

## Macroeconomics Research Project IV

### Quantity Theory of Money and Applications

In this project, our task is threefold: 1) examine and compare major money stock measures; 2) investigate the relations among the variables in the quantity equation; 3) investigate the relation between money growth rate, inflation rate and the federal funds rate. Please follow the steps below and download relevant dataset first.

1. Review lecture slides and notes on macroeconomic measurements, inflation and monetary policy.
2. Access Federal Reserve Board data download program, download monetary base series  
<http://www.federalreserve.gov/datadownload/Build.aspx?rel=H3>
  - a. Select 1. “H.3 Aggregate Reserves of Depository Institutions and the Monetary Base”
  - b. Select 2. Reserves “MB Monetary Base”
  - c. Select 3. Reserves Detail “MB\_TOT, Total”
  - d. Select 4. Frequency “Monthly” and click “Add to package”
  - e. Click “Format package” and choose Dates from Dec. 1990 to Dec. 2020
  - f. Download either the file type CSV or Excel
3. Access Federal Reserve Board data download program, download M1 and M2 money stock series  
<http://www.federalreserve.gov/datadownload/Build.aspx?rel=H6>
  - a. Select 1. Data set “H6 M1 Money Stock Measure”
  - b. Select 2. Component “M1 monetary aggregate” and 3. Institution “TOT Total”
  - c. Select 4. “SA Seasonally adjusted” and 5. Frequency “Monthly”
  - d. “Add to package” and then click “Add more” to choose “H6 M2 Money Stock Measure”
  - e. Now you have M1 and M2 in the package; “Format package” and choose Dates from Dec 1990 to Dec 2020; Download either the file type CSV or Excel
4. Access Federal Reserve Board data download program, download the monthly Federal funds rate  
<https://www.federalreserve.gov/datadownload/Build.aspx?rel=H15>
  - a. Select 1. Data set “Selected Interest Rates” and 2. Instrument “FF Federal funds”
  - b. Select 3. Maturity “O Overnight” and 4. Frequency “Monthly” then add to package
  - c. Click “Format package” and choose Dates from Dec. 1990 to Dec. 2020
  - d. Download either the file type CSV or Excel
5. Retrieve the U.S. nominal GDP data and CPI inflation rate data for the period 1990 to 2020.
  - a. Access National Account Database <http://unstats.un.org/unsd/snaama/selCountry.asp>
  - b. Select Country: United States
  - c. Select Series: Gross Domestic Product (GDP)
  - d. Select Years: ALL 1990 - 2020
  - e. Submit selection and download the data in a spreadsheet

**I. Quantity Theory, Various Money Stock Measures, and the Money Multiplier**

1. Employ the data from step 2 and 3 and compare their similarities and differences.
  - a. What are the definitions of monetary base (MB), M1 and M2? Cite the sources clearly.
  - b. According to these definitions, which measure is the narrowest measure? Which is the broadest measure?
  - c. In spreadsheet, plot the time series of these three money stock measures in a graph for Dec. 1990 to Dec. 2020.
  - d. Comment on the time series patterns: the trend, volatility, break points, peaks and troughs.
  - e. Is there any clear relationship among these three money stock measures?
2. Employ the data from step 2 and 3 to calculate the money multiplier and velocity.
  - a. Based on the money supply model, M1 is a multiple of MB so is M2. Is the value of M1 or M2 always bigger than MB in the sample period? What happened after 2008?
  - b. Calculate the ratio of  $m1 = M1/MB$  and  $m2 = M2/MB$  for each month from Dec. 1990 to Dec. 2020 in the excel spreadsheet. Here suppose m1 is the M1 multiplier and m2 is the M2 multiplier.
  - c. In spreadsheet, plot the time series of m1 and m2 in one graph for the sample period examined.
  - d. What are the patterns observed (trend, volatility, cycle, etc.)? Any significant change since 2008?
  - e. What is the economic implication of the abrupt change in m1 and m2 since 2008? Any explanations?
3. Employ the data from step 3 and 5 to calculate the money transaction velocity from 1990 to 2020.
  - a. Based on the quantity theory of money ( $MV=PY$ ), which money stock measure should be the applicable in practice? Explain clearly. (Hint: check the definitions of MB, M1 and M2.)
  - b. Select the Dec. value of M1 from 1990 to 2020 and make an annual series of M1 in a new spreadsheet. In a column, next to annual M1, paste the nominal GDP series (from research project 1) for the same time horizon
  - c. In excel, calculate the money transaction velocity in each year from 1990 to 2020 by the formula  $V=PY/M$ .
  - d. Plot the time series V in one graph. Comment on the patterns (trend, volatility, cycle, etc.)
  - e. What is the economic meaning of V reflected by the graph? What happened to V since 2008?

**II. Money Growth Rate, Inflation Rate and the Federal Funds Rate**

4. Based on the quantity theory  $MV=PY$ , assuming a constant V, the inflation rate should equal the money growth rate less the real output growth rate. Employ the data from step 3 and 5 to analyze the relations among these variables.
  - a. Select the Dec. value of M1 from 1990 to 2020 and make an annual series of M1 in a new spreadsheet. Calculate its annual growth rates for 1990 to 2017 in another column.
  - b. Retrieve the U.S. nominal and real GDP data (1990 to 2020) in step 5, calculate the growth rate of them. Also calculate the inflation rate by GDP deflator method. (Or nominal GDP growth rate minus real rate.)

- c. Plot the time series of inflation rate and M1 growth rate for 1990 to 2020 period in one graph. Do the two series correlate with each other? Can M1 growth rate fully explain inflation rate?
  - d. Calculate the difference between M1 growth rate and real output growth rate. Plot in one graph the inflation rate and this rate difference. Do the two series correlate with each other? Can the rate difference fully explain the change in inflation rate? What is your conclusion on the validity of quantity theory for U.S. data?
5. Employ the data from step 2, 3 and 4 to analyze the relations between money growth rate and federal funds rate (FFR).
- a. In a spreadsheet, calculate the monthly growth rates for MB, M1 and M2 separately. All for the year 1990 to 2020.
  - b. Plot the time series for MB growth rate and the FFR. Is there any clear relation between the two?
  - c. Plot the time series for M1 growth rate and the FFR. Is there any clear relation between the two?
  - d. Plot the time series for M2 growth rate and the FFR. Is there any clear relation between the two?
  - e. Which money stock growth rate (MB, M1 or M2) has the strongest link with the change in FFR?
  - f. Is it always true that higher money growth rate will lead to lower interest rate based on the data examined?