Elements of Macroeconomics

March 2023

10 Inequality: The lorenz curve and the Gini coefficient

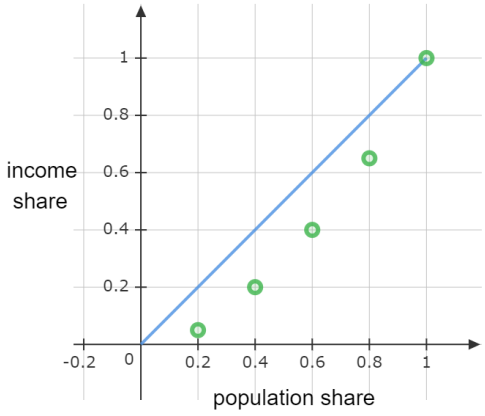
The Lorenz Curve: The lorenz curve visualizes the distribution within a population. It shows how much income/wealth each share of the population earns/owns.

How to draw a Lorenz Curve for income:

1. Sort everyone by their income. From low to high income.
2. Calculate total income
3. Calculate the population and income share for each group
4. Calculate cumulative population and income shares
5. Graph cumulative shares with x = population share and y = income share
6. Add a 45 Degree line

Exercise: Assume we observe the following group: Ali: \$50, Berta: \$150, Cesar: \$200, David: \$250, Esther: \$350. Draw the lorenz curve.

Solution:



The Gini coefficient: The Gini coefficient is an indicator to measure inequality. It is zero if there is no inequality (Lorenz curve is the 45 Degree line) and (almost) one if only one person holds all the wealth/income.

We need it to compare the inequality across countries. If a lorenz curve in country A is always further away from the 45 Degree line than in country B, we know that country A is more unequal than B, but what if they cross?

11 Short-Term: The Aggregate Expenditure Model

The aggregate expenditure model is about business cycle fluctuation in the short run. This means prices are fixed (Keynesianism). It derives mechanics how a recession and a boom can occur given the difference between planned and actual investment/inventory. Additionally, it highlights how government intervention can help.

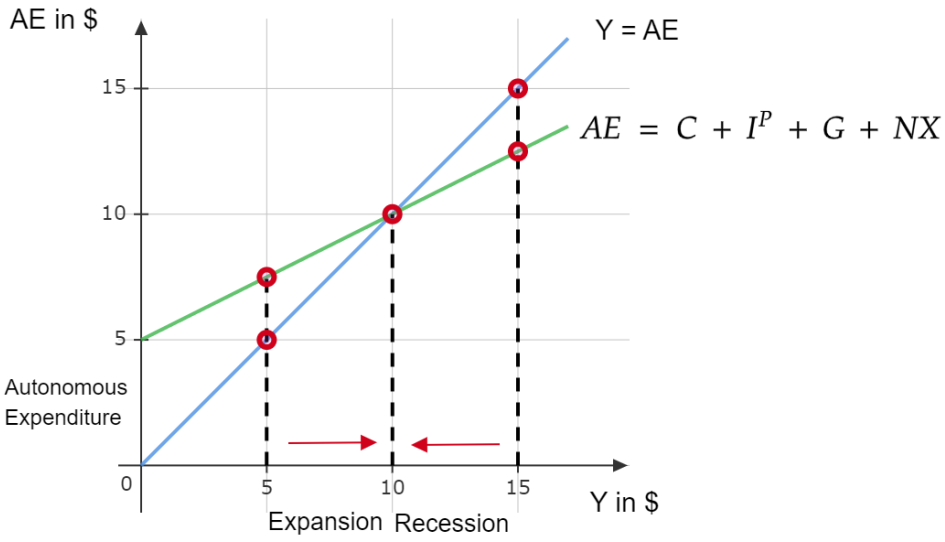
Equations we need:

$$Y = \bar{c} + bY + I^P + I^U + G + NX \tag{1}$$

$$AE = \bar{c} + bY + I^P + G + NX \tag{2}$$

Where:

- Y = Real GDP
- AE = Real aggregate expenditure
- $\bar{c}$ = autonomous consumption
- b = MPC
- I^P = Planned investment
- I^U = Unplanned investment
- G = Government spending
- NX = Net Exports



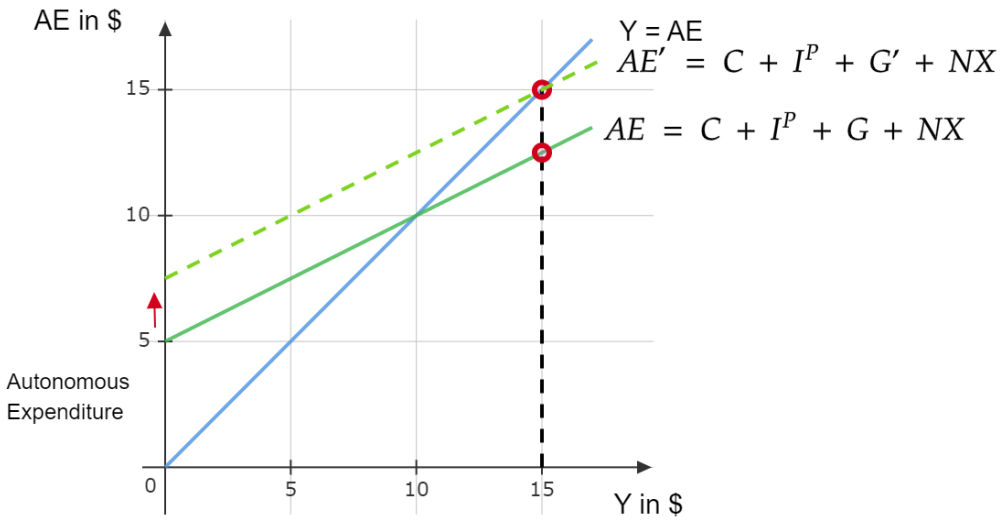
Four things to Note!

1. Y is how much is produced vs AE is how much is sold/bought (*expenditure*)

→ AE does NOT include unplanned investment, Y does

2. When I^U is positive, produce less in the next cycle; when negative, produce more
3. Movement vs Shift vs Rotation:
   - Y increases or decreases, changing bY, and there is a **MOVEMENT** (not a shift) in the AE curve
   - autonomous spending changes $(\bar{C}, I, G, NX)$ the **ENTIRE AE CURVE SHIFTS** up/down to adjust
   - b increases leads to a **ROTATION**

4. We can change the equilibrium by shifting the curve
   - A new equilibrium is created based on where the new AE curve intersects with the Y=AE line
   - In the first graph below, there is a recessionary gap because AE is below Y. Since it takes time for firms to adjust, the government may want to step in by increasing government spending.
   - This increase in G shifts the AE curve up, creating a new equilibrium at which AE = Y



Equilibrium Let us derive the equilibrium:

$$Y = AE \tag{3}$$
$$Y = C + I^P + G + NX \tag{4}$$
$$Y = \bar{c} + MPC * Y + I^P + G + NX \tag{5}$$
$$Y - MPC * Y = \bar{c} + I^P + G + NX \tag{6}$$
$$Y(1 - MPC) = \bar{c} + I^P + G + NX \tag{7}$$
$$Y = \left(\bar{c} + I^P + G + NX\right) \frac{1}{(1 - MPC)} \tag{8}$$

Now, let us plug in some numbers:

$$C = 2,000 + 0.65Y$$
$$I^P = 3,500$$
$$G = 2000$$
$$NX = -500$$

Result: We should get: $Y^* = 20.000$.

Multiplier Now, let's focus on the consequences on Y when Fiscal policy changes.

1. Government spending

Let's fix all autonomous expenditure and assume G increases by ΔG

$$Y = \left(\bar{c} + \bar{I^P} + \bar{G} + \Delta G + \bar{NX}\right)\frac{1}{(1 - MPC)}$$

Subtracting this from equation 8 gets us:

$$\Delta Y = \frac{\Delta G}{(1 - MPC)}$$

Bottom line: Y increases not only by the additional amount of government spending, but by even more! *Why?*

2. Reducing Taxes

Now, let's assume the government does not increase G, but lowers taxes by ΔT. The consumption equation changes!

$$C = \bar{c} + MPC * (Y - T)$$

Redoing the same steps as above:

$$\begin{aligned} Y &= \bar{c} + MPC * (Y - T) + I^P + G + NX \\ Y - MPC * Y &= \bar{c} - MPC * T + I^P + G + NX \\ Y(1 - MPC) &= \bar{c} - MPC * T + I^P + G + NX \\ Y &= \left(\bar{c} - MPC * T + I^P + G + NX\right)\frac{1}{(1 - MPC)} \end{aligned}$$

So far so good, let's reduce taxes by ΔT:

$$Y = \left(\bar{c} - MPC * \bar{T} - MPC * \Delta T + \bar{I^P} + \bar{G} + \bar{NX}\right)\frac{1}{(1 - MPC)}$$

and take the difference:

$$\Delta Y = \frac{MPC * \Delta T}{(1 - MPC)}$$

Bottom line: Y increases by more than the tax cut IF $MPC > 0.5$. But strictly less than increasing government spending. *Why?*

3. Balanced budget:

But wait, where does the government got the money from? Either it increases it's debt or increases taxes. The first case was the former. Now let's look at the balanced budget, eg. government spending increases by increasing taxes: $\Delta G = \Delta T$

$$Y = \left(\bar{c} - MPC * \bar{T} - MPC * \Delta T + \bar{I^P} + \bar{G} + \Delta G + \bar{NX}\right)\frac{1}{(1 - MPC)}$$

Taking the difference leads to:

$$\Delta Y = \frac{\Delta G}{(1 - MPC)} - \frac{MPC * \Delta T}{(1 - MPC)} = \Delta G$$

Bottom line: in this model, the government can increase output by spending more and increasing taxes!!