance, with positive inflation, firms can give smaller nominal wage increases that, when adjusted for inflation, effectively reduce real wages. Without inflation, direct nominal wage cuts would be necessary, which are often resisted by workers.

Monetary Policy Limitations: The zero lower bound on nominal interest rates restricts the central bank's ability to stimulate the economy when rates are near zero. A positive inflation target ensures that real interest rates can go negative, providing additional policy flexibility during economic downturns.

Deflation Risks: Targeting 0% inflation leaves little room for error. Even minor economic disturbances or measurement inaccuracies can push the economy into deflation, which can exacerbate economic downturns by increasing real debt burdens and discouraging consumption.

Money and banking

Money supply: currency in circulation (CU) + bank deposits (D) (money on hand)

Bank reserves: Assets a bank can use to pay the depositors their money back. It equals to cash on hand + deposits with central bank.

We assume all reserves are held as deposits with central bank.

Reserve ratio: Fraction of deposits a bank holds as reserves.

$$\text{reserve ratio } (rr) = \frac{RE}{D}$$

Balance sheet for commercial bank

Assets	Liabilities
Reserves (RE)	Deposits of customers (D)
Loans made to customers (L)	Capital (K)

Assets = liabilities.

For example: Deposite \$100 into a savings account. RE +100, D +100

Consider this example: rr ratio = 10%

Assets	liabilities
reserve 10	Deposits 100
loan 290	Capital 200

At the begining:

Target reserve = rr · Total deposits = 10% · 100 = 10

Excess reserve = reserve - target reserve = 10 - 10 = 0

loanable funds = excess reserve = 0

Assets	liabilities
reserve 10	Deposits 100
+50 = 60	+50 = 150
loan 290	Capital 200

Now, someone deposit \$50 in to bank.

Target reserve = 10% · 150 = 15

Excess reserve = 60 - 15 = 45

loanable funds = 45

Assets	liabilities
reserve 10	Deposits 100
+50 = 60 - 40	+50 = 150
= 20	
loan 290 + 40	Capital 200
= 330	

Now, Someone come borrow 40

Target reserve = 10% · 150 = 15

Excess reserve = 20 - 15 = 5

loanable funds = 5

Balance sheet for central bank

Assets	Liabilities
Treasury bills	Currency in circulation
Mortgage backed securities	Bank reserves
	Treasury account
Repos and loans	Reverse Purchase agreements

Market for reserves

Central bank indirectly sets the interest rate for market for reserves (policy rate)

There are two ways:

- Discount windows: Banks borrow from central bank, which is lender of last resort when there is crisis
- Open market operations: Central bank buys / sell treasury bills (government debt)

For example: Central bank buys 100 mill T-bills from bank.

Bank of Canada **Assets**	**Liabilities**
Treasury Bills **(+100)**	Currency in circulation ***Reserves with Bank (+100)***

Commercial Bank **Assets**	**Liabilities**
Reserves with BoC (+100) Treasury Bills **(-100)** Loans	Deposits Capital

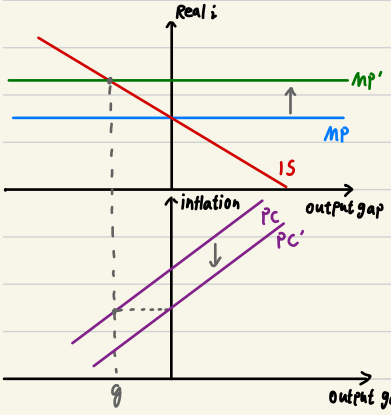
The open market operation influences the inflation

- policy rate affects all other interest rate
- All other interest rate affect AE
- Shifts IS-curve to affect output gap
- Affect inflation.

Disinflation

Disinflation: the process of bringing down inflation from a high level to a lower level.

Consider the following model using monetary policy:



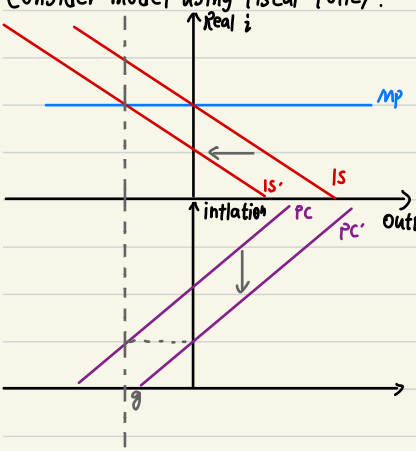
The output gap is 0, but the inflation (PC) is too high.

The central bank will increase interest rate ⇒ shift MP upwords ⇒ creates recessionary output gap

As there is a negative output gap, actual inflation ↓ ⇒ over time, people realized the lower inflation ⇒ Expected inflation ↓

Expected inflation ↓ ⇒ PC shift down ⇒ lower inflation achieved.

Consider model using fiscal policy:



The output gap is 0, but the inflation (PC) is too high.

Government apply contractionary fiscal policy ⇒ T ↑, Tr ↓, G ↓ ⇒ AE ↓ ⇒ IS shift to left ⇒ creates recessionary output gap ⇒ Acutal inflation decreases ⇒ overtime output gap people's expected inflation ↓ ⇒ PC shift down ⇒ inflation decreased.

$M \cdot V = P \cdot Y$

$$M \cdot V = P \cdot Y$$

- M: Money supply
- V: velocity
- P: Price level (e.g. CPI)
- Y: Real GDP

$$\%\Delta M + \%\Delta V \approx \%\Delta P + \%\Delta Y$$

In the long run: $Y = Y^{pot} \Rightarrow \%\Delta M + \%\Delta V \approx \%\Delta P + \%\Delta Y^{pot}$, $\%\Delta V \approx 0$, $\%\Delta Y^{pot} \approx 0$

$\Rightarrow \%\Delta M \approx \%\Delta P$.