

Should Do (Ch11): Empirical estimation of the IS Curve

Jared Bean
Daniel Moncayo

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Introduction

GDP is calculated using several key components, including consumption, investment, and imports. This report observes how these components change over some quarterly and yearly data. This helps us better understand an economy's stability and growth.

Interpretation of Parameters 4.1

Consumption is mathematically expressed as:

$$\frac{C_t}{Y_t} = a_c - b_c(R_t - r_t) \quad (1)$$

where:

C_t = Consumption

Y_t = Output

a_c = Autonomous consumption component

b_c = Sensitivity of consumption to the interest rate gap

R_t = Market interest rate

r_t = Natural interest rate

Consumption is largely a function of the base line level of spending and interest rates. When R_t or market interest rate are higher then the r_t or natural interest rate borrowing becomes more expensive. When the market interest rate is lower borrowing is cheaper. The sensitivity of this is determined by b_c .

Investment is mathematically expressed as:

$$\frac{I_t}{Y_t} = a_i - b_i(R_t - r_t) \quad (2)$$

where:

I_t = Investment

Y_t = Output

a_i = Autonomous investment component

b_i = Sensitivity of investment to the interest rate gap

R_t = Market interest rate

r_t = Natural interest rate

Investment is very similar to consumption. When market rates are higher then natural rates there is less borrowing meaning there are fewer investments. When market rates are higher borrowing is cheaper. This means more people can invest.

Imports is mathematically expressed as:

$$\frac{Im_t}{Y_t} = a_{im} - n\tilde{Y}_t \quad (3)$$

where:

Im_t = Imports

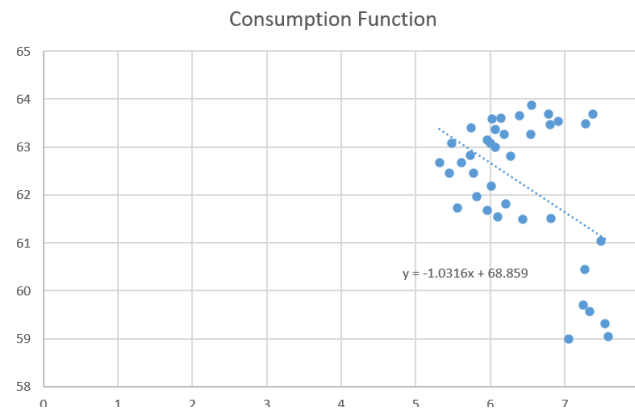
Y_t = Output

a_{im} = Autonomous imports component

n = Sensitivity of imports to domestic output

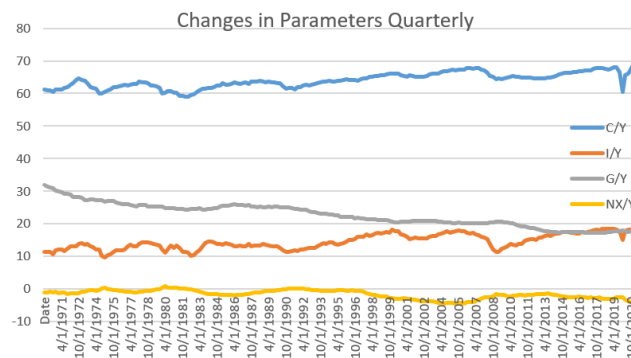
\tilde{Y}_t = Domestic output gap

Imports are a little different. They are determined largely by domestic economic conditions. When \tilde{Y}_t or the domestic output gap is positive, it means the economy is growing above its normal level. Domestic producers can't keep up with the demand and imports increase. when the gap is negative imports decline. The sensitivity of these changes is determined by n .



Looking at the data there is a surprisingly sharp drop in consumption. I believe this points match up with the COVID 19 pandemic. People were able to consume much less due to people being unable to work.

Interpretation of Quarterly Data 4.2



This is a graph of consumption(C/Y or a_c), investment(I/Y or a_i), government spending(G/Y or a_g), and net imports & exports (NX/Y or a_{nx}).

Consumption and investment appear to be much more sensitive to change. They are much rougher than the other parameters. This is because they are affected more by changes in interest rates than other parameters. Net imports and exports appears to remain relatively constant across time. government spending seems to be declining but has started increasing around 2020. This could be due to COVID-19 relief programs.

These are the averages of each over time:

Averages		
C/Y	64%	a_c
I/Y	13%	a_i
G/Y	24%	a_g
NX/Y	-2%	a_{nx}

Each of these values represents how much of GDP is allocated to different economic parameters. According to the U.S. Bureau of Economic Analysis Consumption normally takes up around 65% to 70% of GDP. This data shows consumption is slightly lower than the norm. Historical FRED data suggests that investment is usually around 15% to 20%. Investing also appears to be lower. Government spending, according to the Congressional Budget Office should be around 17% to 23%. That lines up with our data. Net imports and exports are expected to be at a deficit of -3% to -5%. This data has significantly less of a deficit.

Differences in Quarterly and Yearly data 4.3

	Yearly	Quarterly	
C/Y	62	64	a_c
I/Y	13	14	a_i

The yearly and quarterly data show slightly different results. Quarterly is going to be more accurate because data is taken more frequently. There are more data points in the quarterly data than in the yearly data. However, they are fairly close to each other.

Since quarterly data is recorded more frequently, it will better reflect short term fluctuations in the market. While yearly data would better capture long run effects of the parameters.

Evaluating Assumptions 4.4

It is assumed that output (Y or GDP) is made up of Consumption, Government spending, Investment, and net imports & exports. This is the national income accounting identity.

$$Y = C + G + I + NX \quad (4)$$

To express these components as a percent of GDP we use.

$$a = a_c + a_g + a_I + a_{nx} \quad (5)$$

This leads us to the assumption we want to test with this data.

$$a = a_c + a_g + a_I + a_{nx} - 100 = 0 \quad (6)$$

The data doesn't perfectly follow this assumption. Plugging in the quarterly data into the formula gives us roughly 1. However, it seems close enough to suggest that the assumption has merit.

References

- [1] Jones, Charles I. *Macroeconomics*. 4th ed., W.W. Norton, 2018.
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