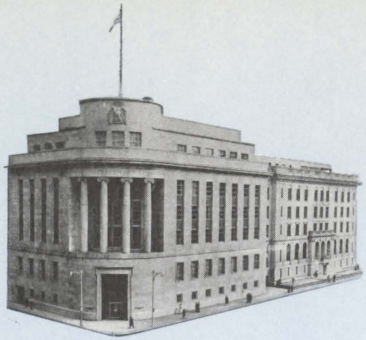

March/April **1977**

FEDERAL RESERVE BANK OF BOSTON

NEW ENGLAND ECONOMIC REVIEW

An Assessment of the Council of Economic Advisers' Forecast of 1977

This article assesses the probable accuracy of the CEA forecast by comparing it with those made by prominent, private forecasters and by examining errors of previous forecasts.

Behavior of Monetary Velocity

This article analyzes monetary velocity among various sectors of the economy, past and present, here and abroad, in an attempt to find clues for forecasting future trends.

Currency in Use and in Hoards

Surprisingly, estimates indicate that each adult in the United States holds on average about $500 of currency and coin. This article analyzes the reasons for and the implications of this large amount.

An updated and corrected version of "The Forecasting Performance in the Early 1970's," which originally appeared in the July/August 1976 issue of this Review, is available on request from the Research Department of this Bank. The new article incorporates the January 1976 benchmark revisions of the National Income and Product Accounts. These revised data alter several of the article's previous conclusions. In addition, the analysis is extended through 1976.

The **New England Economic Review** is produced in the Research Department, and is edited by Mrs. Ruth Norr. The views expressed are those of the individual authors, and do not necessarily reflect official positions of the Federal Reserve Bank of Boston or the Federal Reserve System. The authors will be glad to receive comments on their articles.

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An Assessment of the Council of Economic Advisers' Forecast of 1977

STEPHEN K. MCNEES*

THE Annual Report of former President Ford's Council of Economic Advisers (CEA), released in January, projects a continued moderate recovery during 1977. Real GNP is expected to rise by 5.2 percent from 1976 to 1977. Unlike 1976, when nearly one-third of the increase in real GNP was attributable to the swing to inventory accumulation, virtually all of this year's increase is expected to come from final (i.e., noninventory) purchases. Somewhat slower growth of consumer spending (particularly for autos) and residential investment will be more than offset by larger increases in government purchases and in business fixed investment (BFI) and a smaller decline in net exports. The CEA Report stresses that "the expected [15 percent] recovery of business fixed investment, will be an essential component of this [strong growth in final] demand."[1]

This rise in production is expected to bring the unemployment rate (UR) down to 7.3 percent from its 7.7 percent level in 1976, and to nearly 7 percent by year's end. Simultaneously "the rate of inflation is not expected to rise above the 5 to 6 percent range."[2] The rise in the implicit GNP price deflator (IPD), one comprehensive measure of inflation, is expected to climb to 5.6 percent from last year's 5.1 percent, but the consumer price index (CPI) is expected to decelerate from last year's 5.7 percent to 5.1 percent.

This note assesses the probable accuracy of the CEA's forecast by comparing it with other forecasts and by examining the errors in previous forecasts. It is intended to provide some idea of the range of outcomes which can be considered highly likely.

The Predictive Performance of Previous CEA Forecasts

One method of assessing this year's forecast is to examine the accuracy of previous CEA forecasts. Table 1 provides a summary of the predictive accuracy of CEA forecasts over the last 15 years. The left side of the table shows the mean (i.e., average) errors. For example, over the entire 15-year period, *on average* the CEA underestimated the rate of inflation by .8 percentage points, overestimated the rate of growth of real GNP by .4 percentage points, and neither over- nor underestimated the unemployment rate. If it were assumed that this year's forecast were subject to the average error of the last 15 years, the actual rate of inflation would be 6.4 percent, the actual rate of real growth would be

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[1] *Economic Report of the President*, 1977, p. 36.

[2] *Ibid.*

Table 1

The Predictive Performance of CEA Forecasts
1962 – 1976

	MEAN ERROR (Percentage points)*				MEAN ABSOLUTE ERROR (Percentage points)*			
Forecast Period	GNP	Real GNP	IPD	UR	GNP	Real GNP	IPD	UR
1962 – 1976	–.4	+.4	–.8	–.0	1.0	1.1	1.1	.2
1960s, (8 years)	–.7	+.1	–.7	+.1	1.3	1.0	.7	.1
1970s, (7 years)	–.1	+.8	–.9	–.2	.7	1.2	1.6	.2

*UR errors are percents.

Source: CEA forecasts of GNP, real GNP, and IPD for 1962 through 1971 were taken from Geoffrey H. Moore's, "Economic Forecasting — How Good a Track Record?", *The Morgan Guaranty Survey*, January 1975, p. 6. The other forecasts were inferred from statements in various issues of the CEA's *Annual Report*. Actual data from Bureau of Economic Analysis, U.S. Department of Commerce, *Survey of Current Business*, January 1977.

4.8 percent, and the actual unemployment rate would be the 7.3 percent which was predicted.

Because the membership of the CEA has changed frequently, the more recent record may be a more reliable indicator of its current probable predictive performance. As shown in Table 1, the mean errors of the CEA forecasts in the 1970s (the forecasts made by the CEAs of Republican Presidents) differ from the mean errors of the forecasts of the 1960s (made by Democratic CEAs). Over the 1970s, CEA forecasts, on average, underestimated the rate of inflation by .9 percentage points, overestimated the rate of growth of real GNP by .8 percentage points, and underestimated the unemployment rate by .2 percent. If the history of the early 1970s holds true on average for this year's forecasts, the rate of inflation would be 6.5 percent, real growth 4.4 percent, and the unemployment rate 7.5 percent.

In fact, mean errors are not very informative measures of forecasting accuracy because overestimates and underestimates are offsetting. For example, the zero mean error of unemployment rate forecasts does not mean that the unemployment rate was predicted with perfect accuracy, but rather that the magnitude of overestimates was equal to underestimates. The mean absolute error (MAE), or average error without regard to sign, is a preferable summary measure of forecast accuracy. The CEA's MAEs are shown in the right side of Table 1. On average the CEA forecasts missed GNP growth by 1.0 percentage point, real GNP growth and the rate of inflation (IPD) by 1.1 percentage points, and the unemployment rate by .2 percent. If the future resembles the past, these figures suggest GNP is likely to rise by 10 to 12 percent, real GNP by 4.1 to 6.3 percent, inflation by 4.5 to 6.7 percent, and the unemployment rate to average between 7.1 percent and 7.5 percent this year.

"Unofficial" Forecasts of 1977

The CEA forecast is the only "official" forecast issued by the U.S. government. Table 2 compares the CEA forecast with those of seven prominent private forecasters each of whom uses a different forecasting technique or "model."[3] The table shows that the CEA forecasts of GNP and real GNP slightly (by .2 percentage points

[3] The forecasts included are the median forecast of the survey by the American Statistical Association and the National Bureau of Economic Research (ASA), and those issued by Chase Econometric Associates, Inc. (Chase), Data

Table 2

Forecasts of 1977

	Rate of Growth of				
	GNP	Real GNP	IPD	BFI	UR
CEA	11.0	5.2	5.6	15.0	7.3
ASA	10.8	5.0	5.4	n.a.	7.3
Chase	10.1	4.4	5.5	13.7	7.5
DRI	10.4	4.8	5.3	11.4	7.1
GE	10.9	4.9	5.8	13.7	7.4
MHT	9.5	4.2	5.1	11.9	7.4
UM	10.4	4.4	5.7	13.9	7.1
Wharton	10.7	5.0	5.4	15.6	7.3
Private Forecasts:					
Range	10.9-9.5	5.0-4.2	5.8-5.1	15.6-11.4	7.5-7.1
Median	10.4	4.8	5.4	13.7	7.3

n.a. = not available

or less) exceed the upper end of the range of private forecasts. The CEA's forecasts of IPD and BFI fall toward the upper end of the range of private forecasts. The CEA's UR forecast is identical to the median forecast of the seven private forecasters.

The questions inevitably arise — are these differences between the CEA and private forecasts "significant" or not? If they are "significant," which is more likely to be more accurate? Although the answers are unknown, the past may provide some guide to the inevitably uncertain future.

The History of Forecasting Errors in the Early 1970s

Table 3 contains the MAEs of forecasts by the CEA and seven private forecasters in the early 1970s. The forecast period starts in 1971 because many of these forecasters were not in operation before 1970. There are at least two differences between the nature of CEA forecasts and the private ones: (1) The private forecasts selected were those issued late in the preceding calendar year.[4] They were presumably available to the CEA when it devised its forecast, whereas the opposite is definitely not true.[5] (2) As a consequence of its advisory role to the President, the CEA knew and based its forecast upon the Administration's recommended legislative program for the forecast period (tax and expenditures legislation, as well as "structural" policies, such as wage and price controls and

Resources, Inc. (DRI), the MAPCAST group at the General Electric Company (GE), Irwin L. Kellner of Manufacturers Hanover Trust (MHT), RSQE forecasting service at the University of Michigan (UM), and Wharton Econometric Forecasting Associates, Inc. (Wharton).

[4] Strictly speaking the private forecasts are not entirely comparable to each other because of differences in their release dates. Release dates can have an important effect on forecast accuracy. For a comparison of private forecasters and an illustration of the importance of release dates, see "An Evaluation of Economic Forecasts," *New England Economic Review*, November/December, 1975, pp. 16–39.

[5] This year's CEA forecast, however, did not have the benefit of the "preliminary" GNP data for the fourth quarter. See *The Budget of the United States Government, Fiscal Year 1978*, p. 41.

Table 3

Mean Absolute Errors by Forecaster, 1971–76

	Rate of Growth of				Change in
	GNP	Real GNP	IPD	BFI	UR
CEA	.7	1.2	1.6	n.a.	.2
ASA	1.2	.8	1.6	n.a.	.4
Chase	1.0	.8	1.5	3.0	.4
DRI	.9	.7	1.5	3.1	.2
GE	1.2	.8	1.6	3.1	.5
MHT	1.5	1.1	1.9	4.9	.4
UM	.9	1.2	1.8	4.0	.4
Wharton	1.2	.8	1.6	3.5	.5
All	1.1	.9	1.6	3.6	.4

n.a. = not available for part or all of forecast period

trade policy). While private forecasters could guess what these policies would be, they could not have known them with certainty. On the other hand, the CEA was constrained to base its forecast on the presumed enactment of the President's proposed legislative program. Throughout this period, the Congress was controlled by Democratic majorities while the Administrations were Republican. Private forecasters were free to base their forecasts on the expected outcome of any differences between the President and the Congress.

As shown in Table 3, over the last six years the CEA has had a superior record in forecasting GNP and UR. Its performance on IPD has been about average when compared with private forecasters. The CEA has been relatively unsuccessful at predicting real GNP despite its nearly perfect forecast a year ago. With only one exception the 1977 CEA forecasts differ from the private forecasts by no more than one MAE (of the private forecast). The sole exception is the BFI forecast which is more than one MAE higher than DRI's. Reconciliation of the other discrepancies would involve errors of "normal" magnitudes.

The figures in Table 3 are averages of errors over six years. They conceal wide disparities among the individual errors for different forecast periods. Table 4 displays the MAEs of the forecasts by forecast period. It shows that the averages are heavily influenced by extraordinary errors in some years. Most notably, the errors in the forecasts of real GNP in 1974 and the unemployment rate in 1975 were roughly three times larger than average over the period. Each of these errors is the only "above-average" error for real GNP and UR in the six-year period. Without these extraordinary errors, the MAEs of real growth and unemployment forecasts would have been about half as large.

Inflation and BFI errors have been comparatively uniform. There were extraordinary errors in the forecasts of IPD in 1974 (when the effects of energy price increases and the end of controls were underestimated) and of BFI in 1975 (when the role of capital spending in the recovery was overestimated).

Table 4

Mean Absolute Errors
by Forecast Period
1971 – 76

	Rate of Growth of				Change in
	GNP	Real GNP	IPD	BFI	UR
1971	1.3	.4	1.2	2.8	.4
1972	.9	.3	1.0	4.1	.2
1973	1.9	.8	2.5	3.7	.2
1974	.6	2.8	3.7	1.4	.2
1975	1.0	.8	.6	8.1	1.1
1976	.7	.4	.9	1.6	.2
All	1.1	.9	1.6	3.6	.4

Note: Based on eight forecasters, except BFI which is based on six forecasters.

Conclusion

The CEA's 1977 forecasts of GNP and real GNP are higher than those of a group of prominent private forecasters. (See Table 2.) In recent years, the CEA has been more accurate than other forecasters of GNP (Table 3) and overestimates have been as common as underestimates (Table 1). For real GNP, the CEA's track record has been inferior to those of private forecasters; in addition, the CEA forecasts have tended to overestimate real GNP growth (Tables 1 and 3).

The CEA's forecasts of inflation and unemployment fall well within the range of private forecasts. These consensus estimates should, nevertheless, be regarded as points within a range of likely outcomes. Inflation forecasts have erred (disregarding sign) by 1.5 to 2.0 percentage points and unemployment forecasts by .2 to .5 percent. Combining these figures with the consensus forecast suggests the unemployment rate in 1977 will average between 7 and 7.5 percent while the rate of inflation can be expected to fall within a broad 4 to 7 percent range.

Behavior of Monetary Velocity

PAUL S. ANDERSON*

MONETARY velocity is a measure of the rate of use of money. It is a somewhat shadowy figure on the financial scene since it is only a statistic and not visible like money in the form of cash or a check. Velocity is derived from the equation $M \times V = GNP$, where M is money and V, income velocity. To calculate V, we must first get GNP and M and then divide the former by the latter.

Even though velocity is not visible, it is fully as important as money in accounting for the volume of expenditures in the economy. For example, of the 18 percent rise in GNP since mid-1975, the growth of M accounted for only 8 percent while the increase in velocity accounted for 10 percent. Over the entire period since 1946, almost half of the growth in current dollar GNP was due to an increase in velocity.

This article is an analysis of past velocity behavior with the goal of uncovering clues which might help in forecasting future trends. Both American and foreign experience are studied, with the American data including velocity behavior of households, corporations and state and local governments.

* Assistant Vice President and Financial Economist. The opinions expressed are those of the author and not necessarily those of the Federal Reserve Bank of Boston or the Federal Reserve System.

How Velocity Rises

The phrase "increased velocity" suggests that money, like a speeding bullet, goes more quickly from payer to receiver. While such developments as greater use of planes for transporting checks and use of computers for processing them have undoubtedly shortened the time between payer and receiver, these innovations account for but a small part of the postwar rise in velocity.

The chief way in which velocity increases is closer management of money balances. For example, a manufacturing firm's treasurer might analyze his receipts and payments and find that he can invest 5 percent of the firm's average money balance in Treasury bills and still have enough left to cover payments. This would increase the firm's velocity by 5 percent. As the firm grows and receipts and payments rise by, say, 10 percent per year, the treasurer might find that by proper planning and employing new money management techniques he can get by with only a 5 percent larger money balance each year. This would again increase the firm's velocity by 5 percent per year.

Thus, the process of increasing velocity is really the economization of money balances. Accordingly, it is more appropriate to approach this issue from the aspect of desired cash

balances rather than velocity since money holders have little control over the speed with which money travels but they have considerable control over the size of the average balances they maintain. The American economist, Irving Fisher, introduced the term velocity and it has grown popular despite its inappropriateness.

The British counterpart to velocity, called the Cambridge University k, emphasizes cash balance holdings and thus is more relevant to decision making. The Cambridge equation is $M = k \times GNP$, where k is the proportion of expenditures, GNP, that money balances equal. This k is simply equal to 1/V but it rightly focuses attention on the cash balance that is held to facilitate expenditures, while velocity is usefully viewed as the statistical result that ensues from dividing the given volume of expenditures by the corresponding cash balances held. Thus, when money holders take action to economize on their money balances, the result is that velocity rises.

The velocity measure used here, GNP/money, is called income velocity. Another velocity measure is demand deposit turnover which is debits (check payments) divided by demand deposits. Demand deposit turnover has grown explosively, rising seven-fold since 1946 while income velocity less than tripled. Debits totals are greatly affected by financial transactions. Demand deposit turnover in New York City is currently over 400 times a year, or over 1½ times a day. In light of this volatile behavior of demand deposit turnover, it has not been used much in analyses of velocity.

History of Velocity

Shown in Chart 1 is the history of monetary velocity since 1910. Three velocity measures are plotted. The one at the top is the standard measure using M_1, which is the conventional money supply. The other two measures use M_2, which is M_1 plus all time and savings deposits at commercial banks except large negotiable certificates of deposit, and M_3, which is M_2 plus time and savings accounts at savings banks and savings and loan associations.

Some analysts prefer to use M_2 velocity because it has been so stable since 1960. But it was as variable as M_1 velocity in prior years. Thus, there is no assurance that it will remain stable in the future, particularly since M_2 is so crucially affected by interest rate ceilings on deposits, both their levels and differentials. Furthermore, most savings and time deposits cannot be used for making payments, so it seems inappropriate to use them in computing velocity, which implies movement.[1] If the idea behind using M_2 is to include "store-of-value" substitutes for money in the velocity denominator then surely large certificates of deposit should be included also, as well as thrift deposits, of course. And if all these are included, why not other liquid assets, such as Treasury bills, commercial paper, repurchase agreements, etc.? Actually, a financial asset total that has correlated most highly with GNP over the postwar period and thus had the most stable velocity is total financial wealth, which includes bonds and stocks as well as all liquid assets.

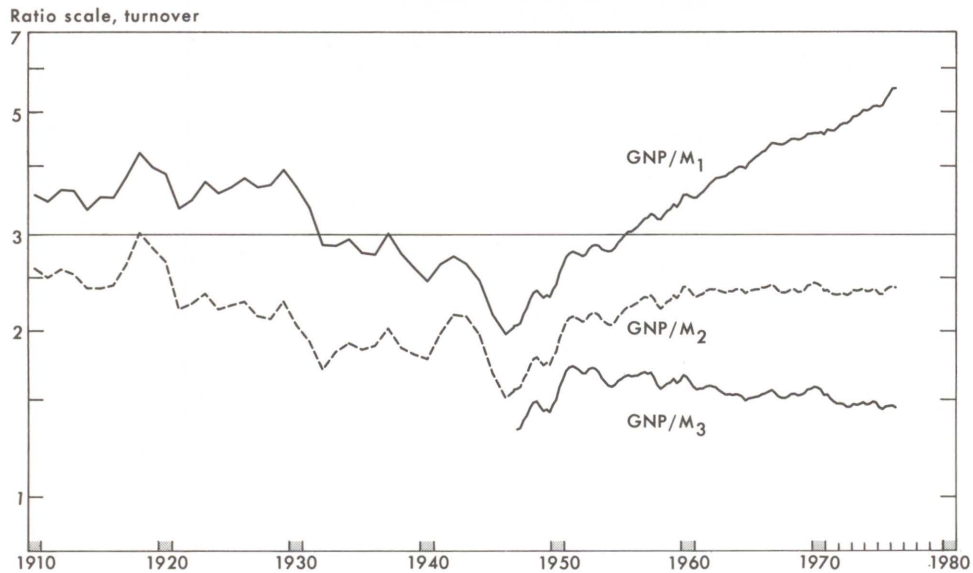
M_1 velocity is the most commonly used velocity measure and is the measure analyzed in this article. As seen in the chart, M velocity has had three fairly distinct trends since 1910, a moderate rise up to 1930, then a substantial decline to the end of World War II, and a rapid and steady rise since. The fall from 1930 to 1946 was due, of course, to the abnormal develop-

[1] Recent legislative and regulatory changes have made savings deposits more liquid. In the six New England states, banks and thrift institutions can offer Negotiable Order of Withdrawal (NOW) savings accounts to individuals which function as checking accounts. In late 1975, banks were authorized to accept ordinary savings accounts up to $150,000 from business; these can be transferred to demand deposits by telephone.

Chart 1

INCOME VELOCITY OF MONEY

Annually, 1910-1946; Seasonally Adjusted, Quarterly, 1947-



ments over that period, first the Great Depression and then World War II with its massive deficit financing which expanded money holdings tremendously.

The postwar rise in velocity might be explained largely as a recovery from the preceding abnormal fall. A question is why this recovery was so slow — why did it take some 20 years to regain the velocity level of 1929? Evidently financial habits are adjusted fairly slowly to changing conditions.

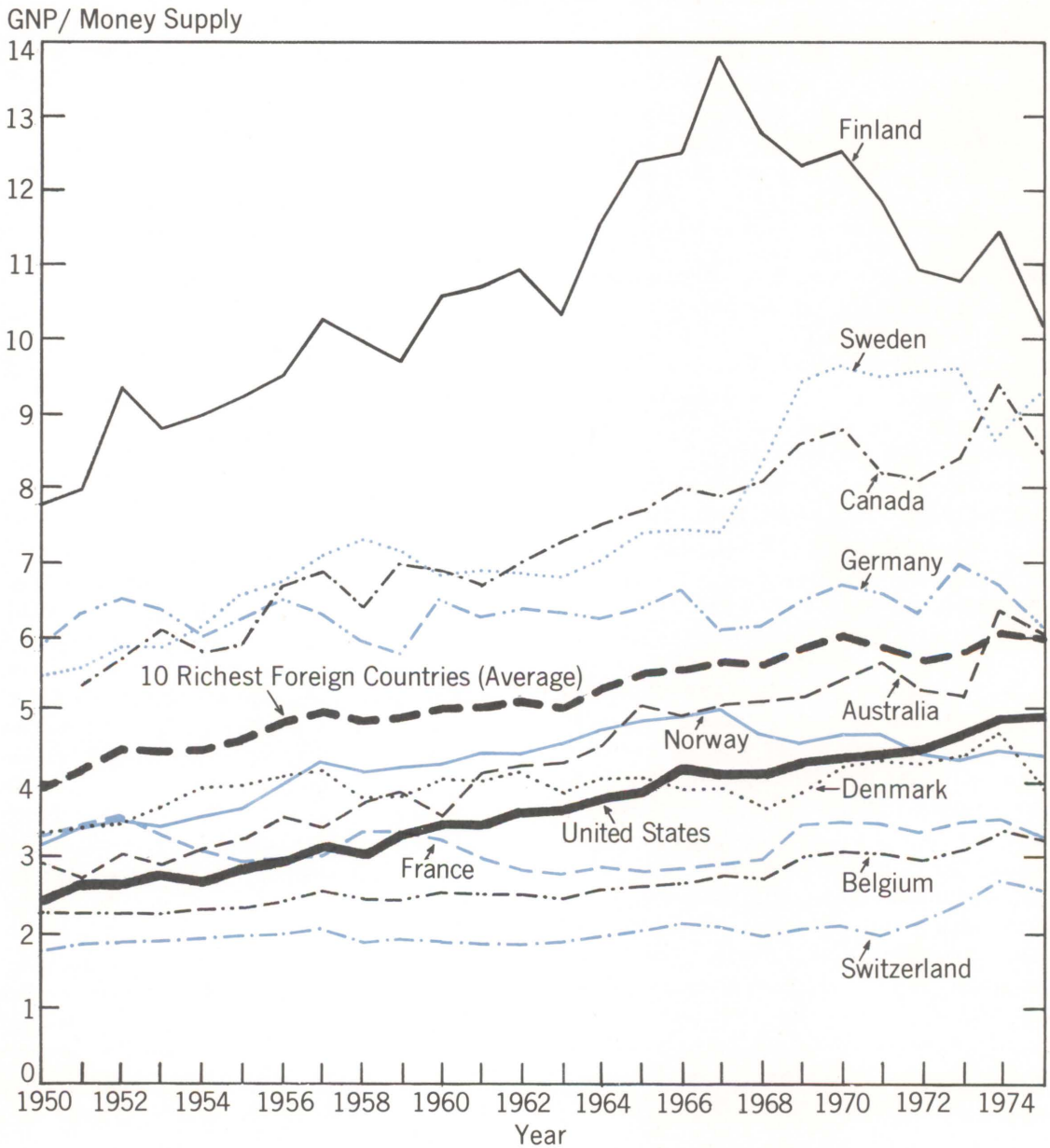
The most important monetary policy question with regard to velocity is its future course. How long might the present rapidly rising trend continue? One indication of future trends is to compare velocity levels and trends of other industrial nations from data compiled by the International Monetary Fund. Shown in Chart 2 are M_1 velocities of the United States and of the ten richest foreign countries — Switzerland, Sweden, Denmark, Canada, Germany, Norway, Belgium, Australia, France and Finland. (The somewhat surprising absence of the United Kingdom from this list is a result of the decline in the exchange rate of the British pound which lowers the dollar level of its GNP per capita.) While these countries differ substantially in velocity levels, their velocity trends have generally been up. Their differing velocity levels seem to be due largely to differences in what is included in their money supplies.[2]

For simplicity, U.S. velocity can be compared with the overall average of the 10 foreign countries shown in the chart. The foreign average has

[2] Transferable savings depoists are fairly sizable in Finland, Sweden, and Canada but are not included in their M_1 money supplies so their money supplies are correspondingly lower and velocities, higher. The money supplies of Belgium and France include giro accounts as well as deposits earning interest so they are correspondingly larger and their velocities, lower. The extremely low velocity in Switzerland evidently mainly reflects the large quantity of money placed in that country because it is considered a "safe haven."

Chart 2

INCOME VELOCITY, UNITED STATES AND 10 RICHEST FOREIGN COUNTRIES, 1950-1975



consistently been higher than velocity here, but our velocity is catching up. It was only 60 percent of the foreign average in 1950 but it is 80 percent now. In general the velocity trends of the foreign country average have been similar to those of the United States. There was a fairly rapid rise to the mid-1960s and then a fairly slow increase until the last several years. At present both trends seem to be up a little more sharply again. Judging from the precedent set by the foreign average, U.S. velocity should continue rising fairly rapidly for quite a few years yet.

Explanations of Velocity Trends

What factors determine or influence monetary velocity? Until several years ago there were two leading explanations for velocity behavior, interest rates and the level of income.[3] Interest rates and velocity obviously are closely related, but the nature of their relation is somewhat ambiguous. High interest rates will, of course, lead money holders to economize on their non-earning demand deposits and currency, but the same fundamental forces that raise interest rates also tend to raise velocity.

Interest rates are prices, and like other prices, are the result of demand and supply conditions. Similarly, velocity can be viewed as the result of the same demand and supply conditions. In the velocity ratio, expenditures/money, the numerator, expenditures, represents the need, or demand, for money. The denominator is the current supply of money. Thus when the demand for money rises more than the available supply, velocity, like interest rates, would tend to rise.

While interest rates and velocity generally have similar movements, at times they do diverge markedly. For example, interest rates rose sharply in 1966 and were at a much higher level until 1970 than in the preceding 20 years. Velocity, however, slowed its rise to less than 2 percent a year during those four years after rising at more than a 4 percent rate following the war. Since mid-1975, interest rates have been relatively low, yet velocity has grown at an 8 percent annual rate, the sharpest rise since 1950. Also, during that record increase in 1950, interest rates were very low, with the Treasury bill rate averaging just over 1 percent. Thus, while movements in velocity will normally parallel movements in interest rate levels, divergent trends do occur fairly frequently.

The second explanation of velocity movements, advanced primarily by Professor Milton Friedman, is that the public increases its money holdings faster than income as incomes rise; as a result, velocity declines. In British terms, the Cambridge k rises as incomes rise. Friedman labeled this the luxury-good effect. In economic parlance, a luxury good is a good (or service) on which people spend or invest a greater share of their incomes as incomes rise. Thus, a luxury good is the opposite of a necessity such as food which absorbs a smaller share of spending with higher incomes.

An explanation of a decline in velocity appears quite strange now that velocity has been rising for three decades. But prior to 1946, velocity had been on a declining trend for most of the preceding six decades. The decline from 1930 to 1946 was associated with the Great Depression and World War II. While there was a slight upward trend from 1910 to 1930, as seen in Chart 1, velocity declined, according to available data, from 1870 to about 1900. Since this period had neither major wars nor deep and long-lasting depressions, the velocity decline needs some other explanation and the luxury-good hypothesis is one possibility.

But the luxury-good explanation does not seem to correspond to public attitudes toward money holdings. As an economy progresses and incomes rise, we would expect people to become more knowledgeable about financial matters and to economize on idle balances. The luxury-

[3] H. G. Johnson, "Monetary Theory and Policy," *American Economic Review*, June, 1962, pp. 354–57.

good idea seems to imply that some form of hoarding is becoming more widespread and there is no indication that this is occurring. Hoarding should be reflected especially in increased currency holdings, and during the 30-year decline in velocity from 1870 to 1900, currency in the hands of the public increased only about threefold while demand deposits rose about fourfold and GNP just less than threefold.

A more believable explanation of the 1870-1900 decline in measured velocity is that of economic development and financial maturation. A primitive economy composed largely of self-sufficient farms needs little money. Nevertheless, a GNP total can be estimated for it. Dividing this GNP by a minute amount of money yields a very high velocity. As the economy progresses and becomes more market-oriented, the need for money will rise faster than estimated GNP and measured velocity will fall.

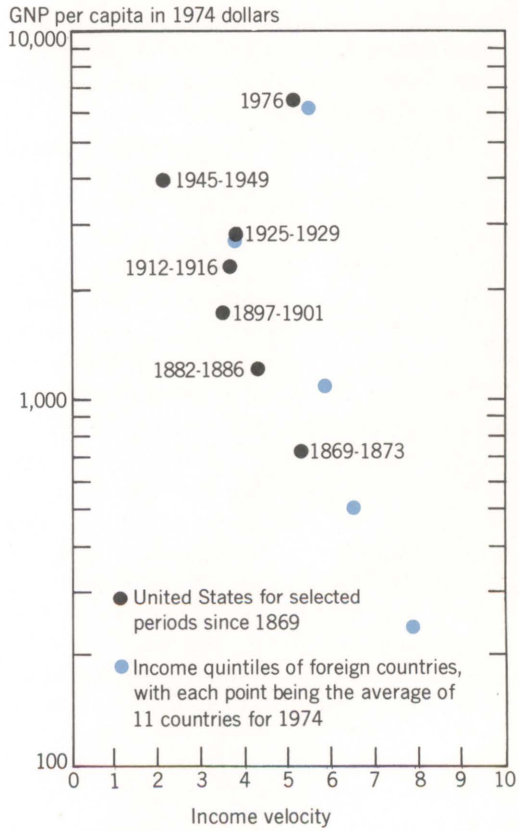
The fall in velocity of those countries that are in the process of changing from a relatively primitive economy to one that is money- and market-oriented is shown clearly in velocity data compiled by the International Monetary Fund for 55 countries. For simplication, these 55 countries were ranked by GNP per capita and then divided into five groups or quintiles of 11 countries each. The highest income group is made up of the Western nations enumerated earlier while the lowest group consists of five Asian, three African and three Latin American countries.

Average GNP per capita and average income velocity were computed for each group. These are plotted in Chart 3. Average GNP per capita of the lowest group is $240 while its average income velocity is 7.9. Average GNP per capita of the next lowest group is $500 and velocity, 6.5. Velocity falls with each higher income group up to the second highest, where average GNP per capita is $2,700 and velocity, 3.8. Velocity of the highest income group is up again, to 5.5. As incomes rise from low levels, a country's velocity falls substantially until at a certain point in economic and financial development this fall ceases and then a rise begins.

Chart 3

INCOME LEVELS AND VELOCITY

United States, 1869-1976 and Foreign Countries Grouped by Income Levels, 1974



The same effect is evident in the velocities of

individual countries over the past 15 years. Of the 25 countries in the three lowest income groups for which velocity data are available for both 1960 and 1974 (or 1973), 19 had declines and only six had rises over this span. But for the highest income group, 8 out of 11 had increases over the same period.

Also plotted in Chart 3 are similar historical data for the United States. Just as in the case of the foreign country averages, velocity in the United States has first fallen and then risen as incomes rose. A break in the pattern occurred with the Great Depression and World War II but since then U.S. velocity has again regained a rising trend.

Thus, both the 55 country income-velocity comparison and U.S. history support the idea that velocity declines in the earlier stage of a country's economic development. The need for money to facilitate production for the market causes money to rise more rapidly than GNP and velocity falls. When essentially all production is market- and money-oriented, money no longer has to grow more rapidly than measured GNP. At that point, improvement in cash management and payment techniques allows more expenditures to be supported by a given stock of money and velocity stops its decline and begins to rise. The lesson in Chart 3 is the same as in Chart 2; velocity in advanced countries can be expected to rise for the foreseeable future unless massive economic calamity or wars occur.

Velocity Among Various Sectors

The Flow of Funds accounts compiled by the Federal Reserve provide data on money holdings of economic sectors in the United States. These money holdings can be divided into measures of expenditures of each sector to yield velocity figures. Plotted in Chart 4 are such velocity figures for three important sectors for which some sort of expenditure measures are available, nonfinancial corporations, state and local governments, and household and nonprofit institutions. The expenditure measure used — outlays for households and governmental units, and gross corporate product for nonfinancial corporations — are not entirely comparable. Whereas outlays probably are not far from total payments in the case of households, they do not include purely financial transactions like repayments of debt which are quite sizable in the case of state and local governments. But the largest discrepancy is for nonfinancial corporations, where gross corporate product essentially measures value added which is only a fraction, perhaps one-fourth or less, of the total of operating costs, debt repayments, and other money transactions.

The velocities of all three sectors have had generally upward trends since 1951, but otherwise the patterns have been quite different. Corporate velocity started its rapid rise earliest and it has gone up furthest. Household velocity has been very sluggish with almost no rise over the past 10 years.

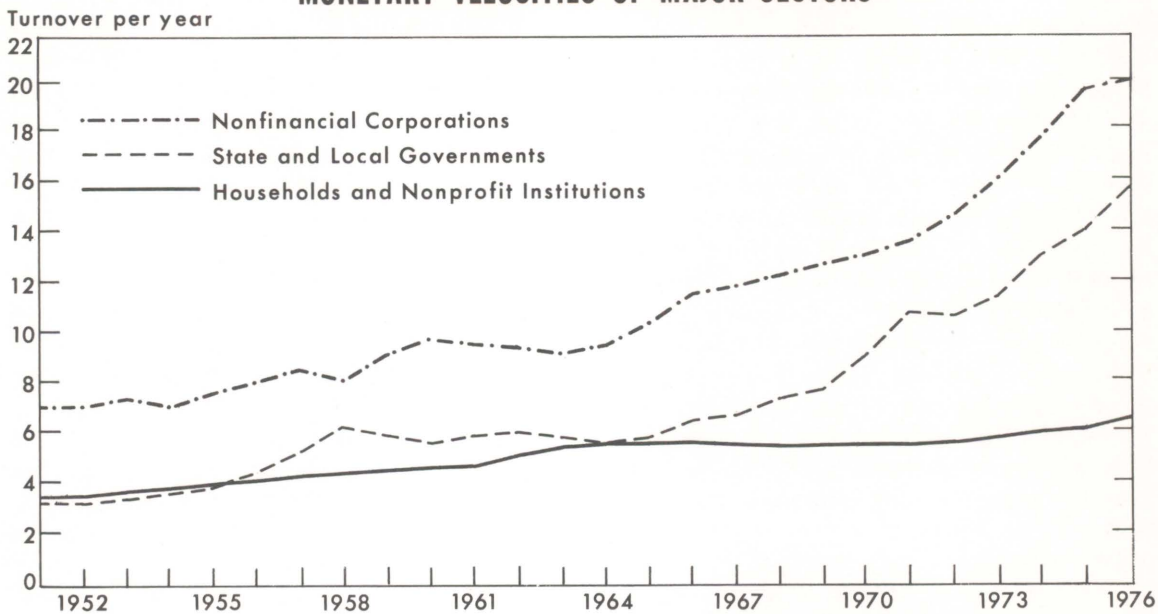
Nonfinancial Corporations

Among the various sectors, corporations would be expected to be most diligent in the management of cash balances. They are profit-oriented, their cash balances are usually large enough so that economizing is worthwhile, and cash management is a prime function of their treasurers. The corporations' antagonists in this effort to pare down cash balances are their banks, because reducing demand deposits and investing the funds in certificates of deposit, Treasury bills, and other such assets results in reduced earnings for the banks. Thus, the cash management that underlies velocity increases involves a tug-of-war between banks and their business customers much like that which occurs between sellers and buyers in the markets for goods and commodities.

The size of the average balance that a cor-

Chart 4

MONETARY VELOCITIES OF MAJOR SECTORS



Note: Velocity data are derived by dividing average yearly money balances into annual outlays in the case of households and state and local governments and into annual gross corporate product in the case of nonfinancial corporations.

porate depositor must maintain at its bank is only one aspect of the bank-customer relationship. This relationship involves an entire package which includes the size and terms of the line of credit to the customer, the other services the bank will provide, the cost of these services, and the interest credit the customer receives on his maintained balance which is used as an offset against the various service charges.

Corporate demand deposits are a very profitable component of banking so banks have competed aggressively to get corporations to open up accounts. This has placed corporations in a good position to gain favorable accommodations from banks. As suggested by their velocity rises, they have taken advantage of it by not increasing their average balances nearly as rapidly as their expenditures for productive inputs.

Banks have one important advantage in these negotiations, they are the prime source of short-term credit. When credit is readily available, this advantage is not of much value, but when a credit crunch occurs, as happened in 1966 and again in 1969-1970, it becomes crucial. At such times availability of credit becomes much more important to corporations than the relatively moderate amounts they can earn by investing idle balances. Many shift from economizing on cash balances to maintaining adequate levels in order to solidify their credit standing with banks. Some open up accounts with other banks in order to obtain an additional line of credit.

Banks will often also change their attitudes

toward business customers at such times. Many raise their compensating balance requirements from, say, 10 percent to 15 or 20 percent of the line of credit. In fact, a practice which became more widespread during these tight money periods was the requiring of a given percentage compensating balance over and above the regular working balance. One reason banks took these actions was that they felt constrained from raising their loan rates, particularly the prime business loan rate, as much as the rise in the cost of funds. At times during these years, the net cost of funds including reserve requirements obtained through certificates of deposit rose higher than the prime loan rate. Banks could recoup the extra cost without having to raise the announced prime rate by requiring an additional compensating balance. This raises the borrower's cost per dollar of usable funds, of course.

Thus the onset of tight money is likely to affect the trend of corporate velocity as the problem of credit availability introduces a new consideration for corporations which have been paring down excess cash balances. The result is seen in Chart 4; while corporate velocity had generally risen more rapidly during periods when interest rates were rising — 1956-1957, 1959-1960, and 1963-1966 — there was a marked slowing from 1966 to 1971 even though interest rates averaged much higher than in these earlier periods.

But if tight money affects corporate velocity, why was there no similar pause in the upward trend in 1973-74? One difference in this latest high interest rate period was that banks did have access to loanable funds because rate ceilings on large certificates of deposit were suspended on short maturities in June 1970 and on all other maturities in May 1973. Thus banks were able to accommodate deserving borrowers and availability was not the problem it had been in the two earlier periods of extreme restraint. Business loans of banks rose an unbelievable 40 percent over these two years, as compared to modest rises averaging less than 10 percent annually in the earlier restraint periods.

Banks reported in surveys of lending practices that they had substantially tightened their compensating balance requirements during 1973 and 1974. Despite this, corporate balances did not keep up with outlays and velocity rose right on trend. Evidently enough corporations still had excess balances at the beginning of this period that they were able to pare down so that overall corporate velocity rose. Also, many corporations may have learned effective cash management practices in the earlier restraint periods which they put to profitable use with the record high interest rates in 1973-74. Finally, in the earlier periods some businesses may have found that the lack of credit availability was not as severe a problem as they had anticipated so they took their chances with minimum deposit balances in 1973-74.

State and Local Governments

Measured velocity of this sector has risen almost five-fold since 1950, a faster rise than that of nonfinancial corporations. But on an absolute basis, state and local velocity, currently around 15 times a year, is still appreciably lower than that of businesses, about 20 times a year. Furthermore, as noted previously, the velocity figure computed for corporations is a substantial underestimate of their actual use rate of cash since this measure is based essentially on value added rather than on total purchases made. Thus, velocity of state and local governments seems to be far from any absolute ceiling and continued rises can undoubtedly be expected.

Households

Data for the household sector includes nonprofit organizations but these latter account for

only a small fraction of the sector's cash holdings so they can be ignored in the analysis. It should also be noted that estimates of household holdings of money are subject to a greater margin of error than those of other sectors because they are obtained as the residual after estimates for the other sectors have been made. This probably is not a serious problem, however, because household money holdings are very large, accounting currently for about $170 billion, well over half of the total money supply, so even an error of as much as $25 billion would only affect household velocity a relatively little, making it 7.0 times a year, for example, rather than 6.0.

Two characteristics distinguish household velocity from that of the other two sectors shown in Chart 4. Household velocity has risen little since 1950, not even doubling, and it is very low. Household velocity is low, of course, because household holdings of money are so high with each household having an average of almost $2,500 of demand deposits and currency, an unbelievable amount. Even if this sum were reduced by 20 percent to allow for error of measurement, average holdings per household would still come to $2,000.

Of the estimated $2,000 average about half is currency and the other half demand deposits. Both averages seem extremely high, the currency one more so. Currency holdings and use are analyzed in some detail in the following article while the discussion here focuses on household checking accounts. But much of this analysis applies to currency holdings also.

A $1,000 average for personal checking accounts appears to be much higher than that which most families maintain. (Actually, this average might be raised to $1,100 or higher since an estimated 10-20 percent or so of all families have no checking accounts.) It might be assumed that the typical personal checking account fluctuates from a low of around $200-300 just before payday to a high of $500-600 after the deposit of the average $300 of disposable income earned each week. If payday comes every two weeks, the average deposit would be $600, raising the highest level of a typical deposit to $800-900. The average balance over the pay period in such accounts would be from $400 to $550.

As a matter of fact, most personal checking accounts average less than $400. According to data collected in the Federal Reserve Functional Cost survey, half of all checking accounts are below $300. Personal accounts comprise about four-fifths of all accounts, and they are the smaller accounts on average so more than half of them must be below $300. To bring the average for all personal accounts up to $1,000, some of them must be very large. The distribution of personal accounts might be about as follows:

Below $300	55 percent
$300 - $500	20 percent
$500 - $1,000	15 percent
$1,000 - $5,000	5 percent
Over $5,000	5 percent

For the overall average size to be $1,000, the top 5 percent of personal accounts must average somewhat over $10,000. If this is so, then half of the dollar volume of personal checking accounts is held by this top 5 percent, while half is held by the remaining 95 percent. This would explain how the average account size can be as large as $1,000 even though most people have accounts of less than half that size.

Since this top 5 percent is so important in determining the average size of personal checking accounts, this group is likewise overwhelmingly important in determining the behavior of household velocity. If this top 5 percent had the same size balances as the remaining 95 percent, the average balance size would be halved and household velocity would be doubled to almost 15 times a year, a velocity equal to that of state and local governments.

With the high interest rates from 1966-1974 and the resulting "disintermediation" as

individuals withdrew deposits from savings accounts to invest in higher-yielding market securities, we might expect this top 5 percent to have behaved similarly by paring down their apparently excess demand balances in order to earn these attractive yields. But evidently they did not do so. The average size of household demand deposits increased from the $700 level at the time of the Federal Reserve Consumer Finances Survey in 1962 to the present $1,000. Over this period, the proportion of households with demand deposits increased from 60 percent to an estimated 80-90 percent. The top 5 percent must have increased their balances substantially to raise the overall average in the face of the increasing total number of accounts.

What is the reason for these large balances? Some must be temporary holdings between investments where the owner expects to reinvest the cash within a short period. In these cases it may not be worthwhile to place the funds into an earning asset. But most large holdings are probably fairly permanent and the holder is not interested in maximizing yields. Bankers who were interviewed all said they had at least a few such depositors and they certainly appreciated them because the individual checking account function would incur appreciable losses if it were not for these depositors. The typical large depositor is well off, does not really need the income from investing these idle funds, and evidently prefers the freedom and flexibility of a "comfortable" checking account. Apparently most are in the over 60 age group and a large proportion are widows.

The future course of household velocity depends largely on the behavior of this top depositor group. In fact, this group has a significant impact on overall velocity because its holdings of money of near $40 billion account for over a sixth of total demand deposits. Just as it is hard to understand why this group has maintained such excessive demand balances in the face of attractive investment alternatives in the past, it is similarly hard to foresee influences that would cause its behavior to change in the future.

But developments over the past three years do seem to indicate a change. According to available data, household demand deposits have declined slightly since 1973 even though household outlays rose 25 percent, suggesting that the velocity of household demand deposits rose substantially. (Currency payments are unlikely to have increased their share of household outlays.) But whether this marks the emergence of a new trend or is simply an aberration remains to be seen.

Summary and Problems for Monetary Policy

Monetary velocity in the United States has been on a rising trend for the past 30 years. But in the preceding 60 years it declined most of the time. The decline from 1930 to 1946 was associated with the Great Depression and World War II which involved massive deficit financing and greatly expanded the money supply. The decline from 1870 to 1900 was due to the change from an underdeveloped to a fully developed economy. A primitive economy requires relatively little money as much of its production is for its own use. But as production becomes market-oriented, money is needed to facilitate trade. Thus, economic development entails a faster rise in the stock of money than in the value of total production and velocity falls.

The rise in velocity since World War II is partly a recovery from the abnormal decline from 1930 to 1946 and partly a return to the rising trend which was evident from 1900 to 1930. While shorter-run trends have generally been associated with rising interest rates, velocity and interest rate movements have frequently diverged. The most notable period of divergence was 1966-1970 when interest rates rose to very high levels but the velocity trend dropped to 1½

percent annually after rising at a 4 percent annual rate since 1946. Starting in mid-1975, however, velocity spurted at a 6 percent rate. All major sectors participated in this speed-up. Businesses evidently have pared down compensating balances and have used their new power to hold ordinary savings accounts which can be transferred back to demand deposits by telephone. Consumers in many Northeastern states have transferred demand deposits into Negotiable Order of Withdrawal (NOW) accounts (savings deposits which can be used for payments) or into demand deposits at mutual savings banks (which are not counted as part of the conventional money supply under present definitions).

Among the major sectors, velocity has increased most rapidly in the postwar period among nonfinancial corporations and state and local governments. Nonfinancial corporate velocity was marked by a pause in its upward trend during the 1966-1970 credit crunch period. This may have been occasioned by corporate concerns about bank credit availability which led to their maintenance of larger balances in order to solidify relations with banks. State and local velocity has increased quite steadily over the postwar period with some acceleration beginning in 1966.

Household velocity has been quite sluggish with practically no rise from 1965 to 1975. Households did not economize on their cash holdings even though many of them engaged in disintermediation during the high interest rate periods after 1965 by shifting funds from savings accounts to higher-yielding market securities. Evidently about one-half of the dollar volume of household demand deposits is held by relatively few owners in very large accounts and they seem not to be interested in maximizing their returns by investing these largely idle cash balances. If these idle holdings were activated, both household and total velocity would rise significantly but since they remained largely dormant over the past 10 years, there is little expectation that they will be activated any time soon.

Variations in velocity greatly complicate the formulation of monetary policy. The main aim of policy is to regulate the volume of money expenditures so that they are neither too large, thereby fostering inflation, nor too little, which could lead to a slowdown in business activity. The technique for regulating the volume of expenditures is to regulate the volume of money. When the velocity trend varies as it has recently, however, from near a 1 percent annual rise from 1966 to 1970 to a 4 percent annual rise from 1971 through 1974 to an 8 percent rise from mid-1975 to mid-1976, it is quite obvious that the volume of expenditures is behaving quite independently of the money supply.

These variations in velocity would seem to be an obvious argument against following a policy of steady growth in the money supply. Why not, instead, use control of the money supply to offset variations in velocity so that total expenditures would not fluctuate so widely? There are at least two reasons for not trying to offset velocity variations with the money supply. First, control of the money supply is very difficult, and a given target growth rate seems to be reachable only over a period of six months or longer. Thus adding a second goal of offsetting velocity variations would complicate policy operations and jeopardize attainment of the primary steady growth goal.

Second, it is probable that fluctuations in the velocity trend are at least partly caused by fluctuations in the growth of the money supply. This is not easy to prove but the following data are suggestive:

	1946–1957	1957–1967	1967–1971	1971–1976
	(percent)			
Average annual growth of money	2.3	2.9	6.0	6.0
Average annual growth of velocity	4.7	3.1	1.5	3.7

It would be expected that 1) velocity increases would be large after World War II because velocity declined to such a low level and 2) the rate of velocity increase would gradually decline as the years elapsed. These did, in fact, occur; velocity grew almost 5 percent per year until 1957, then slowed to a 3 percent rate of increase in the subsequent decade. But velocity fell sharply in the 1967-1971 period, and a contributing cause must have been the substantially larger growth rate of money from less than 3 percent up to 1967 to a 6 percent rate thereafter. It seems reasonable to speculate that velocity in the 1967-1971 period would not have declined as much if the money supply had not leaped up as it did. If this is so, then the aberration in money supply behavior did lead to the aberration in velocity behavior.

After 1971 velocity spurted up at a rate exceeding that of the 1957-1967 decade but this probably represented more of a catching up after the sluggish 1967-1971 rate than a reversal of the gradually declining postwar period trend. The high growth rate of money which occurred after 1971 despite the velocity acceleration demonstrates the difficulty of controlling the money supply during a period when inflation and recession coincide.

Even though velocity has behaved erratically over the past 10 years, it still lies fairly close to its long-term rising trend. The evidence analyzed in this article supports the expectation that the basic trend will continue to be upward for the foreseeable future in the absence of financial or other calamities.

Currency in Use and in Hoards

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OVER $80 billion of currency and coin is currently in circulation outside banks. Holdings by businesses and by governmental units are assumed to be quite small, probably less than 10 percent of the total. Thus some $75 billion is held by individuals. Dividing this total by the roughly 150 million adults in the country yields the result that on average each adult is currently holding $500 of currency and coin. This average is five to ten times larger than most people would guess. What explains it — are the data wrong, is it illegal activities, are there hoarders in our midst, has much been lost or destroyed or do foreigners hold a lot?

Answers to these questions are pursued in this article. The major conclusions are that about two-thirds of currency in circulation seems to be in savings hoards while only about one-third is in active use. Neither the hoards nor the actively used currency appears to be associated to any great extent with tax evasion or other illegal activities. A more complete summary and some implications of the findings are presented at the end of this article.

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Historical and Foreign Comparisons

The amount of currency and coin in circulation raised questions even before the large increase that occurred during the Great Depression and World War II. To quote from the 1913 *Annual Report of the Secretary of the Treasury*, "It is apparent from the increasing growth in the amount of money in circulation that it is equal to if not in excess of the legitimate demand therefor. The extension of habitation into remote districts, the multiplication of lines of traffic, and the development of industrial activities are some of the requirements that must be provided for by an annual increase of money in circulation." (page 216).

The amount of currency and coin in circulation in 1913 was only about $50 per adult as compared to $500 today, but compared to income it was 50 percent larger then, being 10 percent of personal income as compared to only 7 percent now. Even though cash was probably used for a greater share of consumer expenditures in 1913 than today, that could hardly account for the size of the cash holdings — they amounted to over a month's personal income, or equivalent to around $700 of currency and coin per adult today.

Holdings of currency and coin are also large

in foreign countries. In the ten richest foreign countries for which data are available, currency and coin outside banks average about $600 per adult. A higher average than in the United States might be expected since personal checking accounts are not as widespread as here but $600 per adult is as surprising as $500 in the United States.

Lost or Held by Foreigners?

The first question that arises concerning the volume of currency and coin held by consumers is accuracy. The only truly accurate data are the amounts of currency and coin issued by government agencies (and in times past, by national banks). Unknown are the amounts lost or destroyed, held by foreigners and held by businesses.

While the volume of currency and coin lost or destroyed is unknown, it seems to be very small. This judgment can be made on the basis of those issues of currency which have been discontinued and are being retired from circulation. The amounts of these issues that remain unredeemed are lost or destroyed or remain in hoards and collectors' inventories. Thus the total amount unredeemed is the maximum that could be lost or destroyed and is certainly an overestimate since currency which is no longer issued tends to become a collectors' item.

The Treasury Notes of 1890 were issued from 1890 to 1900 and then ordered retired. The total amount issued was $447 million and about $1.1 million remains outstanding. Thus ¼ of 1 percent of this issue remains unredeemed and represents the maximum that could be lost or destroyed. The old, large series of Federal Reserve Notes were discontinued in 1929, to be replaced by the present smaller-sized notes. About $24 billion of these old notes were issued and about $34 million remains unredeemed, about ⅛ of 1 percent. Thus, it seems reasonable to assume that less than 1/10 of 1 percent of the currency and coin outstanding is lost or destroyed.

It is more difficult to estimate foreign holdings. U.S. currency and coin are widely used in Panama and Liberia. If holdings of U.S. cash per adult were as large in these countries as in the United States, domestic holdings would have to be reduced by a little over 1 percent. Other foreign holdings are unknown, but since U.S. currency is not commonly used even in the neighboring countries, Canada and Mexico, the amounts must be relatively small.

Foreign acquisitions of currency evidently were involved in an increase of large-denomination notes in the latter 1930s. From 1934 to 1940, the amount of $5,000 and $10,000 notes increased from $12 million to $75 million. Most of these notes were issued from the Federal Reserve Bank of New York and apparently were associated with the uncertainty stemming from the rise of Hitler and Nazism in Europe. After 1941, these notes began to flow back so that by 1945, only $30 million remained outstanding. Since then, they have continued to be redeemed so that at the present time only about $6 million remain. (The Federal Reserve discontinued issuing large-denomination notes of $500 and larger in 1969.)

Banks are the only businesses that report their currency and coin holdings separately from demand deposits. Commercial banks hold about $10 billion of the roughly $90 billion of "money in circulation" which is currency and coin outside the Treasury and Federal Reserve banks. Mutual savings banks and savings and loan associations together account for less than $1 billion. Other financial businesses such as credit unions and finance companies presumably hold even smaller amounts.

Among nonfinancial businesses the biggest holders of currency and coin must be retail stores. Their holdings can be assumed to equal roughly a day's retail sales paid for in currency and coin. These amounts are usually deposited

at a bank daily but the bank does not enter them until the next day. Total sales amount to about $800 billion a year, or $2.5 billion per day. Department stores, whose experience is probably about average for all retail stores, report that less than a third of their sales are for currency and coin. This means average daily cash sales, and average cash holdings, of retail stores amount to less than $1 billion. All other nonfinancial businesses probably hold even smaller amounts. While all these estimates of business holdings are very rough, they do suggest that business holdings are but a small part of the $80 billion currency and coin outside commercial banks.

Individual Holdings

By the process of elimination, individuals appear to hold well over 90 percent of the cash money outside commercial banks, amounting to around $1,000 per household. Since this is quite difficult to believe, direct evidence is needed to dispel doubts. But direct evidence on currency and coin holdings is not available. In the 1963 Survey of Consumer Finances sponsored by the Federal Reserve, consumers were not even asked about their cash holdings because it was felt that accurate responses would not be obtained. As it was, checking accounts and savings accounts, which were surveyed, were underreported by about 50 percent.

Data on demand deposit holdings of individuals tend to support the estimate of the volume of currency and coin holdings. These demand deposit holdings are quite well documented by bank records and they amount to about the same average per household as currency and coin, about $1,000. This amount is also extremely high but seems, nevertheless, correct. Thus, even though $1,000 of cash money holdings is unbelievably high, it may equally well be accurate.

Typical holdings probably amount to $100-$200 per household among those that have demand deposits. For those households without demand deposits where payments are made by cash or purchased money order, typical cash holdings would be correspondingly larger, perhaps in the $300–$500 range. These two groups should account for the bulk of households and their holdings average somewhere around $200–$300 per family.

The minority of remaining households have to have much larger holdings in order to bring the overall average up to $1,000. One possible explanation often offered for such large holdings is that the holders are engaged in illegal activities, such as the illegal numbers game, black market operations, the purchase and sale of stolen goods, and income tax evasion. These activities do exist and most involve almost exclusive use of currency for payments, but still they do not appear to account for appreciable amounts of currency holdings.

The first three illegal activities, numbers, black markets, and stolen goods, are all business operations. Their volume must certainly be only a fraction of total retail sales made for cash and since the latter explains only about $1 billion of currency and coin, these illegal activities must account for only a fraction of $1 billion.

Income tax evasion is the most popular explanation of the large amount of currency outstanding. But the connection between currency use and tax evasion is probably not as obvious as often imagined. First, contrary, to the common assumption, the tax evader will hardly solicit cash payment from customers in order to hide evidence of income received because that would give some payers the opportunity of notifying the tax authorities and obtaining the 10 percent informer's reward. Therefore, the evader would probably hide only those income payments he normally received in cash and this, in itself, should not affect the amount of cash used in making payments.

What the evader does with his unreported

cash can affect currency outstanding. If he spends it in a normal pattern, it would make no difference whether he reported it or not, the currency *flow* would be the same. If, however, he saves it in a hoard, then currency *outstanding* would be higher than otherwise so long as the hoard is maintained.

If the tax evader holds his unreported income in a cash hoard, he is losing the interest income he could get by putting his money into a savings deposit. At 5 percent interest, an individual in the 30 percent tax bracket would be as well off in 12 years by paying his income tax originally and earning 5 percent before tax on the remaining "honest" income. After 12 years, of course, he is progressively worse off with his unreported cash hoard.

Granting that income tax evasion can be associated with increased hoarding and a consequent growth in excess currency outstanding, how big is the impact? This is unknown, but several clues indicate that tax evasion is not the main reason for the large amount of currency outstanding and probably is not even an important factor. First, as noted earlier, holdings of currency were relatively much larger in the early years of the 1900s (10 percent of personal income) than they are now (7 percent of personal income) even though there was no income tax then.

A second reason for questioning whether tax evasion has to account for such otherwise irrational behavior as hoarding nonearning currency is that movements of currency levels have not been too much different from movements of individual demand deposit levels. Both grew tremendously during World War II, much more rapidly than GNP, but since then they have grown more slowly than GNP. Demand deposits are also nonearning assets and their holdings seem to be distributed among individuals much like currency holdings. Thus holdings of nonearning demand deposits can be considered almost as irrational as currency holdings, but the motive of hiding income cannot be applied to them so why must it apply to currency?

A third reason for discounting the tax evasion explanation is that the annual growth in currency holdings has been negatively correlated with the estimated annual amount of unreported personal income since 1944, the earliest year for which unreported income estimates have been made.[1] This is not to deny, however, that some currency hoards undoubtedly represent unreported income. But evidently the magnitudes involved are not large enough to account for a significant portion of the level of currency outstanding. Hoarding currency is certainly not a necessary factor in tax evasion; while the annual amount of unreported personal income since 1944 has varied between $20 and $60 billion, the amount of total currency outstanding has varied between a slight decline to plus $7 billion.

Savings

Explaining the growth in currency and coin outstanding as representing personal saving is as redundant as calling a savings deposit saving. Currency and coin that are not spent are obviously saved. What is meant by ascribing saving as the motive for cash holdings is that the growth in these holdings is explained by the action of individuals who prefer to save in this form rather than in the more conventional financial savings forms like savings deposits, bonds, and stocks. Practically all households save and evidently some of them save a sizable amount in the form of currency.

The large increase in currency holdings during World War II clearly appeared to represent savings. Savings in all forms of liquid financial assets rose tremendously as the large government deficit had to be matched by private

[1] See Paul S. Anderson, "The Rise of Currency in Circulation During World War II," *The National Banking Review*, March 1966, p. 364.

saving. After 1945 all these forms of saving declined precipitiously from wartime levels, currency along with the others.

It is fairly easy to accept the savings motive as the explanation for the wartime growth. Interest rates on savings deposits were so low, often 1 percent per year or so, that little income was lost by saving in a nonearning form. While savings bonds had yields of almost 3 percent, they were not understood by many savers and they also involved some trouble to purchase.

It is much more difficult to understand why currency and coin have been accumulated over the past 10 years when interest rates on savings deposits have been 5 percent and higher. Evidently some individuals do not place their liquid savings in savings accounts for the same reason that some do not use checking accounts. Some may simply not want anyone to know how much they have in savings. Others may be shy and feel uncomfortable in the white-collar atmosphere of banks or they may dislike the prying that is involved in opening a deposit account. Still others may be classical misers who enjoy viewing and handling their financial wealth.

One possible way to "smoke out" hoards is to recall all outstanding currency and to exchange it for new issues, forcing exchangers to validate any large amounts. This process would, however, be very expensive and troublesome for both the government and the citizens. It probably would not accomplish the goal of uncovering hoards of cash that could be proved to be associated with illegal actions. Thus it is likely to be a wasteful operation.

Currency in Active Use and in Hoards

Whatever the reason for cash hoards, whether savings or tax evasion, it seems quite apparent that they must exist in substantial volume in order to account for the massive levels of currency outstanding per capita. About the only direct corroboration of these hoards would be a currency recall which would be very disruptive and, in the end, probably not of much value. But indirect evidence of the existence of unused currency in hoards can be obtained if some estimate could be made of the amount of currency that is in active use. The remainder then must be in idle hoards. One available measure of currency usage is the volume that is turned back to the U.S. Treasury each year for redemption as unfit for further use.

To derive the estimated amount of currency in active use from annual redemptions, we must have an estimate of the average use life of currency so that we can use the following formula:

Currency in active use =
Redemptions per year × average life in years.

Thus if the average life is two years, the amount of currency in active use is double the volume of annual redemptions.

What is the use life of currency? If we assume that practically all $1 notes are in active use, then we can get the use life of these notes by dividing average outstandings by annual redemptions; the result of this division over the past 30 years has been close to 1½ years. This contrasts with the result for higher denomination notes. For $20 notes, for example, dividing average outstandings by annual redemptions gives an apparent life of five years. The discrepancy in use lives must be explained by the fact that a good share of the $20 notes are not in active use and thus are not getting worn out. Thus, 1½ years is probably a much more accurate figure for the life of currency in active use. Using this figure in the above formula results in Table 1.

According to these calculations, only a third of the currency outstanding is in active use. Two-thirds is in savings hoards, which goes far in explaining the large amounts outstanding. The saved amounts are mostly in large denomina-

Table 1

Currency Outstanding, Redeemed, In Active Use, and In Hoards, June 1975

Denomination	Redeemed	Outstanding	Estimated to be in active use	Estimated amount in idle hoards
		(billions)		
$ 1	$ 1.7	$ 2.6	$ 2.6	$ 0.0
2	0.0	0.1	0.0	0.1
5	1.9	3.6	2.9	0.7
10	3.7	10.2	5.7	4.5
20	5.9	26.8	9.0	17.8
50	0.8	7.7	1.3	6.4
100	1.0	21.3	1.5	19.8
500 and over	0.0	0.4	0.0	0.4
Total	$15.0	$72.7	$23.0	$49.7

tions, as would be expected. One hundred dollar notes comprise 40 percent of the estimated savings hoards and since these are unlikely to be obtained in the ordinary course of payments, the owners must have obtained them, presumably from banks, with the express purpose of saving them. This would seem to indicate that they were not trying to conceal their currency acquisitions in order to avoid suspicion of tax evasion.

The same technique for using redemptions to estimate the amount of currency in active use was applied to selected years since 1890. At least one representative year was selected from every decade except the 1930s and 1940s for which redemption data by denomination were not available.[2] The estimated amounts of currency are expressed as ratios to GNP for comparability over time. Also presented in Table 2 are the average sizes of currency in use and in hoards.

Estimated currency in active use has declined quite steadily as a percentage of GNP except for the slight rise from 1925 to 1950 during the Great Depression and World War II. Currently the ratio is about one-half its size at the turn of the century. Probably even more of a decline might have been expected and could well have occurred if the depression and war had not occasioned the slight reversal. The decline in the relative amount of currency in active use somewhat contradicts the results of surveys made of the proportion of cash in money deposited in banks. This cash deposit proportion was almost the same in New England and Texas in the early 1960s as it had been some 70 years earlier.[3] One possible explanation of such surprising stability in this proportion is that in those early years, cash was probably circulated more times before being deposited in a bank, thus cash usage was relatively greater than its proportion

[2] The basic data for estimation up to 1930 were from the standard table in the *Annual Report of the Secretary of the Treasury* entitled "Amount of United States Notes, Treasury Notes, gold and silver certificates of each denomination issued, redeemed and outstanding." This table excludes National Bank and Federal Reserve notes but it was assumed that their unfit redemption rates by denomination were the same as those of the included currency. Also, denominations larger than $100 were redeemed in substantial amounts in those years but since they were obviously not in active use but were probably used for settlements with other banks and the U.S. Treasury, they were excluded from the estimates.

[3] See the Federal Reserve Bank of Boston, *New England Business Review*, September, 1963 and the Federal Reserve Bank of Dallas, *Monthly Review*, February 1965.

Table 2

Estimated Currency In Use and In Hoards: Percentages of GNP and Average Sizes

Year	Percentage of GNP		Average size of currency[1]		
	In active use	In hoards	Total	In active use	In hoards
1890	3.4	3.1	$ 6.80	$ 5.10	$10.20
1901	2.9	3.1	6.30	4.40	10.60
1907	2.5	3.4	5.90	3.60	10.80
1913	2.7	3.0	5.30	3.20	10.80
1925	2.2	2.8	5.70	3.20	13.70
1950	2.5	6.5	10.00	4.50	19.60
1957	2.6	3.9	9.50	4.60	21.00
1960	2.1	3.8	9.40	4.70	21.00
1964	2.1	3.4	9.20	4.70	23.00
1970	2.1	2.9	10.00	5.40	26.00
1974	1.7	2.9	11.40	5.60	28.00
1975	1.5	3.3	11.80	5.40	27.00

[1] Average size is calculated by dividing the amount outstanding by the number of pieces of currency making up that amount.

in money deposited in banks. Another explanation is that those early deposit surveys were based on a single day's deposits and none were taken on a Monday which appears to be the day with the largest incoming cash deposits. (The New England and Texas surveys covered deposits for an entire week.)

In 1974 and 1975, the ratio of currency in active use to GNP dropped fairly sharply from the stable level of the 1960s. While this ratio has been declining, the recent drop is sharper than customary. Whether this truly reflects a faster relative decline in the use of currency or whether it is caused by some factor like a change in the use life of the larger sizes of currency is unknown. Redemptions of $5, $10 and $20 notes declined slightly in 1975 from 1974 even though redemptions of $1 notes rose slightly. According to the method used for estimating currency in active use, a decline in redemptions lowers the estimate.

The ratio of estimated currency in savings hoards to GNP is currently at much the same level as it was at the turn of the century. A decline in this ratio would probably be expected with the greater availability of a variety of interest-earning savings assets. One factor which might bear on this ratio is the large amount of gold coin that was in the hands of the public in the 1890–1915 period. If gold coin had been saved in the same proportion as currency, the 1901 ratio of cash savings hoards to GNP would be up from 3 to 5 percent.

The ratios to GNP of currency in use and in hoards apparently shed little new light on the question of the relation of currency holdings to tax evasion. The decline in the relative amount of currency in active use since the imposition of the income tax in 1913 would seem to contradict the notion that excessive amounts of currency are used in transactions to hide evidence of income received. The stability of the ratio of currency in hoards to GNP since the income tax could be taken, on the one hand, as an indication that the size of these hoards does not reflect income tax evasion. On the other hand, since this

ratio might be expected to fall over time, its stability could be ascribed to tax evasion. The pronounced rise in the ratio of cash hoards to GNP during World War II was matched, as noted earlier, by similar rises in the ratio of savings deposits to GNP so it cannot be taken as evidence of a desire to hide income received.

The average size of total currency outstanding has changed surprisingly little over the past 85 years. Movements in the average size of the two components, in use and in hoards, determine, of course, any change in the overall average. The average size of currency in use declined fairly sharply from 1890 to 1907, probably reflecting increased use of checks by consumers. This average remained approximately stable to the 1920s, perhaps because the downward influence of increasing check usage was being offset by the upward influence of rising prices (most price indexes almost doubled over World War I) and rising real incomes. While rising real incomes are usually associated with automobile and home purchases which are likely to involve payments by check, rising incomes apparently also result in a greater than proportionate increase in cash purchases of "sundries" such as newspapers and magazines, food and beverages away from home, tobacco, and small items available from "dime" and drug stores.

Check usage undoubtedly declined during the depression years which probably accounts for most of the jump in average use size between 1925 and 1950. After 1950, personal check usage apparently started climbing again, but this influence evidently was more than offset by rising prices and rising real incomes so that average use size rose steadily to 1974.

The average size in hoards has behaved very consistently, rising steadily over the entire period, except for the decline in 1975 which is suspect, probably due to shifts in redemption patterns, as noted earlier. This trend increase in average size reflects the growing dominance of $100 notes in hoards, as shown by the following approximate breakdowns of estimated savings hoards currently and in 1901:

	1975	1901
	(percent)	
$100 notes	40	10
$ 50 "	15	5
$ 20 "	35	30
$ 10 "	10	35
$ 5 "	0	20
	100	100

An interesting item in a recent (December 12, 1976) *Wall Street Journal* article on layoffs in Pittsburgh's steel plants corroborated the use of large size notes for savings. A retailer reported, "People are coming in now with $50 and $100 bills they had stashed away. I got three $50s and one $100 one day."

As contrasted with the substantial shift in the estimated structure of saving hoards, the structure of currency in use has been quite stable. One-dollar notes currently comprise roughly 10 percent of the amount and 60 percent of the number of pieces of currency in active use, not much changed from 1901. Twenty-dollar notes supplanted $10 notes in first place in amount, while $5 notes fell from second to third place. Out of every 20 pieces, totalling roughly $100, of currency now in active use, there are about 12 $1 notes, three of each of $5 and $10 notes and two $20 notes.

Coin

Coin accounts for around 10 percent of cash money and 2 percent of the total money supply. Since 1890, it has generally been a fairly stable .4 to .5 percent of GNP. At present it is just over .5 percent of GNP a ratio exceeded only at the end of World War II and then by only a slight margin.

Now around $40 of coin per capita is outstanding. This is certainly much more than is

carried in pockets and purses. Even coin vending companies would need but a dollar or less per capita to supply all change requirements for their machines. Thus, as with currency, most coin must be in idle hoards, both in ordinary piggy-bank-type savings and in collections. It is likely that a greater percentage of coin than currency is lost but such losses are probably still in small percentage of the amount of coin recorded as outstanding.

A special reason for hoarding coin over the past 10 years or so has been the hope for speculative gain by holders as a result of the rises in the prices of silver and copper. If these prices go high enough, the metallic, or intrinsic, value of coins would exceed the monetary value and the coins could be melted at a profit, even though this is illegal. The possibility of such speculation can lead to anticipation of coin shortages which itself causes shortages as individuals and businesses begin to hoard coin so that they will not be caught short.

Summary and Implications

An unbelievably large amount of currency and coin is in the hands of the public with most apparently owned by consumers. The $80 billion outstanding averages out to be about $1,000 per family. Most families do not hold anywhere near this amount, so a minority of individuals must have very large holdings, perhaps of $5,000, $10,000 or even more. Only a minute percentage of the currency outstanding is lost or destroyed.

The volume of redemptions of worn-out currency indicates that only about one-third of the total outstanding is in active use. The smaller denomination rates are mostly in active use, judging from the rates at which they wear out. The $50 and $100 notes, which together comprise about 40 percent of outstanding currency, are evidently almost entirely in hoards because only very small proportions of them are turned in for replacement.

The amount of currency and coin currently outstanding, while unbelievably large, is not unusual compared to either historical U.S. experience or current foreign holdings. In fact, more currency per capita is currently outstanding in most European countries than here, and compared to GNP, more currency was outstanding in 1900 in the United States than now.

Why certain individuals hold such very large amounts of currency in hoards is puzzling. These holders are losing the interest income they could earn from a savings deposit which, at current rates, would almost double their money in a dozen years, and hoards can also be stolen, destroyed by fire or mislaid and forgotten. Since it appears irrational to hold idle currency instead of a savings deposit, it is widely suspected that these holders are engaged in illegal business activities or are evading income taxes. Even though sales of drugs and stolen goods are largely paid for in currency, the probable magnitude of such transactions seems not to be large enough to account for a significant portion of the amount in circulation. Retail sales made for cash, for example, only account for an estimated $1 billion of currency and coin out of the $80 billion outstanding and these illegal transactions must amount to only a fraction of legitimate cash sales.

Tax evasion could conceivably account for a sizable amount of cash in hoards. Contrary to common assumption, however, evaders would probably not request payments to them to be made in cash because this would attract attention. But presumably they receive substantial amounts in cash anyway which they could then neglect to report as income. Such normal cash receipts would, however, generally be in smaller denomination notes while about two-thirds of the estimated growth in cash hoards over the past 15 years has been in $50 and $100 notes which tends to cast some doubt on the tax evasion explanation for the growth in hoards. Also, estimated cash hoards (including gold coin) were

relatively larger at the turn of the century, before the imposition of the income tax, than they are now.

Another weakness in the tax evasion explanation is that many individuals hold huge amounts, $10,000 or more, in demand deposits which, like currency, do not earn interest. Since these demand deposits are obviously not accumulated to hide income, why must similarly sized currency hoards be attributed to the desire to hide income? A final factor casting doubt on the tax evasion argument is that the annual growth of currency hoards since 1944 has been negatively correlated with the estimated annual amount of unreported income. It seems reasonable to conclude, therefore, that the large currency growth simply represents ordinary liquid savings by individuals who distrust banks, perhaps because they lost deposits during the banking crisis of the early 1930s, or who prefer not to have bankers or anyone else know how much they hold in liquid savings.

Judging from the volume of currency worn out and redeemed, currency in use has declined relative to GNP. At the turn of the century, currency in active use equalled around 3 percent of GNP, today it is about half that. The residual, unused currency in hoards, has had a fairly stable ratio to GNP, near 3 percent, since 1900.

One of the practical implications of the conclusion that most hoarded currency represents ordinary savings rather than efforts to evade income taxes is that it would be largely fruitless to recall all outstanding currency in order to "smoke out" tax evaders. Such a recall would be quite costly for the government as well as for citizens, yet it would be unlikely to uncover much income that could be proved to be untaxed. As it is, the estimated $50 billion in currency savings hoards represents interest-free borrowing by the government which saves about $3 billion annually in interest costs, given that the average Treasury borrowing cost is currently near 6 percent.[4]

Currency and coin account for an estimated 5–10 percent of money deposited at banks and presumably the same proportion of payments. Since cash comprises about a quarter of the money supply, it has a lower turnover rate than demand deposits. In light of this, it seems a misnomer to label currency and coin held by the public high-powered money. While currency and coin in banks are bank reserves and thus high-powered money, currency and coin held by the public are simply another liquid asset and do not provide the basis for multiple expansion of money supply.

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[4] The actual operation involved in issuing currency is as follows: The Bureau of Engraving and Printing of the Treasury Department prints Federal Reserve notes which are shipped to Federal Reserve banks as needed. The Federal Reserve banks issue currency on demand to member banks, getting U.S. Government securities in exchange. The interest earnings on these securities are turned back to the U.S. Treasury.

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