Aggregate Consumption, Aggregate Demand, GDP and the Keynesian Cross[1]
Instructional Primer[2]

To understand the relationship between consumption, savings, expenditures, and GDP think of consumption as a function of income less expenditures and savings, or in this case C = f(income, expenditures, savings or investment), holding government spending, taxes, borrowing, and transfer payments constant[3].

Perfectly clear, right? In truth this is no different than how you might think about your consumption at the household level. Suppose that government spending, taxes, borrowing, and transfer payments are held constant at the household level; that's the same thing as deciding not to borrow for household expenditures, recognizing that your payroll tax withholding amounts from your paycheck really doesn't change from paycheck to paycheck (or at least you don't have much control over it), that you're not going to consider in your consumption decisions any transfer payments that a government might have to offer, and that the amount the government spends each month is irrelevant to you (at that moment).

So you spend your net income less any amount you might choose to save. We're going to concede that your savings equals your investment here, and that your net income is equal to your disposable income. We recognize then that your personal marginal propensity to save (MPS) is equal to your savings divided by your disposable income (Y_D), and that your marginal propensity to consume (MPC) is equal to your consumption (C) divided by your disposable income, which happens to be the same things as your disposable income (Y_D) minus your savings (S), all divided by your disposable income and is the same as 1-MPS.

What we can say then is that the level of consumption in a society is calculated by taking some initial level of spending plus disposal income multiplied by the MPC. This initial level of spending is referred to as autonomous aggregate spending (AAS) and is simply a level of spending not dependent on the change we're seeking to calculate or describe. We generalize this with the following equation:

$$C = AAS + MPC\ (Y_D) \quad (1)$$

And we can say that changes in consumption can be calculated as follows:

$$\Delta C = \Delta AAS + MPC(\Delta Y_D) \quad (2)$$

[1] This primer is intended to present an abbreviated discussion of the included economic concepts and is not intended to be a full or complete representation of them or the underlying economic foundations from which they are built.

[2] This primer was developed by Rick Haskell, Ph.D. Student, Department of Economics, College of Social and Behavioral Sciences, The University of Utah, Salt Lake City, Utah (2013)

[3] This starts out very similarly to the primer on *Marginal Propensities to Save and Consume* because the concepts discussed herein share foundational constructs with those concepts.

So let's take this a little further and include our level of savings, or investment (I), in the equation. We'll suppose that our level of investment is something we plan, so we'll call it investment planned or I_P, and that investment planned (I_P) and consumption equal our disposable income – this is very similar to what might be said of a household as well as an aggregate economy. When seeking to describe aggregate expenditures, which is something we're going to suppose is planned so we'll call it aggregate expenditure planned (AE_P), we can generalize it as follows:

$$AE_P = C + I_P \quad (3)$$

Substituting for C from equation (1) above we get

$$AE_P = AAS + MPC(Y_D) + I_P \quad (4)$$

In order to take the next step and expand this discussion to a description of GDP for an entire economy we first need to accept that investment (I) is equal to planned investments (I_P) and unplanned investments (I_U). For this level of discussion we're going to suppose that the only unplanned investments a business might make are reflected in changes in inventory. These might be the result of a certain level of output, based on planned investments in production, during a period in which consumption was lower than expected such that inventory at the end of a particular year is greater than inventory at the beginning of the same year - we can also think about this in just the opposite terms with consumption being greater than expected and the change in inventory being negative. We call this unintended change in inventory, inventory unplanned (I_U).

So, reflecting back on the initial assumptions we made (taxes, government spending, borrowing, transfer payment, etc. being held fixed) we see that GDP is simply the sum of consumption (C), investment planned (IP), and Investment unplanned(I_U), which can be generalized as follows:

$$GDP = AE_P + I_U \quad (5)$$

Recall that $C + I_P = AE_P$ such that

$$GDP = C + I_P + I_U \quad (6)$$

Just as considered changes in consumption (ΔC), we can consider changes in AE_P and GDP as follows:

$$\Delta AE_P = \Delta C + \Delta I_P \quad (7)$$

$$\Delta GDP = \Delta AE_P + I_U \quad (8)$$

Let's assume the following data for 2001 and 2002:

AAS_{2001} = \$200 MPC = .8 Y_D = \$1,000 I_P = \$100 I_U = \$50

$$C = AAS + MPC\ (Y_D) \quad (9)$$
$$= \$200 + .8\ (\$1{,}000) = \$1{,}000$$

$$AE_P = C + I_P \quad (10)$$
$$= \$300 + .8(\$1{,}000) = \$1{,}100$$

$$GDP = AE_P + I_U \quad (11)$$
$$= \$350 + .8(\$1{,}000) = \$1{,}150$$

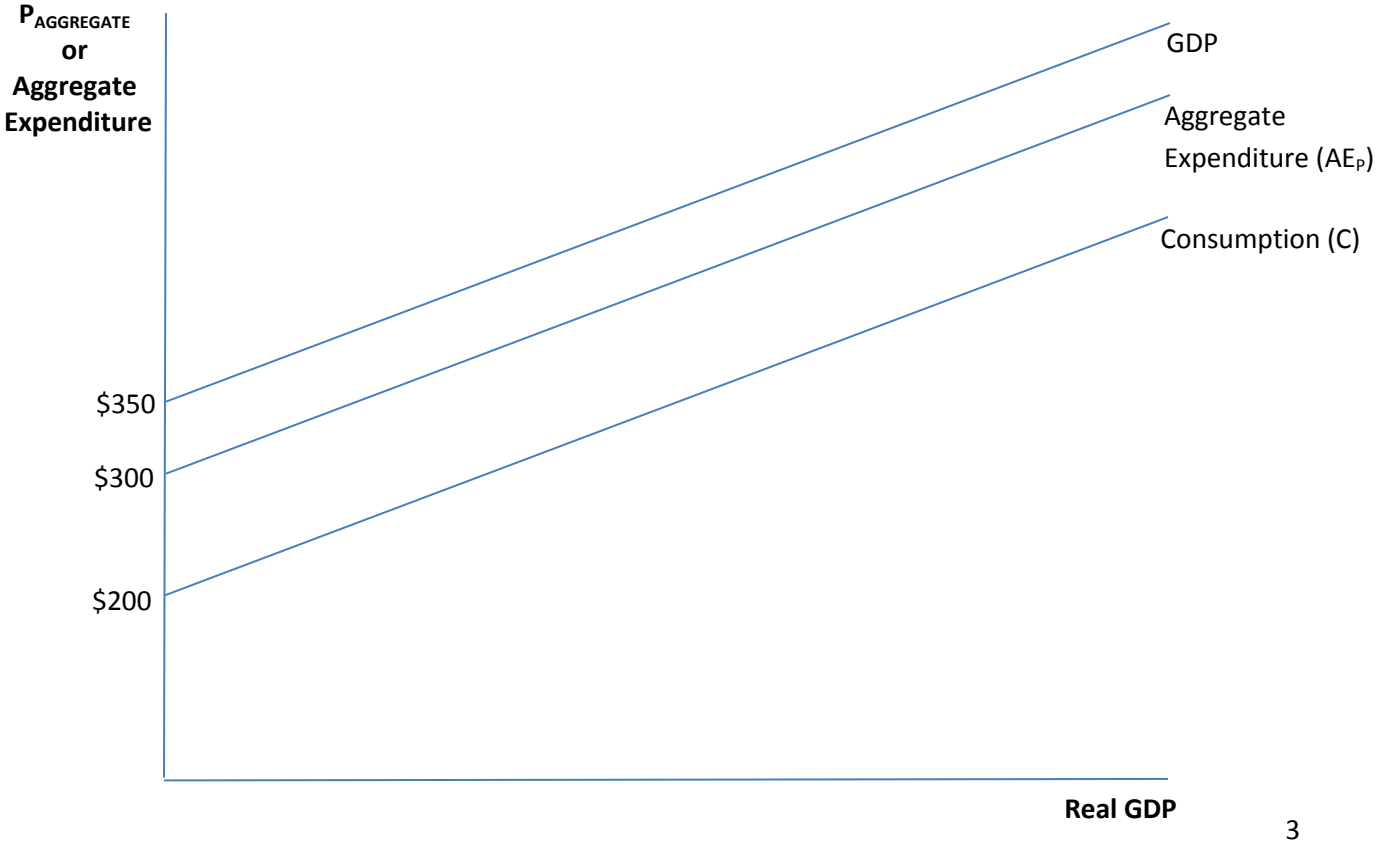
We can also think about this in visual terms. Begin with a basic point/slope form of the consumption function where A is a proxy for AAS and becomes the Y intercept and MPC is the slope:

$$C = A + MPC(Y_D) \quad (12)$$
$$= \$200 + .8(\$1{,}000) = \$1{,}000$$

$$AE_P = C + I_P \quad (13)$$
$$= A + MPC(Y_D) + I_P$$
$$= (A + I_P) + MPC(Y_D)$$
$$= \$300 + .8(\$1{,}000) = \$1{,}100$$

$$GDP = AE_P + I_U \quad (14)$$
$$= A + MPC(Y_D) + I_P + I_U$$
$$= (A + I_P + I_U) + MPC(Y_D)$$
$$= \$350 + .8(\$1{,}000) = \$1{,}150$$

Such that A, A + I_P, A +I_P + I_U (A + I) becomes the Y axis intercept for consumption (C), aggregate expenditure planned (AE_P), and GDP respectively, and MPC is the slope as shown in the following graph.

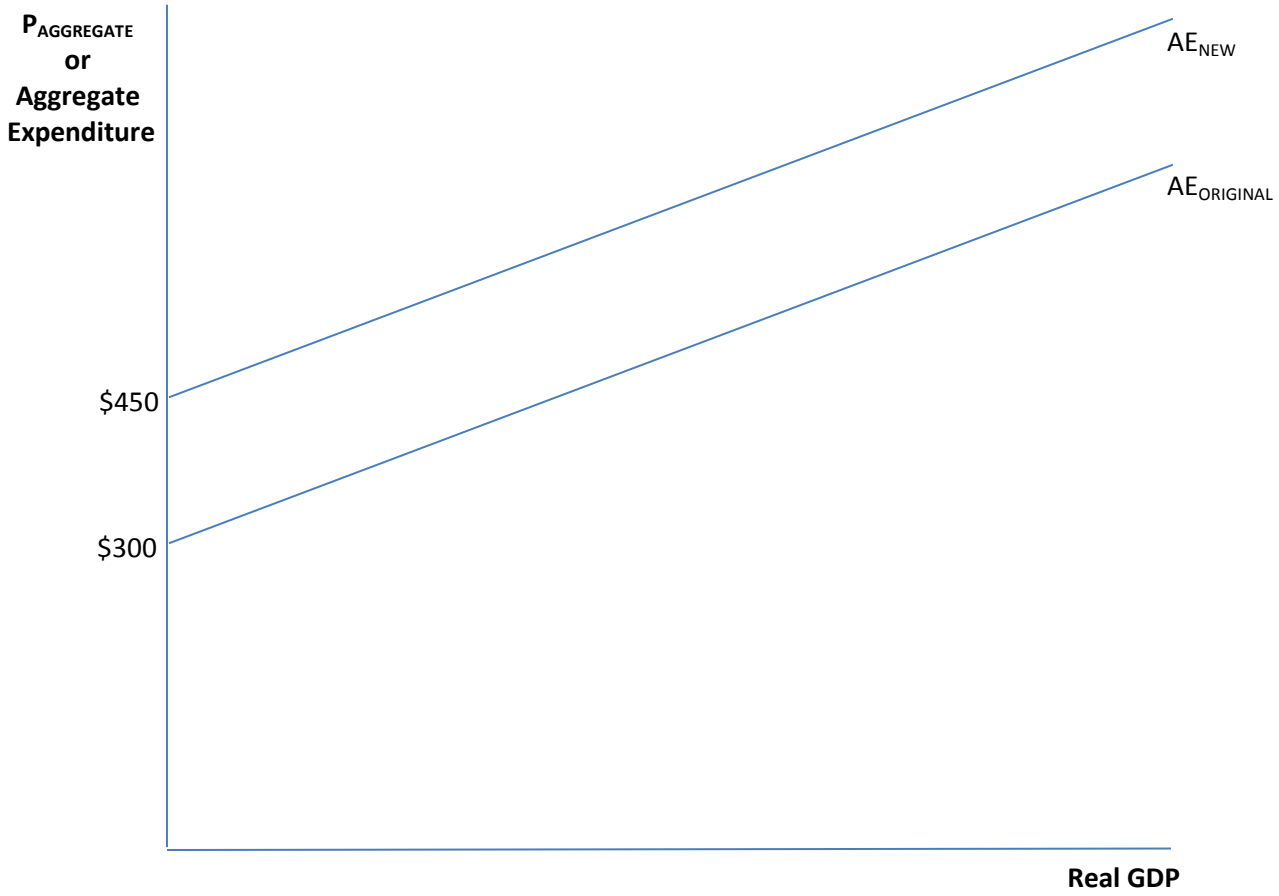


Notice that the slope of each line is constant due to the constancy of MPC used in each equation. The only thing that has changed is the Y axis intercept as we sum AAS, I_P, and I_U to calculate C, AE_P and GDP.

We can also think about this in terms of changes in Consumption, Aggregate Expenditures, or GDP. Let's assume that AAS increased by $150 and we're interested in finding the effect of this change on AE_P, we know the initial (pre-change) level of AE_P, so all we need to do is determine the level of AE_P following the change:

$$\begin{aligned} \Delta AE_P &= \Delta C + \Delta I_P \\ &= \Delta AAS + MPC(\Delta Y_D) + \Delta I_P \\ &= \$150 + .8(0) + \$0 \\ &= \$150 \end{aligned} \qquad (15)$$

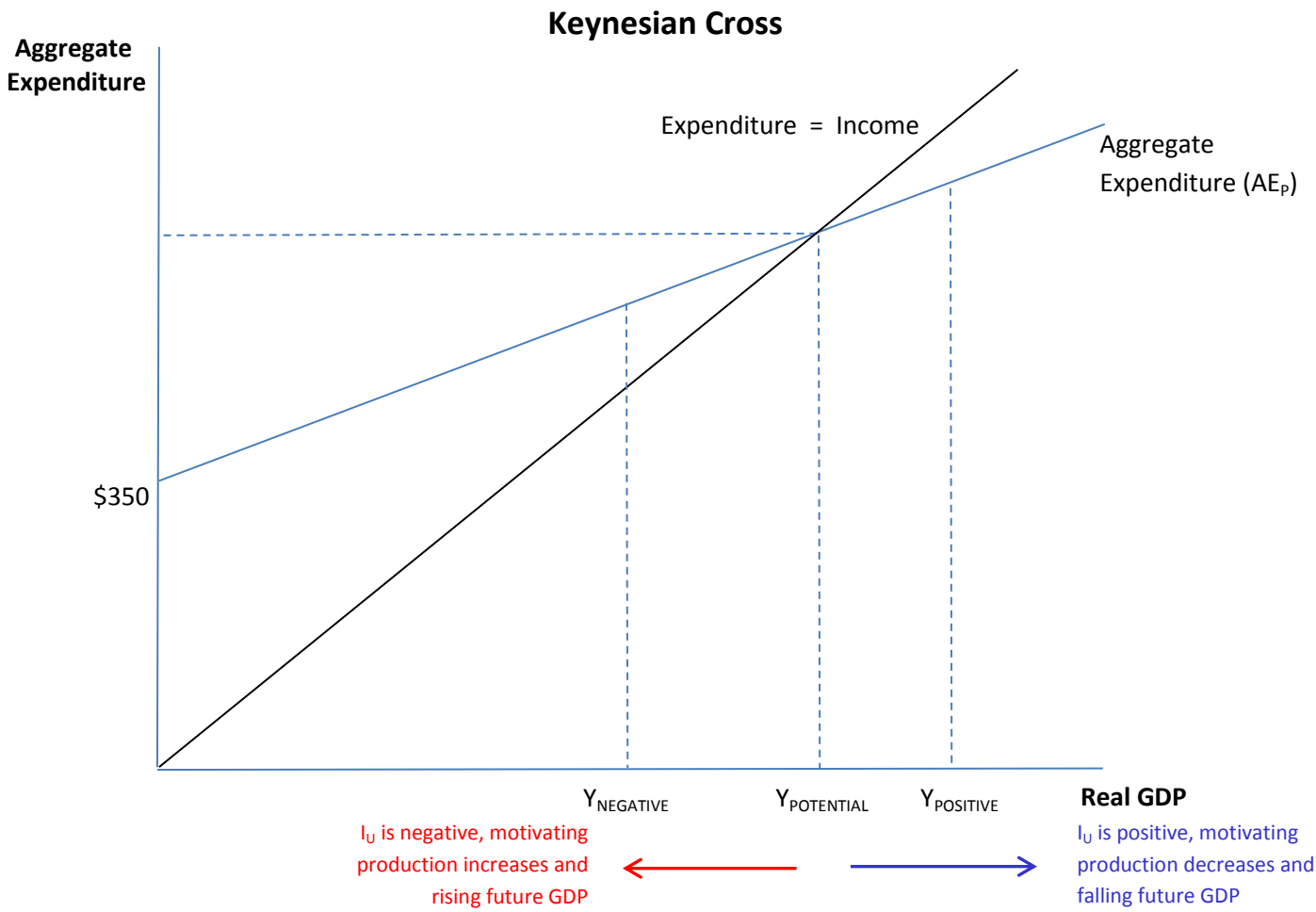
Notice that we used a zero value for Y_D and I_P since these levels were unchanged. As such, all we're interested in is the Y axis intercept given. In this case we see that the intercept changes by $150 and goes from the original intercept of $300 to a new intercept of $450. We can visualize this as follows:



The Keynesian Cross

So far all we've done is considered the levels of C, AEP, and GDP, but what import do these levels hold other than to understand the placement of different components of our economy on a graph. To consider this further and to begin to interpret these levels in respect to macroeconomic policy issues we'll constrain ourselves to observing AE_P and think about the relation to this level and increases or decreases in I_U; we'll do this by considering the ***Keynesian Cross*** applied to the above graph. This includes simply overlaying a 45^0 line starting at the X,Y axis intersection; this line has a slope equaling 1 and represents the line on which GDP is equal to AE_P at any level – this is the Income = Expenditure line and forms the **Keynesian Cross**.

At the transection of the Income = Expenditure line and the Aggregated Expenditures (AEP) line we note that the economy is operating at $Y_{POTENTIAL}$, suggesting that the economy is at full output based on full utilization of the various forms of capital available. Recall that the slope of AE_P is bound by the MPC, which is always less than 1 and greater than 0, so we will most often find that AE_P transects the Cross from below. At any level of real GDP greater than $Y_{POTENTIAL}$, we see that the economy is adding unplanned inventory (I_U); at any level below $Y_{POTENTIAL}$, the economy is depleting inventory levels.



Based on the graph above, we see that if Real GDP is at $Y_{NEGATIVE}$, then I_U is negative or the economy is in a state such that planned expenditures are greater than GDP. Think about this in terms of the equations developed earlier; if I_U is negative, then the equation $GDP = AE_P + I_U$ becomes $GDP = AE_P - I_U$ or $GDP + I_U = AE_P$. Conversely, if the economy's real output is at $Y_{POSITIVE}$, this suggests that the economy is adding to inventory levels or I_U is increasing: $GDP = AE_P + I_U$ or $GDP - I_U = AE_P$.

In and of itself the potential changes in GDP based on the **Keynesian Cross** relation may not indicate contraction or expansion in the long-run, but may indicate the effects of unanticipated short-run economic pressures as AE_P is greater or lesser than GDP in that firms plan their expenditures such that they expect aggregate consumption and investment levels to be equal to planned expenditures.