Money

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The Government Budget Identity

The government at every level faces a budget constraint that must hold at each period, $t$:

$$G_t + TR_t + (1 + r_{t-1})B_{t-1} = T_t + B_t + \frac{M_t - M_{t-1}}{P_t}$$

where

- $G_t = \text{Government spending during period } t$
- $TR_t = \text{Transfer payments (e.g. social security) during period } t$
- $B_{t-1} = \text{Bonds that were issued last period } (t - 1) \text{ that are due this period } (t)$
- $B_t = \text{New bonds issued this period } (t)$
- $r_{t-1} = \text{The interest rate last period}$
- $M_t = \text{Stock of currency outstanding this period } (t)$
- $M_{t-1} = \text{Stock of currency outstanding last period } (t - 1)$
- $P_t = \text{Price level this period } (t) \text{ – relative price of money in terms of goods}$
Deficits, Surpluses, and Balanced Budgets

- The budget deficit that gets reported in the newspaper is $G_t + TR_t + r_{t-1}B_{t-1} - T_t$.
  - When this number is positive there is a budget deficit.
  - When this number is negative there is a budget surplus.
  - Currently this number is positive.
  - The balance budget amendment would require that this number be zero or negative.

- The net-of-interest deficit or primary deficit is $G_t + TR_t - T_t$.

- The total deficit tells the amount the government must borrow to cover all of its expenditures.

- The primary deficit tells if the government’s receipts are enough to cover its current purchases and transfers.

- The primary deficit ignores interest payments, because those are payment for past government spending.
• The debt is the total value of the government bonds outstanding, $B_t$.

• Return to government budget constraint:

$$G_t + TR_t + (1 + r_{t-1})B_{t-1} = T_t + B_t + \frac{M_t - M_{t-1}}{P_t}$$

So the deficit is:

$$G_t + TR_t + r_{t-1}B_{t-1} - T_t = B_t - B_{t-1} + \frac{M_t - M_{t-1}}{P_t}$$

• Congress and the President set $G_t$, $TR_t$, and $T_t$.

• The Fed decides the mix of $B_t$ and $M_t$.

• What is the Federal Reserve?

  – It’s a bank with one client: the Federal government. That makes it the central bank of the United States.
  
  – When the Federal government needs a loan, it goes to the Fed.

• Decisions about $G_t$, $TR_t$ and $T_t$ are called fiscal policy. Decision about $B_t$ and $M_t$ are called monetary policy.
Currency, Bonds, and Legal Restrictions

So what is the distinction between money and bonds?

- Bonds \((B_t)\) pay interest while currency \((M_t)\) does not. So why does anyone hold currency?

- One reason. Legal restrictions. The U.S. government makes it illegal to carry out transactions in anything but U.S. currency.

- Related issue – minimum denominations of government securities

<table>
<thead>
<tr>
<th>Government Liability</th>
<th>length of maturity</th>
<th>Minimum denomination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currency</td>
<td>0</td>
<td>one penny</td>
</tr>
<tr>
<td>Cash Management Bills</td>
<td>a couple of weeks</td>
<td>$100,000</td>
</tr>
<tr>
<td>Treasury Bills</td>
<td>3, 6, or 12 months</td>
<td>$10,000</td>
</tr>
<tr>
<td>Treasury Notes</td>
<td>2 to 10 years</td>
<td>$5,000</td>
</tr>
<tr>
<td>Treasury Bonds</td>
<td>more than 10 years</td>
<td>$1,000</td>
</tr>
</tbody>
</table>

Table 1: Maturity Structure and Minimum Denominations of U.S. Debt Instruments
Defining Money

- This is complicated.
- **Definition:** Asset. Something of value which lasts over time.
- Three properties most assets called “money” have.
  1. Medium of exchange
  2. Unit of account
  3. Store of value
- Many assets have these properties.
  - Government debt in the form of Federal Reserve Notes (green things in your wallet)
  - Food Stamps
  - cigarettes (POW camps)
  - Big Stones (The Island of Yap)
  - various pieces of paper which give the owner the option of demanding Federal Reserve Notes if they feel like it.
  - Stored value cards

Usually, but not always the case, that the unit of account is an asset commonly accepted in trade (or a “medium of exchange”).
What about other things which are also media of exchange such as various promises to deliver dollar bills?

- These can be considered close substitutes for dollar bills.
- We might even find it useful to lump them together with dollar bills when talking about quantities of “money.”
- We do this with many things (e.g. coffee, oil, ...).

**Monetary Aggregates**

- Monetary Base (MB): Federal Reserve Notes (Currency) and Bank Deposits at Fed.
- M1: Currency held by public + Traveler’s Checks + Demand Deposits (Checking Accounts which don’t bear interest) + Other Checkable deposits (Interest bearing checking accounts).
- M2: M1 + Savings Deposits + Certificates of Deposit (CD’s for the older set) + Money Market Mutual Funds + Other small stuff.
- M3, and L: Throw even more in.
Money Supply

- Quantity of Monetary Base \( (M_t) \) determined by Federal Reserve System.

- Open Market Operations

- Why are deposits of banks at the Fed the same as currency?
  - The Fed doesn’t actually have to print currency to count the same as currency in the monetary base. Deposits by banks at the Fed are exactly the same as printed notes.
  - All a Federal Reserve Note is in the first place is a promise from the Fed to give you a fresh new one if you want so there is no difference between the actual bill and a promise to deliver one upon demand.

- Quantity of other components of M1 are determined or regulated by the government.
  - Fed sets reserve requirements for banks, or how much currency a bank must either have in its vaults or on deposit at the Fed as a percentage of its deposits by the public.
  - If there is a $100 billion monetary base and a 10% reserve requirement, an upper bound on deposits is $1 trillion.
  - Money Market Mutual Funds are also regulated.

- In this class, we simply assume that money supply simply gets chosen by the government or central bank.
Money Demand

- If an asset is in existence, someone has to own it.

Why isn’t money demand zero?

- Answer: Because everyone expects this situation to continue. Even though the government limits people from carrying out transactions in other assets than “money”, ultimately there are limits to government’s ability to restrict trade in other assets.

- Example: Disintegrating money.
  Suppose we had a constant supply of dollar bills (the government couldn’t add or subtract from the total) and everyone knew that dollar bills were going to disintegrate at noon on Jan 1, 2005.
  Should anyone accept them on Dec. 31, 2004?
  Given this, should anyone accept them on Dec. 30, 2004?

- Twist on Example: Government support of money.
  Suppose that government agreed (well in advance) to exchange dollar bills for tax receipts on Dec. 31, 2004.
  Given this, should anyone accept them on Dec. 30, 2004?

- What is needed for money demand not to be zero are beliefs that someone will always be willing to accept the money in the future.
Fiat money vs. commodity money

- What we mean by fiat currency is that it is unbacked.
- Fiat currency is a relatively new thing.
- So money has been around for many centuries; but unbacked money has only been around for 35 years.
- In the past most money has been backed by either gold or silver. Usually gold.
- There is an inefficiency with commodity money. We dig up gold only to bury it. Like cigarettes in the POW camp.
- Gold versus Silver Remember William Jennings Bryant “Cross of Gold” speech.
- The Wizard of Oz
What determines the level of money demand?

- Answer: Asset portfolio allocation.

- People generally care about three things when deciding how to allocate their wealth among various assets.
  1. Expected return
  2. Risk
  3. Liquidity

- The expected return on money

  - The rate of return on money is 1 - the inflation rate.
  - What’s the opportunity cost of holding money? In other words, suppose you decide, on average, to keep $100 in your wallet. What are you giving up?
    1. real return you would have received by holding your wealth in some other form.
    2. devaluation of money in pocket due to inflation.
  - Alternatively, one can simply think of the cost in nominal terms.
    * If I keep $100 in my wallet, at the end of a year I have $100.
    * If I lend the $100 for one year, at the end of a year I have $100 \times (1 + i)$.
    * Cost (per dollar) of holding money equals $i$.
  - Makes sense since we know $i \approx r + \pi^e$. 
• **Risk**
  
  – Risk is the degree of uncertainty in an asset’s return.
  – People don’t like risk.
  – Currency is not a risk free asset. The Asian and Argentinean crises make this point.
  – The rate of inflation, devaluations are all uncertain.

• **Liquidity**
  
  – Liquidity is the ease and quickness with which an asset can be traded.
  – Assets like houses are very illiquid - hard to sell quickly.
  – NYSE – very liquid.
  – U.S. dollars are VERY liquid.
  – People tend to like liquidity.

• Money has a low rate of return, can at time be very risky, but is very liquid.
Macroeconomic factors that effect money demand

- Real Income (or real GDP) $Y$
- The price level
- Cost of Using Money Substitutes.
- Size of the Underground Economy
- Scope of acceptability of money.
The money demand function

- The demand function for nominal money balances:

\[ M^d = PL(Y, i) = PL(Y, r + \pi^e). \]

where

- \( M^d \) = nominal aggregate money demand
- \( P \) = price level
- \( L \) = real money demand function
- \( Y \) = real income or output
- \( i \) = nominal interest rate of non-monetary assets
- \( r \) = real interest rate of non-monetary assets
- \( \pi^e \) = expected inflation rate

- Nominal money demand is proportional to the price level.
- A rise \( Y \) increases money demand.
- A rise in \( i \) reduces money demand.
- Changes in the cost of money substitutes cause the money demand curve to shift.
• We can also talk about *real money balances*:

\[
\frac{M^d}{P} = L(Y, i)
\]

\[\therefore\]  
• Note that the function \( L \) expresses how much money the economy is willing to hold in terms of real \( L(Y, i) \) is how many “market baskets” worth of money the economy is willing to hold.

• This concept of “demand for real balances” is important. Remember it.
Some Facts about Currency Holdings


| Total currency in circulation | $177 billion |
| Currency held by households  | $23 billion  |
| Currency held by firms       | $5 billion   |
| "Missing Currency"           | $149 billion |

• So 84% of the outstanding currency is “missing”. Where is the missing currency?
  1. domestic illegal (underground) economy
  2. children under 18
  3. foreigners

• IRS study: underground economy is about $9 billion.

• Children under 18? Must be held by foreigners.
• Table 1. How do U.S. currency holdings compare to other industrialized nations?
• Germany, Japan, Switzerland have large per capita currency holdings.
• Note Iceland and New Zealand. Might assume their per capita currency holding of about $215 represent the *domestic* per capita currency holdings of all developed countries.
• Some back-of-the-envelop calculations:
  Total domestic currency demand
  \[ \frac{$215}{\text{person}} \times 786 \text{ million people} = $169 \text{ billion} \]
  Total foreign currency demand
  \[ $990 \text{ billion} - $169 \text{ billion} = $821 \text{ billion} \]
  So
  \[ \frac{$821 \text{ billion}}{$990 \text{ billion}} \times 100 = 83\% \]
  Pretty close to the 79% we estimated for the U.S.
• Table 2. How do people manage their currency?
Prices and Market Clearing

Let’s return to the general money demand function.

What determines the price level?

- Consider the equation

\[
\frac{M^d}{P} = L(Y, i).
\]

- Assume (for now)
  1. \( r \) is determined by the supply and demand for saving/investment.
  2. \( \pi^e \) is fixed.
  3. \( Y \) is fixed from \( Y = AF(K, N) \) where \( K \) was determined last period and \( N \) clears the labor market.

Imply demand for real balances \( L(Y, i) \) is fixed.
• The money market has to clear.
  
  – All the money in existence has to be willingly held by someone.
  
  – Implies something must happen so that nominal money demand equals nominal money supply

\[ M^s = M^d = PL(Y, i) \]

where \( M^s \) is the nominal Money Supply set by the government.

– By assumption, \( L(Y, i) \) and \( M_s \) are fixed.
– Implies \( P \) adjusts so that nominal money demand equals nominal money supply.
Velocity and the Quantity Theory of Money

- Velocity, $V$, measures how much money “turns over” each period.

$$V \equiv \frac{\text{Nominal GDP}}{\text{nominal money stock}} = \frac{PY}{M}.$$ 

- The way the quantity theory of money is usually written is:

$$M \times V = P \times Y$$

This is just from the definition of velocity.

- Book: Real money demand is proportional to real income. So

$$\frac{M^d}{P} = kY$$

Assumes constant velocity.
Money and Inflation

- Inflation is an increase in the price level. Recall we defined inflation as:

$$\pi = \frac{\Delta P}{P}$$

- A famous quote from Milton Friedman:

Inflation is always and everywhere a monetary phenomenon.

- In a world without frictions (think POW camp), doubling the money supply has no effect on output, it just doubles the price level. So

$$\pi = \frac{P_{t+1} - P_t}{P_t} = \frac{\Delta P}{P} = \frac{\Delta M}{M}$$

- Output does not change, velocity does not change. Quantity theory of money.

- Money had no effect on anything anybody cared about. In other words money is neutral.

- The classic dichotomy: money only changes the prices level.
Deficits and Inflation

- Recall the government budget constraint

\[ G_t + TR_t + (1 + r_{t-1})B_{t-1} = T_t + B_t + \frac{M_t - M_{t-1}}{P_t} \]

where

\[ G_t = \text{Government spending during period } t \]
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\[ P_t = \text{Price level this period } (t) \text{ – relative price of money in terms of goods} \]
• Set $TR$ to zero.

• We write the budget constraint in the following form

$$G_t + r_{t-1}B_{t-1} - T_t = B_t - B_{t-1} + \frac{M_t - M_{t-1}}{P_t}$$

• If set government borrowing to zero, we get

$$G_t - T_t = \frac{M_t - M_{t-1}}{P_t}$$

So this an all-currency economy.

• The revenue that a government raises by printing money is called *seignorage*. This is the inflation tax.
• So why do governments use money creation to finance deficits, knowing it will cause inflation?

  – Some people argue inflation is good for the economy in the short run.
  
  – In general, most developed countries rarely use seigniorage as primary source of revenue because it doesn’t raise much revenue.
  
  – But some countries are unable to raise taxes directly, so they must resort to inflation tax. Russia ...
Real seignorage and inflation

Lenin is said to have declared that the best way to destroy the capitalist system was to debauch its currency. By a continuing process of inflation, governments can confiscate, secretly and unobserved, an important wealth of their citizens.

John Maynard Keynes

- Consider our all-currency economy. No government debt.
- Assume real money demanded is constant. So in equilibrium the real money supply must be constant.
- If the velocity of money is fixed and output is fixed, then

\[ \pi = \frac{\Delta P}{P} = \frac{\Delta M}{M} \]

- Real seignorage revenue, R, is

\[ \frac{M_t - M_{t-1}}{P_t} \]

or in the book’s notation,

\[ \frac{\Delta M}{P} \]

- Since \( \pi = \frac{\Delta M}{M} \), real seignorage revenue is

\[ R = \pi \frac{M}{P} \]
• So seignorage is a tax at the rate of inflation on real money balances. That’s why it is called the inflation tax.

• The government collects revenue from the inflation tax when it buys goods with newly printed money.

• The inflation tax is paid by everyone who holds money.

• So Friedman’s really should have said,

    Inflation is always and everywhere a fiscal phenomenon.

• Since seignorage is a distortionary tax, as the government increases this tax, people will hold lower real balances.

• Whether seignorage rises or falls depends on whether inflation rises more or less than the decline in money holdings.