

# Problem Set 1

ECON 40364: Monetary Theory and Policy

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**Instructions:** Please answer all questions to the best of your ability. You may consult with other members of the class, but each student is expected to turn in his or her own assignment. This problem set is due on August 26. You should write or type your answers and upload one pdf document on Sakai.

1. Suppose that an economy is comprised of five actors – two households, one non-financial firm, one commercial bank, and a central bank. This problem will give you balance sheet information on four of the five actors, and will ask you to infer the balance sheet of the fifth actor (one of the households). The two households (combined) own the non-financial firm and the commercial bank. This means that the total equity in non-financial firm and the bank is held in the form of stock by the two households. The central bank operates with zero equity. The balance sheets of the non-financial firm, the commercial bank, and the central bank are, respectively:

Non-Financial Firm			
Assets		Liabilities + Equity	
Plant + Equipment	\$200,000	Bank loan	\$100,000
Checking account	\$100,000	Corporate Debt	\$50,000
		Equity	\$150,000

Commercial Bank			
Assets		Liabilities + Equity	
Business Loan	\$100,000	Deposits	\$200,000
Mortgage Loans	\$130,000		
Reserves	\$50,000		
		Equity	\$80,000

Central Bank			
Assets		Liabilities + Equity	
Corporate Debt	\$50,000	Reserves	\$50,000
		Equity	\$0

There are two households in the economy – Brian and Kelly. Brian's balance sheet is:

Brian			
Assets		Liabilities + Equity	
Home	\$100,000	Mortgage Loan	\$80,000
Checking Account	\$50,000		
Stocks	\$75,000		
		Equity	\$145,000

Note that Brian's stock ownership could be both bank stock and stock in the non-financial firm, or just one or the other. For the purposes of this problem, it does not matter.

Now consider the second individual in the economy, Kelly. All you know about her balance sheet is that she lives in a home worth \$100,000. You will have to determine the rest of her balance sheet. We have:

Kelly			
Assets		Liabilities + Equity	
Home	\$100,000	Mortgage Loan	?
Currency	?		
Checking Account	?		
Stocks	?		
		Equity	?

- (a) Given available information, determine the missing values in Kelly's balance sheet.
  - (b) What is the total value of non-financial assets (physical capital) in this economy? Does this coincide with the total value of household equity summed across Bryan and Kelly?
  - (c) In what sense do the two households (combined) own the plant and equipment in possession of the non-financial firm? Explain briefly.
  - (d) What is the monetary base? What is the money supply (use  $M1$ , the sum of currency in circulation and deposits)? What is the ratio of the money supply to the monetary base? Does this coincide with the (general) formula for the money multiplier given in class (you do not need to know the split between required and excess reserves to answer this question)?
2. Suppose that there is an individual investor named Frank. Frank has \$1 million in a checking account with the Bank of South Bend and holds \$1 million in currency in his home. He has a mortgage with outstanding principal of \$200,000 that is owned by the Bank of South Bend. The value of the house is \$300,000. The bank faces a required reserve ratio of  $rr = 0.2$  and holds no excess reserves. It also holds \$1 million in government securities. Frank owns all of the equity in the bank via stock. In the background there is a central bank (the Fed, who creates currency and reserves) and a government (that issues government securities), but for the purposes of this problem we need not worry about these actors.
- (a) Use T-Accounts to show the initial balance sheets of Frank and the Bank of South Bend. Assuming that Frank is the only individual in the economy, and that the Bank of South Bend is the only bank, calculate the values of the monetary base, the money supply (currency plus deposits), and the money multiplier.

- (b) Suppose that the Fed sells \$1 million in securities to Frank, who pays for these securities with his cash. Show how this transaction affects the balance sheets of both Frank and the Bank of South Bend. What are the new values of the monetary base, the money supply, and the money multiplier?
  - (c) Continue with the setup in part (b). Suppose that now the Fed purchases \$0.2 million in securities from the Bank of South Bend. Show how this impacts the Bank of South Bend's balance sheet, assuming that no other transactions take place. Calculate the new values of the monetary base, the money supply, and the money multiplier.
  - (d) Now suppose that there is another actor, Benedict, who lives in South Bend and owns a home worth \$200,000. He has no other assets, holds no cash, and does not have a bank account. Use a T-Account to describe his balance sheet.
  - (e) Suppose that Frank and the Bank of South Bend's balance sheets are as you found in part (c). Frank decides that he wants to buy Benedict's home, and wants a no money down loan to do so. The Bank of South Bend loans him the needed \$200,000 and credits his checking account with this amount. Show Frank's and the Bank of South Bend's balance sheets change *before* the purchase takes place.
  - (f) Now suppose that Frank purchases the house from Benedict, writing Benedict a check for \$200,000. Benedict doesn't trust the banking system, and chooses to cash the check. Show how the balance sheets of Frank, Benedict, and the Bank of South Bend are affected.
  - (g) Calculate the values of the monetary base, the money supply, and the money multiplier given the balance sheets you found in part (f).
3. Go to the St. Louis Fed FRED website and look at weekly data on the currency component of M1 (available [here](#)). Produce a plot of total currency from September of 1999 through January of 2000. You can produce the figure either in Excel or directly on the FRED website. Aside from the upward trend, what jumps out at you from the figure? What historical event do you think can account for what we see in the figure? Briefly explain.
4. The quantity theory of money posits that money demand is a stable proportion of nominal GDP:

$$M_t = \kappa P_t Y_t$$

- (a) Take logs of this equation and then first differences (assuming that  $\kappa$  is in fact constant) to derive a relationship between money growth, inflation, and real output growth.
- (b) Go to the St. Louis Fed FRED website ([here](#)) and download annual data on M2. The underlying series is monthly; click on "edit graph" and change the frequency to "annual." The sample period should be from 1959 to 2016. Also download data on real GDP over the same period ([here](#)) and annualized inflation as measured by the GDP price deflator ([here](#)). After you create growth rates, your sample period should be 1960 to 2016. Use your expression from (a) to create a time series of implied inflation (equal to 100 times the expression from (a), since we want to express the data at an annualized percentage rate). Plot this along with the actual inflation series you download. What is the mean of each series? Are the means close? What is the correlation between the two series over the whole sample period? What is the correlation between the two series from 1960-1983? What about from 1984-2016? From this exercise, do you think that the quantity theory provides a good theory of money demand? Explain.