

4. GDP, inflation rate, sectoral identity and savings identity

1. Gross domestic product (GDP)

A good is final if it is not used to produce other goods. The gross domestic product (GDP) of an economy is the market value of all the final goods produced in the economy during a period of time.

2. Relevance of the GDP concept

GDP is the most common measure of aggregate production, a crude estimator of how rich and how big an economy is and a measure of economic performance: a rough quantitative evaluation of aggregate economic activity. GDP has become a key macroeconomic variable because of the general perception that it is a key variable. Macroeconomic policy is mostly driven by the policy maker's perception of reality through the dynamics of GDP.

3. GDP data as fiction

It is practically impossible to compute GDP according to the definition because of in a modern economy millions of goods are produced and because their prices vary during the period with respect to which GDP is defined. In practice GDP is an estimated value. The actual calculation of GDP involves a large amount of data (statistics on employment, trade, industrial production, tax revenue, transportation...) and the participation of many organizations (surveys from manufacturers, builders, retailers, financial institutions...). Macroeconomic statistics is in practice a branch of politics.

4. Limitations of the GDP concept: a short list of accusations

1. The GDP of different economies cannot be compared. It is even difficult to compare the GDP of the same economy in two moments of time.
2. GDP ignores negative byproducts and externalities of economic activity, like pollution or crime. Ironically, polluting activities (such as burning fossil fuels or emissions from industrial facilities) increase GDP. And GDP rises again when conducting activities to clean up pollution.
3. GDP ignores how it is distributed among the agents of the economy. GDP does not worry about inequality or equity. Top 10% earners tend to make around 60-70% of income.
4. GDP ignores the exhaustion of natural wealth. The depletion of natural resources (clean water, breathable air, virgin landscapes) is good for GDP. GDP includes the new wealth created but not the wealth destroyed when natural resources are used to produce goods.
5. Structural changes in the economy tend to make obsolete the way GDP is estimated. Conceptually, GDP seems to presume that all wealth created in an economy is physical wealth (manufactured goods). Yet most economic activity in modern economies (between 50% and 80%) involves services, which in general do not create physical output and are difficult to measure.
6. The information sector contributes marginally to the computation of GDP (less than 5%?), just as a generation ago, despite the ongoing transition to an information-based digital economy. GDP looks like a concept more suited for a 20th century economy than for a 21st century economy.
7. GDP ignores home production and do-it-yourself activities. GDP does not value goods such as the quality of education, life expectancy, income inequalities, pollution, social and political institutions, leisure time, moral values, loss of natural resources, environmental damage...

8. GDP does not properly account for changes in the quality, novelty, and diversity of the goods manufactured and services provided. Moreover, should services that merely contribute to create and circulate debt instruments (and make the economy more vulnerable to a financial or debt crisis) be considered equivalent to services that increase wealth?
9. Underground, hidden, black market and illegal economic activities (the shadow economy) are excluded from GDP, as they are not taxed, not reported, or illegal (like prostitution or the illegal drug trade). Second-hand sales are also excluded (they represent production previously counted).

5. Nominal GDP

Nominal GDP (GDP^n) values production at current prices. Changes in nominal GDP are misleading: they reflect changes in both production and prices.

6. Real GDP

Real GDP (GDP^r or GDP at constant prices or GDP adjusted for inflation) values production each period using the prices of a fixed period (the base period). By valuing the production in two periods using the same prices, changes in real GDP can only be attributed to changes in the amount of goods produced.

7. Real vs nominal GDP: an example

This example computes GDP in an ideal situation. The table on the right presumes that there are only two goods (1 and 2) and lists, for two periods, the amount q produced of each good i and its price p .

8. Real vs nominal GDP: an example

This example computes GDP in an ideal situation. The table on the right presumes that there are only two goods (1 and 2) and lists, for two periods, the amount q produced of each good i and its price p .

time t	p_1^t	q_1^t	p_2^t	q_2^t
1	4	6	2	8
2	9	5	3	5

- Nominal GDP in $t = 1$. $GDP_1^n = p_1^1 \cdot q_1^1 + p_2^1 \cdot q_2^1 = 4 \cdot 6 + 2 \cdot 8 = 40$ (monetary units of $t = 1$).

- Nominal GDP in $t = 2$. $GDP_2^n = p_1^2 \cdot q_1^2 + p_2^2 \cdot q_2^2 = 9 \cdot 5 + 3 \cdot 5 = 60$ (monetary units of $t = 2$).

From $t = 1$ to $t = 2$, GDP^n has increased by 50% : the rate of GDP^n is $\widehat{GDP}^n = \frac{60-40}{40} = \frac{1}{2} = 0.5 = 50\%$.

- Real GDP in $t = 1$ at constant prices of period $t = 1$ is $GDP_1^{r,t=1} = p_1^1 \cdot q_1^1 + p_2^1 \cdot q_2^1 = 4 \cdot 6 + 2 \cdot 8 = 40$ (monetary units of $t = 1$). Conclusion: $GDP^r = GDP^n$ at the base period (this always happens).

- Real GDP in $t = 2$ at constant prices of period $t = 1$ is $GDP_2^{r,t=1} = p_1^1 \cdot q_1^2 + p_2^1 \cdot q_2^2 = 4 \cdot 5 + 2 \cdot 5 = 30$ (monetary units of $t = 1$).

From $t = 1$ to $t = 2$, GDP^r has fallen a 25%: $\widehat{GDP}^r = \frac{30-40}{40} = -\frac{1}{4} = -0.25 = -25\%$.

- Real GDP in $t = 1$ at constant prices of $t = 2$ is $GDP_1^{r,t=2} = p_1^2 \cdot q_1^1 + p_2^2 \cdot q_2^1 = 9 \cdot 6 + 3 \cdot 8 = 78$.

- Real GDP in $t = 2$ at constant prices of $t = 2$ is $GDP_2^{r,t=2} = p_1^2 \cdot q_1^2 + p_2^2 \cdot q_2^2 = 9 \cdot 5 + 3 \cdot 5 = 60$.

Hence, by taking the base period to be $t = 2$, GDP^r has fallen by 23%. What is 'actually' the change in real GDP? There is no answer for this question. Real GDP solves the problem of the dependence of nominal GDP on the change of prices but real GDP has the shortcoming of depending on the base period chosen. This makes the revelation of economic information subject to manipulation. In the example above, a government would prefer to reveal \widehat{GDP}^n to \widehat{GDP}^r and $\widehat{GDP}^{r,t=2}$ to $\widehat{GDP}^{r,t=1}$.

9. Price indices

A price index is a measure of the general price level of an economy. This level can be thought of as a weighted average of the prices of all the goods. By assuming the fiction that there is a unique, aggregate good (the domestic product), the price level would represent the price of the aggregate good just as GDP would measure the amount of good. As distinguished from GDP, price indices have no units and the value by itself means nothing. It is the rate of change of the index that is relevant.

10. GDP deflator

The GDP (implicit price) deflator measures the changes in prices in all the goods produced in an economy between the base period used to calculate real GDP and the current period. The GDP deflator is the price index defined as

$$\text{GDP deflator} = \frac{\text{Nominal GDP}}{\text{Real GDP}}.$$

11. GDP deflator: an example

If $\text{GDP}_{2015}^n = 100$, $\text{GDP}_{2015}^r = 80$, $\text{GDP}_{2016}^n = 135$ and $\text{GDP}_{2016}^r = 90$, then GDP_{2015} deflator = $100/80 = 1.25$ and GDP_{2016} deflator = $135/90 = 1.5$. The fact that GDP_{2016} deflator $>$ GDP_{2015} deflator indicates that a general price increase took place between 2015 and 2016.

12. Consumer price index (CPI)

The CPI is a measure of the cost of purchasing a fixed basket of goods of a consumer considered representative. The formula on the right defines CPI_t in period t . For the index to have base 100, the right-hand side of the formula must be multiplied by 100. Criticisms analogous to those levied on the GDP concept could be adduced against the CPI concept, its definition and the way in which it is in practice implemented.

$$\text{CPI}_t = \frac{\text{value of the basket at prices of period } t}{\text{value of the basket at prices of the base period}}$$

13. Consumer price index: an example

Suppose the basket of goods is given by $(x, y, z) = (3, 2, 1)$, where the numbers represent the amounts of each of the three goods. The table below shows the prices of the goods in four periods and the value of the basket in each period. Taking $t = 1$ as the base period, $\text{CPI}_1 = \frac{V_1}{V_1} = 1$ (or 100 in base 100); $\text{CPI}_2 = \frac{V_2}{V_1} = \frac{16}{16} = 1$; $\text{CPI}_3 = \frac{V_3}{V_1} = \frac{12}{16} = 0.75$; (75 in base 100); and $\text{CPI}_4 = \frac{V_4}{V_1} = \frac{20}{16} = 1.25$ (125 in base 100).

period	p_x	p_y	p_z	$V_t = \text{basket value in period } t$	CPI_t	CPI_t (base 100)	π_t
1	1	4	5	$3 \cdot 1 + 2 \cdot 4 + 1 \cdot 5 = 16$	1	100	–
2	2	1	8	$3 \cdot 2 + 2 \cdot 1 + 1 \cdot 8 = 16$	1	100	0%
3	3	1	1	$3 \cdot 3 + 2 \cdot 1 + 1 \cdot 1 = 12$	0.75	75	–25%
4	2	5	4	$3 \cdot 2 + 2 \cdot 5 + 1 \cdot 4 = 20$	1.25	125	66.6%

14. Inflation rate

The inflation rate π based on, or associated with, the price index P is the rate of change of the price index P . The formula on the right defines the inflation rate π_t from period $t - 1$ to period t , where P_t is the price index in the current period t and P_{t-1} is the price index in the immediately preceding period $t - 1$. To express the inflation rate as a percentage, the right-hand side of the formula has to be multiplied by 100.

$$\pi_t = \frac{P_t - P_{t-1}}{P_{t-1}}$$

15. Inflation rate: examples

If $P_t = 50$ and $P_{t-1} = 40$, then $\pi_t = \frac{50-40}{40} = \frac{1}{4} = 0.25$ (= 25%): the price index has been pushed up a 25%. The last column in the table in §13 shows the inflation rate π_t from $t - 1$ to t . The values are obtained as follows: π_1 is not defined (since there is no CPI_0); $\pi_2 = \frac{CPI_2 - CPI_1}{CPI_1} = \frac{1-1}{1} = 0$; $\pi_3 = \frac{CPI_3 - CPI_2}{CPI_2} = \frac{0.75 - 1}{1} = -0.25$ (or -25%); and $\pi_4 = \frac{CPI_4 - CPI_3}{CPI_3} = \frac{1.25 - 0.75}{0.75} = \frac{2}{3}$ (or 66.6%). Lastly, if π were calculated, for instance, from $t = 1$ to $t = 4$, then $\pi_{1 \rightarrow 4} = \frac{CPI_4 - CPI_1}{CPI_1} = \frac{1.25 - 1}{1} = 0.25$ (25%).

16. Differences between CPI and GDP deflator

- The CPI generally includes imported goods. Contrariwise, the GDP deflator does not: it only includes the goods produced in the economy, not abroad.
- The basket of goods in the GDP deflator may vary from period to period, whereas the basket in the CPI generally does not.

Despite the theoretical differences, when the two indices are computed from empirical data, both indices appear to be strongly correlated and in general tend to move in parallel.

17. Inflation concepts

- **Inflation**. As an economic phenomenon (not as a number), the term 'inflation' refers to the sustained increase in the CPI. It occurs for periods during which the inflation rate is positive.
- **Deflation**. Deflation is the phenomenon opposite to inflation: it is a sustained reduction in the CPI (negative inflation rates, not negative CPI values).
- **Disinflation**. Disinflation takes place when, during an inflation, the inflation rate diminishes, but remains positive.
- **Reflation**. Reflation refers to a period of inflation in which the inflation rate increases. By association, it is also said that the economy itself 'reflates' when the inflation rate increases (since, typically, when economy activity expands, the inflation rate tends to go up).
- **Hyperinflation**. Hyperinflation occurs with astronomical inflation rates (monthly inflation rates of at least 50%). Under a hyperinflation, inflation is out of control.
- **Core inflation rate**. Core inflation rate is an inflation rate computed by excluding the prices of food and energy prices, which tend to be very volatile. Core inflation rate (as opposed to headline inflation rate) is a measure of underlying long-term inflation and can be used as an indicator of future inflation.

18. A three-sector division of an economy

An economy can be divided into three sectors: (i) the domestic private sector (households, firms and banks); (ii) the domestic government sector (local, regional, and national governments); and (iii) the foreign sector (the private and the government sectors of the rest of the world)

19. Sectoral balance

Income flows and spending flows run within and between sectors. Over a given period, a sector

- runs (or has) a surplus if the sector's spending flow is smaller than the sector's income flow over the period;
- runs (or has) a deficit if the sector's spending flow is larger than the sector's income flow over the period.
- is balanced if its spending flow is equal to its income flow over the period.

20. Financial wealth

The net financial wealth of an economic agent (household, firm, government...) is the difference between the agent's financial wealth (value of all the financial assets the agent has purchased) and the agent's financial liabilities (the value of all the financial assets the agent has issued).

21. Financial wealth and sectoral balance

A sector's net financial wealth is the sum of the net financial wealth of all the economic agents in the sector. The balance of a sector is the sector's net financial wealth. The balance is positive (or is in surplus) if the net financial wealth is positive (value of financial assets larger than value of liabilities). The balance is negative (or is in deficit) if the net financial wealth is negative.

22. Sectoral surplus and sectoral deficit

If a sector runs a surplus, then, in net terms, the sector generates a saving flow. This saving flow accumulates to a stock that takes the form of a net accumulation of financial assets, that is, an increase in the sector's net financial wealth. When a sector has a positive net financial wealth some agent in the sector has a claim on some other agent from another sector; for instance, a household owns a government bond issued by the government. If a sector runs a deficit, then the sector reduces its net financial wealth: the sector generates a dissaving flow. When a deficit occurs, the sector sells previously accumulated financial assets or creates (issues) new financial assets. A sector finances its deficit by decumulating financial assets.

23. Flows, stocks and basic principle of accounting

Flows determine whether a deficit or a surplus occur. Stocks represent accumulation or decumulation of debts. The basic principle of accounting states that for every financial asset there is an equivalent financial liability. Accordingly, someone's liability is always somebody else's financial asset.

24. Sectoral basic identity or macroeconomic balance equation

The three-sector basic identity states that the sum of the balances of all sectors is zero:

$$\text{Domestic Private Balance} + \text{Domestic Government Balance} + \text{Foreign Balance} \equiv 0.$$

The sectoral identity implies that a sector's deficit must be offset by some sector's surplus. In particular, for a sector to accumulate net financial wealth, some other sector must increase its indebtedness. It is therefore impossible for the three sectors to simultaneously run a surplus.

25. Accumulation of financial wealth by the private sector

The private sector must run a surplus to accumulate financial wealth. By the sectoral identity,

$$\text{Private Surplus} \equiv \text{Public Deficit} + \text{Balance of Payments Surplus}.$$

Public deficits and balance of payments surpluses create income and financial assets for the private sector. A public deficit is financed by issuing financial assets; by buying those assets, the private sector increases its net financial wealth. A balance of payments (current account) surplus means that the private sector finances the rest of the world, which is a source of income for the private sector. Analogously, public surpluses and balance of payments deficits withdraw income from the private sector and destroy financial assets held by the private sector:

$$\text{Private Deficit} \equiv \text{Public Surplus} + \text{Balance of Payments Deficit}.$$

26. Wynne Godley (1926-2010)

Orthodox economists did not predict nor anticipate the Great Recession that started in 2007-08. They claimed in their defense that no one saw it coming. But some did. Wynne Godley, a heterodox economist, issued warnings, using models based on the sectoral identity, that the unprecedented US expansion of the 1990s was doomed. He noticed that, at the time, relative to GDP, private sector deficit was five times larger than anything achieved previously and was being sustained for longer than in the past. Further economic expansion would raise the government surplus in the presence of a growing foreign deficit. The balance identity implies that the private deficit should worsen to unsustainable levels. GDP will stop growing once private spending no longer increases faster than private income. As soon as this occurs, public surplus will turn into a deficit and private deficit into a surplus. This is exactly what happened.

Wynne Godley; Alex Izurieta (2002): "The case for a severe recession," Challenge 45(2), 27-51.

Wynne Godley; L. Randall Wray (2000): "Is Goldilocks Doomed?," Journal of Economic Issues 34(1), 201-206.

27. Causality

Causality relationships cannot be derived from the sectoral identity. For instance, if the foreign balance is zero, there is a priori no way of telling whether it was the government deficit that caused the net accumulation of financial wealth by the private sector or the private accumulation that caused the government deficit.

28. Causation at the individual level

At least in the private sector, causation for individuals is very likely to run from income to expenditure. If some household (or firm) plans to run a deficit by spending above its income level, then it can issue financial assets to finance the difference between expenditure and income. Some other agent that chooses to save will purchase the financial assets, thereby accumulating as financial wealth the liability generated by the agent that runs the deficit. Thus, the decision to spend in excess gives rise to financial wealth: deficits create financial wealth.

29. Causation at the aggregate level

For the economy as a whole it does not seem possible to decide to have more income, but it is to choose to spend more. Any additional spending is necessarily received as additional income by someone. By the sectoral identity, aggregate spending equals aggregate income. That is why the heterodox view in macroeconomic theory tends to support the idea that income causes spending at the individual level but spending cause income at the aggregate level.

30. The savings identity

The sectoral identity takes into account all the monetary flows in an economy. An apparently close approximation can be obtained by considering the flows associated with GDP. This gives rise to the savings identity, which states that

$$\text{Net Private Savings} + \text{Government (or Public) Savings} + \text{Foreign Savings} \equiv 0$$

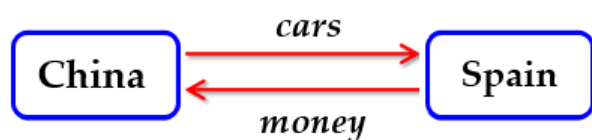
where:

(i) Net Private Savings = Private Savings – Investment = $\mathbf{S - I}$;

(ii) Government Savings = Taxes – Government Purchases – Transfer Payments = $\mathbf{T - G - TR}$;

(iii) Foreign Savings = Imports – Exports = $\mathbf{IM - EX}$.

31. Why $IM - EX$ represents foreign savings



Imagine that China exports only cars to Spain and that China imports nothing from Spain, as depicted below. China runs a trade surplus with Spain and Spain a trade deficit with China. China delivers goods and receives in exchange money. Thus, China is saving and has lending capacity: has money (in general, financial assets) to lend. Trade surplus implies lending capacity and trade deficit implies financial need.

32. Expenditure categories

National income accounting assigns the value of each good produced to one of four categories (all nominal or all real) according to the type of agent that has received the good.

- **Consumption expenditures or, for short, consumption C.** Consumption C is the value of the purchases of new goods (durable and non-durable) and services by households (no matter in which economy the goods have been produced).
- **Gross private domestic investment or investment I.** Investment I consists of the value of:
 - fixed investment (on new factories, office buildings, and machinery to produce goods);
 - residential investment (spending by households or firms on new homes); and
 - changes in the firms' inventories (goods that have been produced but not sold yet).
- **Government consumption and gross investment or government purchases G.** Government purchases G is spending by all levels of government (local, regional, national) on newly produced goods and services. It includes consumption and investment spendings.
- **Transfer payments TR.** Transfer payments TR are payments by the government without receiving anything in return. Typical transfer payments are Social Security payments to retired and disabled people and unemployment insurance to unemployed people. Transfer payments are excluded from government purchases.
- **Exports EX.** Exports EX are the value of the exports of goods and services.
- **Imports IM.** Imports IM are the value of the imports of goods and services.

33. Foreign balance

Net exports NX are defined as exports minus imports: $NX = EX - IM$. The difference "exports minus imports" is also known as trade (or foreign) balance. A trade surplus occurs when exports are greater than imports, so net exports are positive: $NX > 0$. A trade deficit occurs when imports are greater than exports, which means that $NX < 0$.

34. Government budget

Designating by T the taxes paid by households and firms to the government, the government budget (or public deficit) is $PD \equiv G + TR - T$ and equals the government's spending on goods and services plus transfer payments minus the government's tax receipts. A budget (or public) deficit occurs if $PD > 0$: that is, spending is larger than receipts. A budget (or public) surplus occurs if $PD < 0$. The government budget is balanced if $PD = 0$. Public savings is $-DP$ or, equivalently, $T - G - TR$. Public debt is the accumulation of past deficits.

35. Fundamental macroeconomic identity

The fundamental macroeconomic identity asserts that the ex-post aggregate supply of output (that is, GDP Y) equals the ex-post aggregate demand for output. Formally:

$$Y \equiv C + I + G + EX - IM.$$

Imports IM are subtracted because they have been included already in C , I , or G . The identity just tells who makes use of the total production $Y + IM$ available in the economy: households, firms, government, or foreigners (so $Y + IM \equiv C + I + G + EX$).

36. Example on the fundamental macroeconomic identity

A new car is available in an economy. If the car has been produced within the economy, the value of the car is included in Y ; if it has been produced abroad, its value is added to IM . Who gets the car determines the category C , I , G or EX in which the value of the car must be placed.

- (i) If a household purchases the car, its value appears in C .
- (ii) If a firm buys the car to use it in production activities (a leasing car company, for instance), then the value of the car is in I .
- (iii) If some public organization gets the car, then its value is included in G .
- (iv) If someone from another economy obtains the car, then its value counts as EX .
- (v) If the car is produced domestically and no one purchases it, then its value is residually assigned to I : the firm that produced the car is attributed involuntary investment.

37. The income identity

The income accounting identity establishes how income is used and asserts that

$$Y \equiv C + S + (T - TR).$$

Interpreting GDP Y as aggregate income (GDP as net incomes earned by the factors of production), then the income identity states that income can be used to consume, to save, and to pay taxes (taxes net of transfers). Disposable income Y_d is defined as $Y_d \equiv Y - T + TR$. By combining this and identity $Y \equiv C + S + (T - TR)$, it follows that $Y_d \equiv C + S$.

38. The savings identity (new version)

By the fundamental identity, $Y - C \equiv I + G + NX$. By the income identity, $Y - C \equiv S + T - TR$. Combining the two yields $I + G + NX \equiv S + T - TR$. Rearranging, the following expression of the savings identity is obtained:

$$\underbrace{S}_{\text{private saving}} \equiv \underbrace{I}_{\text{investment}} + \underbrace{(G + TR - T)}_{\text{government budget deficit}} + \underbrace{NX}_{\text{trade balance}}$$

This identity tells that there are three ways of disposing of the savings of an economy. Each part of savings can go to firms to finance investment, to the government to finance a budget deficit, or to foreigners, when they buy more from the economy than the economy buys from them (the economy runs a trade surplus, so the rest of the world runs a trade deficit with the economy).

39. The investment identity

Solving for I in the savings identity, the investment accounting identity below obtains. The investment identity holds that investment is financed by private saving S , public saving $T - G - TR$ or foreign saving $-NX$.

$$\underbrace{I}_{\text{investment}} \equiv \underbrace{S}_{\text{private saving}} + \underbrace{(T - G - TR)}_{\text{government saving}} + \underbrace{(-NX)}_{\text{foreign saving}}$$

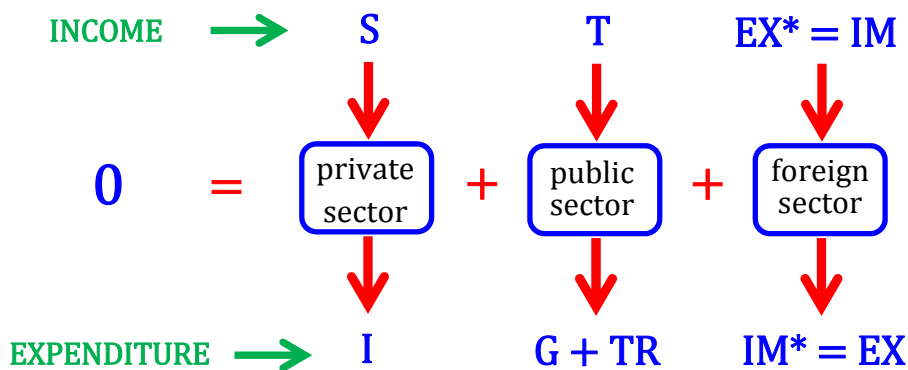
40. Twin deficits

Suppose investment equals savings: $I = S$. By the savings identity, the public deficit $G + TR - T$ equals the trade balance NX . This means that if the government runs a budget deficit, then it must be financed by foreigners: if $I = S$, then $G + TR - T > 0$ implies $NX > 0$. In sum, government and trade deficits simultaneously occur. As a result, the government spends more without having to increase taxes, and households and firms buy from abroad more goods than they sell. Can it be concluded that all of them live beyond their possibilities?

41. Sectoral identity and savings identity

The following GDP-based version of the balance identity is obtained by moving I to the right-hand side of the investment identity:

$$(S - I) + (T - G - TR) + (-NX) \equiv 0.$$



The sketch on the left shows the savings identity as a sectoral identity. First, $S - I$ is the private sector balance. The private sector runs a surplus if $S - I > 0$, that is, when savings exceed investment. Second, $T - G - TR$ represents the public sector balance. The public sector runs a surplus if $T - G - TR > 0$, that is, if

public revenue exceeds public spending. And third $-NX$ captures the foreign sector balance. The foreign sector runs a surplus if $-NX > 0$; that is, if $-(EX - IM) > 0$ or, equivalently, if $IM > EX$. This means that $EX^* > IM^*$, where the asterisk ascribes the variable to the rest of the world. Since $EX^* > IM^*$ implies that the rest of the world has lending capacity, $-NX > 0$ is equivalent to the revenue of the rest of the world being larger than the spending of the rest of the world. For this reason, $-NX > 0$ describes a foreign sector surplus and that the rest of the world have positive savings. Summarizing:

$$\begin{array}{lcl} S - I & \equiv & (G + TR - T) + NX \\ \text{private surplus} & \equiv & \text{public deficit} + \text{trade surplus} \end{array}$$

42. Net borrowing and net lending

A sector runs a deficit when it has an excess of expenditure over income. To finance the deficit, net borrowing is needed: the sector must increase liabilities more than it increases financial assets. In (1) below, which represents the savings identity, each difference within parentheses measures the net borrowing of the sector. By changing its sign, net borrowing is transformed into net lending (which

means net acquisition of financial assets). A sector generates net lending when the sector's income exceeds the sector's expenditure. Foreign net borrowing (the rest of the world's inflows minus outflows) is the reverse of domestic net lending.

$$(\text{Private Expenditure} - \text{Private Income}) + (\text{Government Expenditure} - \text{Government Income}) + (\text{Inflows from the rest of the world} - \text{Outflows to the rest of the world}) = 0 \quad (1)$$

43. Impact on economic activity

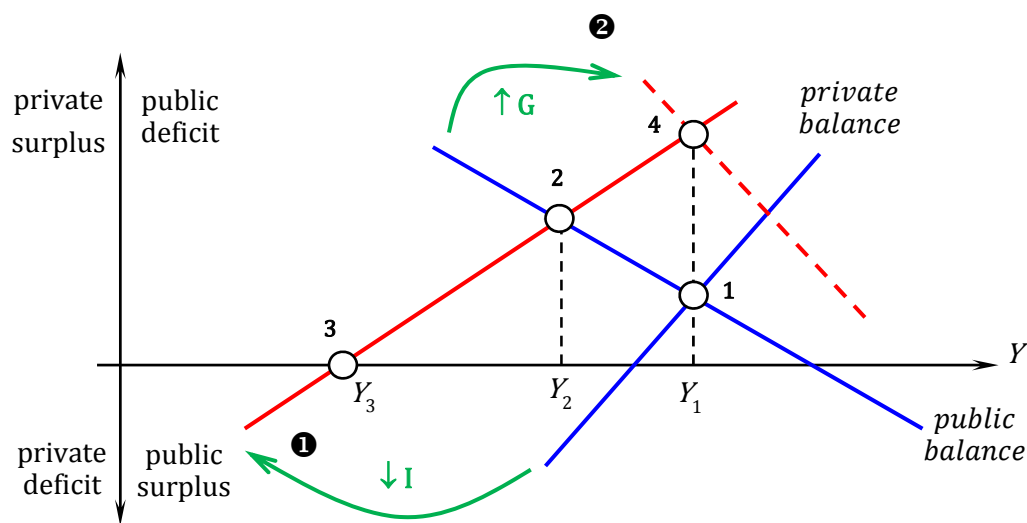
Each difference within parentheses in (1) can be viewed as the sector's contribution to aggregate demand. A positive difference implies a demand expansion, whereas a negative difference implies a demand contraction. Economic activity is held down by any sector whose difference expenditure–income is negative: expansions of **I**, **G** or **X** contribute to push up economic activity.

44. A simple model of the world economy

When all economies are aggregated into a world economy, all the current accounts cancel out, as every current account deficit is offset by some current account surplus. This implies that, for the world economy, there is no foreign sector. Therefore, for the world economy, $S - I \equiv G + TR - T$.

- **Savings a function of GDP.** Suppose **I** is constant (with value \bar{I}) and that $S = s \cdot Y$ is proportional to GDP **Y**, where the saving rate s is a number between zero and one. Hence, the private balance $S - I = s \cdot Y - \bar{I}$ is an increasing function of GDP; see the figure below.

- **Taxes a function of GDP.** Suppose $G + TR$ is constant (with value $\bar{G} + \bar{TR}$) and that $T = t \cdot Y$ is proportional to GDP, where the tax rate t is a number between zero and one. This makes the public balance $G + TR - T = \bar{G} + \bar{TR} - t \cdot Y$ a decreasing function of GDP; see the figure below.



- **Analysis.** It follows from $S - I \equiv G + TR - T$ that $s \cdot Y - \bar{I} = \bar{G} + \bar{TR} - t \cdot Y$. Solving for **Y**, GDP is

$$Y = (\bar{G} + \bar{TR} + \bar{I}) / (s + t).$$

This shows that GDP depends positively on investment, transfers and public spending, and negatively on the saving and tax rates.

- **Responses to negative shocks.** The initial state of the economy is given by point 1. The economy experiences a reduction in investment **I**, which shifts the private balance line to the left. The new state of the economy corresponds to point 2, where GDP Y_2 is smaller than the initial value Y_1 . The orthodox response to the shock is to adopt austerity measures that aim at attaining a balanced government budget (hence, a balanced private sector). The orthodox policy leads the economy to point 3 (the austerity measures must shift the public balance line down to the left to reach point 3). The heterodox response is to neutralize the negative effect on GDP of the reduction in **I** by increasing **G** (and/or **TR**). This prescription shifts the public balance line up to the right, moving the economy to point 4, whose associated GDP is the same as the initial value Y_1 .