Intermediate Macroeconomics

9. Money Demand

Contents

Why do people hold money rather than other more lucrative financial assets like stocks and bonds? Money must provide a service or benefit that other financial assets do not. Theories of money demand are often called *liquidity preference* theories because they address the motives for holding money, which is the most liquid (spendable) of all financial assets. We review three different motives for holding money:

- Transactions motive
- Precautionary motive
- Speculative motive

The benefits of holding money in these models of money demand are compared with the cost of holding money. The benefits of holding money are specific to each motive. The cost of holding money is generally the same across all motives. The cost is an opportunity cost in terms of the interest or profits that could be earned from better paying but illiquid and riskier non-money investments.

The ***demand for money*** is the quantity of monetary assets (e.g., cash and checking account deposits) that people elect to hold. In the previous chapter on Money Supply we proposed that the equation for real money demand was of the form:

$$\frac{M}{P} = k \bullet Q - h \bullet i \qquad (1)$$

where,

M = nominal money supply
P = average price level
M / P = "real" money balances (i.e., purchasing power)
Q = quantity of goods and services desired
i = nominal interest rate earned by alternative non-money assets
k, h = coefficients

We briefly rationalized why money demand may be related to output, Q, and the nominal interest rate, i. In this chapter we take a more detailed look at the theories of money demand to see if and how they are consistent with this equation and what other variables play a role.

Finally, we will take a brief look at some of the empirical studies that quantify the historical relationships between money demand and output (more commonly income) and the interest rate.

1. Transactions Motive

The primary use of money is for transactions. People hold money as cash and in checkable deposits in order to facilitate the purchase of goods and services.

Transactions Demand for Money - people hold money as cash and in checkable deposits in order to facilitate the purchase of goods and services.

Money can be held as either liquid M1 money (cash or checkable deposits) or in non-money investment assets that pay a rate of return through interest or increases in value but cannot be used as a medium of exchange. The transactions motive assumes there are costs for converting liquid money assets to and from illiquid investment assets. The benefit of holding money is the avoidance of the transaction costs of converting cash to interest-bearing deposits and back to cash. The cost of holding money is the opportunity cost of not earning interest or profits on alternative investments.

Transaction costs can be cash costs such as the charge for using an automated teller machine (ATM) or a broker's fee for buying and selling stocks. Transaction costs can also be an opportunity cost such as the time it takes to go to a bank to withdraw money from a savings account. Your time is a valuable asset that could be used in other activities.

A. An Example

We can illustrate the transactions motive using a hypothetical consumer who receives income at regular intervals and spends it steadily between paydays. For example, consider someone who receives $1,000 at the beginning of every month. The pay is deposited directly into a bank savings account and our consumer can withdraw all or part of it on the first day. If the consumer only withdraws part of her salary she must make one or more future trips to the bank. Every trip to the bank (including the first) costs $1.

There are four important variables in our calculation:

1. Income - how much we get paid at the beginning of the month.
2. Interest rate - how much can we earn by leaving money in a savings account in the bank earning interest.
3. Number of trips to bank - how many trips we make to the bank every month determines how much we can leave in our savings account earning interest.
4. Transaction cost - how much does each trip to the bank cost?

Given these four variables we make these five calculations:

1. Average bank balance - determined by our income and the number of trips to the bank.
2. Average cash holdings - this is equivalent to "money demand" and is also calculated from income and number of trips to the bank.
3. Interest earned on savings - determined from the average bank balance and the interest rate
4. Transaction costs - simply the transaction cost per trip times the number of trips to the bank.
5. Net benefit - interest earned on savings minus the total transaction costs

Consider a simple calculation for just 1 trip to the bank every month for our hypothetical worker who gets $1,000

deposited directly into the bank at the beginning of every month. On the first day of the month withdraw all $1,000 cash leaving $0 on deposit. No interest is earned because no money is left in the bank earning interest. The average cash holdings equals $500 because you start the month with $1,000 cash and end the month with $0. The total transactions costs (cost of trips to the bank) is $1 because you only make one trip.

Now consider a sample calculation for 2 trips per month to bank:

- First day of month withdraw $500 cash, keep $500 on deposit earning interest.
- Middle-of-month (day 15) the initial $500 cash withdrawal has been spent (cash balance = 0). Withdraw the remaining $500 on deposit, leaving $0 bank balance.
- End-of-month (day 30) all income has been spent with a cash balance = 0, and a bank balance = 0.

The average cash holdings equals $250. On day 1 you have $500, which declines to $0 by the 15th, for an average of $250. Over the next 15 days you repeat this pattern, withdrawing $500 on the 15th and ending wit $0 at the end of the month. The average cash holding over both 15-day periods and the average for the entire month is $250. Note that the average cash holdings (i.e., money demand) is lower for the 2-trip case than the 1-trip case.

The average bank balance is $250 ($500 on deposit for 15 days and $0 on deposit for 15 days). The interest earned on the average $250 on deposit at 1 percent interest per month is $2.50.

The total transactions cost is $2, representing $1 for each of two trips to the bank.

The botton line is that when the interest rate is 1 perecent per month on bank deposits it pays to make two rather than just one trip to the bak every month. Average cash holdings (money demand) is lower. Hopefully you will see where this is going. As the interest rate rises it pays to make more trips to the bank thereby maintaining higher bank deposits. Average cash holding is lower, which implies money demand declines when the interest rates rises.

Table 1 calculates the interest earned on the average bank balance for 1, 2, 3, and 4 trips to the bank at three different monthly interest rates.

Table 1. Total Benefit

Number of trips to bank (transactions)	Average cash holdings	Average bank balance	Total Benefit: interest earned on average bank balance at monthly interest rate of		
			1 %	2 %	4 %
1	$500	$ 0	$ 0	$ 0	$ 0
2	250	250	2.50	5.00	10.00
3	167	333	3.33	6.66	13.32
4	125	375	3.75	7.50	15.00

Income = $1,000 per month paid at beginning of the month

Cash withdrawn from bank per trip = $\frac{\text{Total income}}{\text{Number of trips to bank}}$

Initial bank balance = Total income - Cash withdrawn from bank per trip
Average cash holdings = 0.5 • Cash withdrawn from bank per trip
Average bank balance = 0.5 • Initial bank balance
Total benefit = Nominal monthly interest rate • average bank balance

Table 1 presents the benefit of holding bank deposits earning interest. Offsetting this benefit are the transactions costs of making trips to the bank. Making two trips to the bank (day 1 and day 15) costs the consumer $2.00. The consumer realizes a net benefit of $0.50 ($2.50 interest earned minus $2.00 transactions cost). The question becomes can the consumer do better by making fewer or more trips to the bank.

In Table 2 the transactions costs are subtracted from the total benefit from table 1 to arrive at the net benefit. At

a 1% interest rate the optimal strategy for the consumer is to make 2 trips to the bank. At a 2% interest rate the optimal strategy is 3 trips to the bank. As the interest rate increases the optimal strategy is for the consumer to make more trips to the bank, which means smaller cash withdrawals and higher average bank deposits.

Table 2. Total Cost and Net Benefit

Number of trips to bank (transactions)	Total Cost = (number of trips to bank) x (cost per trip)	Net Benefit (Total Benefit - Total Cost) at monthly interest rate of		
		1 %	2 %	4 %
1	$ 1.00	- $1.00	- $ 1.00	- $ 1.00
2	$ 2.00	**+ 0.50**	+ 3.00	+ 8.00
3	$ 3.00	+ 0.33	**+ 3.66**	+ 10.32
4	$ 4.00	- 0.25	+ 3.50	**+ 11.00**
Optimum number of trips to bank		**2**	**3**	**4**

Cost per trip to bank = $1
Total cost = (number of trips to bank) • (cost per trip)
Net benefit = Total benefit (Table 1) - Total cost (Table 2)
Optimum number of trips corresponds to greatest net benefit

Money demand represents the consumer's average cash holdings. When the interest rate increases our consumer withdraws smaller sums (making more trips to the bank), implying a lower demand for money. As interest rates increase money demand declines.

B. The Baumol-Tobin Model

We can present our example above mathematically using the Baumol-Tobin model that was developed in the 1950s by William Baumol and James Tobin (Wlliam Baumol, "The Transactions Demand for Cash: An Inventory Theoretic Approach," *Quarterly Journal of Economics* (November 1952) 545-556; James Tobin, "The Interest Elasticity of the Transactions Demand for Cash," *Review of Economics and Statistics* (August 1956) 241-247).

The Baumol-Tobin model assumes that economic agents will attempt to minimize the cost of holding money. There are two costs: the opportunity cost of interest not earned on cash holdings plus transaction costs (the cost of trips to the bank):

$$\text{Total Cost} = \text{Foregone Interest} + \text{Cost of Trips} \qquad (2)$$

The foregone interest is interest that could have been earned on the average cash holdings. The average cash holdings for any number *N* trips to the bank is:

$$\text{Average Cash Holdings} = \tfrac{1}{2} \bullet Y / N \qquad (3)$$

where,

Y = income
N = number of transactions

The total interest that could have been earned on those average cash holding is $\frac{1}{2} \bullet i \bullet Y / N$. The cost of each trip to the bank is designated *tc* for transaction cost. The total transaction cost of *N* trips to the bank is $tc \bullet N$. Thus the total cost of holding money is given in equation (4).

$$C = \frac{i \bullet Y}{2 \bullet N} + tc \bullet N \qquad (4)$$

where,

C = total cost of holding money

i = nominal interest rate earned by alternative non-money assets
tc = transaction cost per N

The economic problem is to minimize the total cost of holding money. The choice variable is the number of transactions. Deriving the optimal number of transactions can be obtained by differentiating the total cost function with respect to N:

$$\frac{\partial C}{\partial N} = -\frac{i \cdot Y}{2 \cdot N^2} + tc \qquad (5)$$

The solution for the optimal number of transactions, N*, can be obtained by setting $\partial C/\partial N = 0$ as in equation (6) and then solving for N in equation (7).

$$0 = -\frac{i \cdot Y}{2 \cdot N^2} + tc \qquad (6)$$

$$N^* = \frac{(i \cdot Y)^{1/2}}{(2 \cdot tc)^{1/2}} \qquad (7)$$

Finally, the optimal solution for the number of transactions in Equation (7) can be substituted into the equation for the average cash holdings in equation (3) to arrive at the equation for nominal money demand shown in equation (8).

$$M^d = \frac{(Y \cdot tc)^{1/2}}{(2 \cdot i)^{1/2}} \qquad (8)$$

C. Implications of the Model

In general we find that the response of money demand under the transactions motive to changes in the interest rate and income are consistent with the money demand equation (1). The transactions model addresses the demand for M1 money that is used for transactions. The model does not represent M2 money demand, which includes interest-paying deposits on which there are costs or penalties for withdrawing (e,g, certificates of deposits charge a penalty of one month's interest).

Interest Rate

Our example in Tables 1 and 2 reveals that an increase in the interest rate on non-money assets reduces the demand for money. Less cash is withdrawn and more money is left in the bank earning interest as the interest rate increases. More trips to the bank are required but the increase in interest earned can be greater than the increase in transaction costs. Nominal money demand is a negative function of the nominal interest rate as we expected. When the interest rate rises the opportunity cost of holding money increases and we hold less money.

Nominal money demand is a negative function of the interest rate:

- As the interest rate increases make more trips to bank.
- Average bank balance increases.
- Average cash holding (nominal money demand) decreases.

Income

Our example in Tales 1 and 2 did not explicitly address an increase in income. You can work out the effect. Double the monthly income in the example from $1,000 to $2,000. The average cash holding and average bank balance will also double for a given number of trips to the bank. But the transaction costs do not change. Does the optimal number of trips change?

You will find that there are offsetting effects. The increase in average cash holdings when income increases (for a given number of trips to the bank) means that money demand increases. But the optimal number of trips to the

bank also increases, which means lower money demand. The net effect is that nominal money demand increases with income as we expected, but by a smaller percentage than the change in income.

Nominal money demand is a positive function of income:

- As income increases make more trips to bank.
- Both average bank balance and cash holding (nominal money demand) increase.

Transaction Costs

As the cost of going to the bank increases you make fewer trips. For example, increasing the transaction cost in our example in Tables 1 and 2 from $1 per trip to $2 reduces the optimal number of trips at 2% monthly interest from 3 down to 1. Fewer trips means you hold more cash. Holding more cash means higher nominal money demand. An increase in transaction costs leads to an increase in nominal money demand.

Nominal money demand is a positive function of transaction costs:

- As transaction costs increases make fewer trips to bank.
- Average bank balance declines.
- Average cash holding (nominal money demand) increases.

Elasticities

One of the most useful feature of the Baumol-Tobin square root formula in equation (8) is that it reveals the elasticity of money demand with respect to income, the elasticity of money demand with respect to transaction costs, and the elasticity of money demand with respect to the interest rate. The elasticity of money demand is the percent change in money demand that results from a 1% change in income, transaction costs, or the interest rate (when only one variable changes and the other two remain constant).

Elasticity of money demand with respect to ***X*** = percent change in money demand when there is a 1 percent change in ***X***, where ***X*** represents income, the interest rate, etc.

Taking the log of both sides of equation (8) we get the following:

$$\ln(M^d) = \tfrac{1}{2} \ln(Y) + \tfrac{1}{2} \ln(tc) - \tfrac{1}{2} \ln(i) \qquad (9)$$

Equation (9) implies the following money demand elasticities:

- Income = + ½
- Transaction costs = + ½
- Nominal interest rate = - ½

For example, a 1% increase in the nominal interest rate will lead to a ½% decrease in nominal money demand. Caution, if the interest rate goes from 4 percent to 5 percent then this is a 25 percent, not 1 percent, change in the interest rate from its original level (the change from 4% to 5% is a one *percentage point* increase).

Inflation

The model explains nominal money demand (M) rather than real money demand (M/P). What happens if we have inflation?

Assume a 1% increase in the average level of prices (i.e., inflation). One percent inflation implies that both income and transaction costs will also increase by 1%. Given the money demand elasticities derived from the model (+ ½ for income and + ½ for transaction costs) we get:

(a) 1% increase in income = ½% increase in nominal money demand

(b) 1% increase in transaction costs = ½% increase in nominal money demand

(a) + (b) = 1% increase in nominal money demand

Since both nominal money demand and the average level of prices increase by 1%, there is no change in real money demand. Real money demand is unaffected by general inflation. In other words, inflation does not change the optimal number of trips to the bank at a given interest rate.

2. Precautionary Motive

The transaction motive assumed regular income and a smooth flow of expenses. However, there can be significant uncertainty as to when income will be received or expenses incurred. The precautionary demand for money arises because people are uncertain about their ability to cover unexpected expenses.

Precautionary Demand for Money - people hold money as to meet unexpected expenses.

The benefit of holding money under the precautionary motive is being able to maximize utility by making all the transactions you can afford and are willing to make. Money shortages result in the lost opportunity to spend. It may be cab fare in a heavy rain or a one-time only sale. You may still be able to cover an unexpected large expense such as an auto accident or medical emergency by withdrawing illiquid non-money investments. However, the conversion of an investment to money entails expense such as the penalty for cashing in a certificate of deposit before it matures.

The cost of holding money for precautionary purposes is the same as under the transactions motive. Holding money prevents you from earning interest on other investments.

The precautionary motive has traditionally been ascribed to the demand for M1 money only. But precautionary funds are also held in M2 money such as savings, money market accounts, and certificates of deposit. Moreover, increasing real income and consumer credit may reduce the costs of liquidating non-money assets.

Again we find that the response of money demand under the precautionary motive to changes in the interest rate and income are consistent with the money demand equation (1).

Interest Rate

The interest rate primarily enters the precautionary motive through the opportunity cost of holding money. A higher interest rate on non-money investment assets reduces the incentive to hold money to cover unexpected expenses. Money demand is a negative function of interest rate as expected

Income

The precautionary motive does not directly address the effect of income on money demand. If we assume that larger unexpected expenses are associated with higher income then we should expect that precautionary money demand is a positive function of income as expected. The magnitude of the relationship in uncertain. For example, higher income may also lead to greater access to credit markets, which may reduce exposure to unexpected expenses.

Uncertainty Over Future Expenses (or Income)

The precautionary motive introduces uncertainty, which is not present in the transactions motive. The interesting implication is that money demand for precautionary purposes may increase during recessions. Greater uncertainty over future income may lead households to increase precautionary money balances.

Cost of Illiquidity

Finally, precautionary money demand increases when the cost of illiquidity increases. This one is a bit harder because it relates to the price and value of foregone opportunities. Suppose that unexpected emergency medical costs increase as you get older. This implies you will hold greater precautionary money balances as you get older. How this translates to measurable economic variables (other than perhaps income) is difficult to say.

3. Speculative Motive

The transaction and precautionary demands for money build on the medium-of-exchange function of money as it is used to make expected and unexpected transactions. The speculative motive considers money as a store of value. You have a wide choice of what financial assets in which to store your wealth. The asset could be cash, a checking account, stocks, bonds, real estate, and so on. The decision on how to allocate wealth among financial assets (called a *portfolio*) depends upon three characteristics of those financial assets:

- liquidity,
- expected return, and
- risk.

So far we have emphasized liquidity and expected return. Liquidity is important because money is needed to make expected and unexpected transactions. Expected return is important because it indicates the opportunity cost of holding money. The speculative motive takes a broader look at the choice among financial assets that provide a store of value. In particular, the speculative motive adds *risk* to the economic calculation

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Speculative Demand for Money - people hold money to reduce the risk of their overall portfolio of assets.

The alternative financial assets have different expected rates of return. The rate of return is the percentage increase in value over a given period of time. Cash has a zero rate of return. Cash doesn't mysteriously multiply in your pocket like hangars do in your closet. Savings accounts usually have a very low rate of return as measured by the savings interest rate. The rate of return on a stock or bond is the dividend or interest paid plus any increase in the stock's or bond's price.

Normally an investor would select those assets that pay the highest rate of return. However, the uncertainty over expected rates of return varies significantly. We can be certain that cash will pay a zero rate of return and a 12-month bank certificate of deposit will return the currently published interest rate. We can't be that certain when it comes to stocks or even bonds. Analysts may predict that a stock will increase 10 percent in value over the next year but the return may be greater or less, and possibly even become worthless if the company goes bankrupt. An asset is a high risk asset when the probability that the actual return could be very different from the expected return is high. Investing in the stock of a startup company is generally riskier than buying stock in one of the large blue chip companies. Bonds are safer than stocks with respect to exposure to default because of a company failure (bondholders get paid before stockholders). But bonds are exposed to possibly significant price fluctuations when interest rates change.

The speculative motive only explains the demand for M2 money rather than M1 money. The speculative motive does not explain why someone would hold cash or a checking account (M1) rather than an equally safe interest-bearing savings account or certificate of deposit (M2).

A. Keynesian Money Demand

John Maynard Keynes introduced the speculative motive for holding money (*The General Theory of Employment, Interest, and Money*, chapter 15, 1936). Keynes observed that the transaction and precautionary motives are mainly influenced by income and changes in the expected return on other financial assets has little effect (we will explain this in more detail in the following section on Empirical Results). It is through the speculative motive that monetary authorities (e.g., the Federal Reserve) can "in normal circumstances" influence

the economy.

The Keynesian speculative motive focuses on uncertainty over the future course of the interest rate. The speculative demand for money rises from expectations that interest rates will rise in the future. For example, consider a 10-year T-bill that returns 4% interest per year. This T-bill pays out $1,000 10 years from now and can be purchased for $676 today (based on compounded annual interest). Compare that with a 10-year T-bill at 5% interest, which could be purchased for $614. As interest rates increase the price of a T-bill declines. Why would you pay $676 today for a 10-year T-bill when you can wait until interest rates rise and purchase it for a lower price? Those who expect the interest rate to rise will hold onto money and wait to transfer it to T-bills (or other securities or financial assets).

Keynes the argued that as the interest rate falls a growing proportion of people holding wealth expect it to rise in the future rather than remain steady or continue to fall. Consequently, as interest rates fall a larger share of wealth is put into money rather than securities. Under normal circumstances money demand is inversely proportional to the interest rate.

But Keynes wasn't that interested in normal circumstances. Keynes wrote his book in the midst of the Great Depression and he was not confident that increasing money supply would have any positive effect on the economy. He suggested "circumstances can develop in which even a large increase in the quantity of money may exert a comparatively small influence on the rate of interest." If interest rates fall low enough then everyone may expect rates to rise in the future and prefer to hold money rather than securities. This is Keynes' ***liquidity trap***. The interest rate can be low enough that any further increases in money supply will have no effect on the interest rate.

B. Capital Asset Pricing Model

The modern treatment of the speculative motive was first developed by James Tobin ("Liquidity Preference as Behavior Towards Risk," *Review of Economic Studies* 25 (February 1958) 65-86) and is commonly called the Capital Asset Pricing Model.

Tobin criticized the Keynesian speculative motive because it implied that an individual investor will hold all wealth in excess of that needed to satisfy the transaction and precautionary motives in either money or non-money financial assets but not both. Increases in aggregate money demand arise when interest rates decline because individuals shift their wealth into money at different rates of interest. For example, when the interest rate drops to 4.5% I may move all my wealth into money. The interest rate trigger point for you may be 4%. At some low interest rate everyone has shifted their all of their wealth into money.

The Capital Asset Pricing Model assumes that people are risk averse. The best investment strategy is to diversify your portfolio of assets. Don't put all your eggs in one basket. You should hold some safe asset (e.g., a savings account or certificate of deposit) with a low rate of return and some riskier assets with higher expected rates of return. The benefit of holding money is the reduction of risk. The cost of holding money is the foregone higher expected rate of return.

Under the Capital Asset Pricing Model money demand may increase not only because of expectation of future changes in interest rates but also because as interest rates decline there is less incentive to hold your wealth in risky assets. The riskiest assets may be dropped first. As interest rates decline further other risky assets may be converted to money. The individual is no longer presumed to make an all or nothing decision.

In general we can say money demand under the Capital Asset Pricing Model increases with:

- Increase in the interest rate of the safe M2 money assets (e.g., money in savings accounts, certificates of deposit, and money market funds).
- Decline in the expected return on risky non-money assets (e.g., stocks and bonds).
- Increase in riskiness of non-money assets.

4. Empirical Results

The empirical method determines the relationships between economic variables through observation or experiment. The Baumol-Tobin model provides the foundation for most empirical studies of money demand. The Capital Asset Pricing Model, while important in financial economics, is viewed to be much less important in determining money demand. Most wealth is shifted under the speculative motive from long-term to short-term securities rather than money. The prices of short-term bonds do not change as much as long-term bonds and there is a default risk with money because of the limit to federal insurance on deposits.

The Baumol-Tobin model (equation 8) implies that the elasticities of money demand with respect to income and the interest rate are exactly ½ and - ½, respectively. The empirical studies start with a functional form for money demand implied by the Baumol-Tobin model (modified using a partial adjustment inventory model) and econometrically estimate the elasticities using historical macroeconomic data.

One of the difficulties in empirical work on money demand is that money demand adjusts to changes in income and interest rates with a lag. In other words, a change in income leads to a delayed change in money demand. Money demand may be slow to change because of adjustment costs, expectations may be slow to adjust, or expectations may hold that a change in income or interest rates is in part temporary. Consequently, empirical studies of money demand look at both short-term and long-term responses to changes in macroeconomic conditions.

A. M1 Elasticities

Table 3 reports some published short-run and long-run M1 money demand elasticities. The estimated elasticity of M1 money demand with respect to income is + ½ in the long-run, consistent with the Baumol-Tobin model. The elasticity is smaller in the short-run implying a lagged response as just discussed.

An increase in the interest rate reduces the demand for M1 money as expected, but the effect is small. An increase in the interest rate from 4 to 5 percent (a 25 percent increase) reduces money demand in the short run by 0.5 percent (= - 0.02 x 25%). The long run response is about a 1.25 percent reduction in money demand. An increase in the interest rate from 10 to 11 percent (a 10 percent change) produces even smaller money demand responses.

Table 3. Elasticities of Real M1 Money Demand

	Short run	Long run
Real Income	0.2	0.5
Interest Rate on Time Deposits	- 0.02	- 0.05

Sources: R. W. Hafer, "Monetary Stabilization Policy: Evidence from Money Demand Forecasts," Federal Reserve Bank of St. Louis, May 1985 (http://research.stlouisfed.org/publications/review/85/05/Monetary_May1985.pdf); Laurence Ball, "Another Look at Long-Run Money Demand," NBER Working Paper Series, No. w6597, June 1998 (http://www.nber.org/papers/w6597)

One explanation for the small interest elasticity of money demand is that behavior may be constrained. For example, in Tables 1 and 2 we used monthly interest rates of from 1 to 4 percent, which translate to annual interest rates of 13 to 60 percent (assuming monthly rates are compounded). These interest rates are obviously beyond the normal range in the U.S. With more normal interest rates on savings of only a few percent per year, the optimal number of trips to the bank may be 1, and remain 1 even as interest rates change. Our hypothetical worker withdraws her entire paycheck on day 1 (or more likely puts it all in her checking account). This implies money demand is insensitive to changes in the interest rate and the interest elasticity of money demand may be closer to 0 than - ½. The income elasticity of money demand, however, would be unaffected by this constraint to behavior. Average cash holdings (money demand) remains ½ of total income.

An additional empirical finding is that the nominal M1 money demand increases proportionally to the price level. A doubling of the average level of prices accompanies a doubling of nominal money balances. This implies that the demand for money is the demand for real money balances or purchasing power as we have suggested.

B. M2 Elasticities

Estimated elasticities of M2 money demand are different. In particular, the long-run income elasticity of money demand is usually close to 1.0. This would be consistent with the quantity theory of money and a constant velocity of money (discussed in the previous chapter on Money Supply). Nominal money demand is directly proportional to GNP (or real money demand is directly proportional to real output).

It is harder to directly compare the interest rate elasticity of M2 money demand with that of M1 money demand. M2 money accounts earn interest while M1-only accounts typically do not. Remember the M2 includes all M1 money. Moving money from your checking account to a money market account to earn interest represents a reduction in the M1 but no change in the M2. An increase in the interest rate may result in a lower M1 money demand but leave M2 money demand unchanged. When estimating M2 elasticities it is necessary to include two interest rates - the interest paid on M2 deposits (e.g., savings, certificates of deposit, or money market funds) and the rate of return on non-money assets such as stocks and bonds (usually the interest rate on commercial paper, which is a type of bond issued by banks and large corporations).

C. Discussions at the FOMC

The following are excerpts from a meeting of the Federal Open Market Committee of the Federal Reserve System held on February 1 and 2, chaired by Paul Volker. The full transcript of the meeting is available on the Federal Reserve web site at http://www.federalreserve.gov/FOMC/transcripts/1982/820202Meeting.pdf.

At this time of this meeting the economy was in the midst of a recession. Real GDP during the first quarter 1982 had declined by 2.9 percent from the 3rd quarter 1981, with most of the decline occurring in investment while consumption and government spending were flat. The Federal Reserve was still fighting inflation, which had peaked at 13.5 percent per year in 1980, declining to 10.3 percent in 1981 and 6.2 perecent in 1982.

This discussion not only reveals the uncertainties regarding money demand elasticities but also the changing structure of the money and asset markets and the shifting sentiment to monitoring the M2 from the M1. If you find yourself confused by some of the discussion you are not alone. Even Chairman Volker had problems following some of the arguments.

Chairman Volcker. We had a discussion of long-range targets at the last meeting. I guess it's appropriate now to ask whether anybody has changed his or her mind or wants to make further observations on that point.

Mr. Balles. Well, Mr. Chairman, I have had a few second thoughts since both our July 1981 meeting and also our preliminary discussion of this in December. And at the risk of being a troublemaker. I do feel fairly strongly that we ought to bite the bullet on the inconsistencies among the M1, M2, and M3 ranges. Specifically by increasing the M2 [growth rate] range by a full percentage point over what it was last year and the M3 range by a point and a half.

Chairman Volcker. You don't want to do anything about Ml?

Mr. Balles. Yes. I'm suggesting, for reasons set forth in this very brief memo, that we ought to increase the lower end of the M2. The reason is that as I looked back to last July, we hadn't known about the weakness now emerging in the economy. We had expected - I think more than we do now - the prospect of a further downward shift in the demand for money and that downward shift seems to have slowed pretty considerably. Given the fact that we now are in a fairly serious recession that we hadn't really anticipated in July, and given the fact that the demand for money is no longer shifting downward as much - and maybe not at all - as compared to last summer, and given the fact that a 2-1/2 percent lower band would seem pretty Draconian right in the middle of a recession in terms of public announcement effects. I believe we would be better advised to use a 3 to 5-1/2 percent range. And this would continue some credibility in our longer-run anti-inflation approach of gradually cranking down the growth ranges every year. The composition of the M2 and M3 aggregates, in terms of the portion that is sensitive to interest rates, has really changed dramatically, as we all know. My staff calculates that as recently as the end of 1978 assets yielding money market rates of interest comprised only 8 percent of M2 and that that's up to 45 percent now. I personally consider the likelihood of strong inflows into these interest-sensitive broader aggregates to be great in a year when there's a good prospect, as we've heard from the staff

today, that interest rates are going to continue at pretty high levels throughout the year. I'd just hate to get in the middle of the year and then-

Chairman Volcker. I'm not sure I understand the reasoning here. Let me explore it. You say there is a lot more interest-sensitive money; that is certainly true. Why do you expect that to be more pronounced in terms of influence this year than last year?

Mr. Balles. I don't necessarily think it will be more pronounced, Paul. But I don't think it could be diminished any in terms of rates of increase in these aggregates. Some of us brought this point up at the meeting the last time. If the staff forecast is correct. as I understand it, it implies a continuation of pretty high interest rates throughout 1982. And that's why I would just-

Chairman Volcker. Yes. But what do you expect could happen? If interest rates come down, what would happen to M2 all else equal? Or if they went up. what would happen to M2, all other things equal? Why is there a presumption one way or the other?

Mr. Balles. The presumption is that M2 and M3 in the future will continue to be more sensitive to interest rates than they were under the old definition.

Chairman Volcker. That means that M2 will go down if interest rates go down.

Mr. Balles. Yes. the growth rate would go down.

Chairman Volcker. Why? What's the mechanism?

Mr. Balles. Well, it's simply the huge proportion that is interest sensitive.

Chairman Volcker. Yes, but where else are people going to put their money?

Mr. Balles. Well. there are some things that aren't in either M2 or M3 such as Treasury securities.

Chairman Volcker. But what if those rates go down just like the certificate rates go down? Now, if people put funds in long-term securities, that will make a difference. But I-

Ms. Teeters. They could move them out just for [unintelligible].

Chairman Volcker. But that's also in M2.

Mr. Black. One can make a clear case if you think about rising rates back when we had ceilings on some of those items in M2

Chairman Volcker. I know what happened when there were ceilings on them, but the point is made that there aren't ceilings. I don't know what will happen now.

Mr. Black. Well, it clearly slowed down then and there are no ceilings now. so-

Chairman Volcker. There is no question that when we had ceilings, [M2 growth] slowed when rates rose and increased when rates fell. It's not clear to me why it would do the opposite now.

Vice Chairman Soloman. We did not find when we analyzed M2 into those components that pay market rates and those that are below market rates-and we analyzed the movements in these two [components]-that we could arrive at any better correlation.

Chairman Volcker. I don't know what the answer to this question is. We have had 3 years since the market rate issue became important and in all of those 3 years the velocity change in M2 has been very close to zero. That's

not a long enough period of time to conclude too much on that, but the evidence that we have since that time is zero [velocity change].

Vice Chairman Soloman. And last year [M2 growth] was 9 percent, virtually the same. Nominal GNP was also up in a range of about 9.4 or 9.3 percent, as compared to M2. And I noticed that everybody's projections were in the 8 to 9 percent range for nominal GNP. If that's one to two percent real growth, plus about 7 percent inflation. then one would think that we would come comfortably within the tentative M2 targets.

Chairman Volcker. Well. can the staff help here? Is there any evidence that they know about that says what the interest sensitivity on M2 is now?

Mr. Axilrod. Well, it's getting much less sensitive to market rates. So, we wouldn't think it's going to be as volatile as those rates change. The conclusion we came to in evaluating this was that with more and more instruments in M2 having market rates. for any given reserve target aimed at we'd get more rate movement in holding money growth and prompter income movements. so to speak. That is, you hold if there's a money demand of so much-

Chairman Volcker. You're losing me.

Mr. Axilrod. There is a money demand of so much. Market rates tend to rise. In the old days people would shift out of M2-type instruments into market instruments. Now, instead of that happening, the institutions mark up the offering rates so people don't shift out. So, if you insist on holding [M2 growth down]. then interest rates rise even more on both instruments until income falls back to where you're producing only enough savings to be consistent with your monetary targets.

Chairman Volcker. What are you saying: that M2 is just going to reflect nominal GNP. period?

Mr. Axilrod. In the limit, not totally

Chairman Volcker. But just to state the converse of that, would you or would you not make a presumption other than through the effect of interest rates on GNP that the interest rate level itself is going to affect M2?

Mr. Axilrod. Well. I don't think the institutions will move their rates quite as fast as the market rates. So, I think it would have some effect.

Ms. Teeters. But it will have an effect of making M1 and M2 diverge?

Chairman Volcker. Reducing it

Mr. Ford. When the rates rise.

Ms. Teeters. When the [market] rates rise over and above the statutory ceilings.

Mr. Ford. When they drop, you would expect them to converge, wouldn't you because of this other phenomenon?

Ms. Teeters. Not at the level the NOWs are at.

Mr. Prell. Mr. Chairman, I think Steve has addressed the question. 'If you're trying to control M2, what would happen?' To focus on the simpler question - the interest elasticity of M2 - the work we've done indicates that it still has a negative elasticity of a minor dimension. When interest rates fall. it grows a little faster. The redefinition, taking out the institutional money market funds. should probably make it even less interest elastic because the lag in the money fund yields stimulated this kind of shifting of funds by institutions into M2 and out of M2. So. we say there's a very small negative elasticity on it.

Chairman Volcker. All right, now you're saying there is a very small negative elasticity; as near as we can say it's declining. If I understand this correctly, that's the opposite of the presumption that Mr. Balles is making.

Mr. Prell. That's right.

Mr. Balles. Well, I'd like to ask you. Mike, you are taking out the institution only money market funds hut aren't you putting in the retail RPs? What about their elasticities?

Mr. Prell. Well, as for the retail RPs. once again they carry a current market yield. So. there are unlikely to be substitutions-a great shifting of funds from outside of M2 into M2 when interest rates change. Our supposition at least has been that most of the money in retail RPs has been diverted from small time deposits. Indeed, that's one of the rationales for putting retail RPs into M2: they are a close substitute for those things that already were in M2.

Mr. Balles. Coming back just for a minute to the facts, we do know for a fact that M3 grew by 11.4 percent last year.

Chairman Volcker. M3. I think, is a different animal. That shows you how fast bank credit is going up and how much financing is being pushed into banks, as one influence anyway. The more financing that is pushed into the banks, the higher M3 will be. If we didn't expect much bond financing, we'd expect high M3 growth.

Mr. Axilrod. Mr. Chairman, it's very difficult to isolate the structural changes as they're occurring now, operating with an instrument that pretty much has market rates in it. For example, I would not argue that M1 was weak last year because in a sense M2 was strong. There was a partial element of that but there was a downward shift in the demand for M1, where people were taking money out of currency and demand deposits and putting it into a lot of other assets, some of which were in M2. But that was a substitution that didn't affect M2 itself. So actually, on the level of M1, the downward adjustment in M1 that occurred was a structural change that was evolving. When we get away from that structural change, it's quite possible that M1 and M2 will move closer together as we are projecting that they will this year. We really have a slower growth in the nontransactions component of M2 this year than last year, largely because income is growing more slowly and we expect M1 to grow a little more normally in relation to income than it did last year. With that combination we still would have M2 slowing in this coming year. We don't have a reason to think the nontransactions component of M2 will grow substantially faster in 1982 than it did in 1981 with a sharp slowing in income in prospect, regardless of the interest rates that they're offering on those [deposits].

Mr. Corrigan. Is that another way of saying. Steve, that you view the midpoints of the tentative ranges for M1 and M2 for '82 as consistent with each other in a structural sense?

Mr. Axilrod. Yes. We have growth a little above the midpoint for M2 but. rather than put our neck out on the line. I think the safer way to put it is that it's a lot more consistent than it was last year.

Mr. Corrigan. May I ask one other definitional question? saw the comment in the Bluebook about retail repos. Has a decision been made to take the IRAs out of M2?

Mr. Axilrod. No. We are just going to be getting the first complete data at the end of February. We may not make [the decision]then.

Mr. Corrigan. What about the ones that are already there?

Mr. Axilrod. Well. we haven't done anything about the IRAs in M2. We're waiting to see what we're dealing with. I

Chairman Volcker. Just one more point on M2. I don't know how strong a case one can make in practice because I don't know how much of this is mostly individual money and how much of that would go long term. But if you have a shift in preference toward longer-term securities. then I would think M2 would be depressed somewhat or vice versa.

Mr. Axilrod. [From] the money market funds they can go into bonds.

Chairman Volcker. And if people really went out and bought bonds-- but not many individuals buy bonds anyway. I don't know how much else is in there that's not--

Mr. Prell. The more attractive time deposit instruments that have been created will tend to limit that effect [on M2] in any event.

Mr. Gramley. Unless we're awfully lucky. I'm afraid those growth rates are not going to permit the economy anything like the kind of progress this year that the staff is projecting. We need to think seriously about doing something that will give the economy some breathing room. Also, I think this year we ought to start out giving more weight to M2 than we have. We ought to express that publicly so that the focus of attention is not all on M1 as it has tended to be recently. And I think there's a way to rationalize John Balles' suggestion that we raise the target range for M2 that's different from the rationale he uses, and that is that the increasing interest-sensitive component of M2 has probably raised the income elasticity of demand for M2. If you look back at history, the studies of demand for M1 and demand for M2 have always come out that M2. the luxury good, has an income elasticity that is bigger than 1 and M1 has an income elasticity of considerably less than 1. The main reason was that M1 didn't have interest payments on it and M2 did. But as more and more assets that are interest sensitive are shifted into M2. the chances are that its income elasticity has grown. And I [considered] the fact that Fred Schultz has said we will have some adverse reaction in terms of loss of credibility if we adjust our targets. But I said at either the last meeting or the previous one. I don't remember which, that I think our credibility basically doesn't depend so much on these targets and whether we stay within the ranges from one month to the next as it does on the basic fact that we've been following a very tough and tight monetary policy since October of 1979. That is what has gained us our credibility. If we stick with that basic posture, we will still have credibility. I think we ought to give serious thought to the suggestion of raising the M2 target range to 7 to 10 percent. And I think we ought to go further than just raising the bottom edge of the M1 target. I would prefer to do something like using a different base--starting out with the lower end or the rangefor 1981 as the base figure rather than starting from the actual.

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