# MACROECONOMICS CLASS REVIEW

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# 1. Background: Fundamental Economic Concepts

**Macroeconomics** concerns itself with the study of "aggregate" economic behavior; that is, the study of the "sum" of individual economic decisions. Therefore, macroeconomics studies the aggregate economic situation of an entire **country**. This is in contrast to microeconomics which is the study of the economic behaviors of individual consumers, individual firms, and individual industries. Macroeconomics can be used to analyze how best to influence the **country**'s policy goals, such as the rate of economic growth, how to achieve price stability, how to achieve full employment and how to attain a sustainable balance of payments.

Until the 1930s most economic analysis did not seperate out "individual" economics behavior from "aggregate" behavior. With the Great Depression of the 1930s, suffered throughout the world, and the development of the concept of national income and product statistics, the field of macroeconomics began to expand. Particularly influential were the ideas of John Maynard Keynes, who formulated theories to try to explain the great depression.

The traditional distinction is between two different approaches to economics: **Keynesian** economics, focussing on demand, and **neo-classical** economics, focusing on supply. Neither, of course, can completely neglect the other aspect - it is a question of emphasis. Most schools are fairly clearly based on one or the other approach.

- Keynesian economics, which focuses on aggregate demand to explain levels of unemployment and the business cycle. That is, business cycle fluctuations should be reduced through fiscal policy (the government spends more or less depending on the situation) and monetary policy. Early Keynesian macroeconomics was "activist," calling for regular use of policy to stabilize the capitalist economy, while some Keynesians called for the use of incomes policies.

- Supply-side economics, which delineates quite clearly the roles of monetary policy and fiscal policy. The focus for monetary policy should be purely on the price of money as determined by the supply of money and the demand for money. It advocates a monetary policy that directly targets the value of money and does not target interest rates at all. Typically the value of money is measured by reference to gold or some other reference. The focus of fiscal policy is to raise revenue for worthy government investments with a clear recognition of the impact that taxation has on domestic trade.

It is important to understand that the various schools of thought are not always in direct competition with one another -- even though they sometimes reach differing conclusions. Macroeconomics is an ever evolving area of research. The goal of economic research is not to be "right," but rather to be accurate. It is likely that none of the current schools of economic thought perfectly capture the workings of the economy. They do, however, each contribute a small piece of the overall puzzle. As one learns more about each school of thought, it is possible to combine aspects of each in order to reach an informed synthesis

**Role of government**:

Most economists would agree that a free and competitive market system would be able to utilize the country's resources more efficiently than a central planning system. In a market economy, the proper role of the government is to support private sector activities, not to replace or duplicate what the private sector can do. In principle, revenue-generating activities can be done by the private sector. However, there are some goods that the private sector can not or may not provide (such as national defense, construction and maintenance of roads, etc). These are called **Public Goods** and should be provided by the government after a cost-benefit analysis show that they are socially or economically desirable. In some other sectors, some market failures (such as lack of information, or large economies of scale that lead to monopolies) require the government to play a role, principally through regulations.

# 2. **National Accounts and GDP**

Measures of the country's overall output and income are used in economics to estimate the value of goods and services produced in an economy. Countries use a system of national accounts or national accounting first developed during the 1940s. Some of the more common measures of the country's output are Gross Domestic Product (GDP), Gross National Product (GNP), Gross National Income (GNI), Net National Product (NNP), and Net National Income (NNI).

Why does anyone bother to estimate the GNP or GDP? For the same reasons statistical data is also gathered on unemployment rates, consumer price levels, the international trade balance and so on – that is, to facilitate economic policy making by government, to assist in planning by decision-makers in private business, and to test economic theories. If government policy makers include among their goals the promotion of economic growth and material prosperity in the national economy as a whole by means of monetary and fiscal policy, they need to have some reasonably precise way of telling how the economy is doing so as to decide whether they should be pushing on the gas or stepping on the brakes. Businessmen responsible for planning new investments in plant and equipment or the introduction of new products can use macroeconomic data and economic theory to forecast the likely levels of demand for their products and the probable trends in their various costs of production. Finally, a historical record of such statistics provides economists with the necessary data to test and refine their theories about how the economy actually works (and, in the process, perhaps to improve the policy makers' understanding of the likely consequences of their policies).

There are various ways of calculating these output numbers. The **expenditure approach** determines aggregate demand, or Gross National Expenditure, by summing consumption, investment, government expenditure and net exports. The **income approach** sums wages, rents, interest, profits, nonincome charges, and net foreign factor income earned. The **output approach** calculates the value added of goods and services in different sectors, such as agriculture, industry, etc. The three methods must yield the same result because total expenditures on goods and services (GNE) must by definition equal the value of goods and services produced (GNP) which must equal total income paid to the factors that produced the goods and services (GNI).

In fact, minor differences are obtained from the various methods due to changes in inventory levels. This is because goods in inventory have been produced (and therefore included in GDP), but not yet sold (and therefore not yet included in GNE). Similar timing issues can also cause a slight discrepancy between the value of goods produced (GDP) and the payments to the factors that produced the goods, particularly if inputs are purchased on credit.

- **Gross Domestic Product (GDP)** is the total money value of final goods and services produced within a country's borders in a year. GDP counts income according to where it is earned rather than who owns the factors of production. (a close value is Net Domestic Product –**NDP**, which equal to GDP Minus depreciation allowances). . ("Final" goods and services means goods and 333services sold or otherwise provided to their final consumers -- that is, to avoid double counting, the value of steel sold to GM to make a car is not added separately into the GNP or GDP totals because its value is already included when we add in the final sales price of the car to the customer.).

- **Gross National Product (GNP)** is the total value of all final goods and services produced in a given one-year period by the factors of production owned by a particular country's residents (even if these production factors are beyond the country's borders). It includes profits/income from capital held abroad. For example, because Mercedes-Benz is owned by Germans, its profits from its Belgian production count towards German GNP (but not German GDP). Also, because those activities take place in Belgium they count toward Belgian GDP. . In this example, all of the income from the (German-owned) car factory would be counted as Belgian GDP rather than German GDP. A UK taxpayer working in Paris would have his income count toward UK GNP but

his output would be part of French GDP (a closely related **Net National Product (NNP)** is GNP minus depreciation allowances.)

GNP and GDP are very closely related concepts in theory, and in actual practice the numbers tend to be pretty close to each other for most large industrialized countries. The differences between the two measures arise from the facts that there may be foreign-owned companies engaged in production within the country's borders and there may be companies owned by the country's residents that are engaged in production in some other country but provide income to residents. So, for example, when Americans receive more income from their overseas investments than foreigners receive from their investments in the United States, American GNP will be somewhat larger than GDP in that year. If Americans receive less income from their overseas investments than foreigners receive from their US investments, on the other hand, American GNP will be somewhat smaller than GDP.

To convert from GDP to GNP you must add net factor income receipts from foreigners that correspond to goods and services produced abroad using factor inputs supplied by domestic sources.

Attachment I contains some further elaborations on the various concepts related to GDP’s measures, composition and interpretations.

# 3. Output Fluctuations and Determination

## A. Fluctuations in Growth and Business Cycles

Why business cycles occur and can they be prevented? What determines output levels over time??

**Keynes explanation**: In good times, firms become optimistic and **overproduce**. With overproduction, inventory accumulates. Then businesses cut production and cut employment. This reduces income of workers and cut demand for goods. There is a depression and no solution. Government need to intervene to spend to give income to workers.

**Classical/neoclassical explanation**: Fluctuations are not due to overproduction: if inventories accumulate, prices will fall and bring equilibrium back. Wages and interest rates will also fall, bringing new production. Therefore, there is no need for government to intervene. In fact, fluctuations are due to **excess money supply** which causes Inflation and which is followed by contractions in money supply to cut inflation. These changes in money supply afffect interest rates and investments causing fluctuations in output. Therefore, fluctuations are due to a lack of incentives to invest due to poor government policies, particularly monetary and fiscal policies.

**More on the Classical Model (with emphasis on supply) versus the Keynes Model (with emphasis on demand)**

The **Classical economists**, whose thoughts were widely accepted in Western economies before the 1920s, believed that economic downturns can best be solved by leaving the economy alone and letting private market forces (lower prices/wages/interest rates) correct the problems. A self-correcting mechanism (Adam Smith's "invisible hand") is in place, which allows for only minimal government involvement in the economy. A key assumption of the classical economists is that prices are flexible and that therefore the market clears demand with supply. That is, with rare exceptions, the classical model assumes market clearing and equilibrium. Because in reality the assumption of price flexibility describes the economy only in the long run, classical theory is best suited for analyzing a time horizon of at least several years.

**Keynes** viewed the depression of 1929 and concluded that the economy will not recover by itself (in the short-term, prices/wages were **sticky** and interest rates were in a liquidity trap). Also, lower wages will depress spending and consumption will not recover. Therefore there was a need for government to intervene with autonomous spending using budget deficits to get money to consumers. **When aggregate demand is low, he theorized, sales and jobs suffer; when it is high, all is well and prosperous.** When prices are sticky, the non-market-clearing model analyzes well short-run issues, such as the reasons for short term economic fluctuations and the influence of government policy on those fluctuations. It is best suited to analyzing the changes in the economy we observe from month to month or from year to year.

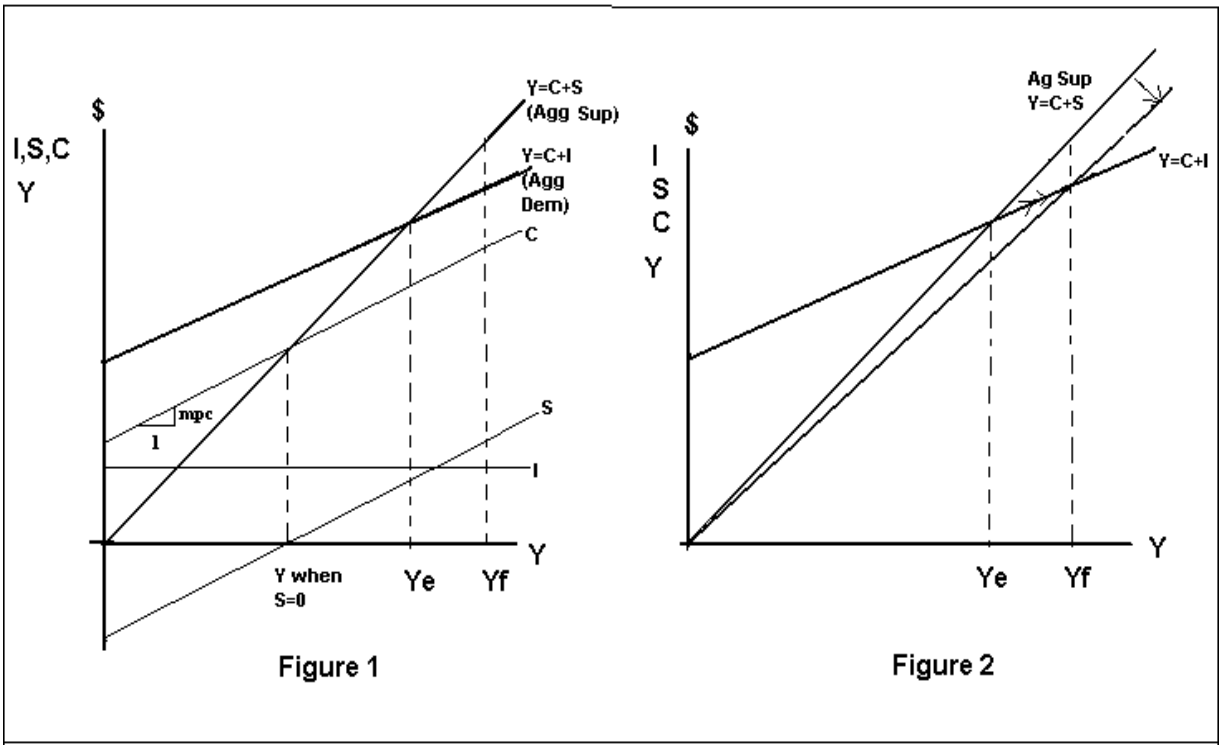
Most macroeconomists believe that the key difference between the short run and the long run is the behavior of prices. ***In the long run, prices are flexible and can respond to changes in supply or demand. In the short run, many prices are "sticky" at some predetermined level.*** Because prices behave differently in the short run than in the long run, economic policies have different effects over different time horizons.
To see how the short run and the long run differ, consider the effects of

# The Keynes Model

## Consumption and the consumption multiplier

- The Keynesian model is based on the belief that consumption demand drives the economy and that a shortfall in this demand causes recessions and depressions. If we can find ways to stimulate consumption, we will solve the problem.
- Keynes invented a concept called the **marginal propensity to consume** (MPC). The MPC indicates how much of any additional earnings people consume. For example, if the government gives me $1000 which I previously did not own, and if I decide to spend $800 of this money to purchase goods (let's say a used car), then my marginal propensity to consume is 800/1000 or .8 or 80%. This additional spending of $800 turns into additional income for the person from whom I bought the goods (the used car). If this person's MPC is also 80%, then we expect him to spend 80% of $800 or $640. He then spends this on goods (say a color television) and this creates income for the person from whom he bought the goods (the television store owner). This person then spends his MPC of the $640 on goods, and so forth. The total amount of additional spending adds up to $1000 (the initial government spending) + $800 (on the used car) + $640 (on the television) + ... This mathematical sum, assuming the MPC is constant, is 5 times $1000 (the initial government spending). The 5 in this equation is called "the multiplier." Note that this number varies with the value of the MPC: the greater the MPC, the more spending at each level, and therefore the greater the multiplier: the multiplier is **1/(1-MPC).**

- The significance of the multiplier, according to Keynes, is that an initial amount of government spending ($1000 in the above example) can create a total amount of spending in the economy equal to a multiple (5 in the above example) times the initial amount ($1000 in the above example). Keynes argued that this additional spending is needed to raise what he called "equilibrium national income" (can be thought of as GDP) to bring about additional spending and income necessary to reach full employment.



**Savings, the Tax Multiplier and Balanced Budget Multiplier**

- Keynes's complement of the marginal propensity to consume is his marginal propensity to save (MPS). Savings is defined as income not consumed. Consequently, if a person receives additional income of $100 and of that he consumes $80, his saving from this same $100 is $20. The MPC in this case is .8 or 80% and the MPS is .2 or 20%. It is true in all instances that the MPC and the MPS add up to 1. Note also that MPS=1-MPC, so that the multiplier can be rewritten as 1/MPS.
- What is true for a government injection (say additional spending of $1000), must work in reverse for a government tax increase. When the government spends money, certain groups in our society receive additional money. When the government raises taxes on certain individuals, these people lose take home earnings. A multiplier effect works for taxes in reverse as well. However, Keynes argued that since people would have spent only a fraction of this money anyway (80% in the above example), the decrease in overall spending from a tax increase is not as large as the increase in overall spending from a government spending increase. The **tax multiplier** can mathematically be derived to equal the negative number of the regular spending multiplier minus 1. In the above example, the spending multiplier is 5 and therefore the tax multiplier is -4. The tax multiplier is: **MPC/(1-MPC)**

- Based on the above, we can conclude then that when the government increases spending by $1000 and also increases taxes by $1000, equilibrium national income (GDP) will change by +$5,000 from the additional spending and -$4,000 from the additional taxes. On balance then equilibrium income will rise by +$1,000. Notice that in the above example, the government did not run a deficit (assuming it did not have a deficit before), but was still able to raise equilibrium income by $1,000. **The balanced budget multiplier** in this example and in all of Keynes's models is 1, i.e. when the government increases (or decreases) spending and taxes by the same amount, then equilibrium income rises (falls) by 1 times this amount.

**Critique of the Keynesian Model and importance of Saving to Allow Spending on Invests.**

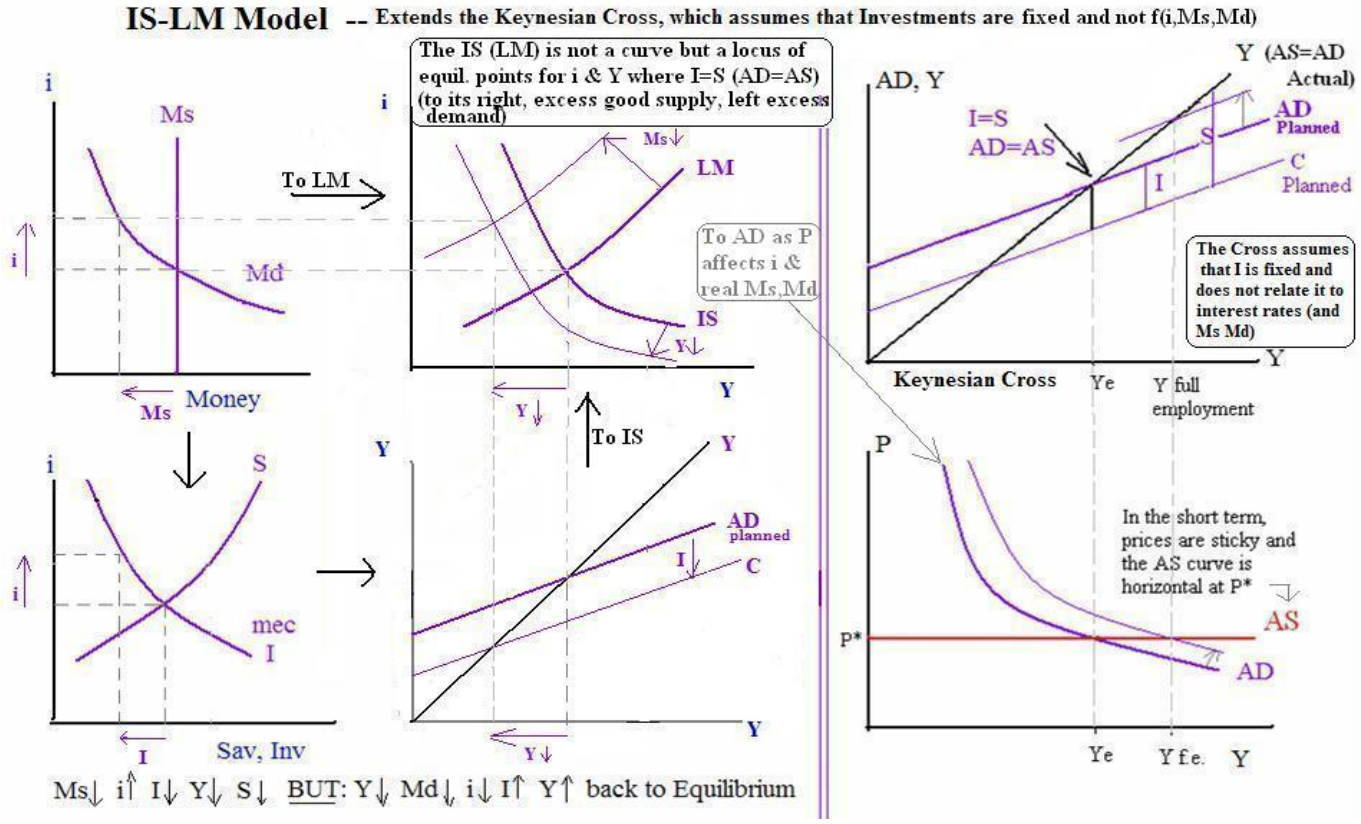
- There are some important flaws in the Keynesian model as described by the following reasoning based on theories heavily influenced by neo-classical and classical economists.
- The main flaw is Keynes's belief that wealth and production can be created and "multiplied" out of nothing, i.e. by artificially stimulating demand. Keynes held that as long as there is enough demand, supply will follow and unemployment will disappear. However, Keynes never considered where the funds for this demand really would come from. In the Keynesian model, if the government increases its spending. It can obtain the funds to do so from only two sources: printing money, or, 2. borrowing from the public.
- If it prints the money, the value of the money decreases by the same amount as the supply of the money increases. In terms of purchasing power, in the long run, therefore, there can be no additional real money and so there can be no additional real demand. It may be true that initially some people feel somewhat wealthier because they are the recipients of the additional government money. These people can indeed increase their spending relative to what it was before. However, as soon as inflation takes effect, there will be in all other parts of the economy groups of people harmed by the rising prices. In the long run (after the inflation takes effect), this group's drop in purchasing power and accompanying decrease in demand offsets the other groups' increase in demand. In reality, because of the harmful effects of inflation, inefficiencies and malinvestments become prevalent in the economy, and the decrease in demand is likely to more than offset the initial increase in demand.
- If the government borrows the funds from the public, a similar effect can be observed. Again, the beneficiaries of the government spending do experience an increase in their income. In this case it is an increase in their real income, because there is no inflation. Consequently, they increase their real demand. However, the people lending their funds to the government experience a decrease in their availability of funds and demand fewer goods or lend less money

to businesses. As they demand fewer goods, it offsets the increase in demand on the part of the government. As they lend less to businesses, investment spending decreases. In either case, no real increase in demand occurs.

- The truth is that any creation of wealth, production and jobs must be initiated at the production side, not the demand side. Only when entrepreneurs and workers become more industrious and productive, is additional real purchasing power created. Additional real purchasing power equates to additional real demand. This important conclusion was first verbalized by a French economist, Jean Baptiste Say, who came up with what is now known as **Say's Law**, which states that any supply creates its own demand.
- **Savings by Consumer and Business** is essential to allow firms to add to production capacities and create additional wealth. When people save, it frees up funds which businesses can use (borrow) to purchase capital goods. It is ironic that Keynes prescribed increases in consumption, when the above shows that what really should be encouraged is greater saving to allow businesses to invest in capital goods to increase production. Only on the long run, as a result of this greater capacity to produce, can consumption increase.

## B. Aggregate Demand: Short-term Equilibrium in Goods & Money Markets: the IS-LM Model

1. The central idea of the Keynesian theory is that prices (& inflation rates), have a great deal of inertia: they do not respond immediately to changes in economic conditions or policy. That allows monetary policy to influence the real rate of interest and output in the short run.
2. The Keynesian Cross is useful because it shows how the spending plans of households, firms, and the government determine the economy's income. Yet it makes the simplifying assumption that the level of planned investment *I* is fixed. But an important macroeconomic relationship is that planned investment depends on the interest rate *r*. This is shown in the IS-LM Model.




3. The IS curve summarizes equilibrium in the goods market. It's downward sloping in the diagram. Increases in Gov Exp (G) shift it to the right/up. The IS is an equilibrium locus, not a curve. Any point in the IS represents a combintion of "i" and "Y" that produces good market

equilibrium where I = S and AS = AD. To the right of the IS there is excess supply of goods (inventory accumulates and there is a tendency to reduce I and Y.) This will bring the system back to equilibrium in the IS curve. To the left of the IS there is excess demand for goods which will encourage additional I and Y, moving back to equilibrium at a ponit in the IS.

4. The LM curve summarizes equilibrium in the market for money. It's upward sloping in the diagram. Increases in Money supply (M) shift it to the right and down. Again, the LM is an equilibrium locus. To the right there is excess money demand and to the left there is excess money supply.
5. Effect of Money Supply on interest rates: Over the long term, the Fisher effect (i = r + inf.) implies that a decline in money supply (tight money) will reduce inflation and nominal interest rates will decline. Therefore, over the long term, Ms↓ ⇒ Prices ↓ ⇒ i↓. But over the short term, prices are sticker and according to the liquidity preference model: Ms↓ ⇒ i↑ This is consistent with real experiences.
6. Equilibrium in the IS-LM model is represented by the intersection of the IS and LM curves. Increases in G raise Income (Y) and interest rates ®. Increases in M raise Y but lower r.
7. Stabilizations of hyperinflations suggest that "price inertia" may be relevant there.
8. Autonomy of the central bank may improve its performance by insulating it from short term political pressures.

**Other Models of Consumption behavior**

- Habit based Consumption (consumption goes up with income, but do not decline)
- Permanent Consumption (consumption is based not on current consumption, but on the expected annual average life-long income, discounting future income by interests rates)
- Life Cycle Consumption (consumption is based on an annual income that changes over time with lower income earlier in life and higher income later in life)

# C. Aggregate Supply

The Aggregate Supply function explains the relationship between the level of Prices and the Supply of Output. That is, how producers will react to different level of prices. But before we can discuss this, we will need to review the production function and its two main factor inputs, capital and labor.

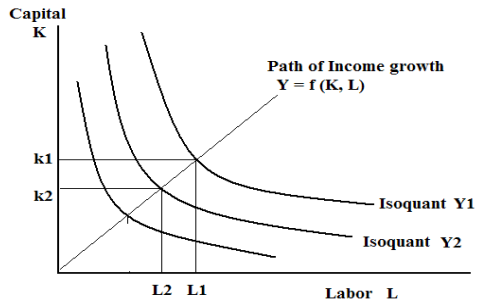
## i. Production Functions

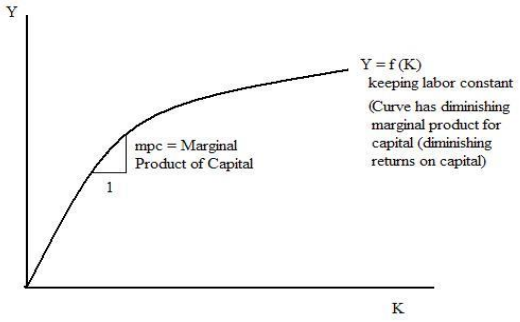
The production function specifies the factors that determine output or production. It establishes that production is determined by the combination of Capital (K), Labor (L). But K and L do not explain 100% of the changes in production from year to years. Therefore, there must be other factors affecting production, such as technology, innovation, human knowledge, etc.

$$Y = A \cdot f(K, L)$$

Cobb-Douglas Production Function: $Y = A \cdot K^{a} \cdot L^{(1-a)}$

where *A* is a parameter greater than zero that measures the productivity of the available technology and “a” is a constant between zero and one that measures capital’s share of income. That is, “a” determines what share of income is due to capital and what share goes to labor. This Cobb–Douglas production function has constant returns to scale. That is, if capital and labor are increased by the same proportion, then output increases by that proportion as well.




But now we need to find out what determines Capital (K) and Labor (L). This is done next.

## ii. Capital: Investment Functions

**Neoclasical Investment Model:** Investments depends on interest rates: I = f (i)

**Accelerator Investment model:** Investment depends on income: I = b . (d Y)

**Liquidity Investment Model:** I = f (liquidity (i..e., Supply of funds), installed capacity, marginal efficiency of investments)

**User cost of Capital Inv Model:** I = f ( price of capital assets, output price, interest, deprec., level of output, maintenace cost)

## iii. Labor: Labor Supply, Wages and Unemployment

**The supply of Labor L**: Ls = f (wages, value of leisure)
**The Demand for Labor:** Ld = f (wages, price of output)
Ls = Ld = L

**Unemployment and Okun's Law:** Okun discovered that in the USA, the unemplyment rate declines when GDP growth is about the trend rate of 2.25% pa. In particular, for every 1% real growth of GDP above this trend, unemployment declines by 0.5%

**The Phillips Curve : Trade off on inflation and Unemployment**

The Neo-Keynesians added the famous Phillips Curve to the Keynes system in order to enable them to account for inflation (changes in prices). The Phillips curve established an inverse relationship between inflation and unemployment: low inflation was historically statistically associated with high unemployment.

**Unemployment:** Full employment is not 100% employment. There is a "natural" unemployment rate of about 3-5%, caused by frictional (takes time to get a new job) and structural (new technologies) unemployment. This natural rate can not be compressed.

**The Natural Rate of Unemployment (NRU)**

The **natural rate of unemployment** is a concept of economic activity developed in particular by Milton Friedman and Edmund Phelps in the 1960s. It represents the hypothetical unemployment rate consistent with aggregate production being at the "long-run" level. This is the level the economy reaches in the absence of various temporary frictions such as incomplete price adjustment in labor and goods markets. The natural rate of unemployment therefore corresponds to the unemployment rate prevailing under a classical view of determination of activity. It is

mainly determined by the economy's supply side, and hence production possibilities and economic institutions. If these institutional features involve permanent mismatches in the labor market or real wage rigidities, the natural rate of unemployment may feature involuntary unemployment.

Occurrence of disturbances (e.g., cyclical shifts in investment sentiments) will cause actual unemployment to continuously deviate from the natural rate, and be partly determined by aggregate demand factors as under a Keynesian view of output determination. The policy implication is that the natural rate of unemployment cannot permanently be reduced by demand management policies (including monetary policy), but that such policies can play a role in stabilizing variations in actual unemployment.[2] Reductions in the natural rate of unemployment must, according to the concept, be achieved through structural policies directed towards an economy's supply side.

The development of the theory of the natural rate of unemployment came in the 1960s where economists observed that the Phillips-curve relationship between inflation and unemployment began to break down. Until then, it was widely believed that a stable negative relation between inflation and unemployment existed. This belief had the policy implication that unemployment could be permanently reduced by expansive demand policy and thus higher inflation.[3]

Friedman and Phelps opposed this idea on theoretical grounds, as they noted that if unemployment was to be permanently lower, some real variable in the economy, like the real wage, would have changed permanently. Why this should be the case because inflation was higher, appeared to rely on systematic irrationality in the labor market. As Friedman remarked, wage inflation would eventually catch up and leave the real wage, and unemployment, unchanged. Hence, lower unemployment could only be attained as long as wage inflation and inflation expectations lagged behind actual inflation. This was seen to be only a temporary outcome. Eventually, unemployment would return to the rate determined by real factors independent of the inflation rate. According to Friedman and Phelps, the Phillips curve was therefore vertical in the long run, and expansive demand policies would only be a cause of inflation, not a cause of permanently lower unemployment.

Milton Friedman emphasized expectations errors as the main cause of deviation in unemployment from the natural rate,[4] whereas Edmund Phelps focused more in detail on the labor market structures and frictions that would cause aggregate demand changes to feed into inflation, and for sluggish expectations, into the determination of the unemployment rate. Also, his theories gave insights into what could cause the natural rate of unemployment to be too high (i.e., why unemployment could be structural or classical).

## The Natural Rate of Unemployment (NRU) and the NAIRU

The Natural Rate of Unemployment (NRU) is the equilibrium level of unemployment to which the economy tends, as defined by Milton Friedman's misperception model of labour markets. This model assumes that, in the long-run, labour markets clear (i.e. supply of and demand for labour are equal, that is, in equilibrium, at a single wage rate and level of employment) and that there are no market frictions. According to this hypothesis, unanticipated inflation can cause *money illusion*: workers will ask for low nominal wage increases and think that their real wages are rising when in fact the real wage rate is falling. The workers' misperception will cause them to increase their labour supply, whilst the actual fall in real wages will cause firms to increase their labour demand, causing an overall increase in employment and output.

Once the workers realise that inflation has occurred, they will adjust their expectations and nominal wage demands, and unemployment will return to the NRU (although at a new, higher

expected rate of inflation). The actual level of the NRU itself is determined by the inherent characteristics of the labour market, such as any market imperfections or informational problems.

The **NAIRU (**Non-Accelerating Inflation Rate of Unemployment) hypothesis, on the other hand, is based on the New Keynesian imperfect competition model of labour markets. This model assumes that both labour and product markets are imperfectly competitive, due to trade unions and oligopolistic firms. Labour (through the process of collective bargaining) can therefore demand a *bargained real wage* (BRW), whilst firms can set a *price-determined real wage* (PRW) at which they can earn supernormal profits. The firms' PRW consists of the actual value of output (as determined by the marginal product of labour) minus a per worker profit for the firm.

In the NAIRU model, labour's BRW increases with the level of employment. This is because increased employment means that there are fewer unemployed workers looking for jobs, so labour markets become tighter and the bargaining power of labour increases. Unemployment disciplines the workforce. The PRW remains fixes at a set wage rate, on the other hand. This is because it represents the claims of firms on output per worker. The wage rate and level of employment at which the BRW and the PRW are equal is known as the NAIRU. This is the wage rate and level of employment at which the competing claims of labour (the workers) and capital (the firms) are satisfied.

The NAIRU model clearly has pseudo-Marxist overtones, especially the notion that wages and employment are determined by the competing claims of labour and capital rather than by the supply of and demand for labour. The Natural Rate of Unemployment model conversely assumes that labour markets can clear in the long-run. The experience of many OECD economies in the 1970s and 80s, during which time mass involuntary unemployment was witnessed, led to a backlash against the Natural Rate model. It was during this time that economists such as Bob Rowthorn began to flesh out the NAIRU model which has since come to prominence in macroeconomic circles.

Empirically, the existence and persistence of involuntary unemployment is the main difference between the NAIRU and the Natural Rate of Unemployment - at the Natural Rate of Unemployment, all unemployment must be voluntary (in the absence of market frictions) , whereas at the NAIRU equilibrium, involuntary unemployment can persist.

## iv. The Aggregate Supply Function in the short run and long run

**Aggregate supply** (*AS*) is the relationship between the quantity of goods/services supplied and the price level. Because the firms that supply goods and services have flexible prices in the long run (that is, in the long run they can change prices) but sticky prices in the short run (it is not easy to changes prices quickly), the aggregate supply relationship depends on the time horizon we are considering. We need to discuss two different aggregate supply curves: the long-run aggregate supply curve *LRAS* and the short-run aggregate supply curve *SRAS*. We also need to discuss how the economy makes the transition from the short run to the long run.

### Long-run Aggregate Supply

Because the classical model describes how the economy behaves in the long run, we derive the long-run aggregate supply curve from the classical model. Recall from Chapter 3 that the amount of output produced depends on the fixed amounts of capital and labor and on the available technology. To show this, we write:

$$Y = \square F(K^*, L^*)$$

$$Y = Y^*$$

According to the classical model, output does not depend on the price level. To show that output is the same for all price levels, we draw a vertical aggregate supply curve.

## Short-run Aggregate Supply

In the short-term, at the extreme, prices, wages and expectations about inflation are fixed. On these extreme assumptions, the short term aggregate supply curve is almost horizontal. But more realistic assumptions show that the short term aggregate supply curve is upward sloping. There are three models of short run aggregate supply and the market imperfection that each uses to explain why the short-run aggregate supply curve is upward sloping. One model assumes nominal wages are sticky; the second assumes information about prices is imperfect; the third assumes prices are sticky. These models are not incompatible with one another. We need not accept one model and reject the others. The world may contain all three of these market imperfections, and all may contribute to the behavior of short-run aggregate supply.

For example, the Sticky-Wage Model argues that because the nominal wage $W$ is stuck, an increase in the price level from $P1$ to $P2$ reduces the real wage from $W/P1$ to $W/P2$. The lower real wage raises the quantity of labor demanded. According to the production function, an increase in the quantity of labor demanded raises output. The short term aggregate supply curve summarizing this relationship between the price level and output.

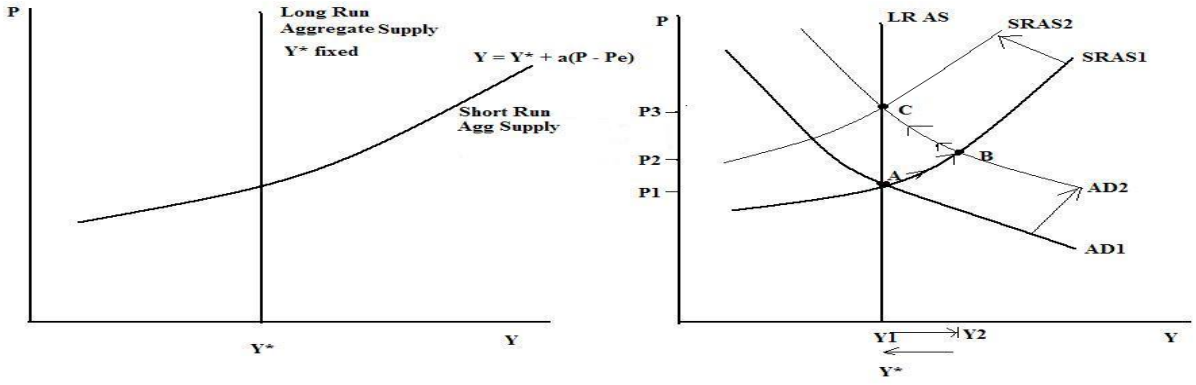
Although the three models of aggregate supply differ in their assumptions and emphases, their implications for aggregate output are similar. All can be summarized by the equation:

$$Y = Y^* + a\,(P - Pe) \qquad a > 0$$

where $Y$ is output, $Y^*$ is the natural rate of output, $P$ is the price level, and $P$e isthe expected price level. This equation states that output deviates from its natural rate when the price level deviates from the expected price level. *If the price level is higher than the expected price level, output exceeds its natural rate. If the price level is lower than the expected price level, output falls short of its natural rate.* All Short term supply models show that the curve is increasing. Notice that the short-run aggregate supply curve is drawn for a given expectation $P$e and that a change in $P$e would shift the curve.

# D. Equilibrium in Aggregate Demand and Supply – Short and Long Run

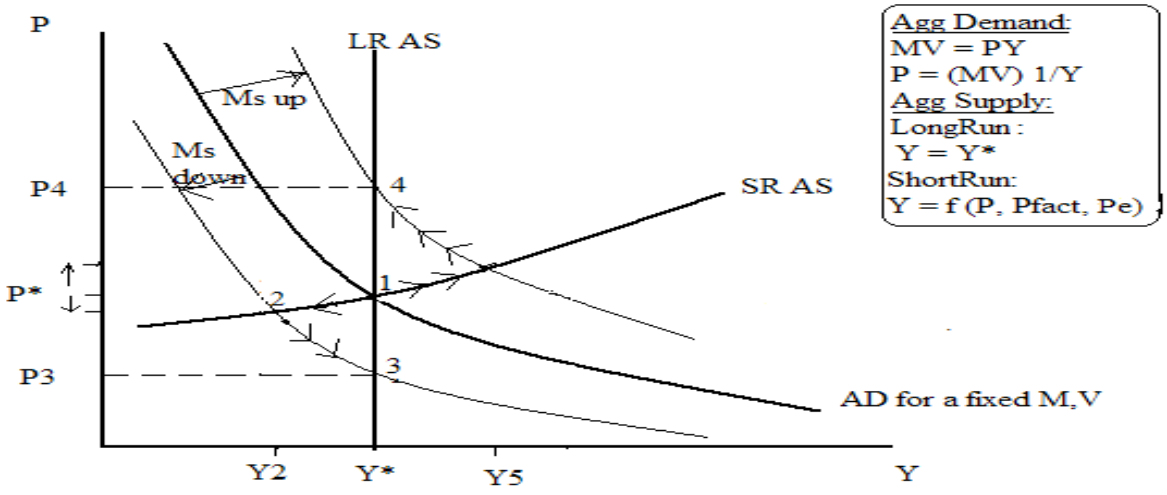
Let's put aggregate supply and aggregate demand back together. The figure below uses the aggregate supply equations to show how the economy responds to an unexpected increase in aggregate demand attributable, say, to an unexpected monetary expansion.



In the short run, the equilibrium moves from point A to point B. The increase in aggregate demand raises the actual price level from *P*1 to *P*2. Because people did not expect this increase in the price level, the expected price level remains at *P*2 e , and output rises from *Y*1 to *Y*2, which is above the natural rate *Y**. Thus, the unexpected expansion in aggregate demand causes the economy to boom. Yet the boom does not last forever. In the long run, the expected price level rises to catch up with reality, causing the short-run aggregate supply curve to shift upward. As the expected price level rises from *P*2 e to *P*3 e , the equilibrium of the economy moves from point B to point C. The actual price level rises from *P*2 to *P*3, and output falls from *Y*2 to *Y**. In other words, the economy returns to the natural level of output in the long run, but at a much higher price level.

This analysis shows an important principle, which holds for each of the three models of aggregate supply: long-run monetary neutrality and short-run monetary *non*neutrality are perfectly compatible. Short-run nonneutrality is represented here by the movement from point A to point B, and long-run monetary neutrality is represented by the movement from point A to point C. We reconcile the short-run and long-run effects of money by emphasizing the adjustment of expectations about the price level.

Further equilibrium analysis: What are the impacts of changes in Money Supply and adverse supply shocks ? And what is the transition from short term to long term?

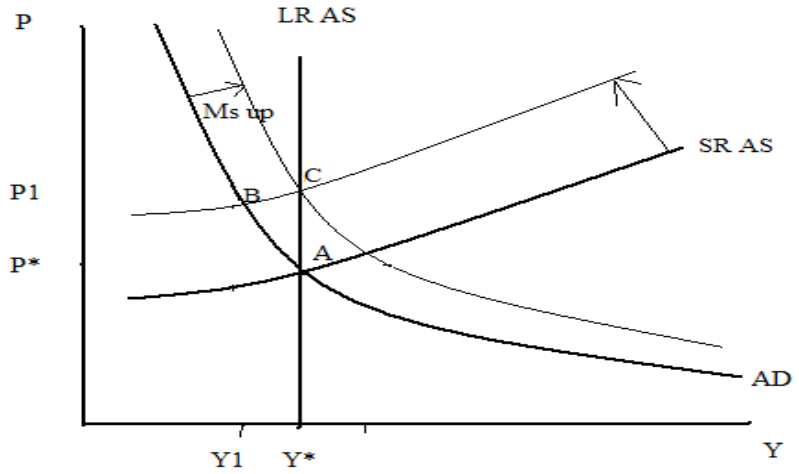



If Money supply declines, Agg demand moves to the left. In the Long run, since Agg supply is fixed at full employment Y*, the final equilibrium is just a reduction in Prices from P* to P3. However, in the short term, as wages are sticky, Prices will be reduced somewhat and Output will be reduced from Y* to Y2.

The transition from short term to long term is indicated by the arrows (the reduction in aggregate demand, caused by a decrease in the money supply, moves the economy from point 1 to point 2, where output is below its natural level. As prices fall, the economy gradually recovers from the recession, moving from point 2 to point 3).

Similarly, an increase in money supply, causes a short term increase in income to Y5, but over the long term, income returns to Y* and we get only inflation with new prices at P4

An adverse supply shock, on the other hand can reduce income permanently. This supply shock pushes up costs and thus prices. If aggregate demand is held constant, the economy moves from point A to point B, leading to stagflation—a combination of increasing prices and falling output. Eventually, as prices fall, the economy returns to the natural rate, point A. But this will be a painful process.




The Fed can accommodate the supply shock and increase money supply. Inn this case the Aggregare Demand curve will move to the right and equilibruim will take place at point C. But the final consequence is a permanent increase in prices to P1.

In Summary:

Keynes had proposed that low aggregate demand was responsible for the low income and high unemployment that characterize economic downturns. He criticized classical theory for assuming that aggregate supply alone—capital, labor, and technology— determines national income. Economists today reconcile these two views with the model of aggregate demand and aggregate supply that shows that in the long run, prices are flexible, and aggregate supply determines income. But in the short run, prices are sticky, so changes in aggregate demand influence income.

Most macroeconomists believe that the key difference between the short run and the long run is the behavior of prices. *In the long run, prices are flexible and can respond to changes in supply or demand. In the short run, many prices are "sticky" at some predetermined level*. Because prices behave differently in the short run than in the long run, economic policies have different effects over different time horizons.

How does introducing sticky prices change our view of how the economy works? We can answer this question by considering economists' two favorite words— supply and demand.

In classical macroeconomic theory, the amount of output depends on the economy's ability to *supply* goods and services, which in turn depends on the supplies of capital and labor and on the available production technology. This is the essence of the basic classical model. Flexible prices are a crucial assumption of classical theory. The theory posits, sometimes implicitly, that prices adjust to ensure that the quantity of output demanded equals the quantity supplied. The economy works quite differently when prices are sticky. In this case, as we see, output also depends on the *demand* for goods and services. Demand, in turn, is influenced by monetary policy, fiscal policy, and various other factors. Because monetary and fiscal policy can influence the economy's output over the time horizon when prices are sticky, price stickiness provides a rationale for why these policies may be useful in stabilizing the economy in the short run.

## E. The Very Long Run: Economic Growth Models and the role of Innovation

We have seen that the economy's natural level of output (Y*) depends on the amount of capital, labor and technology. Therefore, to raise output over the long term, we must aim to increase the amount of capital, the amount of labor, and improve technology (productivity). Economic growth models try to find out the sources of economic growth over long periods of time: what factors explain the economic growth of countries over decades. We are interested on the role of capital on growth.

## 1. Harrod-Domar model

$Y = f(K)$ Income "Y" is a function of capital "K"
$I = S = sY$ Investments "I" equal Savings "S", where "s" is the savings rate
$dY/dK = c = Y/K$ (marginal productivity of capital constant at "c") ----- $dY = c \cdot dK$
$dK = I - \partial K$ where $\partial$ is depreciation rate
$dY = c \cdot dK = c\ (I - \partial K) = c\ (sY - \partial K) = csY - c\partial K = csY - \partial Y = Y(cs - \partial)$
$dY/Y =$ **GDP growth = g = c . s – $\partial$** -- where c is dY/dK and is constant

The rate of growth of GDP will be a fixed amount and will depend only on the **savings rate** (related to capital accumulation) , if dY/dK and depreciation $\partial$ are constant (eg.: $c.s - \partial = 0.3 \times 0.3 - 0.05 = 0.04$) **To increase growth, an economy should save and invest more.**

## 2. Exogenous Growth Model: the Solow Model

It is an extension of the Harrod-Domar model and introduces: (1) Labor (L); and (2) Technological change (A) which leads to increases in productivity- ie. increases in income (output) per worker.

Solow assumed diminishing returns on capital (keeping Labor constant). With diminishing returns on capital, over the long run the contribution of capital percapita to income percapita diminishes over time and tends asymptotically to zero. Therefore, over the very long term, capital and savings do not contribute to a continous growth in income per capita. That is, after reaching a plateu on capital contributions and income percapita, further growth in total income will need to come from dL and dA. Furthermore, even before this platau is reached, the economy will reach a stable steady state level of percapita capital (as depreciation increase offset increases in capital). This also lead to a stable, steady state level of percapita income. Income per capita would be constant and the overall rate of income growth will depend only to the growth of the labor force or growth in output per woker (due to technological change).

If returns to additional investments were not to fall, it will always be profitable to invest, capital will continue to accumulate perpetually, and per capita output can rise indefinitely.

Initially, let's assume that income is only a function of capital and labor (ignoring technological change):

*(1)* $Y = F(K, L) \rightarrowtail Y/L = F(K/L, 1) \rightarrowtail \boldsymbol{y = f(k)}$

- *Where " y" is income percapita and "k" is capital per capita (per unit of labor).*
- *Labor grows at a rate "n"***.**
- *Solow assumes that this production function has diminishing marginal product of capital (mpc), i.e, capital has diminishing returns.*

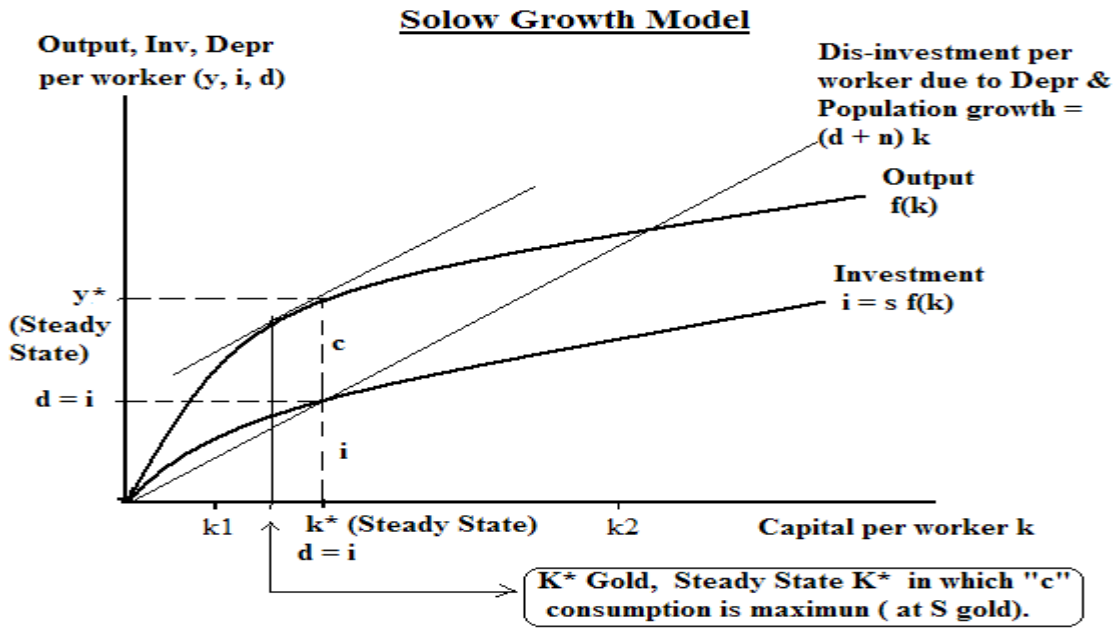
*(2)* $y = c + i \rightarrowtail c = (1 - s)y \rightarrowtail y = (1 - s)y + i \rightarrowtail i = sy \rightarrowtail \boldsymbol{i = sf(k)}$

*(3)* $\Delta k = i - (\partial + n)\, k$ *Investment increases capital, whereas depreciation and population growth decrease capital per unit of labor.*

$\Delta k = sf(k) - (\partial + n)\, k$ *when:* $sf(k) = (\partial + n)\, k$ -- then $\Delta k = 0$;

*At this level:* $k / f(k) = s / (\partial + n)$ *where k is now* constant - *k* ( the higher the s, the higher the k*)*

*At k*, income will also be at steady state y* (Δcapital is not contributing to income growth; income will growth only with increases in labor(population.)*




There is a single percapita capital stock *k** at which the amount of investment equals the amount of percapita depreciation. If the economy ever finds itself at this level of the capital stock, the capital stock will not change because the two forces acting on it—investment and depreciation—just balance. That is, at *k**, $\Delta k = 0$, so **the capital stock *k* and income *f*(*k*)** are steady over time (rather than growing or shrinking). We therefore call *k** and y* the **steady-state** level of capital and income, respectively. Using these few simplifying assumptions about the growth of the inputs, this model demonstrates the existence of a stable growth path for output equal to the growth of the labor force.

The steady state is significant for two reasons. An economy at the steady state will stay there. In addition, and just as important, an economy not at the steady state will go there.That is, regardless of the level of capital with which the economy begins, it ends up with the steady-state level of capital. In this sense, *the steady state represents the long-run equilibrium of the economy*. To see why an economy always ends up at the steady state, suppose that the economy starts with less than the steady-state level of capital, such as level *k*1 in the Figure. In this case, the level of investment exceeds the amount of depreciation. Over time, the capital stock will rise and will continue to rise—along with output *f* (*k*)—until it approaches the steady state *k**. Similarly, suppose that the economy starts with more than the steady-state level of capital, such as level *k*2. In this case, investment is less than depreciation: capital is wearing out faster than it is being replaced. The capital stock will fall, again approaching the steady-state level. Once the capital stock reaches the steady state, investment equals depreciation, and there is no pressure for the capital stock to either increase or decrease.

**Introducing Technological Progress in the Solow Model:**

This prediction of a steady state constant income percapita is at odds with the historical record, which shows sustained increases in per capita income over very long periods. To explain the growth of per capita income, Solow introduced the idea of technological change represented by the parameter "A".

$$Y = A K^{a} L^{(1-a)}$$

$$dY/Y = g = f(dA, dK, dL)$$

when dK=0, then $g = dY/Y = f$ (growth of labor, growth of output per worker)
(dL = n) (dA=x)

After capital percapita have reached steady state, income will only increase with the growth of **labor (dL)** or with the gowth in **technological change (dA)**. Without technological change, in equilibrium, the growth of income is limited to the growth of the labor force, meaning that percapita income (a crude measure of the standard of living) is constant through time. In fact, the model's assumptions about decreasing returns on capital ensure that per capita income does not grow without technological progress. Intuitively, this assumption means that successive increases in the amount of, say, capital used in production (holding the number of workers constant) will yield progressively smaller increases in income.

Alternatively, technological progress can be embodies in the labor input. This form of technological progress is called "**labor augmenting technological progress**". The production function becomes:

$$Y = K^{a} \cdot (E \cdot L)^{(1-a)}$$

Where *E* is a new (and somewhat abstract) variable called the **efficiency of labor**. The efficiency of labor is meant to reflect society's knowledge about production methods: as the available technology improves, the efficiency of labor rises. For instance, the efficiency of labor rose when assembly-line production transformed manufacturing in the early twentieth century, and it rose again when computerization was introduced in the the late twentieth century. The efficiency of labor also rises when there are improvements in the health, education, or skills of the labor force.

In this model, growth can be explained by two different sources. One is factor accumulation or "working harder" which means the growth simply comes from an increase in labor, capital, or any factor endowment. The other source comes from improvements in efficiency or "working smarter" which means there has been a development in technology that brings increasing returns to scale.

The term $L \times E$ measures the number of ***effective workers***.

With E (Efficiency of Labor due to education, technology, etc) growing at a rate "**g**"

and at $\Delta k = 0$; then $i = s\,f(k) = (\partial + n + g)\,k$

**Steady-State Growth Rates in the Solow Model With Technological Progress**

| Variable | Symbol | Steady-State Growth Rate |
|---|---|---|
| Capital per effective worker | $k = K/(E \cdot L)$ | 0 |
| Output per effective worker | $y = Y/(E \cdot L) = f(k)$ | 0 |
| Output per worker | $Y/L = y \cdot E$ | $g$ |
| Total output | $Y = y \cdot (E \cdot L)$ | $n + g$ |

## Summary:

A common prediction of the neo-classical model is that an economy will always converge towards a steady state rate of growth (where new capital does not produce economic growth) , which depends only on the **rate of technological progress (g)** and the **rate of labor force growth (n) (in the short term,** the savings rate that leads to capital accumulation and growth, but since capital has diminishing returns, over the long term the contribution of capital to growth disappear).

At steady state, the level of income per capita becomes constant. But the level of percapita income reached at steady state depends on the savings rate. The higher the saving rate, the higher the steady state level of income percapita. Therefore a high savings rate is a necessary condition to have high standards of living. But further growth in income percapita beyond the steady state level depneds on population growth and most importantly in growth in technology/innovation/education (that is in total factor productivity). Increases in total factor productivity requires a favorable business environment that encourages firms to take risks and invest in R&D. This requires a predictivable legal environment, de-regulation, economic stability, friendly public administration, no corruption, etc.

The Solow neo-classical model makes another important prediction. Developing countries with less capital per person will grow faster because each investment in capital will produce a higher return than in rich countries with ample capital. That is, the income levels of poor countries will tend to catch up with or **converge** towards the income levels of rich countries. Under this convergence process, economies with low starting values of per capita output (developing countries) grow faster than those with higher initial values (rich countries). The model predicts that the level of per capita output in all countries will converge to a common level. Convergence occurs in the neoclassical model because of decreasing returns to capital. Investment should be more profitable in poor countries than in rich ones because poor countries have lower levels of capital per worker and, therefore, a higher return to capital. This means that poor countries not only will get a bigger "bang per buck" of investment spending but also will attract a disproportionate share of foreign investment. One problem with the prediction of convergence is that it requires that countries be identical in every respect except their level of per capita output.

In the Solow model, the role of technological change becomes crucial, even more important than the accumulation of capital. The model notes that countries can overcome a steady state stagnation of growth and continue growing by inventing new technology. In the long run output per capita depends on the rate of saving but the rate of growth of output should be equal for any saving rate! In this model the process by which countries continue growing despite the diminishing returns is "exogenous" and represents the creation of new technology that allows production with fewer resources. Technology improves the steady state level of capital increases and the country invests and grows.

Limitations of the Solow model include its failure to take account of entrepreneurship (which may be catalyst behind economic growth) and strength of institutions (which facilitate economic growth). In addition, it does not explain how or why technological progress occurs. This failing has led to the development of endogenous growth theory, which endogenizes technological progress and/or knowledge accumulation.

## 3. Engonenous Growth models:

Proponents of endogenous growth cite three limitations of the neoclassical model as the motivation for developing their models. First, it relies on technological change to supply growth in per capita output. Instead of explaining the sources of technological change, the model assumes it will occur independent of factors considered by the model.

Second, the neoclassical model provides only a rudimentary framework for analyzing the effects of government policy on long-term growth. Although it is not obvious that government actions can raise economic growth, policy changes clearly affect the day-to-day decisions made by consumers, managers, and investors. It would be desirable to have a framework to analyze the effects of such changes on long-term growth.

Third, the model has limited tools for analyzing international trade and its link with economic growth. In particular, empirical evidence suggests that countries with an outward orientation seem to grow faster than those that are more protectionist The neoclassical model, however, cannot address the question of whether openness to trade causes faster growth.

In Solow's neoclassical growth model, the long-run rate of growth is exogenously determined - in other words, a major variable – technical change -- is determined outside of the model. The rate of technological progress is determined by a scientific process that is separate from, and independent of, economic forces. Neoclassical theory thus implies that economists can take the long-run growth rate as given exogenously from outside the economic system.

**Endogenous growth** theory challenges this neoclassical view by proposing channels through which the rate of technological progress, and hence the long-run rate of economic growth, can be influenced by economic factors.

It starts from the observation that technological progress takes place through **innovations**, in the form of **new products, processes and markets, many of which are the result of economic activities.**

For example, because firms learn from experience how to produce more efficiently, therefore a higher pace of economic activity can raise the pace of process-innovation by giving firms more production experience.

Also, because many innovations result from R&D expenditures undertaken by profit-seeking firms, therefore economic policies with respect to trade, competition, education, taxes and intellectual property can influence the rate of innovation by affecting the private costs and benefits of doing R&D.

These models attempt to endogenize total factor productivity. To understand fully the process of economic growth, they try to develop models that explain technological progress.

Their main assumption is that **capital does not exhibit diminishing returns.** Therefore, the contribution of capital to income percapita can continue indefinitedly.

This assumption becomes plausible if capital is redefined to include **Human Capital**, which is generates innovation and technology change. In most respcts, it has similar conclusions to Solow's model. But it goes a little further in explaining the need to foster education which leads to innovations and technological change.

Let's start with a particularly simple production function:

$$Y = AK$$

where $Y$ is output, $K$ is the capital stock, and $A$ is a constant measuring the amount of output produced for each unit of capital. Notice that this production function does not exhibit the property of diminishing returns to capital. One extra unit of capital produces $A$ extra units of output, regardless of how much capital there is.This absence of diminishing returns to capital is the key difference between this endogenous growth model and the Solow model.

$$\Delta K = sY - \partial K.$$

This equation states that the change in the capital stock ($\Delta K$) equals investment ($sY$ ) minus depreciation ($\partial K$). Combining this equation with the $Y = AK$ production function,we obtain, after a bit of manipulation,

$$\Delta Y/Y = \Delta K/K = sA - \partial.$$

This equation shows what determines the growth rate of output $\Delta Y/Y$. Notice that, as long as $sA > \partial.$, the economy's income grows forever, even without the assumption of exogenous technological progress.

Thus, a simple change in the production function can alter dramatically the predictions about economic growth. In the Solow model, saving leads to growth temporarily, but diminishing returns to capital eventually force the economy to approach a steady state in which growth depends only on exogenous technological progress. By contrast, in this endogenous growth model, saving and investment can lead to persistent growth.

But is it reasonable to abandon the assumption of diminishing returns to capital? The answer depends on how we interpret the variable $K$ in the production function $Y = AK$. If we take the traditional view that $K$ includes only the economy's stock of plants and equipment, then it is natural to assume diminishing returns. Giving 10 computers to each worker does not make the worker 10 times as productive as he or she is with one computer. Advocates of endogenous growth theory, however, argue that the assumption of constant (rather than diminishing) returns to capital is more palatable if $K$ is interpreted more broadly. Perhaps the best case for the endogenous growth model is to view **knowledge** as a type of capital. Clearly, knowledge is an important input into the economy's production—both its production of goods and services and its production of new knowledge. Compared to other forms of capital, however, **it is less natural to assume that knowledge exhibits the property of diminishing returns.** (Indeed, the increasing pace of scientific and technological innovation over the past few centuries has led some economists to argue that there are increasing returns to knowledge.) If we accept the view that knowledge is a type of capital, then this endogenous growth model with its assumption of constant returns to capital becomes a more plausible description of long-run economic growth.

Although the $Y = AK$ model is the simplest example of endogenous growth, the theory has gone well beyond this. One line of research has tried to develop models with more than one sector of production in order to offer a better description of the forces that govern technological progress.

In any event, all these models show that **human capital, technology and innovation** are key determinants of long term growth in income percapita.

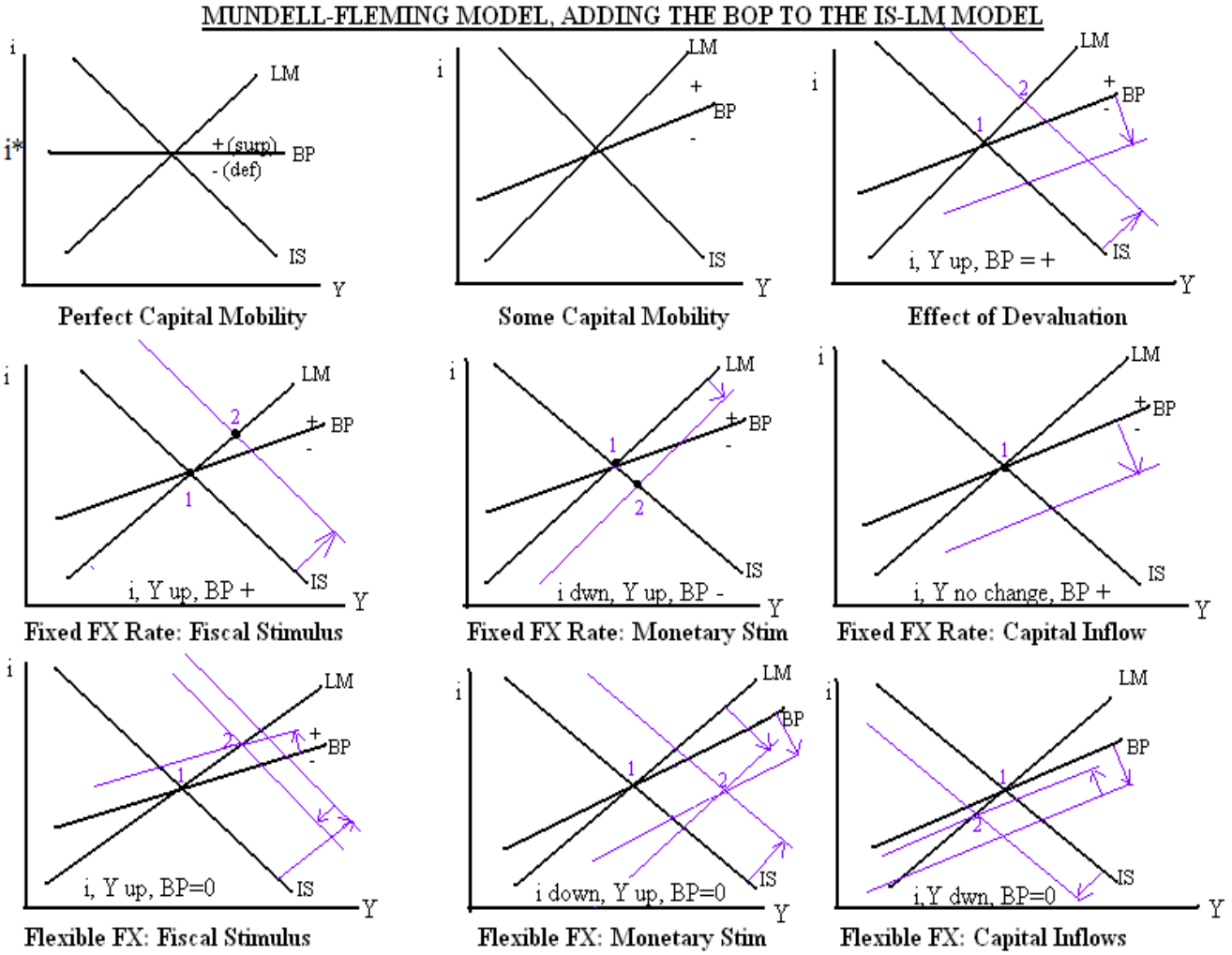
One question these models are designed to address is whether, from the standpoint of society as a whole, private **profit-maximizing firms tend to engage in too little or too much research**. In other words, is the **social** return to research (which is what society cares about) greater or smaller than the **private** return (which is what motivates individual firms)? It turns out that, as a theoretical matter, there are effects in both directions. On the one hand, when

a firm creates a new technology, it makes other firms better off by giving them a base of knowledge on which to build future research. As Isaac Newton famously remarked, "If I have seen farther than others, it is because I was standing on the shoulders of giants." On the other hand, when one firm invests in research, it can also make other firms worse off by merely being first to discover a technology that another firm would have invented. This duplication of research effort has been called the "stepping on toes" effect. Whether firms left to their own devices do too little or too much research depends on whether the positive "standing on shoulders" externality or the negative "stepping on toes" externality is more prevalent.

Although theory alone is ambiguous about the optimality of research effort, the empirical work in this area is usually less so. Many studies have suggested the "**standing on shoulders**" externality is important and, as a result, the **social return to research is large**—often in excess of 40 percent per year. This is an impressive rate of return, especially when compared to the return to physical capital, which we earlier estimated to be about 8 percent per year**. In the judgment of some economists, this finding justifies substantial government subsidies to research.**

# F. The International Sector

The open-economy version of the IS-LM model (that allows for international **trade** and international **capital** flows) was developed by Mundell (1962,63) and Fleming (1962). With Perfect Capital mobility the domestic interest rate will equal the international interest rate and is therefore fixed at i* (if there were differences, they will just induce capital flows to take advantage of this difference). The BP curve (where exports = imports and BP = 0) will be horizontal. With some, but imperfect capital mobility, the BP curve will be upwards sloping.



**Fiscal expansion**

An increase in government spending (or a tax cut) shifts the IS-curve to the right.
With a **fixed exchange rate** this causes income and the interest rate both to rise. The rise in interest rate attracts a capital inflow that, with relatively mobile capital, is sufficient to create a BOP surplus.
With a **flexible exchange rate** this is an excess demand for domestic currency, which therefore appreciates moving the BP curve to the left. The appreciation dampens the increase in both income and the interest rate.

**Monetary expansion**

An increase in the money supply shifts the LM curve to the right, raising income and lowering the interest rate.
With a **fixed exchange rate**, both of these changes contribute to BOP deficit.
With a **flexible rate**, this is an excess supply of domestic currency, which therefore depreciates. The depreciation further stimulates income, but dampens the fall in interest rate.

**Devaluation**

A devaluation of the otherwise fixed exchange rate stimulates demand for domestic goods shifting the IS-curve to the right, but also shifting the BP curve down and creating a BOP surplus. (This ignores the possibility of a J-curve -- see notes below.)

**Capital Inflow**

Under a **fixed exchange rate**, an exogenous capital inflow has no effect on IS or LM, since the central bank is sterilizing its effect on the interest rate. It merely causes a BOP surplus.
With a **flexible rate**, however, this surplus causes an appreciation, which reduces demand and shifts the IS-curve to the left. Thus the capital inflow lowers income and the interest rate under a flexible exchange rate.

## Notes on Mundell-Fleming model:

1. The relative slopes of the LM and BP curves are crucial to some of these results. The case shown assumes that capital is sufficiently mobile internationally that the BP curve is flatter than the LM curve. The extreme case of perfect capital mobility would have a horizontal BP curve.
2. In addition to the two cases shown, one could (and should) also look at the case of a fixed exchange rate with nonsterilization. In that case, whenever there is a BOP disequilibrium the money supply will be changing, rising with a surplus and falling with a deficit (which are in turn indicated by the + and - signs in the diagram). The LM curve therefore shifts until all three curves intersect at once.
3. Exchange rate devaluation (and depreciation) is shown as shifting the IS and BP curves both to the right. This requires that import demand elasticities are large enough to satisfy the Marshall-Lerner Condition. Without this, as is perhaps likely in the short run, both would shift in the other direction. This is one possible cause of the J-curve, worsening the balance of trade in the short run, and also reducing aggregate demand.
4. An exogenous change in exports and/or imports due to any of a variety of causes ranging from changing trade policies to business cycle fluctuations abroad will have effects under fixed exchange rates similar to the devaluation shown above. Under a flexible exchange rate, however, matters are complicated by the need to know how an exchange rate change alters capital flows. Depending on the nature of expectations, among other things, anything -- or nothing -- is possible. In particular, it may be that, say, an exogenous increase in exports will be exactly offset, in its effects on the trade balance and aggregate demand, by an exchange rate appreciation.
5. The model here takes all foreign variables as given, under the assumption that this is a small open economy. If that is not the case, there will be foreign repercussions from the foreign response to this country's changes in trade and capital flows, and results may change.

## G. Economic Policy to Influence Output: Current Schools of Economic Thougth

- Monetarism, led by Milton Friedman, which holds that inflation is always and everywhere a monetary phenomenon. It rejects fiscal policy because it leads to "crowding out" of the private sector. Further, it does not wish to combat inflation or deflation by means of active demand management as in Keynesian economics, but by means of monetary policy rules, such as keeping the rate of growth of the money supply constant over time.
- New classical economics, which explores the implications of rational expectations. Their original theoretical impetus was the charge that Keynesian economics lacks microeconomic foundations -- i.e. its assertions are not founded in basic economic theory. This school emerged during the 1970s. This school asserts that it does not make sense to claim that the economy at any time might be "out-of-equilibrium". Fluctuations in aggregate variables follow from the individuals in the society continuously re-optimizing as new information on the state of the world is revealed.
- New Keynesian economics, which developed partly in response to new classical economics. It strives to provide microeconomic foundations to Keynesian economics by showing how imperfect markets can justify demand management.
- Austrian economics is another laissez-faire school of macroeconomics. It focuses on the business cycle that arises from government or central-bank interference that leads to deviations from the natural rate of interest.
- Post-Keynesian economics represents a dissent from mainstream Keynesian economics, emphasizing the role of uncertainty and the historical process in macroeconomics.

Different analytical approaches lead to different policy conclusions for both fiscal and monetary policies.

# 4. Fiscal Policies and Fiscal Budgets

- Fiscal policies are the government policies to raise funds and spend them.
- The government needs to raise money (from taxes, etc) to provide "public goods" that the private sector can not deliver (defense, judicial, etc).
- But a proper fiscal policy is also one where the government provides an environment conducive for people and businesses to be productive and creative. This business environment is characterized by low taxation, little government spending (limited to defense, judicial and police protection, and possibly some spending on infrastructure and transportation), and some, but limited regulation.

**The Laffer Curve**

- Laffer postulated that the unwise provisions of the tax laws (and especially high marginal rates of personal and corporate income taxation) produce very damaging incentives that lead people to work less and to invest less (and to do both less efficiently) than they otherwise would. Therefore, as tax rates are increased, initially they lead to higher government revenues. But after some point, higher tax rates reduce output and reduce government revenues.

**Discretionary Fiscal policy and automatic stabilizers**

- Discretionary fiscal policy is the deliberate attempt by the government to add to (or deduct from) its spending or tax revenue. If, for example, the government wants to boost the economy by building $10 billion worth of roads and bridges, it is an action which needs to be explicitly approved by Congress and the President.
- This is in contrast to automatic stabilizers, which may change government spending and tax revenues without direct approval by Congress or the President. Automatic stabilizers are expense and taxation items already built-in to our economic and political system.

  Examples of automatic stabilizers are:

  **Unemployment compensation** - if the economy turns down, the government's expense on unemployment compensation automatically increases as more people are without jobs. This increase in government spending prevents the economy from recessing more than what would occur if no unemployment compensation existed, according to Keynesian thought.

  **Progressive tax system** - Our U.S. tax system is set up to tax higher income individuals and businesses at higher rates. If the economy slows down this means that incomes decrease and people pay less money in taxes. This decrease in tax (compared to a system without progressive taxes) puts relatively more money in people's pockets and subsequently stimulates economic activity (or at least prevents it from slowing down more).

**Budget Deficits and Public Debt**.

- The budget deficit is the yearly amount which the government overspends relative to what it receives in taxes.
- This deficit can be financed either by printing money (which will olead to inflation) or by borrowing from the public or abroad (and raising public debt)
- The budget deficit should not be confused with the public (national) debt.
- Public debt represents the accumulation of all past deficits which the country has incurred to finance these deficits. In the EU, the level of public debt should not exceed 60% of GDP. In Ukraine, the level of public debt is only about 10% of GDP.

**Fiscal Budget Balancing**

Economists disagree about how the federal budget should be managed. Below are three common theories.

**The Annually Balanced Budget –** Government expenditures equals government revenues from taxes within one fiscal year.

**The Cyclically Balanced Budget—**Government expenditures equals government

revenues from taxes within one business cycle. A business cycle consists of an expansion and a recession. Keynes proposed that the government increase its expenditures and decrease taxes during recessions in order to provide people with more money and thus to stimulate the economy and vice versa.

**Functional Finance—**Proponents of this theory believe that government budget deficits don't matter as long as full employment is achieved. This appears to be the approach taken (whether they meant to or not) by recent US administrations. Budget deficits meant to stimulate the economy, skyrocketed to very high levels during the 70's and 80's. The long term consequences of large budget deficits can be detrimental to an economy.

# 5. Monetary Policies and Inflation

**Functions of Money:** Money must have the following three values to be called "money":

1. Medium of exchange: Instead of exchanging one good for another ggod, you exchange the good for money
2. Standard of value: it measures the values of goods
3. A store of value: You can accumulate money to increase your wealth

**Money supply measures**:

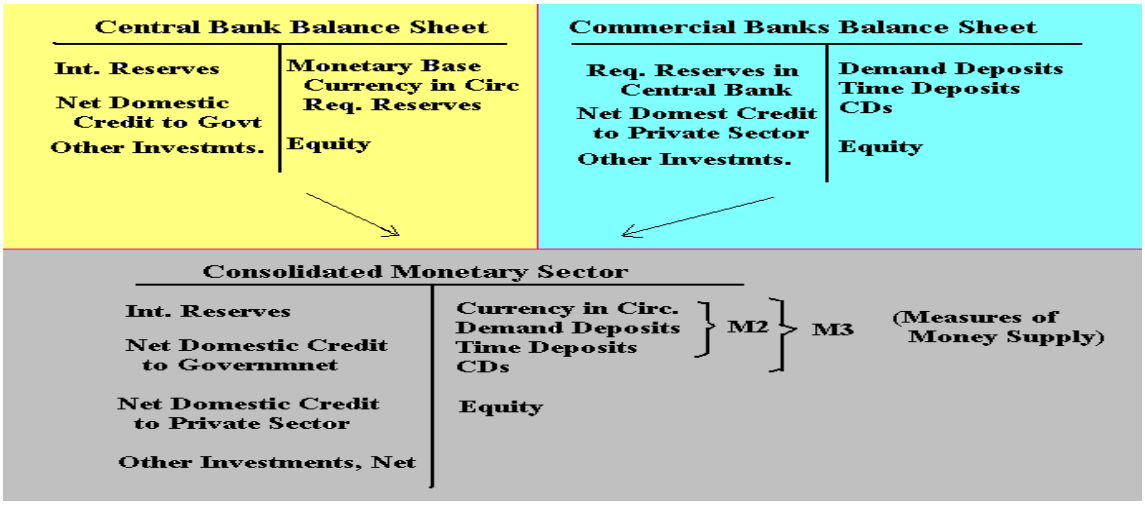
M1 (currency in circulation plus demand deposits);
M2 (M1 + saving deposits and small time deposits (less than $100,000);
M3 (M2 + large time deposits and CDs)

**Central Bank: National Bank of Ukraine**

The NBU holds the commercial bank reserves and changes money supply by:

1. Changing reserve requirements of commercial banks
2. Open Market operations: Buying and selling government securities in order to affect the level of interest rates in the country.
3. Changing directly the interest rate charged by the NBU to banks when they borrow

**The Balance-Sheets of Banks and the Central Bank**




**Money creation by banks and the money multiplier (MM)**

An initial deposit of $1000 enables a bank to loan out $800 (assuming a required reserve ratio (RR) of 0.2 or 20%). This $800 will be spent and deposited into bank B, which in turn can loan out 80%, or $640. Analogously, bank C can loan out 80% of $640, or $512, etc., etc. The initial $1000.- has created demand deposits of an additional $800 plus $640 plus $512, etc. The total increase in the money supply amounts to $5000.- in the above example. Mathematically, the Money Multiplier can be calculated as follows:

$$MM = 1/(RR) \quad \text{or:} \quad MM = 1/(0.2) = 5$$

The Change in Money = (money multiplier) x (the initial deposit) equals: 5 x 1,000=5000

**Velocity of Circulation of money:**

Velocity, V, represents the average number of times a unit of the money supply is spent during a certain period. For example, the money supply at this time is approximately $50 billion. The Gross Domestic Product, the most common measure of spending in our

economy, will be approximately $100 billion this year. Therefore, the average number of times a dollar is spent on goods and services included in GDP is about 2.

$$V = GDP/Money\ Supply$$

## The Quantity Theory of Money

Velocity was defined as: $V = GDP/Money\ Supply$
or: $V = GDP/M$.

Using cross multiplication, this equation can be rewritten as:

$$V \times M = GDP$$

GDP is the quantity of goods (Q) times their prices, so: $GDP = P \times Q$.
Substituting this into the equation we get:

$$V \times M = P \times Q$$

$$\mathbf{P = V \times M/Q}$$

Or: %changes in Price = %changes in Velocity Plus %changes in Money Supply
Minus %changes in Income

If Money Supply increases, Prices will increase
If Money Velocity increase (ie. Money demand decline) prices will increase
If Quatity (production, real GDP) declines, price will increase

Therefore, inflation is caused either by increase in money supply or scarcity of goods (assuming that money velocity – money demand- is not changing)

In addition Cagan has shown that Prices are significantly affected by future expected money supply. That is, future expected inflation.

## Inflation

### Causes of Inflation

The quantity theory of money simply and clearly illustrates that the only explanation for a long term rise in the general level of prices in an economy is a rise in the quantity of money in circulation (Ms) over and above the rise in money demand (Md). This is because over the long term, production is affected by the factors of production and the production function, including technology. Over the long term, production is not affected by prices. The two other factors are the excess of Ms over Md.

A paralell view of the causes of inflation is to look at the gap betweet **Aggregate Demand** (which is a function of the gap between Money Supply and Money Demand) and **Aggregate Supply** (production of goods and services). This formulation introduces more explicitly the role of interest rate and its transmission mechanism towards investments and aggregate demand.

**Measure of Inflation**

The most common measure of inflation is the CPI, or Consumer Price Index. This figure is a weighted average of price increases of a typical "basket" of consumer goods and services. The term "weighted" means that price increases of goods that are bought in large quantities, *i.e. food,* increase the CPI more than goods which are not consumed as commonly (theater tickets) .
Other common measures of the inflation rate in the United States are the GDP deflator and the Producer Price Index (PPI). The PPI is similar to the CPI, but changes in (wholesale) prices which businesses, not consumers, must pay are measured. The GDP deflator is defined as nominal GDP divided by real GDP times 100.

**Money and GDP growth**
Many economists believe that a greater quantity of money available to purchasers stimulates the economy and helps Q (and therefore GDP) grow. However, this is true only in the short-term. Over the long therm this is not the case. The production and supply of goods is determined by the industriousness of entrepreneurs, wage earners, managers, etc. in our economy. The more they produce, the more economic activity we have, and the more our economy is stimulated. Factors which influence this industriousness deal with the inherent desires for workers to produce, better themselves economically and increase their wealth. A country which provides its producers with an economic climate to gain optimally, *i.e.* provides the maximum incentive for its producers to reap their rewards from their production, will stimulate the most economic activity.
The reason why many government economists and politicians believe that an increase in the money supply stimulates economic activity over the long term is that they suffer from the fallacy of composition. When, for example, the government increases its expenditures on social security, it initially benefits all social security recipients. Their income will be higher and they will purchase more goods and services. This appears to initially stimulate the economy. However, what is good for one group in our society is not always good for other groups and the society at large. In fact, in this case, the funds to finance the increase in social security spending can only come from two sources: newly printed money, or higher taxes. If they came from higher taxes, other people's incomes would go down and they would decrease their spending by as much as the social security recipients would increase their spending, *i.e.* there is no stimulation of economic activity. In fact, there will most likely by a **slowing down** of economic activity, because productive members of our society will experience an increase in taxes and will have less incentive to produce. If the funding of the increased social security spending came from newly printed money, it would, as we saw earlier, decrease the value of the money and produce the same harmful effects regarding people's loss of purchasing power as would occur if the government had raised taxes. Higher prices on goods and services will make these people demand less and this will offset any earlier benefits from the social security recipients' increase purchasing. In fact, **overall** economic activity can be expected to slow, because of the harmful effects of the inflation.

**Harmful effects of Inflation**
1. Lead to poor investment selection
2. Encourages consumption not savings
3. Leads to higher interest rates and less investments
4. Reduces exports and increases imports
5. May increase taxes

## Inflation and Interest rates

Perhaps the most important change in Keynes versus the Classics concerns the effect of higher money growth on interest rates. In the Classical theory, higher money growth leads to higher inflation and thus, other things equal, higher nominal rates of interest.
But if you read the newspaper, you get the clear idea that higher money growth lowers interest rates. Over the last months, for example, the Fed loosened monetary policy (higher money growth) in order to lower interest rates and combat the recession.
So if the Fed is not mistaken, the Classical model must be getting the direction wrong.
The reason for this difference is again the difference between the short term and the long term. The data seem to indicate that the long-run effect of money growth on interest rates is just as the Classical theory predicts, but the data also suggest that the short-run effect is the opposite.

Real and nominal interest rates.

(Nominal Interest Rate) = (Real Interest rates) Plus (Inflation)

## Controling Inflation

From the above, it is clear that the control of inflation requires reducing the gap between money supply (Ms) and money demand (Md). Money demand will depend on the rate of growth of the economy. It is therefore important to identify clearly which are the sources for money supply growth.

In Latin America in the past, the financing by the Central Banks of high fiscal budget deficit (through the printing of money associated with borrowings from the Central Bank) led to high increases in money supply and high inflation. The key there was to eliminate the fiscal deficits, a difficult and highly political matter.

In other countries, money supply increases were due to high foreign capital inflows, followed by purchases by the Central Bank of this foreign exchange to limit currency appreciation. In thes ecases, the key is to reduce the interventions of the Central Bank.

In all cases, it is necessary to cool off inflationary expectations. This requires a “credible” and comprehensive program.

As noted, inflation can also be caused by declines in Output. Measures to revive economy growth and increase the supply of goods and services must accompany any disinflation program. In most developing countries, this requires improving the country’s investment climate.

# 6. Foreign Exchange Rate and Balance of Payments

**Foreign Exchange Rates**

Because countries have different currencies, these need to be exchanged before the goods can be purchased. For example, if a United States importing business purchases German cars, it must first buy German marks in exchange for its own dollars before it can pay for the German cars.

Fixed Exchange Rates: The exchange rate is fixed by the central bank which commits itself to buy or sell foreign currencies as needed.

Flexible Exchange rates: The Exchange rate increase or decreases depending on demand and supply of foreign currencies (which in turn depends on imports and exports). The Central bank does not buy or sell.

Managed exchange rates: The Central Bank does not fix the exchange rate but could buy or sell foreign currencies to "influence/manage" the rates.

**Balance of Payments**

**Trade Balance:** Balance of merchandise imports and exports
**Current account Balance:** Trade Balance Plus services, investment income and transfers
**Capital Balance:** Balance of capital flows (investments, debt)
**Overall BOP balance:** Sum of Current and capital balances

**Trade Agreements:**

FTA
Custom Unions
Economic Unions
Monetary Unions
Economic and Monetary Unions

**More on Alternative Exchange Rate Regimes**

**1. Fixed (Pegged) Exchange Rate:**

- The CB fixes the exchange rate and stands ready to buy or sell foreign exchange at the fixed exchange rate. It will buy or sell as much as is needed to maintain the FX rate. The CB is the ultimate "market maker" at a fixed price.
  - Under the fixed exchange regime, the currency could be pegged to another currency, or to a basket of currencies.
  - The benefits of a fixed FX rate system are:
    - Promotes trade and investments by minimizing currency risks
    - Provides a nominal anchor to prices
    - Provides discipline to fiscal budget policies since the CB has no independent monetary policy
  - The CB's stock of foreign currencies (called "international foreign exchange reserves") will fluctuate with its buying/selling of FX.
  - Therefore there is a limit on the amount that the CB can sell, which is given by the size of the "gross" FX reserves held by the CB.
  - When reserves are exhausted, the exchange rate de facto floats.
  - Therefore, the regime is not sustainable if monetary/fiscal policies are not sound and lead to excessive demand for foreign exchange.

– To introduce limited flexibility, a variation of this regime is the "crawling peg": the FX rate is adjusted periodically by the authorities based on inflation differentials with trading partners.

**2. Independently Floating Exchange Rates:**

– Under a Floating FX Regime, the CD will not intervene to buy or sell FX.
– The exchange rate is negotiated in the Interbank Market of commercial banks and authorized foreign exchange dealers. Under an alternative system, export receipts are surrendered to the CB at the prevailing exchange rate and the CB, in turn, decides what amount of foreign exchange must be auctioned.
– In any event, the value of the currency will respond to changes in the supply and demand for foreign exchange.
– The benefits of a Floating Regime are:
  - Ensure balance of payment equilibrium (an unsustainable current account deficit will lead to excess demand for FX & depreciation, which reduces imports and increases exports until balance is restored).
  - Ensures monetary autonomy, enabling each country to set its own money supply and inflation rate.
  - Insulates the economy from foreign inflation, since this new price differential will just lead to FX changes.
  - Facilitates the adjustment to foreign shocks, including devaluations in competing countries.
– But excessive and sudden FX fluctuations are also destabilizing and generate risks to businesses.
– The choice between a fixed or a floating regime is not clear-cut. This is because no regime can deliver the best attributes of an ideal currency:

ATTRIBUTES OF AN IDEAL CURRENCY

An ideal currency should have three attributes, which cannot be achieved simultaneously by a single regime:

(i) Fixed Value – a fixed FX rate generates less risk and facilitates business planning. But, there is no independent money supply.

(ii) Convertibility of financial account – with free capital movements, money supply will be driven by these flows.

(iii) Independent Monetary Policy - to set your own money supply and inflation. This provides a tool to deal with economic disequilibria. BUT, but it requires a floating FX system.

**3. Managed Floating Exchange Rates:**

- Tries to combine the best of the two systems, but requires credibility from sound fiscal, monetary and other economic policies.
- The Central Bank pre-sets a target rate, but allows the rate to vary.
- CB's support of the rate is not automatic, and is based on judgment on B/P position, reserves, black rates, etc.
- CB intervention may aim:
  –at smoothing daily fluctuations, or
  –at delaying, but not resisting, fundamental changes, or
  –at providing market "guidance" that stabilizes FX rates.
- To give "guidance" the CB may establish and announce a "Band" within which the currency would be expected to float. The band could be set periodically; or it could be a "crawling peg band", that moves based on some parameters, such as inflation differentials.

- The CB will seek to maintain a target FX rate by influencing the "motivations" of market activity (such as interest rates), or also through direct intervention (purchase/sale of FX) in the markets.

**4. Hard-Fixed Rates and Currency Boards**

Under a "Currency Board" the currency is irrevocably fixed against a foreign currency. CB operations stop as it is not allowed to own any domestic assets, so that its currency is fully backed by FX only.

In practice, the CB is closed: this constrains the scope for excessive monetary expansion and helps to control inflation.

A Currency Board requires relinquishing the CB's ability to issue money freely: high-powered money can only be issued to a value equal to foreign exchange reserves, at a fixed exchange rate. The domestic currency is fully backed, has a known value, and is fully convertible into the "anchor currency".

Thus, monetary policy can not be used to support demand expansion or budget deficits.

Some countries with a history of instability (Argentina, Bulgaria, Bosnia, Estonia, Lithuania) opted for fixed exchange rates under "Currency Boards" to stabilize the currency, reduce uncertainty, improve business confidence and encourage investments (by removing monetary policy from politicians).

The credibility gain helps to reduce speculative attacks and crises.

Currency Board Disadvantages:

- If exports and capital inflows increase, foreign exchange rises, and so does money supply. This expands bank credit & Invt's.
- But if foreign exchange reserves decline (due to domestic or international shocks), then this reduces money supply and bank credit. This forces companies to reduce investments.
- The depth of business cycles may be exacerbated by the pro-cyclical behavior of credit.
- Without a lender of last resort, there will be bank and business failures and unemployment (Lithuania experienced all these problems. Unemployment in Argentina was around 20%).
- Equilibrium will not be reestablished by a FX change, but only by reductions in asset prices and labor wages – which are very hard to implement.
- With credibility loss, the currency and banks may collapse.
- Despite its attractions, Currency Boards can not be substitutes for sound fiscal, monetary and exchange policies. If they exist, there is no need for a Currency Board. If they do not exist, a Currency Board will give only temporary solutions.

**Factors in Selecting an Exchange Rate System**

- Size and degree of openness of the economy: the higher the share of trade in output, the higher the costs of exchange rate volatility, the more likely to follow a pegged exchange rate regime.
- Level of inflation: a country maintaining a rate of inflation that is higher than that of its trading partners needs to maintain a flexible exchange rate.
- Degree of price and wage flexibility: the more rigid real wages are, the greater the need for FX rate flexibility to respond to external shocks.
- Degree of financial development: if financial markets are thin, a flexible FX rate regime may lead to large fluctuations in the exchange rate.
- Degree of credibility of policymakers: the weaker is the anti-inflation reputation of the central bank, the stronger the case for pegging the FX rate in order to build confidence that inflation will be controlled.
- Degree of capital mobility:
  - ➔ the more open the economy is to capital movements, the more difficult it is to defend and maintain a fixed exchange rate regime.

- ➔ Fixed exchange rate is a target for speculators because it offers a one-sided bet (leads to overborrowing and to increases in spending and speculative bubbles).

**Purchasing Power Parity (PPP).**

- PPP is a method for calculating the "correct value" of a currency, which may differ from its current market value.
- "Correct value" means the exchange rate that would bring Demand and Supply of a currency into equilibrium over the long-term. The current market rate is only a short-run equilibrium.
- Purchasing power parity (PPP) says that goods and services should cost the same in all countries when measured in a common currency. PPP is the exchange rate that equates the price of a basket of identical traded goods and services in two countries.
- PPP is often very different from the current market exchange rate. Economic theory says that once the exchange rate is pushed away from its PPP, trade and financial flows in and out of a country can move into disequilibrium, resulting in potentially substantial trade and current account deficits or surpluses.
- Some economists argue that PPP is too narrow a measure for judging a currency's true value. They prefer the fundamental equilibrium exchange rate (FEER), which is the rate consistent with a country achieving an overall balance with the outside world, including both traded goods and services and capital flows.

  – In its "relative form", PPP states that the rate of exchange S (S = P / P*) of one currency for another can be expected to change over time (dS) at a rate equal to the relative expected inflation rates in the two countries [domestic inflation (dP), foreign inflation (dP*)]:

$$(1+dS) = (1+dP)/(1+dP^*)$$

  – An increase in domestic prices leads to an increase in the exchange rate (S)↑ which means a depreciation (more domestic currency to but a unit of foreign currency).
  – This formula can be simplified to: $dS = dP - dP^*$

For an Ukrainian investor: S= UAH/$ ==> 5.05 UAH/$

dP=15%; dP*=3%; dS = (1.15/1.03) – 1 = 0.116 or 11.6%

approx: dS = 15% – 3% = 12% $S_1$ = 5.64 UAH/$

- PPP is based on the "Law of One Price": Goods priced in different currencies should have the same price when one currency is translated into the other using the spot exchange rate (P=SxP*).
- The Law of One Price would be enforced by arbitrageurs: they would buy and sell the good across borders to exploit price differences. It assumes no trade barriers, no market imperfections, and no transaction and transportation costs.
- Generalizing from one good into all goods, the "Law of One Price" becomes the "Absolute Form of PPP". It states that national price "levels" are equated by the spot exchange rate: P=(S)(P*), where P and P* are now the domestic and foreign price "levels".
- Taking derivatives of the absolute PPP, we get the "relative" PPP:

$$P=(S)(P^*) \rightarrow dP=dS + dP^* \rightarrow dS=dP-dP^*$$

If domestic prices increase, the domestic currency will depreciate.

- PPP hold poorly for developed countries in the short term, but it holds better over the long term. For EMs, PPP is quite relevant.

Reasons for Poor Statistical Evidence of PPP:

- High transaction costs (transportation costs, duties, arbitrage costs).
- Non-tradable goods are more difficult to arbitrage.
- Country risks and exchange rate volatility may discourage arbitrage.
- There may be measurement problems.
- There may be market imperfections (lack of adequate information, home bias, restrictions to trade, subsidies, autonomous capital inflows) that allow current account deficits to run unchecked for many years, without affecting price levels.
- There may be "real" economic effects (such as permanent productivity improvements) that change fundamentals and foreign exchange rate relations.

**The Real Exchange Rate ($S_r$ ) is a useful concept related to PPP.**

- The Real Exchange Rate is the relative price of the "goods" of two countries (rate at which you can trade a good in one country for the good of another). This contrasts with the nominal exchange rate which is the relative price of the "currencies" of two counties.
- The real exchange rate is: $S_r = S ( P^*/P)$ [American Notation].
- The real exchange rate is used to "measure" the price competitiveness of domestic goods.
- For example, if the FX rate is 5 H/$, and the price of a BigMac is $2.5 in the US and H10 in Ukraine, at the official rate the BigMac in Ukraine cost $2. Ukraine is more competitive by 2.5/2 or 25%
- That is: $S_r = 5$ H/$ ($2.5/H10) = 1.25
- If the BigMac is a "typical" good, the Hryvnia is "undervalued" in real terms by 25%. That is, the exchange rate should be "appreciated" to 4 H/$ so that Sr = 4 H/$ ($2.5/H10) = 1.00
- If the real exchange rate is high (higher than 1.0), domestic goods are inexpensive and the country is more competitive.
- More typically, P* and P are price levels and $S_r$ becomes just an index that measures the "unofficial or real " change in value of the currency over a period of time due to inflation differentials between the two countries.
- When relative inflation doubles in the country, the real exchange rate has declined by 50%, regardless of the "nominal/actual" exchange rate.
- For the BigMac: Sr = 5 H/$($2.5/H20) = 0.625 or ½ of the previous 1.25
- If PPP holds (e.g., the nominal exchange rate adjusts according to inflation differentials), the real exchange rate would not change and would be equal to 1.0 (or more commonly, 100).
- But if the nominal exchange rate is kept fixed (not adjusted for inflation changes), the real exchange rate will be under 100. Domestic goods have become more expensive due to local inflation and the country is less competitive.
- A decline in the real exchange rate means that the country is less competitive. This is referred to as a real appreciation of the domestic currency (an appreciated currency is less competitive)
- For example, from 1986 to 1994, Mexico followed a "stabilization" policy under which the devaluation of the peso was less than the difference of inflation with the US. During this decade, the real exchange rate declined by 50% from 160 to 80 and the country became less competitive. It accumulated substantial Current Account deficits that led to the 1994 financial crises.

Some PPP indexes calculated by the World Bank are: US, 1.0; UK, 0.6; France, 0.9; Germany, 0.9; Romania, 1.4, Ukraine, 1.7; Poland, 1.9.

Ukraine had a boost in competitiveness in 1998 with a devaluation of 265%. But accumulated inflation since 1999 to 2008 is now 270 %.

**The Effective Exchange Rate is another useful related concept.**

•It is an index based on the weighted average of bilateral exchange rates with all trading partners.
•The weighting reflects the size of bilateral trade.
•The Effective Exchange Rate measures the change in value of a currency due to value changes in the currencies of trading partners.

**Parity Relationships:**

The Parity Relationships imply the following:

***Exchange Rate changes = Inflation differentials = Interest Rate differentials***

- For developed countries, the Parity Relationships do not hold true over the short/medium term. Significant deviations may last a few years (2-4 year half-live). Therefore, they should be used cautiously for short term conclusions.
- Over the long term, they hold better, even for developed countries.
- On the other hand, the Parity Relationships hold better for Emerging Markets -- which could face wide variations on their economic variables, including prices and interest rates.
- But for all markets, these parity relationships are useful to organize and discipline our thinking about exchange rate determination.
- They are also sufficiently relevant to permit the formulation of economic models of FX rate determination & forecasting.

**Theoretical Models of Foreign Exchange**

Based on "Parity" and other economic relationships, several economic models of FX rate determination and forecasting have been developed. The main ones are as follows:

1. Balance of Payment (Flow) Model.

2. Asset (Stock) Models

   A. Monetary Models (Asset is Money):

      a. Monetary Inflexible-Price Model

      b. Monetary Flexible-Price Model

      b. Monetary Sticky-Price Model (Overshooting Model)

      c. Real Interest Differential Model

   B. Portfolio Balance Models (Assets are Money and Bonds)

      a. Preferred Local Habitat Model

      b. Uniform Preference Model

Note: In these models, S = (P)/(P*); American Notation (UAH/US$).

An increase in S is a devaluation of the domestic currency (UAH).

### 1. Balance of Payments (Flow) Model.

- A model of demand and supply for FX based on the "flows" of currencies passing through the foreign exchange markets.
- The gap between the FX demand flow and FX supply flow affect international reserves, and therefore the sustainability of the FX rate.
- Flow imbalances can be maintained over the short term, as long as countries are willing to adjust FX reserves or receive foreign funds.
- Eventually, however, flow imbalances can not be left unchecked. They will need to be balanced, leading to changes in the FX rate.
- Therefore, the exchange rate is determined by the main determinants of the B/P: Domestic and foreign income (y, y*) and domestic and foreign interest rates (i, i*). That is, if S = P/P*, then :

$$ln\ S = f\ [+(y - y^*), -(i - i^*)]$$

(y)↓ → (Imports)↓ → (Int.Reserves)↑ → (S)↓ (appreciates)

(i)↓ → (Cap inflows)↓ → (S)↑(depreciation) -- Opposite to UIRP

- The effect of a FX rate change will depend on the elasticities of demand for exports and imports: a devaluation will improve B/P equilibrium if the sum of elasticities exceeds 1 (Marshall-Lerner).

### 2. Asset (Stock) Models

- The Asset Models focus on the total quantity (stock) of financial assets outstanding at a moment of time.
- Mundell-Fleming recognized that capital asset flows were becoming more important than trade flows, with higher speed of change thanks to the removal of capital controls in Europe.
- Since asset portfolios can be rebalanced quickly, these actions will affect the FX rate over the short-term more than foreign trade flows (goods and services), which can be played down or ignored.
- Asset models assume a high degree of capital mobility.
- At a time, the money stock is in fixed supply and will be willingly held at equilibrium currency prices. The models assesses the effects of excess money demand (L) relative to their supply (M).
- There are two formulations for asset models, depending on the menu of Assets used in their formulation:

(2.A) Monetary Models: The key asset is money, domestic and foreign.

(2.B) Portfolio Balance Model: The key assets are money and bonds, domestic and foreign.

### 2.A Monetary Models

- The most relevant assets are domestic money (m) and foreign money (m*).
- These models assume that domestic and foreign bonds are perfect substitutes once expected devaluations are offset by interest rate differentials (i.e., Fisher International holds).
- They are an direct outgrowth of the Purchasing Power Parity and the Quantity Theory of Money.
- There are three types of Monetary Models, depending on the assumptions on the rigidity of commodity prices. That is, how quickly local prices adjust to changes in other economic variables:
  - Monetary Inflexible-Price Model (developed by Mundell-Fleming) – Short run situation
  - Monetary Flexible-Price Model – Long run situation.

– Monetary Sticky-Prices Model, developed by Rudy Dornbusch and Real Interest Differential model developed by Jeffrey Frankel which consider the move from short run to long run.

### 2.A.a Monetary Inflexible-Price Model

- Developed by Mundell-Fleming, it assumes that in the short run, prices are not flexible.
- In an open economy, a monetary expansion reduces domestic interest rates (i) below international interest (i*). This leads to capital outflows and to a depreciation of the currency (S↑).

Therefore, in this model: $\Delta S = f ( i^* - i )$

- A reduction of interest rates leads to a depreciation of the currency.
- This is contrary to the Uncovered Interest Rate Parity which require a higher interest rate for a depreciating currency.
- The M-F solution is not feasible over the long run, as investors will not hold a local currency which is depreciated and has lower interest rates.
- Also, if: S = P/ P* PPP holds (American term)
- Then since P is constant in the short term:

S > P/P* which implies a "real" depreciation, with the

country becoming more competitive

### 2.A.b Monetary Flexible-Price Model

It assumes that domestic good prices are fully flexible: that is, if domestic money supply increases relative to money demand, then the domestic prices will increase proportionally. It also assumes that money demand is a function of Y and i and that PPP holds.

| | |
|---|---|
| S= P/P* | PPP holds (American term) |
| P=M/L | Prices (P) = money supply (M)/ money demand (L) |
| P*=M*/L* | Same for the foreign country |
| L=K(Y^a)(e^-bi) | Money demand = Constant (k),+Income (Y), -interest (-i) |

Or: S =P/P* = ML*/M*L = MK*(Y*^a)(e^-bi*) / M*K(Y^a)(e^-bi)

Using logs: $ln\ S = (m-m^*) + a(y^*-y) + b(i-i^*) + (k^*-k)$

- This equation predicts the domestic currency will depreciate (S)↑ with an increase in (domestic) money supply (m)↑ ; and also with a decline in income (y)↓ or an increase in interest rates (i)↑(per UIRP) (<u>because both effects will reduce the demand for money</u>).
- The transmission effects are through increases in domestic prices.
- The predictions on interest rate effects are contrary to the predictions under the B/P model and the Mundell-Fleming model.

## 2.A.c Monetary Sticky-Price Model (Overshooting)

- Developed by Rudy Dornbusch in 1976 to revise the effect of interest rates on FX changes under the previous fixed/flexible price models.
- It was the first of the so-called "dynamic" models, setting a new standard for model-making.
- It is based on the premise that good prices adjust more slowly over time that financial asset prices (good prices are sticky).
- When changes in money supply are announced, Citibank acts faster to adjust security portfolio positions than Sears, which will act to adjust good prices only as inflationary pressures spreads.
- With sticky good prices, assets prices (i.e., interest rates) will need to move by a larger amount (overshoot) to permit a temporary equilibrium in the markets, returning to long term equilibrium slowly as good prices are adjusted over time.
- This also implies that FX rates will overshoot initially and return to long term equilibrium gradually.
- The short run equilibrium includes all the Mundell-Fleming features of inflexible prices in which Ms↑ → i ↓ → Cap Out → S↑ (dep)
- The long run equilibrium is consistent with the Monetary LT model in that: Ms↑ → P↑ → S↑ (dep), with no effect on LT interest rates.
- In response to an anticipated jump in domestic money supply, domestic interest rate falls, capital will outflow and the domestic currency will depreciate (as per Mundell-Fleming).
- But this is not a feasible equilibrium (it is contrary to UIRP), since traders will not hold a domestic currency in which interest rates are lower than international rates and the currency is depreciating. To hold the currency with low "i", there must be expectations that the exchange rate will appreciate.
- The key is that if the initial depreciation is overshot (due to sticky goods prices), then the currency will appreciate over time, which is needed for as long as interest rates remain low.
- Over time, the excess money supply leads to inflation, and interest rate raises.
- As the liquidity effect dissipates, the exchange rate gradually appreciates.
- In the long run, interest rates return to the original "international" level.
- The exchange rate depreciated in nominal terms, but in real terms, it is unaffected.
- Under the Sticky-Price model, the path of exchange rate movement is given by:

$$ln\ S = (m-m^*) + a(y^*-y) + (1/H)(i-i^*)$$

where H is the rate at which FX rate adjust towards equilibrium and has a negative sign.

- In this model, initially, the decline in interest rates (i)↓ will cause the domestic currency to depreciate (S)↑ (in with Mundell-Fleming and the BOP model). But with the overshooting, gradually over time, interest rates will increase (i↑) as the exchange rate appreciates (S↓) to its long term equilibrium.

## 2.A.c Real Interest Differential Model

- In 1979, Jeffrey Frankel argued that the pure sticky-price monetarist model was deficient because the nominal interest rate (i) reflected both, real interest rates (r) and inflation (dp).
- Frankel's modification led to another exchange rate equation

$$ln\ S = (m-m^*) + a(y^*-y) + (1/H)(r-r^*) + b(dp-dp^*)$$

- This equation associates lower real interest rates (r)↓ with currency depreciation (S)↑ (as was the case with the sticky-price model).
- But it also associates higher inflation rates (dp)↑, with currency depreciation (S)↑.

- In other words, we expect the coefficient of (r-r*) to be negative and the coefficient of (dp-dp*) to be positive.

**2.B Portfolio Balance Model**

- The relevant assets are both domestic and foreign money (m, m*) and the supply of domestic and foreign bonds (b, b*).
- It assumes that domestic and foreign bonds are not perfect substitutes and investors will require a "foreign exchange risk premium", in addition to the interest rate differential, due to expected devaluations [E(S)].
- It also postulates that investors react to "changes" in interest rate differentials [$\Delta(i-i^*)$] not to the differentials per se.
- According to this model:

$$ln\ S = f\ [(b-b^*),\ \Delta(i-i^*),\ E(S),\ W,\ C\ ]$$

- Under one of its formulations, bond investors have a "Preferred Local Habitat": investors prefer to hold a larger share of their Wealth in local bonds (vs foreign bonds). In this case, Wealth (W) and Current Account balances (C) become relevant explanatory variables.
- Under the "Uniform Preference Model", W and C are not relevant.

**C. Forecasting Foreign Exchange**

Fundamental and Technical models are the two major forecasting methods.

**Medium Term Forecasts (≈ 5 years)**

- The previous review of theoretical models suggest that fundamental macroeconomic models (such as differentials in price levels, foreign and domestic money supplies, real growth rates, interest rates, and balance of payments) explain the behavior of exchange rates.
- Over the last five years, empirical work on PPP and other fundamentals by Nagayasu (1998), Coakley and Fuertes (1997), and M-Azali et al. (2001), found support for the hypothesis that these fundamental relationships can be used for forecasting foreign exchange rates for the medium term (about 5 years) in a number of Asian and African countries.
- These studies are in line with the general view that PPP and other fundamentals are important in forecasting foreign exchange rates over the medium run and that overtime prices adjust and PPP is reestablished.
- Furthermore, when exchange rates are far out of line with the fundamentals (such as in many emerging markets), the models are useful in predicting that the exchange rate will return to its fundamental level over the medium term.

**Short Term Forecasts of Exchange Rates(1 to 6 months)**

- However, for short term forecasts, these fundamental models do not perform satisfactorily: studies found that even when the fundamental exchange rate models fitted very well in-sample periods, they tended to have a very poor out-of-sample fit for short-run forecasts.
- The mean-squared error of the models' prediction of the exchange rate tended to be no different than the mean-squared error of the naïve model that predicts no change or a random walk model of the exchange rate.
- This is because over the short term, exchange rate markets are not "economic efficient" and are subject to many "noises" (including speculation), irregularities and excess volatility relative to fundamentals.

- Therefore, for short term forecasting, most researchers have resorted to the so-called "technical analysis" of time-series: identify patterns, trends and information that could be obtained from past behavior of exchange rates to capture the dependency between the future and past rates.
- It assumes that historical data incorporates all those behaviors and can play a major role on predictions.
- Practitioners resort to such techniques as sentiment and positioning surveys, FX dealer customer-flow data, trend-following trading rules, etc.
- Some also use classical linear statistical time-series techniques (such as autoregressive, moving averages) but they generally give poor results.
- However, a new contingent of economists have shown that nonlinear "technical" models have much better forecasting power for the short run, since they are able to approximate the various nonlinearities in the data.
- As a result, models using nonlinear techniques, particularly those based on artificial intelligence, have developed rapidly. These include models such as artificial neural networks (directly inspired from the real neuron present in our nerve system) and multilayer feed-forward networks.
- The neural models have the ability to extract complex nonlinear and interactive relations from historical data. This is done as follows:
  - In the initial step the model compares the actual value of a time series with the forecast value of the linear components in order to extract and obtain a series of nonlinear components.
  - Once these nonlinear characteristics of the time series are captured, these data can be used to "train" the model. The model is "trained" by adjusting the model's parameters iteratively by a process of minimizing the forecasting errors resulting from additional fittings of the nonlinear components of the time series.
  - By training the neural model using previously generated nonlinear time series as inputs, the trained model is then used to generate a series of forecasts of the nonlinear components of time series.
  - This data is then used to generate foreign exchange forecasts.

- Usually, the neuron model consists of an input layer, an output layer and one or more intervening layers also referred to as hidden layers.
- The hidden layers capture the nonlinear relationship between variables. Each layer consists of multiple neurons that are connected to neurons in adjacent layers. Since these networks contain many interacting nonlinear neurons in multiple layers, the networks can capture relatively complex phenomena.
- Also, recent studies show that using ensemble models consisting of a number of different neural network structures gives results that consistently outperform a single network design.
- Recently, more hybrid forecasting models have been developed that integrate neural network techniques with conventional forecasting methods such as fundamental econometric models to improve prediction accuracy.
- Some other studies have shown that a linear combination of forecasts would also give a smaller error variance than any of the individual methods.
- The studies on these topics have expanded dramatically.

**Long term forecasts (for one or two decades)**

- Over the longer term, in addition to the previously mentioned fundamental economic variables (PPP, interest rates, etc) other economic forces are important in explaining foreign exchange rates.
- These are the economic forces that give rise to long-term cycles and that establish permanent differences in exchange rates.
- These economic forces including changes in relative productivity growth rates (a country becoming more efficient in a permanent way due to better technolgy and innovation); trends in a country's terms of trade (for example, due to the discovery of oil); and changes in the country's savings and investment bahaviours.

**Guide to Medium-Term FX Rate Forecasting**

- Balance of Payments: An increase in the current account deficit is an early sign of currency depreciation.
- Foreign Exchange Reserves: Intervention to support the currency will deplete reserves and led to depreciation.
- GDP Growth: Growth will affect exports and imports, and depending on Marshall-Lerner conditions, affect the FX rate.
- Relative Inflation: Inflation would lead to depreciation (PPP).
- Money Supply Growth: It is a major cause of inflation, which would lead to depreciation.
- Government Spending: This may lead to increases in money supply, inflation and then devaluation.
- Interest Rate Spreads: Effect depends on other fundamentals, which will need analysis.
- Exchange Rate Spreads: The black market is a good indicator.
- Capital Controls: Signal difficulties in keeping equilibrium.

# ATTACHMENT I

## National Income, Personal Income and Personal Disposable Income.

- **Net National Income** (NNI) is Net National Product minus indirect taxes
- **Personal Income** (PI) is NNI minus retained earnings, corporate taxes but it includes transfer payments, and interest on the public debt
- **Personal Disposable Income** (PDI) is PI minus personal taxes.

# National accounting formulae (expenditure approach)

C = Personal consumption expenditures
I = Gross private domestic investment
G = Government consumption expenditures
X = Gross exports of goods and services
M = Gross imports of goods and services
**Total = Gross Domestic Product (GDP)**

NR = + or - Net income from assets abroad (net income receipts)
**Sub Total = Gross National Product (GNP)**

CC = Depreciation
IBT = Indirect business taxes
NDP = Net Domestic Product
NI = National Income
PI = Personal Income
DI = Disposable income

Note: (X - M) is often written as "NX," which stands for "Net Exports"

GDP = C + I + G + (X - M)
GNP = C + I + G + (X - M) + NR
GNI = C + I + G + (X - M) + NR - IBT
NI = C + I + G + (X - M) + NR - IBT - CC

**The Flow of Income**
NDP = GNP - CC
NI = NDP - IBT + net foreign factor income
PI = NI - corporate taxes - retained earnings - social security + transfer payments + net interest
DI = PI - Personal taxes

**-----**

## Nominal versus Real Values

**Nominal GDP** measures the value of output during a given year using the prices prevailing during that year. Over time, prices may rise due to inflation, leading to an increase in nominal GDP even if the volume of goods and services produced is unchanged. GDP does not include goods produced on a subsistence level, i.e. farmers who eat their own products do not have their crops included in the GDP.

**Real GDP** measures the value of output in two or more different years by valuing the goods and services adjusted for inflation. For example, if both the "nominal GDP" and price level doubled between 1995 and 2005, the "real GDP" would remain the same. For year over year GDP growth, "real GDP" is usually used because it gives a more accurate view of the income and output.

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# Measuring GDP (Gross domestic product)

A region's **gross domestic product**, or **GDP**, is one of the ways for measuring the size of its economy. GDP was defined as the market value of all final goods and services produced within a country in a given period of time. It is also considered the sum of value added at every stage of production of all final goods and services produced within a country in a given period of time. Until the 1980s the term **GNP** or gross *national* product was widely used. The two terms GDP and GNP are almost identical - and yet entirely different; GDP (or GDI - Gross Domestic Income) being concerned with the region in which income is generated and GNP (or GNI - Gross National Income) being a measure of the accrual of income to a region.

Equivalent estimates of GNP (or GDP) produced in a given year may theoretically be arrived at through at least three different accounting approaches, depending upon whether the transactions that determine the prices of final goods and services are looked at and tallied up by focussing on the buying or by focussing on the proceeds from selling or by focussing on the nature of the products themselves.

Using the ***expenditure approach***, you can estimate total GNP as the sum of estimates of the amounts of money that are spent on final goods and services by households (*Consumption*), by business firms (*Investment*), by government (*Government Purchases*), and by the world outside the country (*Net Exports*).

Using the ***incomes approach***, you can estimate total GNP by summing up estimates of the different kinds of earnings people receive from producing these same final goods and services:

- Total wages and salaries
- Profits of incorporated and unincorporated businesses
- Rental incomes
- Interest incomes

(Plus certain adjustments to account for wear and tear on productive assets like plant and machinery -- *depreciation* -- and what are called *indirect business taxes*).

Using the ***product* or *output* approach**, you can estimate GNP by summing up the output of all the various organizations producing goods and services in the country, subtracting out the costs of their raw materials to avoid double counting and making suitable adjustments for depreciation and for the value of imports and exports. (In theory, all three approaches should give you the same grand totals -- but of course in actual practice there will be discrepancies, and sometimes sizable discrepancies, between the three estimates.)

The most common approach to measuring GDP is the expenditure method:

$$GDP = consumption + investment + (government\ spending) + (exports - imports)$$

"Gross" means depreciation of capital stock is not included. With depreciation, with net investment instead of gross investment, it is the net domestic product. Consumption and investment in this equation are the expenditure on final goods and services. The exports minus imports part of the equation (often called

**cumulative exports**) then adjusts this by subtracting the part of this expenditure not produced domestically (the imports), and adding back in domestic area (the exports).

Economists (since Keynes) have preferred to split the general consumption term into two parts; private consumption, and public sector (or government) spending. Two advantages of dividing total consumption this way in theoretical macroeconomics are:

- **Private consumption** is a central concern of welfare economics. The private investment and trade portions of the economy are ultimately directed (in mainstream economic models) to increases in long-term private consumption.
- 
- If separated from endogenous private consumption, **government consumption** can be treated as exogenous, so that different government spending levels can be considered within a meaningful macroeconomic framework.

## The components of GDP

Each of the variables **C**, **I**, **G** and **NX** (where **GDP** = **C** + **I** + **G** + **NX** as above):

(Note: * **GDP** is sometimes also referred to as **Y** in reference to a GDP graph)

**C** is **private** consumption in the economy. This includes most personal expenditures of households such as food, rent, medical expenses and so on but does not include new housing.

**I** is defined as business investments in capital. Examples of investment by a business include construction of a new mine, purchase of software, or purchase of machinery and equipment for a factory. Spending by households on new houses is also included in Investment. Unlike general meaning, 'Investment' in GDP is meant very specifically as non-financial product purchases. Buying financial products is classed as 'saving' , as opposed to **investment**. The distinction is (in theory) clear: if money is converted into goods or services, it *is* investment; but, if you buy a bond or a share, this transfer payment is excluded from the GDP sum. Although such purchases would be called *investments* in normal speech, from the total-economy point of view, this is simply swapping of deeds, and not part of the real economy or the GDP formula.

**G** is the sum of government expenditures on final goods and services. It includes salaries of public servants, purchase of weapons for the military, and any investment expenditure by a government. It does not include any transfer payments, such as social security or unemployment benefits.

**X** is gross exports. GDP captures the amount a country produces, including goods and services produced for overseas consumption, therefore exports are added.

**M** is gross imports. Imports are subtracted since imported goods will be included in the terms **G**, **I**, or **C**, and must be deducted to avoid counting foreign supply as domestic.

**NX** are "net exports" in the economy: gross exports − gross imports. There is a fixed relation: **NX = X − M**.

It is important to understand the meaning of each variable *precisely* in order to: Read national accounts Understand Keynesian or neo-classical macroeconomics.

## Examples of GDP component variables

Examples of **C**, **I**, **G**, & **NX**: If you spend money to renovate your hotel so that occupancy rates increase, that is private investment, but if you buy shares in a consortium to do the same thing it is saving. The

former is included when measuring GDP (in **I**), the latter is not. However, when the consortium conducted its own expenditure on renovation, that expenditure would be included in GDP.

If the hotel is your private home your renovation spending would be measured as **C**onsumption, but if a government agency is converting the hotel into an office for civil servants the renovation spending would be measured as part of public sector spending (**G**).

If the renovation involves the purchase of a chandelier from abroad, that spending would *also* be counted as an increase in imports, so that **NX** would fall and the total GDP is unaffected by the purchase. (This highlights the fact that GDP is intended to measure domestic production rather than total consumption or spending. Spending is really a convenient means of estimating production.)

If you are paid to manufacture the chandelier to hang in a foreign hotel the situation would be reversed, and the payment you receive would be counted in **NX** (positively, as an export). Again, we see that GDP is attempting to measure production through the means of expenditure; if the chandelier you produced had been bought domestically it would have been included in the GDP figures (in **C** or **I**) when purchased by a consumer or a business, but because it was exported it is necessary to 'correct' the amount consumed domestically to give the amount produced domestically. (As in Gross Domestic **Product**.)

## The GDP income account

Another way of measuring GDP is to measure the total income payable in the GDP income accounts. In this situation, one will sometimes hear of Gross Domestic Income (GDI), rather than Gross Domestic Product. This should provide the same figure as the expenditure method described above. (By definition, GDI=GDP. In practice, however, measurement errors will make the two figures slightly off when reported by national statistical agencies.)

The formula for GDP measured using the income approach, called GDP(I), is:

> *GDP = Compensation of employees + Gross operating surplus + Gross mixed income + Taxes less subsidies on production and imports*

- **Compensation of employees** (COE) measures the total remuneration to employees for work done. It includes wages and salaries, as well as employer contributions to social security and other such programs.
- 
- **Gross operating surplus** (GOS) is the surplus due to owners of incorporated businesses. Often called profits, although only a subset of total costs are subtracted from gross output to calculate GOS.
- 
- **Gross mixed income** (GMI) is the same measure as GOS, but for unincorporated businesses. This often includes most small businesses.

The sum of **COE**, **GOS** and **GMI** is called total factor income, and measures the value of GDP at factor (basic) prices.The difference between basic prices and final prices (those used in the expenditure calculation) is the total taxes and subsidies that the Government has levied or paid on that production. So adding taxes less subsidies on production and imports converts GDP at factor cost to GDP(I).

Another formula can be written as this:

GDP = R + I + P + SA + W

where R = rents
I = interests

P = profits
SA = statistical adjustments (corporate income taxes, dividends, undistributed corporate profits)
W = wages

# Problems of Measurement

GNP and GDP are among the most comprehensive measures of the overall amount of economic production taking place in a national economy. Nevertheless, the available statistics produced by government agencies are always far from perfect estimates of what they purport to measure. They are measured in money value terms to get around the problem of adding up total output of many different goods and services that are normally expressed in many different kinds of incomparable physical units. Microeconomic theory gives us lots of reasons for believing that the relative prices at which products trade on a free market represent reasonably unbiased estimates of the relative values consumers put upon the various kinds of goods and services traded -- at least where there are no large problems with externalities or public goods.

But not all the final goods and services produced in a society **are traded** on the free market, and the relative contributions of these untraded goods and services to the consumers' material living standards are therefore awfully difficult to estimate very well. Most of the services produced by government, to take the largest example, cannot be valued at a free market price because they are not offered for voluntary purchase on a free market -- instead, the presumed beneficiaries of these services (the citizenry) are forced to pay for them through taxes, whether they think the benefits are "worth it" or not. In compiling the national accounts, the government statistical offices simply make the heroic (and self-flattering) assumption that all the goods and services provided by government are "worth" at least what was spent to produce them, however outrageous the costs might have been and however worthless (or harmful) the output might have been in the eyes of the citizenry.

A very large category of privately produced goods and services whose production does not register at all in the official GNP or GDP statistics (because they do not trade for money on the market) consists of householders' home production for their own use -- things like backyard vegetable gardening, do-it-yourself home and auto repairs, and the innumerable productive service activities of homemakers in cooking, cleaning, sewing, childcare and so on. Another major omission from the national accounts consists of goods and services that actually are traded for money on markets -- black markets -- but the transactions are deliberately concealed from government information collectors, either to avoid prosecution for trading in illegal demerit goods (for example, drugs and prostitution) or simply to avoid paying taxes or submitting to costly regulations on otherwise potentially legal business transactions (working off the books, unauthorized import/export trade, "moonshine" production of liquor, etc.). Economists' unofficial estimates of the size of the American "underground economy" in recent years range from no less than 5% to as much as 30% of official GDP!)

If one wants to use GNP (or GDP) to measure **changes** in overall levels of economic production from one year to the next, then using money prices as a "common denominator" for adding up all the disparate kinds of goods and services introduces another problem for the accuracy of the estimates -- inflation. Using money valuations to measure output at several points in time is a little like using a rubber tape-measure to measure several different distances. Part of the increase in GNP (or GDP) from one year to the next really is the result of increased output, but part is also likely to be due merely to change in the value of the currency unit used to measure it. Government statistical compilers try to deal with this problem by producing estimates of "real" or "constant dollar" GNP (and GDP), dividing their original ("current dollar") estimates by one or another of many possible "price indexes" constructed to account for and remove the effects of general price inflation -- but the problems of choosing and constructing appropriate price indexes for this purpose are themselves numerous and admit of no single unambiguous "best" answer to the problem.

# Measurement of GDP by International standards

The international standard for measuring GDP is contained in the book *System of National Accounts* (1993), which was prepared by representatives of the International Monetary Fund, European Union, Organisation for Economic Co-operation and Development, United Nations and World Bank. The publication is normally referred to as SNA93, to distinguish it from the previous edition published in 1968 (called SNA68). SNA93 sets out a set of rules and procedures for the measurement of national accounts. The standards are designed to be flexible, to allow for differences in local statistical needs and conditions.

The level of GDP in different countries may be compared by converting their value in national currency according to *either the* **current currency exchange rate**: GDP calculated by exchange rates prevailing on international currency markets or the **purchasing power parity exchange rate**: GDP calculated by purchasing power parity (PPP) of each currency relative to a selected standard (usually the United States dollar).

The relative ranking of countries may differ dramatically between the two approaches.

The *current exchange rate method* converts the value of goods and services using global currency exchange rates. This can offer better indications of a country's **international** purchasing power and relative economic strength. For instance, if 10% of GDP is being spent on buying hi-tech foreign arms, the number of weapons purchased is entirely governed by *current exchange rates*, since arms are a traded product bought on the international market (there is no meaningful 'local' price distinct from the international price for high technology goods).

The *purchasing power parity method* accounts for the relative effective domestic purchasing power of the average producer or consumer within an economy. This can be a better indicator of the **living standards** of less-developed countries because it compensates for the weakness of local currencies in world markets. (For example, India ranks 13th by GDP but 4th by PPP.)The PPP method of GDP conversion is most relevant to non-traded goods and services.

There is a clear pattern of the *purchasing power parity method* decreasing the disparity in GDP between high and low income (GDP) countries, as compared to the *current exchange rate method*. This finding is called the Penn effect.

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## Useful GDP Relations: Macroeconomic Stabilization

Macroeconomic instability increases the risk of doing business.
Investors will require significantly higher rates of returns to compensate for the risks of instability.
As a result of this high risk premium, few projects would qualify for investments, reducing the overall level of investments and growth.
Stabilization programs are based on the IMF's Monetary Approach to the Balance of Payments: it postulates that the excess growth of Net Domestic Credit over growth in money demand equals the deficit in the balance of payments.
It is based on the realization that both internal and external stability are closely related: both are dependent of the size of fiscal budget deficits or degree of overspending by the private sector.
The IMF tool is called Monetary Programming, which aims at determining fiscal and monetary policies (the size of the Fiscal Budget Deficit or level of domestic credit) that are "*consistent*" with the country's objectives in terms of (i) GDP growth, (ii) level of inflation, and (iii) level of international reserves.

A. Relation Between Internal and External Stability: Fiscal and Current Account Deficits

Definitions:

| | | |
|---|---|---|
| Y | = | Gross Domestic Product |
| $Y_d$ | = | Gross Disposable Income (C+S) |
| C | = | Consumption, private |
| I | = | Investment, private |
| G | = | Government Expenditures |
| X | = | Exports |
| J | = | Imports |
| S | = | Savings, private |
| T | = | Taxes |
| $TR_f$ | = | Net Transfers Received from Abroad |
| $Y_f$ | = | Net Factor Income from Abroad |
| R | = | International Reserves |
| K | = | Foreign Capital |
| A | = | Absorption (Expenditures) |
| CAB | = | Current Account Balance |

(1) On the expenditure side: $AD \Rightarrow Y = C + I + G + X - J$

(2) On the Income (supply) side: $Y = C + S + T - Y_f - TR_f$

Since Aggregate Demand must equal Income, then (1)=(2); or

$$C + I + G + X - J = C + S + T - Y_f - TR_f$$

Then:

$$\underbrace{X - J + Y_f + TR_f}_{\text{Current Account Balance (CAB)}} = \underbrace{(S - I)}_{\text{Private Sector Balance (PSB)}} + \underbrace{(T - G)}_{\text{Fiscal Budget Balance (FBB)}}$$

If PSB=0, Current Account Balance = Fiscal Budget Balance

A Fiscal Deficit will yield and equally-sized CA Deficit

If FBB=0, Current Account Balance = Private Sector Balance

A Private Sector Deficit will yield an equal CA Deficit

Note: All Savings (private sector, Gvt and foreign savings) must equal Investments for equilibrium in the goods market ($I = \Sigma S$)

## (B) Current Account Deficits & Excessive Expenditures.

(1) $AD = Y = C + I + G + X - J$

(2) $Y = AS = Y_d + T - Y_f - TR_f$ where $Y_d = C + S$

$$Y_d + T - Y_f - TR_f = C + I + G + X - J$$

$$Y_d - [(C + I) + (G - T)] = X - J + Y_f + TR_f = CAB$$

$(C + I)$ = Expenditures of Private Sector = Private Absorption

$(G - T)$ = Excessive Govt. Expenditures = Govt. Absorption

$Y_d$ - [Priv. Abs + Govt Abs] = Current Account Balance

$Y_d$ - Absorption = Current Account Balance

The excess of absorption (expenditures) over disposable income will be reflected as a deficit in the current account of the B/P.
To correct a B/P deficit, you need to reduce Exp. or increase $Y_d$.
A devaluation would improve the B/P if it leads to an increase in income ($Y_d$) that is greater that an increase in expenditures (Abs), including those expenditures generated by the higher income.

## (C) Expenditures (Absorption) and Foreign Debt

If FDIs are constant, the Current Account Deficit can be financed by:

(i) a reduction in International Reserves (R), or

(ii) an increase in Foreign Debt (K), assuming constant FDIs.

$$CAB = X - J + Y_f + TR_f = -\Delta R + \Delta K$$

since: $CAB = Y_d$ - Absorption

therefore: $Y_d$ - Absorption $= -\Delta R + \Delta K$

If expenditures (Absorption) are too high compared to Income, then: International Reserves would be falling or Foreign Debt would be increasing.
To maintain International Reserves and avoid excessive Foreign Debt, expenditures (Absorption) should be reduced, normally by cutting Government expenditures, increasing tax revenues (reducing the fiscal budget deficit) or reducing private expenditures.