ECON 421: Business Fluctuations

Spring 2015
Tu 6:00PM–9:00PM
Section 102

Created by

Richard Schwinn, Ph.D.

Based on
Macroeconomics, Blanchard and Johnson [2011]

Levels of Learning

1. **Knowledge Level** This is the ability to remember specific facts and definitions.
2. **Comprehension Level** This is grasping the meaning of material and is often demonstrated by translating from one medium to another. e.g.
   - from words to graphs
   - from words to calculations
3. **Application Level** This implies using learned material in new and concrete situations.
4. **Analysis Level** This involves breaking down material into its component parts so that its organizational structure may be understood.

Your objective is to perform analyses involving language-based, graphical, and mathematical macroeconomic relationships.

Functional Notation

Consider the equation $y = 2x + 3$.

- Suppose you are told to find y when $x = -1$. You substitute for x and find that $y = 1$.
- Alternatively the equation could be expressed as

$$f(x) = 2x + 3 \; or \; even \; y(x) = 2x + 3.$$

- The LHSs are pronounced, "f of x," and, "y of x."
- While these equations have the same meaning, the second requires a bit of caution due to the ambiguous roll of parentheses.

The functional relationship that we're most concerned with in this chapter is consumption (C) as a function of disposable income (Y). $C(Y_D)$

- When $Y_D = 0$ then $C = c_0$, i.e. autonomous consumption,
- Otherwise

$$C = c_0 + c_1 Y_D$$

- Since $0 < c_1 < 1$, we write

$$C(\underset{+}{Y_D}).$$

- The plus sign indicates that the two variables grow together.

On the expenditure side, GDP can be decomposed into

- consumption C (70.5% of GDP in 2010),
- government spending G (20.4% of GDP in 2010),
- fixed investment I (12% of GDP in 2010),
- and net exports $X - IM$ (-3.5% of GDP in 2010).

- The terms Y, *real GDP, output, national income* and *production* are often used interchangeably.
- The book briefly makes a distinction between the demand for goods (Z) and actual production (Y).
- Total demand appears to be identical to Y. The difference mathematically, is that Z acknowledges the possibility of inventory investment (0.5% of GDP in 2010).
- When firms create goods that are not consumed in the period that they are produced, these goods are recorded as inventory investment.

$$Z \equiv C + I + G + X - IM.$$

C

$$C(Y_D) = c_0 + c_1 Y_D$$

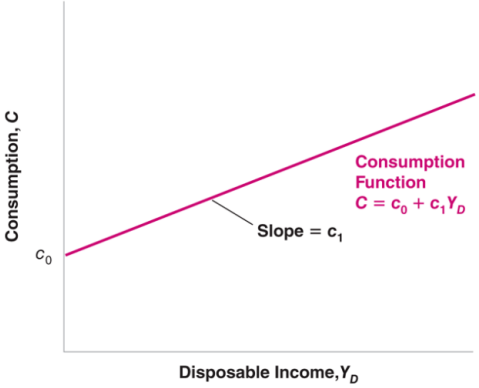
The level of consumption spending depends on many factors.

- Consumption is primarily determined by the level of disposable income, Y_D.
- Disposable income can be defined as $Y_D = Y - t_Y Y$ or $Y_D = Y - T$ when taxes are lump sum.
- Note that taxes T refers to taxes minus government transfers.
- Additionally, autonomous consumption, c_0, represents how much consumption would occur if disposable income were zero. How can consumption be positive if income is zero?
- Dis-savings. It is assumed that the economy borrows to pay for c_0 if needed.
- Thus C is modeled as a function of disposable income (Y_D) and autonomous consumption (c_0).

$$C(Y_D) = c_0 + c_1 Y_D$$

- c_1 is the *marginal propensity to consume*. This tells us how much of each dollar is spent (c_1) and how much is saved $(1 - c_1)$.
- Recall that since $0 < c_1 < 1$, we write $C(Y_D)$ with $+$ above it.
- This means that consumption increases when disposable income increases.
- Try to visualize $C = c_0 + c_1 Y$, where $c_0 > 0$ and $0 < c_1 < 1$.

- At $Y_D = 0$ There is a positive level of C.
- and an upward slowing line with a slope less than 1.



I and G

Assume that investment I is *exogenous*.

- In biology **exogenous** means *growing or originating from outside an organism*.
- If a variable is not a function of any other variables in the model, then it is *exogenous*.
- Notice that consumption is not exogenous since it is a function of Y. Such variables are called **endogenous**.
- Is c_0 exogenous or endogenous? What about c_1?

Government Spending (G) and Taxes (T)

Government spending is exogenous.

- Government spending includes the purchase of newly produced goods and services.
- Transfers, such as Social Security payments, veterans benefits, and interest on the government debt are excluded.
- The variable T is defined as taxes minus transfers and includes taxes minus transfers at all levels of government.

$X - IM$

- Imports are subtracted from GDP on the expenditure side because the domestic spending categories C, I, and G include spending on foreign goods and services.
- To isolate spending on domestically produced goods and services, imports must be subtracted.
- Likewise, exports are added because they represent foreign spending on domestically produced goods and services.

Substituting the definition of consumption,

$$C(Y_D) = c_0 + c_1 Y_D,$$

into

$$Z \equiv C + I + G + X - IM,$$

we have

$$Z \equiv c_0 + c_1 Y_D + I + G + X - IM.$$

- Until the final third of the course, we will assume that $X - IM = 0$.
- Considering that $X - IM$ was only -3.5% of GDP in 2010 for the US, this is not an unforgivable assumption.

The Equilibrium Condition

The **equilibrium condition** is

$$Y = Z.$$

What if $Y \neq Z$?

- If $Y > Z$, then firms have produced more goods than people demand, then firms respond by accumulating inventories.
- If $Y < Z$ then people are somehow spending more money than they're earning (borrowing) on average.
- Each alternative ultimately tends toward the equilibrium $Y = Z$ over time, so we put aside these complications so that income equals demand:

$$Y = c_0 + c_1 Y_D + I + G$$

Three Paths to Comprehension

Recall that the second level of learning is **comprehension**. There are three paths to understanding this material.

1. via algebra,
2. via language, or
3. via graphs.

You will find that by employing all three techniques/mediums, you can solidify your comprehension.

Using Algebra

Let disposable income $Y_D = Y - T$ so that $Y = c_0 + c_1 Y_D + I + G$ becomes

$$Y = c_0 + c_1 Y - c_1 T + I + G.$$

Now solve for Y by adding $-c_1 Y$ to both sides then distribute out the Y.

$$-c_1 Y + Y = c_0 + c_1 Y - c_1 T + I + G + (-c_1 Y)$$

$$(1 - c_1) Y = c_0 - c_1 T + I + G$$

Now divide both sides by $(1 - c_1)$ to isolate Y:

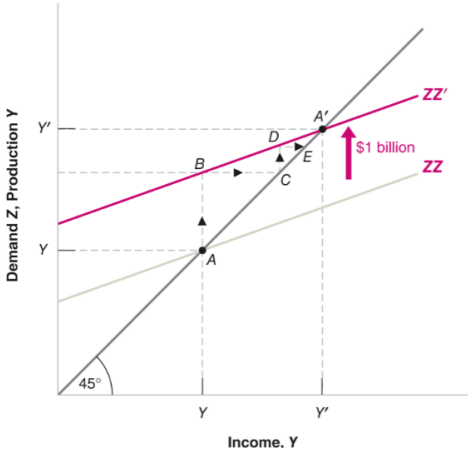
$$Y = \frac{c_0 - c_1 T + I + G}{1 - c_1}.$$

$$Y = \frac{c_0 - c_1 T + I + G}{1 - c_1} = \frac{1}{1 - c_1}\left[c_0 - c_1 T + I + G\right]$$

While this may not yet appear easy to interpret, you will find that it can be used to quickly generate many different macroeconomic insights.

1. What is the effect of taxes have on output?
2. What happens to Y if people increase their savings?
3. If the government expands, is consumption unchanged?

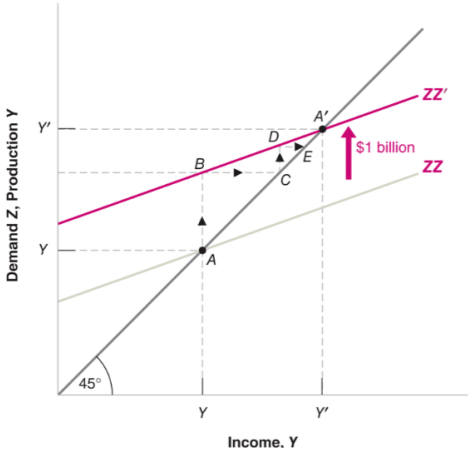
$$Y = \underbrace{\frac{1}{1-c_1}}_{Multiplier} \underbrace{\left[c_0 - c_1 T + I + G\right]}_{Autonomous\ Spending}$$



Equilibrium income is the product of two factors:

- autonomous spending (the term in brackets)
- and the multiplier ($\frac{1}{1-c_1}$).
- Demand depends on autonomous spending and on income, via its effect on consumption.
- The relation between demand and income is drawn as ZZ in the graph.

$$Y = \underbrace{\frac{1}{1-c_1}}_{Multiplier} \underbrace{\left[c_0 - c_1 T + I + G\right]}_{Autonomous\ Spending}$$



- The intercept with the vertical axis is the value of demand when income is equal to zero.
- The intercept is thus autonomous spending.
- When income increases by 1, demand increases by c_1. Since $0 < c_1 < 1$, the line is upward sloping but has a slope of less than 1.
- In equilibrium, production equals demand.

Using Words

Using words to explain the equilibrium is less effective than the other modes:

- Production depends on demand,
- which depends on income,
- which is itself equal to production.

Discussing a change in the equilibrium seems more effective:

- An increase in demand, such as an increase in government spending, leads to an increase in production and
- a corresponding increase in income.
- This increase in income leads to a further increase in demand, which leads to a further increase in production, and so on.
- The end result is an increase in output that is larger than the initial shift in demand, by a factor equal to the multiplier.

How Long Does It Take for Output to Adjust?

The answer for what we have developed is *immediately*.

Our simple model is unsuitable for answering the question of how long it takes to adjust.

In reality, the response to an increase in autonomous spending is not an instantaneous jump to a new equilibrium. It increases more gradually over time.

Recall from principles, the definitions of private, public, and national savings:

- Private savings: $S_{prv} = Y - T - C$
- Public savings: $S_{pub} = T - G$
- National savings: $S = S_{prv} + S_{pub} = Y - C - G$

Next notice that if we subtract C and G from both sides of the national income equation ($Y = C + I + G$), then

$$Y - (C + G) = C + I + G - (C + G)$$

$$Y - C - G = S = I$$

Thus savings exactly equals investment!

Suppose that the economy is characterized by the following behavioral equations:

$$C = 160 + 0.6Y_D$$

$$Y_D = Y - T$$

$$I = 150$$

$$G = 150$$

$$T = 100$$

Solve for the following variables:

1. Equilibrium GDP (Y)
2. Disposable income (Y_D)
3. Consumption spending (C)

Suppose the economy is characterized by the following behavioral equations:

$$C = c_0 + c_1 Y_D$$

$$Y_D = Y - T$$

$$I = b_0 + b_1 Y$$

and government spending and taxes are constant. Note that investment now increases with output.

1. Solve for equilibrium output.
2. What is the value of the multiplier?
3. How does the relation between investment and output affect the value of the multiplier?
4. For the multiplier to be positive, what condition must $(c_1 + b_1)$ satisfy?
5. Suppose that the parameter b_0, sometimes called business confidence, increases. How will equilibrium output be affected?
6. Will investment change by more or less than the change in b_0? Why? What will happen to national saving?

If $C = 2000 + .9Y_D$, what decrease in taxes must occur for equilibrium output to increase by 1000? *(The 2000 is irrelevant so it is replaced with c_0)*

$$Y = c_0 + 0.9(Y - T) + I + G \tag{1}$$

$$(1 - 0.9)Y = c_0 - 0.9T + I + G \tag{2}$$

$$Y = \frac{c_0 + I + G}{0.1} - \frac{0.9}{0.1}T \tag{3}$$

$$Y = \frac{c_0 + I + G}{0.1} - 9T \tag{4}$$

Thus $\Delta T = -111$ yields an increase of \$1000 in GDP.

Comments, questions, or errors detected?

References

Olivier Jean Blanchard and David Johnson. *Macroeconomics*. Prentice Hall, 6th edition, 2011. ISBN 9780133061635.

Uncopyright

This version of my notes is *uncopyrighted.*

This means I've put them in the public domain and released my copyright. Use this content however you want: email it, share it, change it, reprint it with or without credit.

Attribution is greatly appreciated but not required.