Prep-Course Macroeconomics

Lecture Notes
September 2019

Silvia Surricchio
s.surricchio@gmail.com

Course Information

This a collection of lecture notes intended for the Preparatory Course in Macroeconomics for EEBL graduate students at Tor Vergata University of Rome.

- Lecture 1 (Sept, 10 from 10AM to 1PM): Main Economic Concepts. Measuring the value of economic activity, the cost of living and the joblessness.
- Lecture 2 (Sept, 10 from 2PM to 6PM): Inflation and the Quantity Theory of Money. The Phillips curve.
- Lecture 3(Sept, 12 from 10AM to 1PM): The Monetary System: Money, its role and Monetary Policy.
- Lecture 4 (Sept, 12 from 2PM to 6PM): The IS-LM model.
- Lecture 5 (Sept, 14 from 10AM to 1PM): Open Economy: exchange rate regimes, the Mundell-Fleming model and International Trade.

References

- O. Blanchard, A. Amighini, F. Giavazzi, *Macroeconomics: A European Perspective*, Pearson, 3rd Edition (Chs. 2,3,4,5)
- D. Salvatore, *International Economics*, Wiley, 11th Edition (Chs. 15, 16)

1 Main Economic Concepts

1.1 Measuring the value of economic activity

Gross Domestic Product (GDP): total market value of all the finished goods and services produced within a country's borders in a specific time period.
GDP includes all private and public consumption, government outlays, investments, additions to private inventories, paid-in construction costs, and the foreign balance of trade.
The OECD defines GDP as "an aggregate measure of production equal to the sum of the gross values added of all resident and institutional units engaged in production and services (plus any taxes, and minus any subsidies, on products not included in the value of their outputs)."

There are several types of GDP measurements:

- *Nominal GDP* is the measurement of the raw data, also called GDP at current prices.

- *Real GDP* takes into account the impact of inflation and allows comparisons of economic output from one year to the next and other comparisons over periods of time, also called GDP in terms of goods, GDP at constant prices, GDP adjusted for inflation – if the year in which real GDP is set equal to nominal GDP is a base year (currently the year 2000 in EU national accounts).
- *GDP growth rate* is the increase in GDP from quarter to quarter.
- *GDP per capita* is the ratio of GDP to the total population of the region and therefore it measures the GDP per individual; it is a useful way to compare GDP data between various countries.

GDP can be represented by the equation:

$$Y \equiv C + I + G + NX \tag{1}$$

where:

- C: consumption of goods and services by consumers;
- I: investment;
- G: government spending, that is purchases of goods and services by the national, regional and local governments;
- NX: net exports, that is the difference between exports E (the purchases of domestic goods and services by foreigners) and imports IM (the purchases of foreign goods and services by domestic consumers, domestic firms, and the government)

This equation is an identity (which is why it is written using the symbol $\equiv$ rather than an equals sign). It defines Y as the sum of consumption, investment, government spending, and exports, minus imports.
Under the assumption that the economy is closed we do not have imports nor exports, such that $X = IM = 0$, so the demand for goods, Y, is simply the sum of consumption, investment, and government spending:

$$Y = C + I + G \tag{2}$$

Gross national product (GNP): estimate of total value of all the final products and services turned out in a given period by the means of production owned by a country's residents. GNP is commonly calculated by taking the sum of personal consumption expenditures, private domestic investment, government expenditure, net exports and any income earned by residents from overseas investments, minus income earned within the domestic economy by foreign residents.

1.2 Measuring the cost of living

Cost of living: amount of money needed to sustain a certain standard of living by affording basic expenses such as housing, food, taxes, and healthcare. The cost of living is often used to compare how expensive it is to live in one city versus another, and it is strictly tied to wages. If expenses are higher in a city, such as New York, for example, salary levels must be higher so that people can afford to live in that city.

Purchasing power: value of a currency expressed in terms of the amount of goods or services that

one unit of money can buy. Purchasing power is important because, all else being equal, inflation decreases the amount of goods or services you would be able to purchase.

Inflation: quantitative measure of the rate at which the average price level of a basket of selected goods and services in an economy increases over a period of time. It is the constant rise in the general level of prices where a unit of currency buys less than it did in prior periods. Often expressed as a percentage, inflation indicates a decrease in the purchasing power of a nation's currency.

Price inflation: increase in the price of a standardized good/service or a basket of goods/services over a specific period of time (usually one year). Because the nominal amount of money available in an economy tends to grow larger every year relative to the supply of goods available for purchase, this overall demand pull tends to cause some degree of price inflation. Price inflation can also be caused by cost-push, when the cost of inputs to the production process increase and push prices upwards.

Inflation rate π_t: rate at which the price level increases, more specifically percentage variation on P_t, that is:

$$\pi = \frac{P_t - P_{t-1}}{P_{t-1}} \tag{3}$$

How do we measure inflation? Macroeconomists typically look at two measures of the price level, at two price indexes: the GDP deflator and the consumer price index.
GDP deflator: measure of the changes in prices for all of the goods and services produced in an economy; it is given by the ratio of nominal GDP to real GDP, times 100:

$$\text{GDP Price Deflator} = \frac{\text{Nominal GDP}}{\text{Real GDP}} * 100 \tag{4}$$

Consumer price index (CPI): measure of the average price of consumption or, equivalently, the cost of living.
In the USA, the CPI has been in existence since 1917 and is published monthly. In Europe, the price index which is most frequently used is the harmonised index of consumer prices, or HICP, measured by Eurostat, the Statistical Office of the European Communities. The HICP gives comparable measures of inflation in the euro area, the EU, the European Economic Area (EEA). They provide the official measure of consumer price inflation in the euro area for the purposes of monetary policy and assessing inflation convergence as required under the Maastricht criteria.

1.3 Measuring the joblessness

Employment (N): number of individuals who have a job.

Unemployment (U): number of individuals of working age who are capable of work, and are actively looking for work, but who are not employed.

Labour force (L): sum of employment and unemployment, that is:

$$L = N + U. \tag{5}$$

Unemployment rate (u): ratio of the number of people who are unemployed to the number of people in the labour force, that is:

$$u = \frac{U}{L}. \tag{6}$$

Note: only those looking for a job are counted as unemployed; those who do not have a job and are not looking for one are counted as not in the labour force. When unemployment is high, some of the unemployed give up looking for a job and therefore are no longer counted as unemployed. These people are known as *discouraged workers*. A higher unemployment rate is typically associated with a lower *participation rate*, defined as the ratio of the labour force to the total population of working age.

We have different classes of unemployment:

1. *Cyclical unemployment*: component of overall unemployment that results from economic upturns and downturns. Unemployment rises during recessions and declines during economic expansions. Moderating cyclical unemployment during recessions is a major motivation behind the study of economics and the goal of the various policy tools that governments employ to stimulate the economy.

2. *Structural unemployment*: a longer-lasting form of unemployment caused by fundamental shifts in an economy and exacerbated by extraneous factors such as technology, competition, and government policy. Structural unemployment occurs because workers' lack the requisite job skills or workers live too far from regions where jobs are available and cannot move closer. Jobs are available, but there is a serious mismatch between what companies need and what workers can offer.

3. *Frictional unemployment*: result of employment transitions within an economy. Frictional unemployment naturally occurs even in a growing, stable economy. Workers leaving their jobs or new workers entering the workforce both add to frictional unemployment.

4. *Natural rate of unemployment*: minimum unemployment rate resulting from real, or voluntary, economic forces. Natural unemployment reflects the number of people that are unemployed due to the structure of the labor force such as those replaced by technology or those who lack certain skills to gain employment.

2 Inflation

Fisher Effect: economic theory created by economist Irving Fisher that describes the relationship between inflation and both real and nominal interest rates. The Fisher Effect states that the real interest rate equals the nominal interest rate minus the expected inflation rate. Therefore, real interest rates fall as inflation increases, unless nominal rates increase at the same rate as inflation. The Fisher Effect equation reflects that the real interest rate can be taken by subtracting the expected inflation rate from the nominal interest rate. In this equation, all the provided rates are compounded.

Deflation: general decline in prices for goods and services occurring when the inflation rate falls below 0%. Deflation happens naturally when the money supply of an economy is fixed. In times of deflation, the purchasing power of currency and wages are higher than they otherwise would have been. This is distinct from but similar to price deflation, which is a general decrease in the price level.

Hyperinflation: rapid, excessive, and out-of-control price increases in an economy. While inflation is a measure of the pace of rising prices for goods and services, hyperinflation is rapidly rising inflation.
Although hyperinflation is a rare event for developed economies, it has occurred many times throughout history in countries such as China, Germany, Russia, Hungary, and Argentina.

Disinflation: temporary slowing of the pace of price inflation. It is used to describe instances when the inflation rate has reduced marginally over the short term. It should not be confused with deflation, which can be harmful to the economy.

2.1 The Quantity Theory of Money

The quantity theory of money is a theory that variations in price relate to variations in the money supply. The most common version, sometimes called the "neo-quantity theory" or Fisherian theory, suggests there is a mechanical and fixed proportional relationship between changes in the money supply and the general price level. This popular, albeit controversial, formulation of the quantity theory of money is based upon an equation by American economist Irving Fisher.

$$M * V = P * T \tag{7}$$

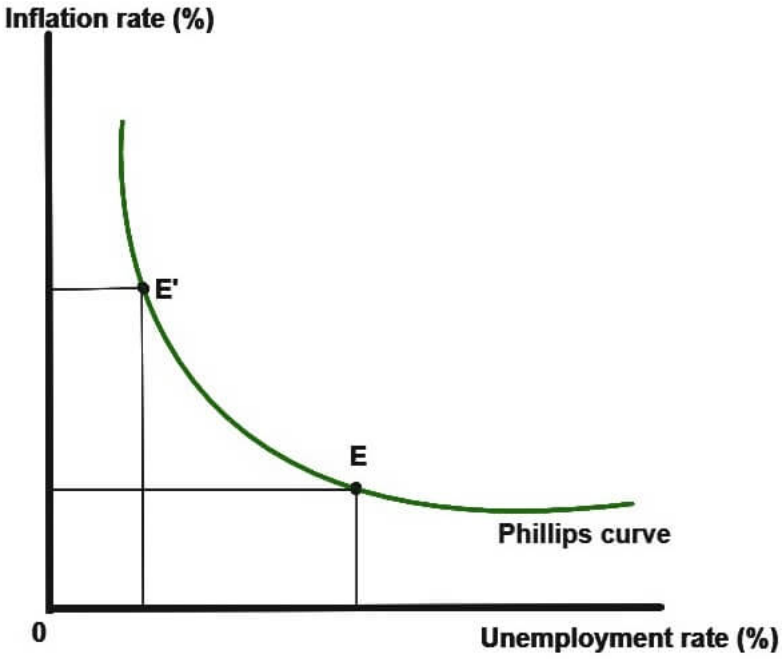
where

- M: money supply;
- V: velocity of money;
  The velocity of money is the rate at which money is exchanged in an economy. It is the number of times that money moves from one transaction to another. It also refers to how much a unit of currency is used in a given period of time, so it can be seen as the rate at which people spend money. The velocity of money is usually measured as a ratio of gross national product (GNP) to a country's total supply of money.
- P: average price level;
- T: volume of transactions in the economy.

The quantity theory of money assumes that increases in the quantity of money tend to create inflation, and vice versa. For example, if the Federal Reserve or European Central Bank (ECB) doubled the supply of money in the economy, the long-run prices in the economy would tend to increase dramatically. This is because more money circulating in an economy would equal more demand and spending by consumers, driving prices north.
Economists disagree about how quickly and how proportionately prices adjust after a change in the quantity of money. The classical treatment in most economic textbooks is based on the Fisher Equation, but competing theories exist.

2.2 The Phillips curve

Phillips curve: economic concept developed by A. W. Phillips stating that inflation and unemployment have a stable and inverse relationship. The theory claims that with economic growth comes inflation, which in turn should lead to more jobs and less unemployment. (Note that the original concept was used to guide macroeconomic policy in the 20th century, but has been somewhat disproven empirically due to the occurrence of stagflation in the 1970s, when there were high levels of both inflation *and* unemployment.



The concept behind the Phillips curve states the change in unemployment within an economy has a predictable effect on price inflation. The inverse relationship between unemployment and inflation is depicted as a downward sloping, concave curve, with inflation on the Y-axis and unemployment on the X-axis. Increasing inflation decreases unemployment, and vice versa. Alternatively, a focus on decreasing unemployment also increases inflation, and vice versa.

3 The Monetary System: Money, its role and Monetary Policy

3.1 Functions of money

Money is often defined in terms of the three functions or services that it provides. Money serves as a medium of exchange, as a store of value, and as a unit of account.

1. *Medium of exchange.* Money's most important function is as a medium of exchange to facilitate transactions. Without money, all transactions would have to be conducted by barter,

which involves direct exchange of one good or service for another. The difficulty with a barter system is that in order to obtain a particular good or service from a supplier, one has to possess a good or service of equal value, which the supplier also desires. In other words, in a barter system, exchange can take place only if there is a double coincidence of wants between two transacting parties. The likelihood of a double coincidence of wants, however, is small and makes the exchange of goods and services rather difficult. Money effectively eliminates the double coincidence of wants problem by serving as a medium of exchange that is accepted in all transactions, by all parties, regardless of whether they desire each others' goods and services.

2. *Store of value.* In order to be a medium of exchange, money must hold its value over time; that is, it must be a store of value. If money could not be stored for some period of time and still remain valuable in exchange, it would not solve the double coincidence of wants problem and therefore would not be adopted as a medium of exchange. As a store of value, money is not unique; many other stores of value exist, such as land, works of art, and even baseball cards and stamps. Money may not even be the best store of value because it depreciates with inflation. However, money is more liquid than most other stores of value because as a medium of exchange, it is readily accepted everywhere. Furthermore, money is an easily transported store of value that is available in a number of convenient denominations.

3. *Unit of account.* Money also functions as a unit of account, providing a common measure of the value of goods and services being exchanged. Knowing the value or price of a good, in terms of money, enables both the supplier and the purchaser of the good to make decisions about how much of the good to supply and how much of the good to purchase.

3.2 Demand for money

The demand for money refers to how much assets individuals wish to hold in the form of money (as opposed to illiquid physical assets).

The demand for money is affected by several factors, including the level of income, interest rates, and inflation as well as uncertainty about the future. The way in which these factors affect money demand is usually explained in terms of the three motives for demanding money: the transactions, the precautionary, and the speculative motives.

1. *Transactions motive*: individuals need money to purchase goods and services in day to day life.
   In the classical quantity theory of money, the demand for money is a function of prices and income (assuming velocity of circulation is stable), so that if income rises, demand for money will rise.

2. *Precautionary motive*: individuals may need money for unexpected purchases or emergencies. People in fact often demand money as a precaution against an uncertain future.

3. *Speculative motive*: Money, like other stores of value, is an asset. The demand for an asset depends on both its rate of return and its opportunity cost. Typically, money holdings provide no rate of return and often depreciate in value due to inflation. The opportunity cost

of holding money is the interest rate that can be earned by lending or investing one's money holdings. The speculative motive for demanding money arises in situations where holding money is perceived to be less risky than the alternative of lending the money or investing it in some other asset.
Keynes explained the asset motive through what he termed "speculative demand". In this theory, he argued that demand for money is a choice between holding cash and buying bonds. According to this theory, if interest rates are low, then people will tend to expect rising interest rates, and therefore a fall in the price of bonds. In this case, demand for holding wealth in the form of money will be higher. If interest rates are high, and people expect interest rates to fall, then there is likely to be greater demand for buying bonds and less demand for holding money. If interest rates fall, then the price of bonds will rise. It might also also be known as the *asset motive*: people demand money as a way to hold wealth. This may occur during periods of deflation or periods where investors expect bonds to fall in value.

We may also find the *portfolio motive*, which represents another way of considering the asset motive. This theory, developed by James Tobin, underlines the trade off between asset growth and risk aversion. For example, if an individual is nervous about future economic trends, he will hold money rather than purchase more risky bonds and shares. If the individual is optimistic, he will take risks and purchase fewer bonds and shares.

The money demand equation takes the following form:

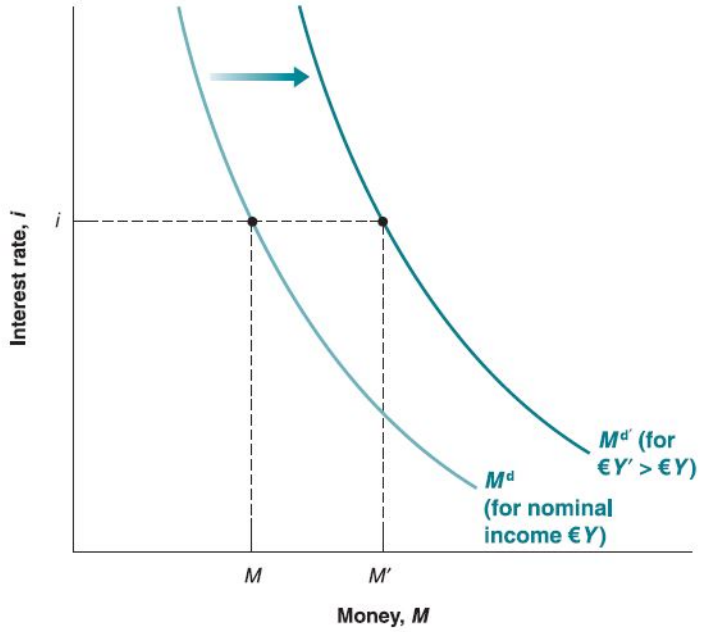
$$M^d = P * L(Y, i) \tag{8}$$

where:

- M^d: demand for nominal money balances (demand for M1);
- $L(Y, i)$: liquidity demand, as an increasing function of real income Y and a decreasing function of nominal interest rate on non-money assets i;
- P: aggregate price level (CPI or GDP deflator);

This expression underlines that money demand M^d, that is the amount of money people want to hold in the economy, depends on the overall level of transactions in the economy and on the interest rate. The overall level of transactions in the economy is hard to measure, but it is likely to be roughly proportional to nominal income (income measured in euros). Note that the interest rate has a negative effect on money demand: an increase in the interest rate increases the opportunity cost of holding money and so the demand for nominal money balances decreases.

Graphically the money demand is a downward-sloping curve with the interest rate i on the vertical axis and real money demand $\frac{M^d}{P}$ on the horizontal axis.



3.3 Money supply

The money supply is the entire stock of currency and other liquid instruments circulating in an economy in a particular time period. The money supply can include cash, coins, and balances held in checking and savings accounts, and other near money substitutes.

There exists various types of money in the money supply, defined *monetary aggregates*. According to ECB, monetary aggregates are classified, according to their liquidity, in:

- M1: sum of currency in circulation and overnight deposits;
- M2: sum of M1, deposits with an agreed maturity of up to two years and deposits redeemable at notice of up to three months; and
- M3: sum of M2, repurchase agreements, money market fund shares/units and debt securities with a maturity of up to two years.

The money supply is provided by the Central Bank according to monetary policy, so we can write:

$$M^s = \bar{M}. \tag{9}$$

3.4 Equilibrium in financial markets

Equilibrium in financial markets requires that money supply be equal to money demand, that $M^s = M^d$. Then, using $M^s = \bar{M}$ and equation for money demand, for which $M^d = P * L(Y, i)$, the equilibrium condition is

$$\bar{M} = P * L(Y, i) \tag{10}$$

This equation tells us that the interest rate, i, must be such that, given their income Y, people are willing to hold an amount of money equal to the existing money supply, $\bar{M}$. This equilibrium relation is called the *LM relation*.

3.5 Banks and the money supply

Bank Reserve: currency deposit that is not lent out to the bank's clients. A small fraction of the total deposits is held internally by the bank in cash vaults or deposited with the central bank. Minimum reserve requirements are established by central banks in order to ensure that the financial institutions will be able to provide clients with cash upon request.
Bank reserves are typically held by financial institutions to avoid bank runs and have sufficient cash on hand, should an unexpected and large withdrawal request come up. Bank reserves are divided into required reserves and excess reserves. Because of the banking industry's importance to the economy, national authorities regulate banks by obligating them to hold a certain amount of required reserves with central banks.

Excess reserves are capital reserves held by a bank or financial institution in excess of what is required by regulators, creditors or internal controls. For commercial banks, excess reserves are measured against standard reserve requirement amounts set by central banking authorities. These required reserve ratios set the minimum liquid deposits (such as cash) that must be in reserve at a bank; more is considered excess.
Excess reserves may also be known as secondary reserves.

Excess reserves are a safety buffer of sorts. Financial firms that carry excess reserves have an extra measure of safety in the event of sudden loan loss or significant cash withdrawals by customers. This buffer increases the safety of the banking system, especially in times of economic uncertainty. Boosting the level of excess reserves can also improve an entity's credit rating, as measured by rating agencies such as Standard & Poor's.

The money multiplication process *Money multiplier*: can be defined as the ratio of commercial bank money over central bank money, based on the actual observed quantities of various empirical measures of money supply, such as M2 (broad money) over M0 (base money); it can be also the theoretical "maximum commercial bank money/central bank money" ratio, defined as the reciprocal of the reserve ratio, $\frac{1}{RR}$.
The multiplier in the first (statistic) sense fluctuates continuously based on changes in commercial bank money and central bank money (though it is at most the theoretical multiplier), while the multiplier in the second (legal) sense depends only on the reserve ratio, and thus does not change unless the law changes.

Deposit multiplier, also known as deposit expansion multiplier: basic money supply creation process that is determined by the fractional reserve banking system.
Banks create what is termed checkable deposits as they loan out their reserves. The bank's reserve requirement ratio determines how much money is available to loan out and therefore the amount of these created deposits. The deposit multiplier is then the ratio of the amount of the checkable

deposits to the reserve amount. The deposit multiplier is the inverse of the reserve requirement ratio.

3.6 Monetary Policy

Monetary policy: process by which the monetary authority of a country, typically the central bank or currency board, controls either the cost of very short-term borrowing or the money supply, often targeting inflation or the interest rate to ensure price stability and general trust in the currency.

European Central Bank (ECB): central bank responsible for monetary policy of those European Union (EU) member countries which have adopted the euro currency. This region is known as the euro area or eurozone and currently comprises 19 members. The principal goal of the ECB is to maintain price stability in the euro area, thus helping preserve the purchasing power of the euro.

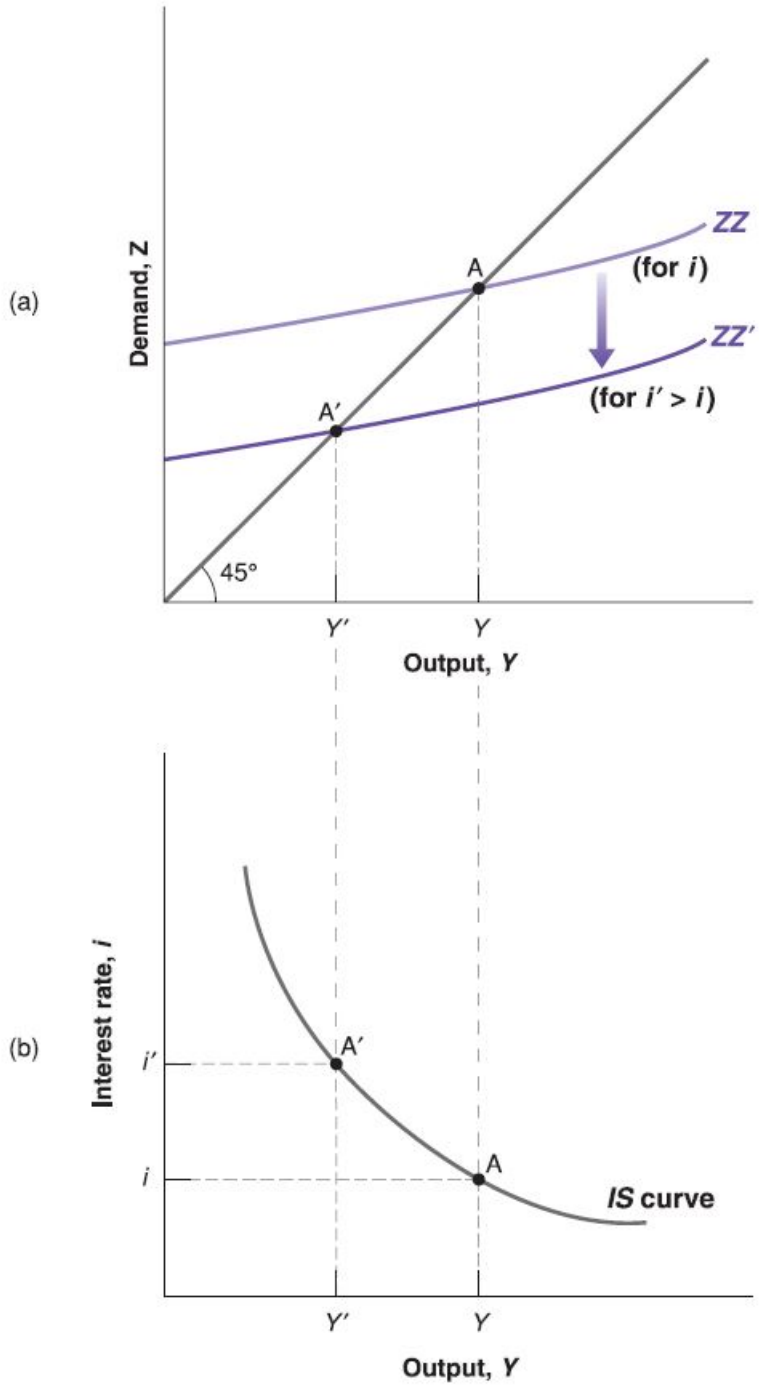
Open market operations (OMO): central bank's buying and selling of government securities in the open market in order to expand or contract the amount of money in the banking system. Securities' purchases inject money into the banking system and stimulate growth, while sales of securities do the opposite and contract the economy.

Liquidity trap: a situation in which interest rates are low and savings rates are high, rendering monetary policy ineffective. In a liquidity trap, consumers choose to avoid bonds and keep their funds in savings because of the prevailing belief that interest rates will soon rise (which would push bond prices down). Because bonds have an inverse relationship to interest rates, many consumers do not want to hold an asset with a price that is expected to decline.

4 The IS-LM model

4.1 Goods market and the IS relation

The IS (Investment- Saving) curve represents all the combinations of output and interest rate for which the goods market is in equilibrium, that is, the demand for goods equals the supply of goods. Graphically, it is represented as downward-sloping curve with the interest rate i on the vertical axis and output Y on the horizontal axis.



The IS Curve is defined by the equation:

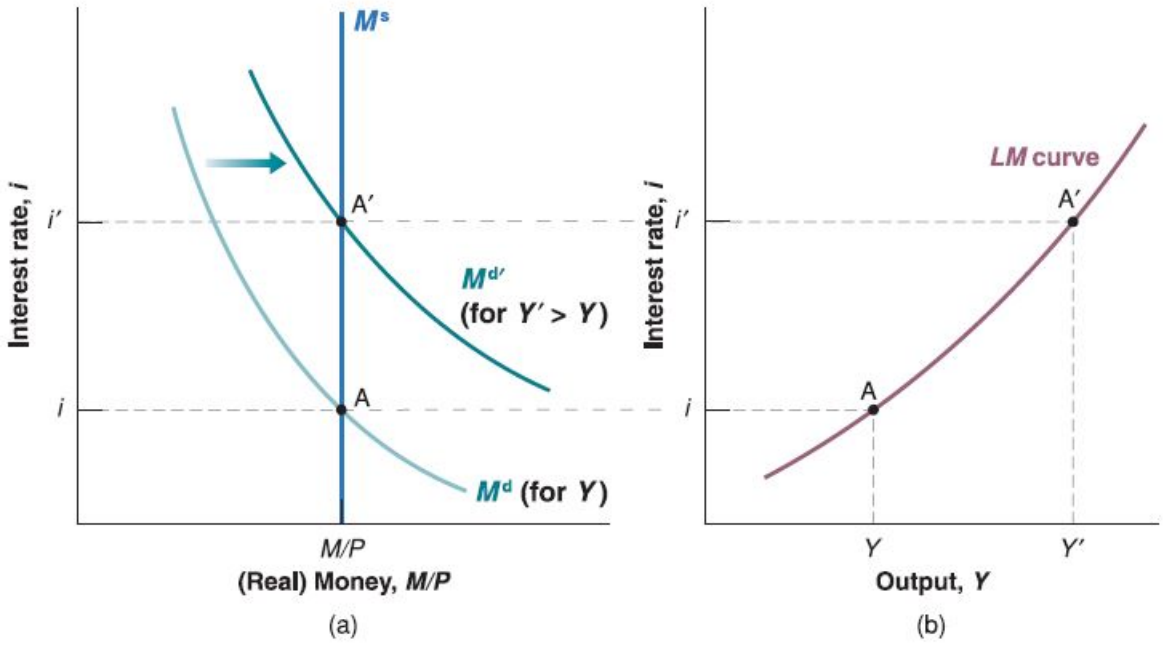
$$Y = C(Y - T) + I(Y, i) + G + NX(Y) \tag{11}$$

where:

- Y: income
- C: consumer spending as an increasing function of disposable income
- T: taxes
- I: physical investment as a decreasing function of the real interest rate
- i: real interest rate
- G: government spending
- NX: net exports (exports minus imports) as a decreasing function of income (decreasing because imports are an increasing function of income)

4.2 Financial markets and the LM relation

The LM (liquidity preference and money supply) curve represents all the combinations of output and interest rate for which the money market is in equilibrium, i.e. the demand for money equals the supply of money.
Graphically, it is represented as upward-sloping curve with the interest rate i on the vertical axis and output Y on the horizontal axis.



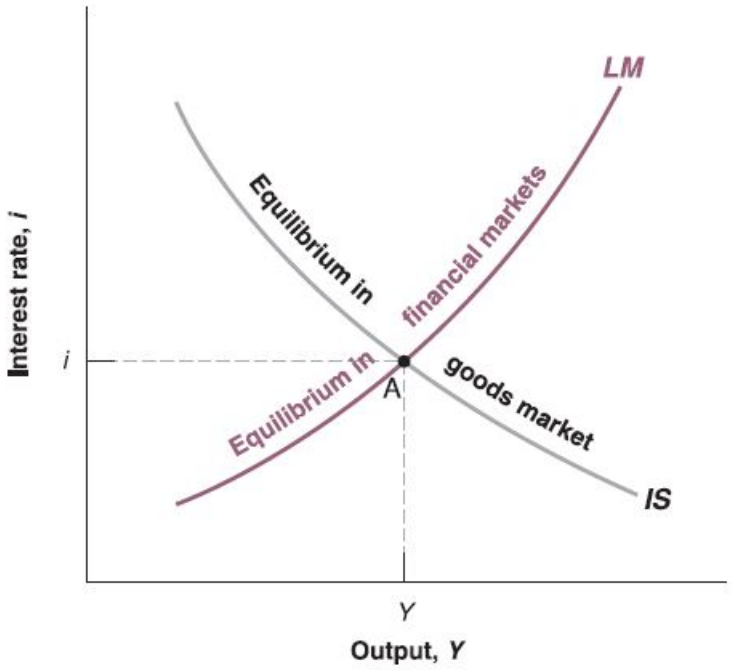
The LM Curve is defined by the equation:

$$\frac{M}{P} = L(Y, i) \tag{12}$$

where:

- $\frac{M}{P}$: real money stock
- $L(i)$: demand for money, as an increasing function of output Y and a decreasing function of nominal interest rate, i.

4.3 Equilibrium



5 Open Economy

5.1 Introduction

Exchange rate: the rate at which one currency will be exchanged for another. It is also regarded as the value of one country's currency in relation to another currency.

Exchange rate regime: the way a monetary authority of a country or currency union manages the currency in relation to other currencies and the foreign exchange market. It is closely related to monetary policy.

There are two major regime types:

- *Fixed exchange rate* regime, also called pegged exchange rate regime: a type of exchange rate regime in which a currency's value is fixed or pegged by a monetary authority against the value of another currency, a basket of other currencies, or another measure of value, such as gold.

- *Flexible exchange rate* regime, also called fluctuating or floating exchange rate: a type of exchange rate regime in which a currency's value is allowed to fluctuate in response to foreign exchange market events.

In the modern world, most of the world's currencies are floating, and include the most widely-traded currencies: the United States dollar, the Swiss franc, the Indian rupee, the euro, the Japanese yen, the pound sterling, and the Australian dollar.

However there is also the *linked exchange rate system*, a type of exchange rate regime that pegs the exchange rate of one currency to another. It is the exchange rate system implemented in Hong Kong, to stabilise the exchange rate between the Hong Kong dollar (HKD) and the United States dollar (USD). The Macao pataca (MOP) is similarly linked to the Hong Kong dollar.

5.2 The Mundell-Fleming model

The Mundell–Fleming model, also known as the IS-LM-BoP model (or IS-LM-BP model), is an economic model developed (independently) by Robert Mundell and Marcus Fleming.
The model is an extension of the IS-LM model. But, whereas the traditional IS-LM model deals with economy under autarky (or a closed economy), the Mundell–Fleming model describes a small open economy.
The Mundell–Fleming model portrays the short-run relationship between an economy's nominal exchange rate, interest rate, and output (in contrast to the closed-economy IS-LM model, which focuses only on the relationship between the interest rate and output). The Mundell–Fleming model has been used to argue that an economy cannot simultaneously maintain a fixed exchange rate, free capital movement, and an independent monetary policy. This principle is frequently called the "impossible trinity," "unholy trinity," "irreconcilable trinity," "inconsistent trinity," "policy trilemma," or the "Mundell–Fleming trilemma."

The Mundell–Fleming model is based on the three following equations:

1. the IS curve:
$$Y = C + I + G + NX \tag{13}$$
2. the LM curve:
$$\frac{\bar{M}}{P} = L(i, Y) \tag{14}$$
3. the BoP (Balance of Payments) Curve:
$$BoP = CA + KA \tag{15}$$

   where

   - Y: real GDP
   - C: real consumption
   - I: real physical investment

- G: real government spending (an exogenous variable)
- NX: real net exports
- $\bar{M}$: exogenous nominal money supply
- P: exogenous price level
- L: liquidity preference (real money demand)
- i: the nominal interest rate
- BoP: balance of payments surplus
- CA: current account surplus
- KA: capital account surplus

In particular, we have:

$$CA = NX \tag{16}$$

That is, the current account is viewed as consisting solely of imports and exports. And:

$$KA = z(i - i^*) + k \tag{17}$$

where

- i^*: foreign interest rate
- k: exogenous component of financial capital flows
- z: interest-sensitive component of capital flows, and the derivative of the function z is the degree of capital mobility (the effect of differences between domestic and foreign interest rates upon capital flows KA).

5.3 Purchasing Power Parity

Purchasing Power Parity (PPP): economic theory that compares different countries' currencies through a "basket of goods" approach, and it states that the price of a good in one country is equal to its price in another country, after adjusting for the exchange rate between the two countries. According to this concept, two currencies are in equilibrium — known as the currencies being *at par* — when a basket of goods is priced the same in both countries, taking into account the exchange rates.

There is an absolute and a relative version of the Purchasing Power Parity (PPP) theory:

- Absolute Purchasing-Power Parity Theory
  The absolute purchasing-power parity theory postulates that the equilibrium exchange rate between two currencies is equal to the ratio of the price levels in the two nations. Specifically:

$$R = \frac{P}{P^*} \tag{18}$$

  where:
  - R: exchange rate
  - P: domestic price level (that is, general price level in the home nation)
  - P^*: foreign price level (general price level in the foreign nation)

- Relative Purchasing-Power Parity Theory
  The more refined relative purchasing-power parity theory postulates that the change in the exchange rate over a period of time should be proportional to the relative change in the price levels in the two nations over the same time period. Specifically, if we let the subscript 0 refer to the base period and the subscript 1 to a subsequent period, the relative PPP theory postulates that:

$$R1 = \frac{P_1}{P_0}\frac{P_1^*}{P_0^*} * R_0 \tag{19}$$

  where
  - R_0 exchange rates in the base period
  - R_1 exchange rates in period 1

  The relative version of PPP is calculated with the following formula:

$$S = \frac{P_1}{P_2} \tag{20}$$

  where:
  - S: exchange rate of currency 1 to currency 2
  - P_1: cost of good X in currency 1
  - P_2: cost of good X in currency 2

5.4 International Trade

World Trade Organization: global organization made up of 164 member countries that deals with the rules of trade between nations. Its goal is to ensure that trade flows as smoothly and predictably as possible.
The WTO was born out of the *General Agreement on Tariffs and Trade* (GATT), established in 1947. GATT was part of the Bretton Woods-inspired family, including the International Monetary Fund (IMF) and World Bank. A series of trade negotiations, GATT rounds began at the end of World War II and were aimed at reducing tariffs for the facilitation of global trade.
The WTO replaced GATT as the world's global trading body in 1995, and the current set of governing rules stems from the Uruguay Round of GATT negotiations, which took place from 1986 to 1994.