

# Currency Movements In the United States

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Currency movements have long fascinated both the general public and the economics profession. Contributing to this fascination is that currency is the most liquid and safest of all financial assets. It is also a tangible asset that a person can actually hold and count rather than just observe as a bookkeeping entry in a checkbook or savings passbook. Economists study currency because it is a component of the money stock—usually defined to include demand deposits plus currency—which in turn is related to the level of economic activity. Furthermore, currency in the United States is now supplied almost entirely by the Federal Reserve System, which has the responsibility for formulating and implementing monetary policy. Hence, the interaction of the Federal Reserve's supply of currency and the public's demand for currency can have important implications for the conduct of monetary policy.

In recent years, there has been a very large increase in the amount of currency held by the public. Between December 1965 and December 1975, the currency component of the money stock just about doubled, rising from \$36.3 billion to \$73.7 billion.<sup>1</sup> A disproportionate amount of the increase has been in higher

denomination bills. The number of \$20, \$50, and \$100 bills more than doubled, while the number of \$1, \$5, and \$10 bills grew about 45 per cent. The large **increase** in currency outstanding is also reflected in the ratio of currency to money. Over the last 10 years, demand deposits—the other component of the narrowly defined money supply (M1)—increased by only 64 per cent. As a result, the ratio of currency to money rose from 21.2 per cent in December 1965 to 25.0 per cent in December 1975.

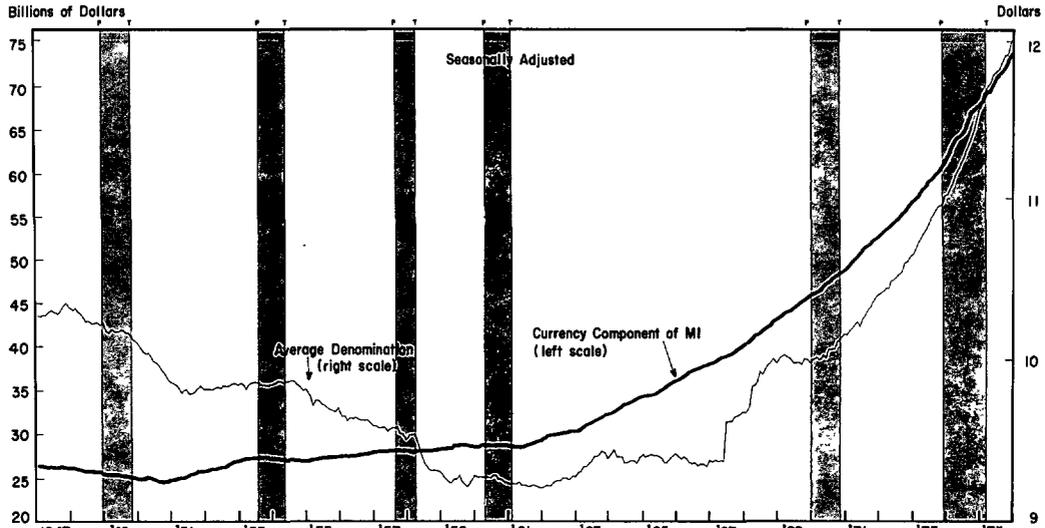
This article examines some of the reasons for currency movements in the post-World War II era. First, the trend, cyclical, and seasonal characteristics of currency movements are briefly reviewed. Next, the process by which the Federal Reserve supplies **currency** through the nation's commercial banking system is **dis-**

<sup>1</sup> The currency component of the money stock includes all currency outside the U. S. Treasury, the Federal Reserve Banks, and the vaults of commercial banks. A related concept, currency in circulation, also excludes currency held by the U. S. Treasury and the Federal Reserve, but includes commercial bank vault cash.

Currency in circulation totaled \$86.5 billion in December 1975 and consisted of the following denominations

Coin . . . . .	\$8,959 million	Twenty dollars . . . . .	\$28,344 million	
One dollar . . . . .	2,809 million	Fifty dollars . . . . .	8,157 million	
Two dollars . . . . .	135 million	One hundred dollars . . . . .	23,139 million	
Five dollars . . . . .	3,841 million	Five hundred dollars . . . . .	and over . . . . .	385 million
Ten dollars . . . . .	10,777 million	<i>Total</i> . . . . .	\$86,547 million	

**Chart 1**  
**CURRENCY MOVEMENTS: 1947-75**



NOTE: Shaded areas represent recessions and P and T designate the business cycle peaks and troughs as dated by the National Bureau of Economic Research. November 1973 and March 1975 are tentative benchmark dates for the recent business cycle.

cussed. Finally, some of the major factors affecting the public's demand for currency are analyzed in an attempt to explain recent currency movements.

**THE BEHAVIOR OF CURRENCY**

The behavior of currency and its average denomination are depicted in Charts 1 and 2. Chart 1 shows the trend and cyclical characteristics of the currency component of M1 and the average denomination of currency between 1947 and 1975.<sup>2</sup> Chart 2 shows the monthly seasonal adjustment factors applicable to the currency component of money and to the average denomination of currency in 1973.<sup>3</sup>

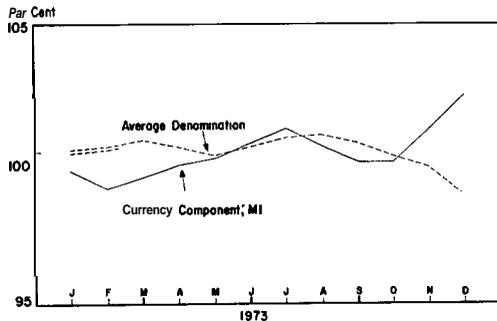
Total currency in the hands of the nonbank public expanded slowly during the 1950's, but has been growing more rapidly from 1961 to the present. (See Chart 1.) Currency holdings increased at an average annual rate of 0.6 per cent in the 1947-60 period, in contrast to an annual rate of 6.4 per cent in the 1961-75 period. On a cyclical basis, the public's currency holdings have shown a very mild propensity to fluctuate in the same direction as the business cycle. Currency holdings have tended to decline or grow slowly after the peak of the business cycle, and to increase or accelerate their growth shortly after business cycle troughs.

While the total dollar value of currency rose slowly in the 1950's, the average denomination of currency declined. In the early 1960's, however, the average denomination began to rise slightly, and then—in the late 1960's to the present—it increased quite rapidly. Cyclically, in the period prior to the 1960's, the average denomination tended to stabilize or decline

<sup>2</sup> The average denomination of currency is equal to the total dollar value of all paper currency outstanding divided by the number of bills outstanding.

<sup>3</sup> A seasonal adjustment factor of 100 per cent for a given month indicates no special seasonal influences are present in that month; upward seasonal pressures exist when the factors are above 100 per cent, and downward pressures are present when the factors are below 100 per cent. The seasonal adjustment factors shown in Chart 2 were obtained through the application of the U. S. Census Bureau's X-11 seasonal adjustment program, which employs a technique using 5-year moving averages. As a consequence, 1973 is the last year for which currently available data can be used to determine seasonal adjustment factors not subject to major revision.

**Chart 2**  
**SEASONAL ADJUSTMENT FACTORS**  
**FOR CURRENCY: 1973**



slightly in recessions and to fall sharply in the initial phases of recoveries. No clear pattern is evident in more recent business cycles.

On a seasonal basis, there is typically a large increase in the public's currency holdings in November and December. (See Chart 2.) This increase is returned to the banking system in January and February when the currency component of M1 hits its yearly low. A secondary seasonal peak in currency holdings occurs during July. The average denomination of currency has its seasonal peak in August, which is about the same time as the secondary seasonal high in total currency holdings. In contrast, the average denomination has its seasonal low in December, when currency holdings are highest.

### **THE FEDERAL RESERVE AND THE SUPPLY OF CURRENCY**

Currency gets into circulation when Federal Reserve Banks supply currency upon demand to the nation's commercial banking system. The demand for currency by commercial banks, in turn, generally reflects the needs of the nonbank public. To pay for currency obtained from the Federal Reserve, commercial banks authorize a charge against their reserve accounts at the Federal Reserve. Hence, an increase in the amount of currency in the hands

of the public tends to cause a reduction in the reserves available to the banking system and vice versa.

Suppose, for example, a bank depositor decides to convert part of his money holdings from demand deposits to currency. He cashes a check at his commercial bank, which reduces the bank's vault cash. The bank's demand deposits and vault cash, therefore, decline by an equal amount. To replenish its vault cash, the bank can order additional currency from its Federal Reserve Bank. If the bank is a member of the Federal Reserve, currency is shipped to the bank with the Federal Reserve taking payment by debiting the bank's reserve account. If the bank is a nonmember, it can obtain currency by working through a member bank; i.e., currency can be shipped directly to a nonmember bank but payment must be made out of a member bank's reserve account. In either event, the public's increased desire to hold currency is satisfied and the reserves available to the banking system are reduced.

The ultimate consequences of Federal Reserve accommodation of the public's desire to hold more currency depend on the subsequent actions of the Federal Reserve. If the Federal Reserve were to do nothing but supply the currency demanded, the accompanying decline in member bank reserves would cause a multiple contraction of bank loans and deposits and a reduction in the money supply. As a result of the decline in the money supply, interest rates would come under upward pressure; a higher level of interest rates would tend to discourage spending and cause reductions in either the general price level or total output.

Downturns in economic activity, similar to the sequence described above, were a major problem in the period preceding the creation of the Federal Reserve System in 1913. During the fall of each year, the movement of crops to market increased the demand for currency from banks. When this seasonal currency

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demand coincided with large cyclical credit demands, the resulting currency drain and deposit contraction caused money markets to become tight and on occasion precipitated a banking panic and an economic recession. An important reason for establishing the Federal Reserve was to accommodate seasonal currency needs in a way that would not result in economic instability.

In practice, the Federal Reserve tends to insulate banks and the economy from the effects of changes in the public's holdings of currency. It does so by offsetting—normally through System open market operations—the reserve impact of changes in the public's currency holdings. In the event of an increase in currency demand, for example, the Federal Reserve replaces enough lost reserves to prevent the switch into currency from precipitating a multiple contraction of deposits and money. With the total money supply unchanged—due to a rise in currency equaling a decline in demand deposits—interest rates and total output are not subject to downward pressure. Through offsetting Federal Reserve actions, therefore, an increase in the public's demand for currency is not allowed to adversely affect the money supply, interest rates, and national output.<sup>4</sup>

### **THE PUBLIC AND THE DEMAND FOR CURRENCY**

Since the Federal Reserve supplies currency upon demand, an explanation of recent currency movements requires an examination of the factors influencing the demand for currency. Why do people want to hold currency and what induces them to change their desired levels of currency holdings? An examination of these factors begins with a delineation of the

<sup>4</sup> From the standpoint of conducting monetary policy, either an interest rate or a money supply target would produce the same result. Note, however, that if the Federal Reserve were on a bank reserve target, it would tend to fully offset the effect of an unexpected currency drain on bank reserves, so the money stock would increase by the amount of the currency rise. On the other hand, a monetary base target, i.e., currency plus member bank reserves, would allow an increase in currency demand to be associated with a decline in bank reserves, bank credit, and money.

characteristics of currency that distinguish it from other assets which might be held by the public.

An important characteristic of currency is its lack of interest return. Holding currency necessitates a sacrifice of the income which could be earned by holding an equal amount of an interest earning asset. Thus, the higher the interest rate available on alternative assets, the greater the foregone income and the more intensive the effort likely to be made to reduce holdings of currency.

Another significant characteristic of currency is its acceptability as a means of payment. While demand deposits are also used to make payments, currency is differentiated from demand deposits in ways that make it particularly well adapted for certain types of transactions. Consequently, the demand for currency can be expected to be positively linked to some measure of transactions for which it might be most appropriately used.

The type of transactions associated with currency demand are intrinsically related to the differences between demand deposits and currency as a means of payment. For example, one reason for the use of currency for transactions is its status as a liability of the Federal government, not of a bank or individual. The recipient of currency, therefore, need know little about the financial condition of the payer to be certain that a means of payment has indeed been received and is available for reuse. Hence, currency is well suited for transactions between strangers when the payer is far from home.

On the basis of cost considerations, currency is also better adapted for small transactions, while demand deposits are more suitable for large transactions. One reason is that an important component of the cost of using currency is the potential for loss through theft, fire, or forgetfulness. This cost rises proportionately with the amount of cash being used. Demand deposits, on the other hand,

carry no such risks, which makes them suitable for large transactions. A second reason is that demand deposits, unlike currency, are subject to service **charges**. These charges are often based on the number of transactions charged against an account and rarely depend on the size of the transaction. Consequently, when demand deposits are used, the cost per dollar of transactions is less the fewer the number and the larger the size of the **transactions**.<sup>5</sup>

These special characteristics of currency help to explain the seasonal variations in currency and its average denomination depicted in Chart 2. Two seasonal peaks in currency were shown: one in July and one in December. At the time of both of **these** seasonal peaks, either vacation or holiday shopping takes place which tends to involve many small purchases with rarely patronized merchants. The seasonal behavior of the average denomination is also instructive. The yearly high occurs near the midsummer currency peak, indicating tourists carry large bills when setting out on trips; and the seasonal low is in December, when currency is mostly used for smaller transactions.

From a longer perspective, however, there seems to be no simple relationship between currency and measures of transactions. For example, currency movements were plotted **against** gross national product (GNP) on the assumption there is a stable relationship between total production and the specific types of transactions best adapted to currency use. (See Chart 3.) Since: **1947**, though, GNP has grown much more rapidly than currency, so that the currency-GNP ratio has declined. The drop in the ratio was quite pronounced up to the mid-1950's and it has continued to fall at a

<sup>5</sup> Currency will be used for both large and small **transactions** if there is a desire to have the **transactions** unrecorded. Thus, currency use might **be** related to black market sales **in times of price control or rationing**, and to the volume of **receipts** not reported to **taxing** authorities

One writer has put great **emphasis** on the use of currency for illegal purposes **in** explaining its demand **relative to checking** accounts. **especially** during World War II. See Philip Cagan. *The Demand for Currency Relative to Total Money Supply*. NBER Occasional, Paper 62. New York: 1958. Subsequent work, however, has cast some doubt on the **empirical work backing** this analysis. See George G. Kaufman. *The Demand for Currency*. Staff Economic Study. Board of Governors of the Federal Reserve System.

reduced rate up to the present. This suggests that while currency may be positively related to GNP transactions, it is not exactly **proportionately** related. Retail sales were also examined as a proxy for the type of expenditures to which currency may be related. However, the currency-retail sales ratio displayed the same basic pattern as the currency-GNP ratio. Finally, while the average denomination of currency has risen since 1961, its rise has been slower than the rise in the consumer price index. (See Chart 3.) This is another indication that the relationship between currency and transactions is not very precise, since otherwise it would be expected that the average denomination would rise in proportion to the prices of goods being purchased.<sup>6</sup>

A final characteristic of currency demand is that it appears to be related to the availability of other means of payment, **i.e.**, demand deposits. If transactors have predetermined the proportions of their money they wish to keep as currency and checking account, an increase in demand deposits—perhaps engineered through an expansion of bank reserves by the monetary authorities—would tend to cause a proportional rise in the demand for currency at every level of transactions and interest rates. Some writers have contended that efforts to restore currency-deposit ratios after they have been altered by some outside force are an important cause of business cycles, as credit ease and tightness proceed from attempts to shift into or out of bank deposits.'

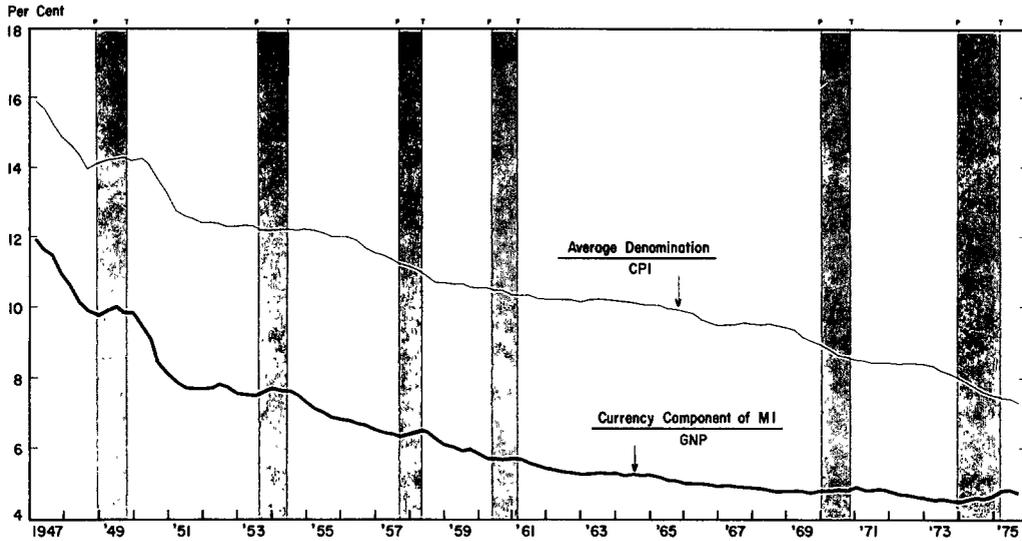
## **REGRESSION RESULTS**

Regression analysis was employed to gain a better idea of the relationships between

<sup>6</sup> One reason for a relative decline in the **use** of currency, especially for larger purchases, **might** be an increased **use** of consumer credit. While the **proportion** of retail sales made on **credit** has increased **in** the post-World War II era, the increase has carried **into** the **1960's** when the **decline** in the currency-sales **ratio** has greatly **diminished** and the real value of the average denomination has **continued** to fall.

<sup>7</sup> See, for example, Irving Fisher. *The Purchasing Power of Money* (New York: Macmillan), 1911.

Chart 3  
SELECTED CURRENCY RATIOS: 1947-75



NOTE: See note to Chart 1.

currency demand and the factors thought to motivate it. As indicated above, the demand for currency is thought to be related negatively to interest rates and positively to the value of transactions and the availability of demand deposits. To test this hypothesis, quarterly changes in the logarithms of currency (C) were regressed on current and lagged changes in the logarithms of real income (G), the GNP price deflator (P), demand deposits (DD), and on the change in the interest rate on commercial paper (I). The variable representing transactions, GNP, was split into two components, the price variable (P) and the real income variable (G). This was done to examine the different response of currency demand to changes in prices and real income on the assumption that the failure of currency and GNP to rise proportionately reflects the changing mix of price and real variables in the GNP measure. The estimated equation for the 1952I-1975III period is shown below.<sup>8</sup>

$$C_t = -0013I_t - 0009I_{t-1} + 104G_t + 138G_{t-1} + 0917G_{t-2} \\ (-2.95) \quad (-1.96) \quad (3.25) \quad (4.29) \quad (2.94) \\ + .279P_t + 425P_{t-1} + 111P_{t-2} + 166DD_t \quad \bar{R}^2 = .873 \quad \text{Rho} = .823 \\ (3.25) \quad (5.13) \quad (1.34) \quad (3.06) \quad \text{SE} = .0029 \quad \text{DW} = 2.28$$

Overall, the regression results appear to support the general hypothesis. The regression accounts for 87 per cent of the variation in currency movements. Also, each of the explanatory variables has the expected sign. For example, currency demand is found to be related negatively to the commercial paper rate, i.e., the higher the interest rate the less currency is held. The effect, however, is not large. An increase of 100 basis points (one full

<sup>8</sup> All variables are first differences of the natural logarithms of seasonally adjusted quarterly average levels, except I, which is the first difference of the quarterly average level. A change in the natural logarithm of a variable is roughly equal to a percentage change in the variable. A subscript preceded by a minus sign indicates that the variable is lagged that many quarters. The numbers in parentheses are t-statistics for the regression coefficients. All the coefficients were statistically significant at the 99 per cent level except the coefficient of the price variable (P) lagged two quarters. SE is the standard error of estimate of the regression. Rho is the autocorrelation coefficient obtained with the Cochrane-Orcutt technique for correction of the first order autocorrelations. DW is the Durbin-Watson statistic.

percentage point) in the commercial paper rate reduces the growth of currency demand only .13 per cent in the current period and a further .09 per cent in the following period.

The regression also indicates a significantly different response of currency demand to changes in prices and real income. A larger increase in currency demand results from a rise in income due to inflation than from a rise in real income. Altogether, a 1 per cent increase in prices produces a .7 per cent increase in currency demand, while a 1 per cent increase in real income produces only a .3 per cent rise in currency demand. Increases in currency demand nearly match increases in prices because consumers tend to maintain the same volume of real purchases during inflation and need proportionately more currency to do so. When real incomes rise, however, currency demand rises relatively modestly because additional consumption is likely to be less concentrated on items purchased by currency, and more on large-ticket items purchased on credit and paid for by check. The regression results also show that it takes longer for currency demand to adjust to a change in real income (three quarters) than to a change in prices (two quarters). This suggests that the full impact of rising real income on consumption, and hence on currency demand, is likely to be delayed until consumers are assured of the permanency of their higher incomes.<sup>9</sup>

Finally, the regression results indicate some independent effect of demand deposits on currency but no evidence of a desire to hold

currency and demand deposits in some constant proportion to each other. Rather, a 1 per cent increase in the growth of demand deposits will raise currency growth around .2 per cent, other factors remaining unchanged.

## CONCLUSION

The preceding analysis allows some light to be shed on the rapid growth in currency and high denomination bills over the last few decades. First, a detailed examination of currency movements showed that despite its rapid growth, currency has not kept pace with the increase in nominal transactions, i.e., GNP, over the postwar period. Also, the increase in large denomination bills has not prevented the average denomination of all currency from lagging the rate of inflation. Therefore, perhaps currency has not grown more rapidly than might have been expected in the post-World War II economic environment.

Second, the Federal Reserve acts as a passive supplier of currency while seeking to prevent changes in the public's currency demand from having multiplied effects on the availability of money and credit. The increases that occurred in currency holdings, therefore, were a result of greater public demand for currency, not of a deliberate policy by the Federal Reserve to enlarge the volume of currency outstanding.

Finally, the regression results confirmed expectations that the volume of transactions was an important determinant of currency demand. The recent rise in currency can be attributed to the very rapid growth of nominal income from the early 1960's to the present. If the growth of currency has seemed particularly rapid in recent years, it may be because of the unfortunately high rate of inflation the nation has experienced, since the demand for currency was found to respond more strongly to price increases than to increases in real income.

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<sup>9</sup> Two further aspects of the relationship between currency demand and income should be noted. Experiments with the regression equation indicated that currency demand responded more strongly to income in the second half of the period under study than in the first half. Coefficients on all income and price variables were higher after 1962 than before, with the contrast particularly marked for the lagged variables. The higher relationship between transactions and currency after the early 1960's is also reflected in the reduced amount of variation in the GNP-currency ratio in Chart 3. In addition, currency was found to be more closely related to GNP than to other measures of transactions or income, such as final sales or consumption expenditures.