Econ 702
Spring, 2020
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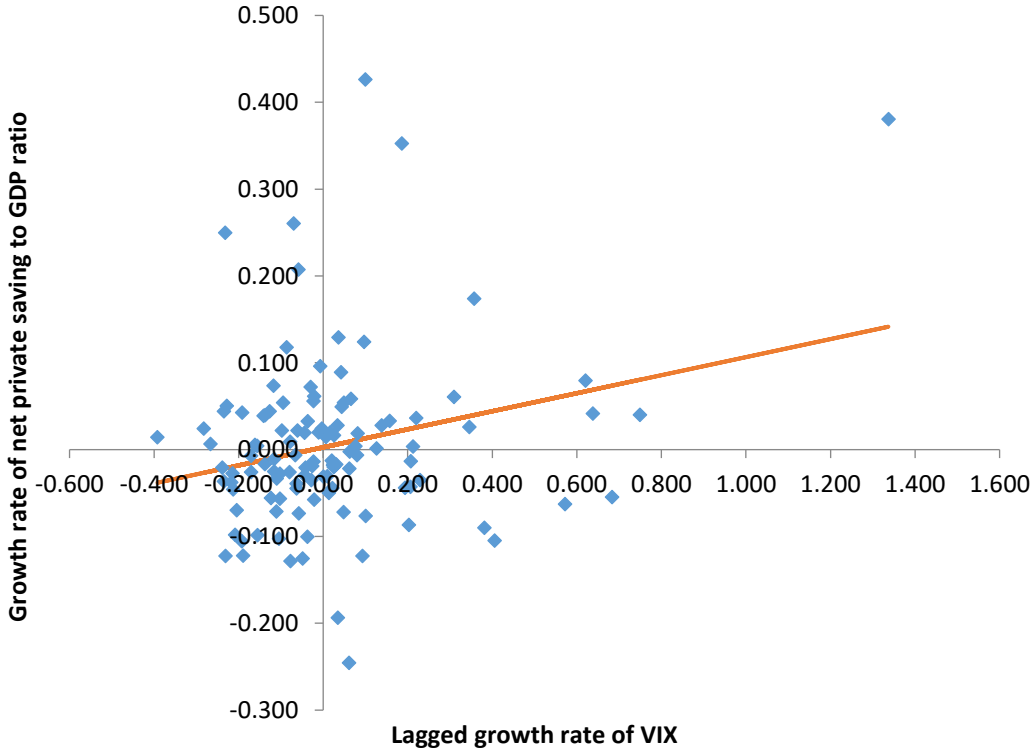
Answers to Homework 6

1. Here we want to investigate how people's savings behavior is affected by the change in uncertainty. The CBOE Volatility Index (VIX) is a popular measure for market's expectation about uncertainty. Download quarterly, seasonally adjusted data on net private saving, (nominal) Gross Domestic Product and CBOE Volatility Index: VIX of US for the period 1990Q1-2019Q2. All of these can be downloaded from FRED, the Federal Reserve Bank of St. Louis database: https://fred.stlouisfed.org/

    a. Generate the net private saving to GDP ratio by dividing net private saving by GDP. Then calculate the growth rate of the ratio ($\{(S/Y)_t - (S/Y)_{t-1}\}/(S/Y)_{t-1}$). Calculate the growth rate of one period lagged VIX index ($(VIX_{t-1} - VIX_{t-2})/VIX_{t-2}$). Create a scatter plot of lagged VIX growth rate on the horizontal axis and the growth rate of net private saving to GDP ratio on the vertical axis with a trendline. (Note: We use lagged VIX growth rate since it could take some time (a quarter) for people to adjust their savings behavior to the change in uncertainty.)

    Answers:
    The scatter plot of growth rate of net private savings to GDP against lagged growth rate of VIX



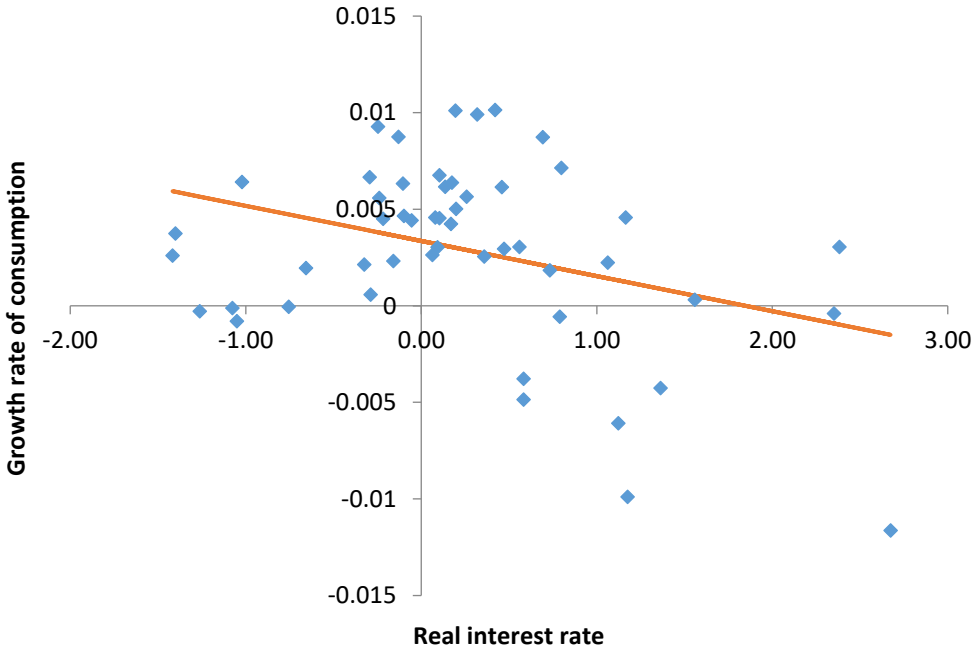
b. Run a regression of the growth rate of net private saving to GDP ratio on the growth rate of one period lagged VIX index. Report R-squared and coefficient estimate and t-statistic for the lagged VIX growth rate.

Answers:
R squared: 0.0626, coefficient estimate: 0.1038, t-statistic: 2.7717

2. Here we want to investigate whether people would lower their consumption when the interest rate increases on average, as suggested in the two period model learned in class. Download 5-Year Treasury Inflation-Indexed Security, Constant Maturity (this is a measure for the real interest rate) and real personal consumption expenditures per capita (Chained 2012 dollars) for the period 2007Q1-2019Q3. All of these can be downloaded from FRED, the Federal Reserve Bank of St. Louis database: https://fred.stlouisfed.org/

a. Calculate the growth rate of consumption per capita ($(C_t - C_{t-1})/C_{t-1}$). Create a scatter plot of Treasury interest rate on the horizontal axis and consumption growth rate on the vertical axis with a trendline.

Answers:
The scatter plot of growth rate of consumption against real interest rate



b. Run a regression of consumption growth rate on Treasury interest rate. Report R-squared and coefficient estimate and t-statistic for Treasury interest rate.

Answers:
R squared: 0.1190, coefficient estimate: -0.0018, t-statistic: -2.5734

3. Suppose we have the following linear consumption function and the invest demand function.

$$C_t = c_1(Y_t - G_t) + c_2(Y_{t+1} - G_{t+1}) - c_3 r_t$$
$$I_t = -d_1 r_t + d_2 A_{t+1} + d_3 K_t$$

Here c_1 through c_3 and d_1 through d_3 are fixed parameters governing the sensitivity of consumption and investment to different factors relevant for those decisions. The resource constraint is

$$Y_t = C_t + I_t + G_t$$

a. Take $(G_t, G_{t+1}, K_t, A_{t+1}, Y_{t+1})$ as exogenously given. Using the given consumption, investment function and the resource constraint, derive an algebraic expression for the *IS* curve. What is the expression for the slope of the *IS* curve $(\partial Y_t / \partial r_t)$?

Answers:
After plugging consumption and investment function into the resource constraint, one can substitute out C_t *and* I_t *to get*

$$Y_t = c_1(Y_t - G_t) + c_2(Y_{t+1} - G_{t+1}) - c_3 r_t - d_1 r_t + d_2 A_{t+1} + d_3 K_t + G_t$$

The IS curve is

$$Y_t = G_t - \frac{1}{1-c_1}(c_2 G_{t+1} - c_2 Y_{t+1} - d_2 A_{t+1} - d_3 K_t) - \frac{c_3 + d_1}{1-c_1} r_t$$

b. Suppose the parameters are as follows: $c_1 = 0.6$, $c_2 = 0.5$, $c_3 = 10$, $d_1 = 20$, $d_2 = 1$ and $d_3 = 0.5$. Suppose that $Y_{t+1} = 15$, $G_t = 10$, $G_{t+1} = 10$, $A_{t+1} = 5$ and $K_t = 15$. Suppose that $r_t = 0.02$. Calculate the value of Y_t.

Answers:
The IS curve for the given parameters and exogenous variables is

$$Y_t = 47.5 - 75 r_t$$

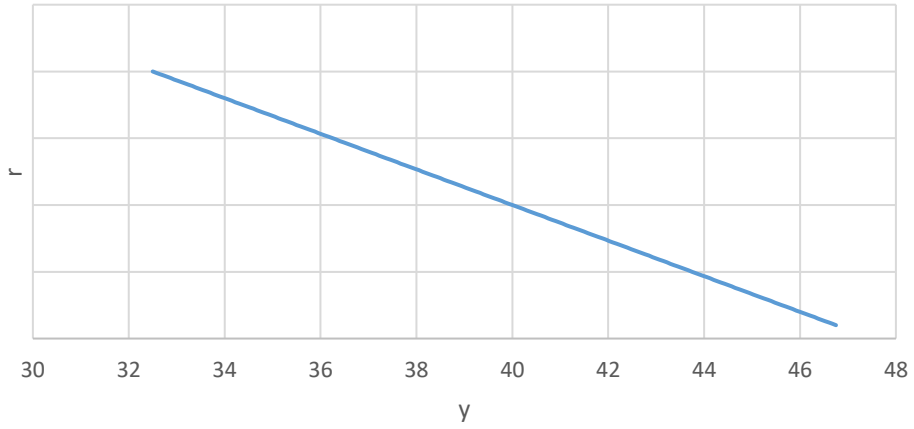
Given $r_t = 0.02$, $Y_t = 47.5 - 75 * 0.02 = 46$.

c. Create a range of values of r_t, ranging from 0.01 to 0.2, with a gap of 0.001 between

values. Then solve for Y_t for each value of r_t (You don't need to report every value of Y_t). Plot the *IS* curve with r_t on the vertical axis and Y_t on the horizontal axis.

Answers:

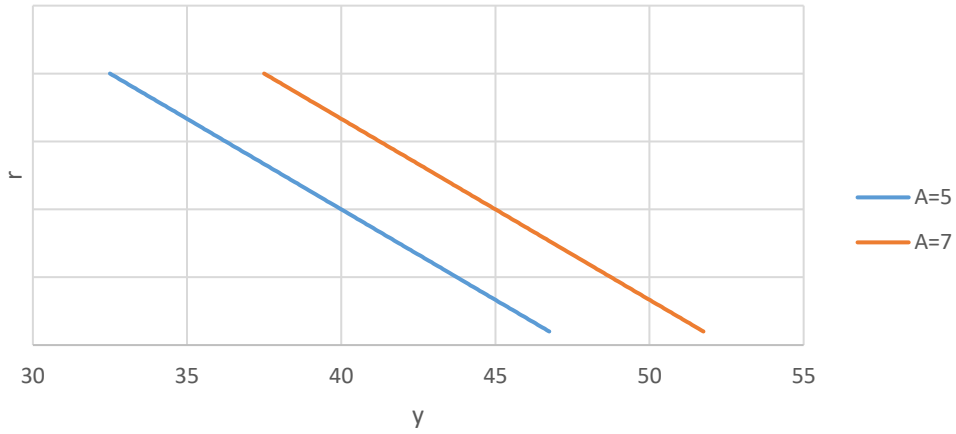
The IS curve



d. Create another version of your *IS* curve when $A_{t+1} = 7$ instead of 5. Plot this along with the original *IS* curve with $A_{t+1} = 5$. Discuss how the change of A_{t+1} affects on the location of *IS* curve.

Answers:
The IS curve when $A_{t+1} = 7$ *is*

$$Y_t = 52.5 - 75r_t$$



Higher A_{t+1} *shifts IS curve to the right (or upward).*