ECON 202 INTERMEDIATE MACROECONOMICS: MONEY LEC 27-28

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APRIL 2021

READINGS

i. Readings: Chapter 14 (pg 313-315 only), Chapter 21 from GLS (2020) and Lecture Slides.

ii. Optional Reading 1 (Non-Examinable): Ferguson, N. (2008). *The ascent of money: A financial history of the world*. Penguin.

iii. Optional Reading 2 (Non-Examinable): Eichengreen, B., Mehl, A., & Chitu, L. (2017). *How global currencies work*. Princeton University Press.

iv. Optional Reading 3 (Non-Examinable): Friedman, M., & Schwartz, A. J. (2008). *A monetary history of the United States, 1867-1960*. Princeton University Press.

OVERVIEW

i. History and Motivation

ii. Basic Concepts of Money and Money Measurement

iii. Stylized Facts about Money Supply

iv. Money Supply and Money Demand Function

v. Money, Price Level and Inflation

vi. Velocity of Money and the Quantity Equation

vii. Money Supply and Real Variables

viii. Monetary Policy

History of Money

i. In Ancient China, money in the form of cowrie shells, spades and knives made of bronze were in use as early as 1000 BC or before.

ii. Ancient Anatolia (6th to 7th Centruy BCE) is thought of be the birthplace of the first ancient coinage.

iii. First paper money: Around 11th century, again in China.

iv. In German POW camps after World War 2, prisoners started using cigarettes as a form of money.

v. Various other precious metals such as gold and silver have been used as money in history.

vi. Lots of other examples exist such as use of cows, beads, strings etc.

Lydian Coins from Ancient Anatolia

Figure: Lydian Coinage

WHAT IS MONEY?

i. Money is any asset that can be used in exchange for goods and services. Money can be physical or digital.

ii. Money serves three main functions
   ▶ Medium of Exchange: prevents use of barter, an inefficient alternative.
   ▶ Store of value: household can transfer resources across time (inflation?)
   ▶ Unit of account: money serves as the numeraire, or the thing which we price all other goods according to: common denomination facilitates trade.

iii. *Liquidity* refers to the ease with which an asset can be used for medium of exchange.

Fiat Money Versus Commodity Money

i. For many years commodities served as money: things like cows, cigarettes, and precious metals (e.g. gold and silver).

ii. In more recent times, we have moved toward Fiat Money. Fiat money consists of pieces of paper (or electronic entries on a computer) which have no intrinsic value.

iii. They just have value because a government declares that they will serve as money and everyone trusts that the money will serve as medium of exchange.

Fiat Money Versus Commodity Money

i. Commodity money has the following problems:
- ▶ Has value, independent of use as medium of exchange: can fluctuate due to demand/supply dynamics of commodity.
- ▶ Can be of limited use as store of value due to physical depreciation.
- ▶ Indivisibility hinders unit of account function.

ii. Fiat money does not suffer from the above problems but can be dangerous if people stop believing that it should be the medium of exchange and governments can simply print it at low cost to pay off debt, causing inflation.

How to Measure the Money Supply?

i.   Not that straightforward because there are many different assets such as currency, demand deposits, mutual funds etc which are denominated in currency units and serve the role of money.

ii. CC or currency in circulation is the most elementary definition of money.

iii. M_1 refers to CC and demand deposits. For instance, in 2016, there were 3.2 trillion US dollars in the form of M_1 in the US.

iv. $M_2 = M_1 +$ Money Market Mutual Funds $+$ Savings Deposits.

v. M_3 includes M_2 and institutional money market funds (money market funds not held by individual investors) and short term repurchase agreements.

Money Time Series for USA
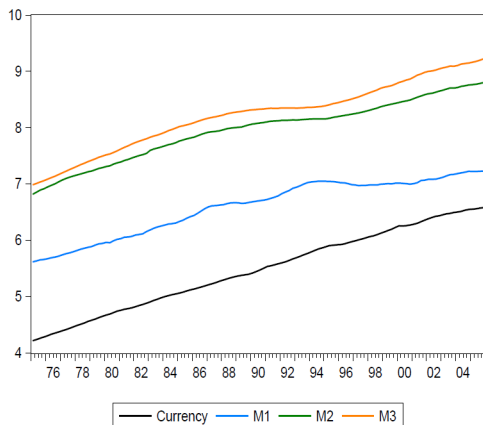
Who Sets the Money Supply?

i. Central banks can only directly control the MB_t (monetary base) not M_t (money supply), where $MB_t = CC_t + RE_t$ (currency in circulation and bank reserves).

ii. Fractional Reserve Banking in modern economies implies that reserve ratio is not 100% so that banks only hold a fraction of deposits as reserves and lend out the *excess reserves*.

iii. $M_t = mm_t MB_t$. mm_t is called the money multiplier which can only be indirectly influenced by central banks through the required reserve ratio policy.

iv. In a simple model in which banks lend out all the excess reserves and households do not withdraw deposits, $mm_t = \frac{1}{RR_t}$ where RR_t is the required reserve ratio.

Money Multiplier for US

Monetary Supply divided by Monetary Base
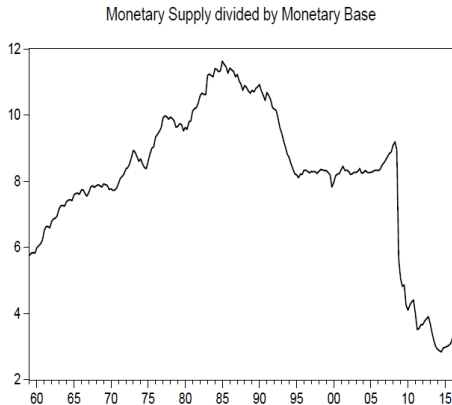
Money Demand Function

i. In many basic models, we treat M_t (money supply) as an exogenously fixed quantity that the central bank can set even though in reality the central bank can only set MB_t.

ii. Meanwhile, we often also assume an ad-hoc money demand function of form
$\frac{M_t}{P_t} = M^d(i_t, Y_t)$, where we assume that money demand is increasing in aggregate expenditure and decreasing in nominal interest rate.

iii. Assume that $M^d(i_t, Y_t) = \psi_t(i_t)^{-b}Y_t = \psi_t(r_t + \pi_{t+1}^e)^{-b}Y_t$, where we used the Fisher equation: $i_t = r_t + \pi_t^e$.

PRICE LEVEL AND INFLATION

i. In the neoclassical model, the classical dichotomy holds.

ii. Since Y_t and r_t are independent of nominal variables and given that π_t^e is also treated as exogenous, we know that changes in M_t will cause a proportionate change in P_t: Quantity Theory of Money.

iii. For inflation, take logs on both sides of money demand function to get: $\ln M_t - \ln P_t = \ln \psi_t - b_1 \ln i_t + \ln Y_t$

iv. Next, subtract the one period lagged money demand function from the equation above:
$\Delta \ln M_t = \Delta \ln P_t + \Delta \ln \psi_t - b_1 \Delta \ln i_t + \Delta \ln Y_t$

INFLATION

i. Consider $\Delta \ln M_t = \Delta \ln P_t + \Delta \ln \psi_t - b_1 \Delta \ln i_t + \Delta \ln Y_t$

ii. If we assume that ψ_t and i_t are roughly constant over time and use the fact that $\Delta \ln x_t \approx g_t^x$, we get: $\pi_t = g_t^M - g_t^Y$.

iii. According to the equation above, and the assumptions going into it, inflation is caused by excessive money growth relative to output growth.

iv. Over relatively long horizons, output growth is roughly constant (Kaldor facts), ψ_t is likely to be closer to constancy and so is i_t. Classical dichotomy is also more likely to hold in long run.

v. Thus, $Corr(\pi_t, g_t^M) >> 0$ at long horizons.

Correlation Between Smoothed Money Growth and Inflation
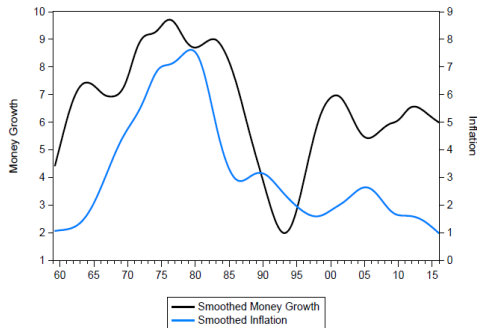
Velocity of Money

i. If we define $V_t^{-1} = \psi_t i_t^{-b}$, the money demand function becomes:
$\frac{M_t}{P_t} = V_t^{-1} Y_t$ which is equivalent to $M_t V_t = P_t Y_t$ which is known as the **quantity equation**.

ii. V_t (velocity of money) was roughly constant during 1960-1990, rose sharply in the 1990's and has been declining since then: Failure of Monetarism?

iii. What drives movements in velocity?: ψ_t (desire to hold money) and i_t (nominal interest rate).

Velocity of Money in US

Velocity of Money
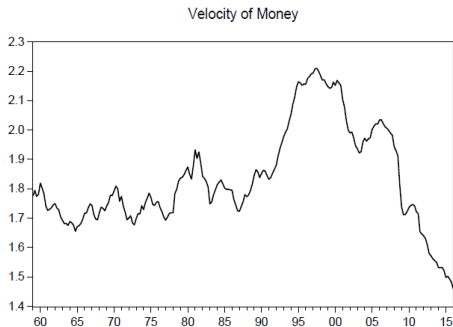
Money Supply and Real Variables

i. The basic neoclassical model makes the stark prediction that money is neutral with respect to real variables: changes in the quantity of money do not impact real GDP or other real variables.

ii. Correlation? Correlation does not imply causation. It could be that the central bank chooses to increase the money supply whenever real GDP increases, for example.

iii. Dynamic correlations? However, it could be that the Fed anticipates that output will be above trend in a year, and increases the money supply in the present in response.

M2 AND REAL GDP
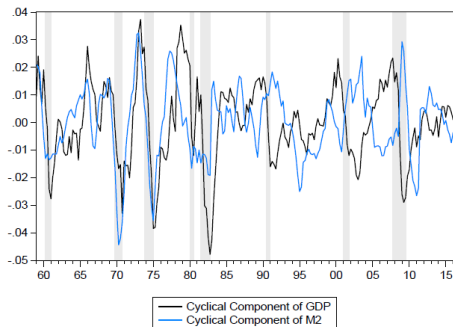
Money Supply and Real Variables

i. The fact that these correlations are larger when output is led several periods than the contemporaneous correlation seems to suggest that changes in the money supply do have some causal effect on real GDP.

ii. There are more sophisticated statistical techniques such as VAR's. Most of these studies find that changes in the money supply do impact real GDP in a positive manner.

iii. Friedman, M., & Schwartz, A. J. (2008). *A monetary history of the United States, 1867-1960*. Princeton University Press.

iv. Christiano and Eichenbaum (1999): benchmark evidence on interplay between monetary and real variables.

Dynamic Correlations Between M2 and Real GDP

Variable	Correlation with $\ln M_t$
$\ln Y_t$	0.22
$\ln Y_{t+1}$	0.32
$\ln Y_{t+2}$	0.37
$\ln Y_{t+3}$	0.37
$\ln Y_{t+4}$	0.33
$\ln Y_{t+5}$	0.26
$\ln Y_{t+6}$	0.19
$\ln Y_{t+7}$	0.10
$\ln Y_{t+8}$	0.03

Modern Monetary Policy

i. Central Bank is the lender of last resort.

ii. Open Market Operations is the standard policy tool to achieve monetary policy objectives.

iii. Reserve Ratio Requirement is another policy tool.

iv. Taylor Rule: $i_t = r^* + \phi_y(y_t - y^*) + \phi_\pi(\pi_t - \pi^*)$, $\phi_\pi > 1$ and $\phi_y \in (0, 1)$ are the standard policy coefficient values.

v. Philips Curve and the Inflation versus Output Trade off

Taylor Rule and Fed Policy

Figure: Correlation between Actual Policy and Taylor Rule

Modern Monetary Policy

i. Inflation Targeting.

ii. Central Bank Independence and Central Bank Conservatism.

iii. Importance of Expectation Management and Central Bank Communication.

iv. Unconventional Monetary Policy: QE and Macroprudential policy such as the BASEL agreements.

FED'S QE POLICY

The Composition of the Federal Reserve System Open Market Account Portfolio
(in trillions of dollars)
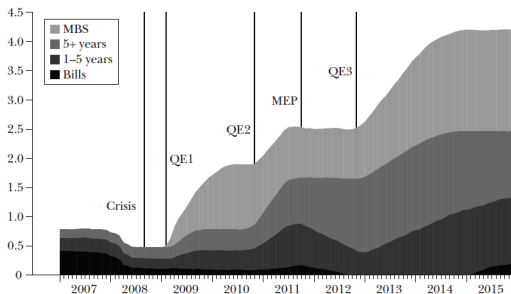
Note: Excludes assets associated with temporary liquidity facilities and US Treasury floating rate notes. "MBS" stands for mortgage-backed securities; "5+ years" stands for Treasuries with maturities of 5 or more years; "1–5 years" stands for Treasuries with maturities of 1–5 years. QE1, QE2, and QE3 are three quantitative easing programs. MEP is the Maturity Extension Program.

Thank you