The Role of Money in Monetary Policy: Why Do the Fed and ECB See It So Differently?

By George A. Kahn and Scott Benolkin

Monetary policymakers and central banks universally recognize that, in the long run, inflation is strictly determined by monetary policy. However, they disagree sharply about the role of monetary aggregates in the conduct of monetary policy. For example, former Federal Reserve Governor Lawrence Meyer has said that "money plays no role in today's consensus macro model…. and virtually no role in the conduct of monetary policy, at least in the United States." In contrast, Otmar Issing, former member of the Executive Board of the European Central Bank (ECB) has said that, "money should never be ignored—neither in monetary policy nor in research."

These differences in views are reflected in the way the Federal Reserve and the ECB conduct monetary policy and communicate with the public. At the Federal Reserve, the Federal Open Market Committee (FOMC) no longer specifies targets or monitoring ranges for the monetary aggregates, and committee members seldom mention the aggregates in their deliberations. For example, a search of the most recently published transcript of an FOMC meeting (for December 2001) reveals that the money supply was mentioned only twice—in the same sen-

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tence. In contrast, at the ECB, money growth represents one of two "pillars" of monetary policy. As such, the ECB regularly examines the implications of money growth for the inflation outlook over the medium term to long term.

While the role of money currently differs sharply in the Federal Reserve's and ECB's conduct of policy, there is ongoing debate within both institutions about what role, if any, money should play. For example, Federal Reserve Bank of St. Louis President William Poole has said he is "uneasy that money plays practically no role in policy discussions in the Federal Reserve today…. if and when [warning signs from money growth] appear, I will not be the only [member of the Federal Open Market Committee] talking about them." More recently, in contrast, some members of the ECB's policy committee have suggested the role of money should be somewhat redefined. For example, Christian Noyer, governor of the Bank of France and a member of the ECB's governing council, has questioned the reliability of recent money growth as an indicator of future inflation given ongoing financial market developments such as the growth in hedge fund assets (*The Wall Street Journal*).

What accounts for these differences of views, and why do the Federal Reserve and ECB see things so differently? This article concludes that the Federal Reserve and ECB differ in their approach to the monetary aggregates for two main reasons. First, their institutional histories are different. And, second, in the United States and the Euro area, there are differences in the usefulness of monetary aggregates as indicators of future economic conditions over the medium to long run. The first section of the article examines the way monetary aggregates are currently used by the Federal Reserve and ECB. The second section explores explanations for the different approaches at the Federal Reserve and ECB. The appendix describes the theoretical basis for the view that money is important in monetary policy as well as the alternative view that money is more of a sideshow.

I.   THE CURRENT ROLE OF MONEY IN FEDERAL RESERVE AND ECB MONETARY POLICY

The Federal Reserve and ECB currently view the role of money in monetary policy very differently. For the Federal Reserve, the monetary aggregates are indicator variables like a myriad of others that are monitored

for clues about the outlook for economic activity and inflation. For the ECB, the monetary aggregates have special status and their behavior is given considerable weight in policy deliberations.

Federal Reserve

The goal of Federal Reserve monetary policy is maximum sustainable growth with price stability. The Federal Reserve seeks to achieve this goal through its influence over the federal funds rate—the overnight rate that banks charge each other for loans of reserves held at the Federal Reserve.[1] To influence the federal funds rate, the Federal Reserve conducts open market operations that affect the supply of money. But, in the Federal Reserve's current approach to policy, the money supply plays no special role in the FOMC's determination of its desired target for the federal funds rate. Instead, the monetary aggregates are viewed as information variables, just like other economic indicators, and are analyzed for their information content in assessing future economic conditions.

The Federal Reserve currently collects data on, and examines the behavior of, two monetary aggregates—M1 and M2. M1 consists of money balances used in making payments, including currency, travelers checks, demand deposits, Negotiable Order of Withdrawal (NOW) accounts, and similar interest-earning checking accounts. M2 consists of M1 plus savings deposits, money market deposit accounts, small time deposits, retail-type money market mutual funds, overnight repurchase agreements, and overnight eurodollars. Thus, M2 comprises balances that can be used in transactions or, for the most part, be easily converted to transactions balances.[2]

A stable and predictable medium- to long-run relationship between money growth and nominal spending is necessary for using monetary aggregates as a front-and-center guide to monetary policy (appendix). Although the Federal Reserve devotes considerable effort to understanding the behavior of the money supply, neither M1 nor M2 has proved to be a reliable guide to policy.[3] As a result, when it comes to policy deliberations and decisions, the aggregates play no special role. For example, in the latest publicly released document summarizing the Board of Governors staff's outlook in advance of an FOMC meeting (the "Greenbook," Part 1), the monetary aggregates were generally not mentioned as a factor in the outlook for economic activity or inflation.[4]

The monetary aggregates received somewhat more attention in the Board staff's latest publicly released document describing monetary policy alternatives for the FOMC's consideration (the "Bluebook").[5] In this document, the recent behavior of various monetary aggregates was described in the text and in tables and charts. In addition, growth of the aggregates was forecast under alternative policy actions. However, in the discussion of the policy alternatives themselves, little or no mention was made of the monetary aggregates.

Finally, since the beginning of 2006, the minutes of FOMC meetings, currently released three weeks after each meeting, have contained only brief, one- or two-sentence summaries of recent developments with respect to M2. For example, the minutes of the May 2007 meeting indicated, "M2 accelerated during March and April, primarily reflecting faster growth in liquid deposits, which were likely boosted in April by tax-related flows" (FOMC).[6] Even more tellingly, the short statement that the FOMC releases after every meeting to explain its actions has *never* made a reference to a monetary aggregate since these statements were first issued in 1994.[7] And, according to the latest transcripts of FOMC meetings that have been released to the public, FOMC members seldom mentioned the monetary aggregates in their deliberations in 2001.[8]

European Central Bank

The role of money is much more prominent at the ECB. The primary objective of ECB monetary policy is to maintain price stability, defined as inflation rates "below, but close to, 2 percent over the medium term." The strategy of the ECB in meeting its objective is based on two "pillars"—economic analysis and monetary analysis. The two pillars are used in "organizing, evaluating, and cross-checking the information relevant for assessing the risks to price stability" (*www.ecb.int*).

The economic analysis pillar takes the form of a broad-based economic assessment called the "macroeconomic projections exercise." In this exercise, the ECB's staff identifies and analyzes economic shocks and the cyclical dynamics of economic activity and inflation. The staff also produces forecasts of inflation and economic activity over the coming two to three years. The analysis is similar to the policy analysis conducted at the Federal Reserve and other central banks.

The monetary analysis pillar, which has no counterpart in the Federal Reserve, consists of a detailed analysis of the implications of money and credit developments for inflation and economic activity.[9] The analysis is contained in the *Quarterly Monetary Assessment* (*QMA*). This document analyzes developments in the monetary aggregates, not simply for their own sake, but to understand their implications for inflation and monetary policy. The analysis focuses not on short-run fluctuations but on the implications of money growth for inflation dynamics over the medium to long run. Finally, the analysis incorporates information from a variety of sources in addition to the monetary aggregates, including a range of financial assets, prices, and yields.

The basic structure of the *QMA* has remained largely unchanged since its inception in December 1999. The assessment is divided into three parts. The first part reviews recent developments with the monetary data, placing them in a longer-run historical context. The second section uses a variety of tools to explain recent monetary developments and uncover "the prevailing underlying rate of monetary expansion corrected for shorter-term distortions" (Fischer, Lenza, Pill, and Reichlin, p. 4). The third section then attempts to determine what recent monetary developments imply for the medium- to long-run outlook for inflation and the associated risks to price stability.

The *QMA* employs with varying emphasis over time three main types of analytical tools. The first tool is a semi-structural model of money demand. The second tool is a judgmental analysis of factors influencing money growth beyond those specified in the money demand model. The third tool is a reduced form money-based inflation forecast. While similar tools are employed at the Federal Reserve, the weight placed on them in policy analysis and decision-making at the ECB is considerably greater. Because of the importance placed on these tools in the ECB's policy process, it is worth taking a closer look at each.

Money demand models. Since its inception, the ECB has evaluated monetary developments relative to a "reference value" for growth in the monetary aggregate M3. M3 is the closest Euro area monetary aggregate to M2 in the United States. It consists of currency in circulation, overnight deposits, deposits with an agreed maturity up to two years, deposits redeemable at a period of notice up to three months, repurchase agreements, money market fund shares/units, and debt securities with maturity up to two years. Assets included in M3 have a high degree of liquidity and price certainty.

The reference value for M3 growth was set at 4½ percent per year in 1998 and remains there today. The reference value was set at a level the ECB considered consistent with maintaining price stability over the medium term. Deviations of money growth from its reference value serve as a "trigger" for further analysis to identify the source of the deviation and its implications for future inflation. A starting point in the analysis is a model of money demand.

The ECB uses a range of money demand models. All assume a stable long-run relationship in which money demand depends on such fundamental factors as real GDP and the spread between short-term market interest rates and the interest rate paid on M3 assets. Money demand is assumed to increase with real GDP and decline as market rates rise relative to the rate of return on M3.[10]

Money demand models are used at the ECB in a number of ways. First, they help confirm signals from the economic analysis pillar of the ECB's policy strategy. For example, strong money growth might be attributed to a low-interest-rate environment and rapid real GDP growth. In this case, both monetary analysis and economic analysis would be sending complementary signals about current economic conditions.

Second, the analysis of money demand models is used to distinguish transitory movements in money growth from longer-run trends. For example, money demand models suggested in 1999 that the steep Euro area yield curve was temporarily holding down money growth so that the observed M3 growth rate was understating the underlying monetary stimulus. The models, therefore, suggested that policymakers needed to take this transitory understatement of monetary expansion into account when evaluating M3 growth relative to its reference value.

Third, money demand models provide a benchmark for evaluating the cumulative effect of past money growth on overall liquidity in the economy. Money demand models provide an estimate of the long-run equilibrium level of money demand that can be compared with the outstanding stock of money. A level of M3 significantly above its equilibrium would suggest the possibility of a buildup of inflation pressures. Moreover, subdued M3 growth due to a "correction of excess liquidity accumulated in the past, (other things equal)…would be viewed less benignly in terms of inflationary pressures than the same subdued rate of monetary growth stemming from other determinants" (Fischer, Lenza, Pill, and Reichlin, p. 6).

Judgmental analysis. The second tool the ECB uses in its monetary analysis is a judgmental examination of movements in M3. The ECB recognizes that factors outside the money demand framework can influence money growth over the medium term. ECB staff uses judgment to identify developments that help explain the otherwise unidentifiable movements in M3. The product of the judgmental analysis is an adjusted M3 data series that removes from M3 the idiosyncratic movements related to factors outside the money demand framework. The resulting data series is referred to as M3C for M3 "corrected."

Three types of judgmental adjustments have been made over time to M3. The first type of adjustment is due to technical factors. For example, when the ECB introduced interest-bearing reserve requirements to the Euro area in 1999, the disincentive to holding funds in reserves was sharply reduced; and banks in some countries shifted holdings from offshore to onshore accounts. The resulting surge in M3 was judged to be a one-time shift that had little potential impact on the outlook for inflation. The size of the effect was estimated and removed in the M3C series.

The second type of judgmental adjustment addresses "specific statistical problems" in the monetary data. The best example of such an adjustment occurred beginning in mid-2000 when nonresidents of the Euro area—mainly from Asia—began purchasing various marketable instruments from Euro area financial institutions in an effort to diversify their portfolios. These purchases had a significant impact on M3 but were not likely to be associated with a buildup of inflationary pressure. In response, ECB staff constructed a measure of nonresident purchases of these instruments and eventually published a revised official M3 series.

The third type of judgmental adjustment reflects "economic behavior…not explained by the conventional determinants of money demand." For example, heightened economic uncertainty from late 2000 to mid-2003, associated with falling equity prices and geopolitical uncertainty, led Euro area investors to seek safe-haven investments. Investors sold equities and purchased M3 assets such as money market mutual funds. These portfolio shifts were thought to be temporary, though perhaps somewhat persistent, and likely to be reversed when economic uncertainty returned to a more normal level.

Chart 1
ANNUAL GROWTH RATES OF M3 AND M3 CORRECTED

Percent
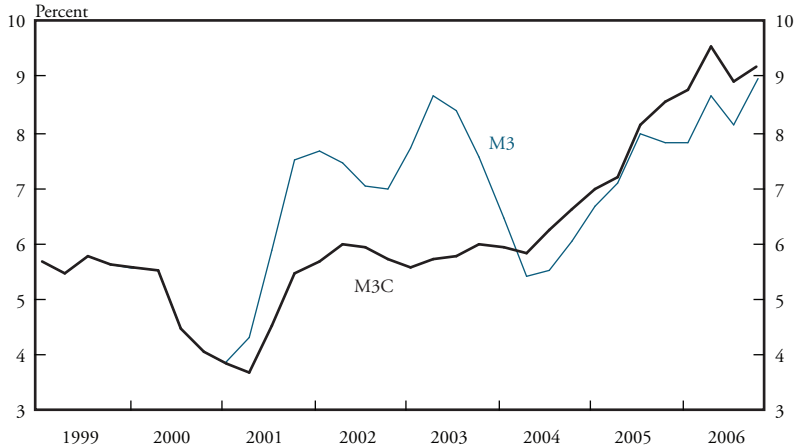
Source: European Central Bank

In each of these cases, judgmental adjustments to M3 were made in real time. Chart 1 shows the cumulative effect of the adjustments to the M3 data beginning in 2001:2. At their peak, the judgmental adjustments subtracted almost three percentage points from growth in M3. From 2001 to 2004, much of the deviation of M3 growth from its reference value of 4½ percent was due to portfolio shifts that were judgmentally excluded from M3C. Because the ECB's money demand models cannot account for such portfolio shifts (especially in real time), the ECB has placed greater emphasis over time on M3C as an indicator of inflationary pressure.

Money-based inflation forecasts. In addition to money demand models and judgmental analysis, the ECB also uses reduced form models to forecast inflation as a function of current and past money growth. These bivariate models regress inflation on lagged values of inflation and lagged values of money growth. The models are then used to forecast inflation at various future horizons using, alternatively, growth in M3 and M3C as the money growth measure.

Whereas initially the ECB staff embedded a money demand equation in a larger macro model to forecast economic activity and inflation, today, the ECB focuses instead on these bivariate reduced form models. Forecasts from larger structural models incorporating money demand equations

"did not provide a satisfactory forecasting performance" (Fischer, Lenza, Pill, and Reichlin, p. 11). As discussed below, the money-based bivariate inflation models have proved to be more promising in providing signals of inflationary pressures.

II.   WHY DO THE FED AND ECB SEE THE ROLE OF MONEY SO DIFFERENTLY?

The differing role of money in the Federal Reserve's and ECB's conduct of monetary policy can be attributed to two main explanations. First, the ECB and the Federal Reserve have very different institutional histories, especially in that the ECB is a relatively new central bank. Second, as an empirical matter, monetary aggregates have been more closely associated with inflation in the Euro area than in the United States in both the medium and long term.

Institutional histories

The Federal Reserve and the ECB have a different historical experience using money in monetary policy. While the Federal Reserve increased its focus on money growth during the period of high inflation in the 1970s and early 1980s, the monetary aggregates have not generally been central to FOMC monetary policy before or after that period.

In the Federal Reserve's early history, reliable money supply statistics did not even exist.[11] From the late 1930s to the 1960s, academic and Federal Reserve interest in measuring the money supply increased, and policymakers looked for ways to use newly available data on the monetary aggregates. Rising inflation in the 1970s led to an increasing emphasis on the aggregates at the Federal Reserve as a way to monitor and counter inflationary pressures. For example, in 1970, the FOMC added a proviso to its policy directive that money growth should not deviate significantly from projections. In 1974, the committee began to specify tolerance ranges for growth in both M1 and M2 over the period to its next meeting. In 1975, under direction from Congress, the FOMC began reporting annual target ranges for various money and credit aggregates including M2. However, money growth often overshot its target and inflation increased.

The period from late 1979 to 1982 represented the high-water mark for the use of monetary aggregates at the Federal Reserve. In an effort to bring inflation down, the Federal Reserve directly controlled the growth of nonborrowed reserves to achieve growth targets for M1 and M2. The policy was successful but broke down in the early 1980s when the introduction of NOW accounts caused the behavior of M1 to deviate unpredictably from its historical pattern. Later, other financial innovations, such as the increased availability and reduced cost of stock and bond mutual funds, reduced the usefulness of M2 as a guide to policy. These innovations led households to shift funds out of M2 at increasing rates over time.[12] As a result, the FOMC discontinued setting target ranges for the monetary aggregates in 2000 after the statutory requirement for reporting them expired.[13]

In contrast, the ECB carries forward the tradition of the German Bundesbank where money growth was always central. As a new central bank, the ECB needed to establish its credibility for maintaining price stability. Inflation-fighting credibility is critical for any central bank because inflation depends to a large extent on people's expectations. If economic agents expect the central bank to deliver price stability, they will not build inflation expectations into their price- and wage-setting behavior. Inflation will remain well anchored as long as the central bank acts in a way consistent with maintaining price stability. But how does a new central bank with no track record establish credibility?

The ECB sought anti-inflation credibility in part by announcing a specific strategy for monetary policy that emphasized the money supply in a way that was similar to, but more flexible than, the one used previously by the Bundesbank.[14] In this way, the ECB hoped to inherit the Bundebank's credibility as an institution that would deliver price stability over the medium to long run. While the ECB chose not to emulate the Bundesbank by setting monetary targets, it chose a strategy that, as described above, placed considerable emphasis on money growth relative to a reference value.[15] This emphasis was based on the idea that inflation is ultimately a monetary phenomenon. The ECB made this strategy public before it began setting monetary policy for the Euro area. In addition, the identification of a specific strategy helped the newly formed Governing Council of the ECB—including governors from the 11 previously autonomous central banks that initially made up the Euro area—to work productively together toward a common agreed-upon goal.
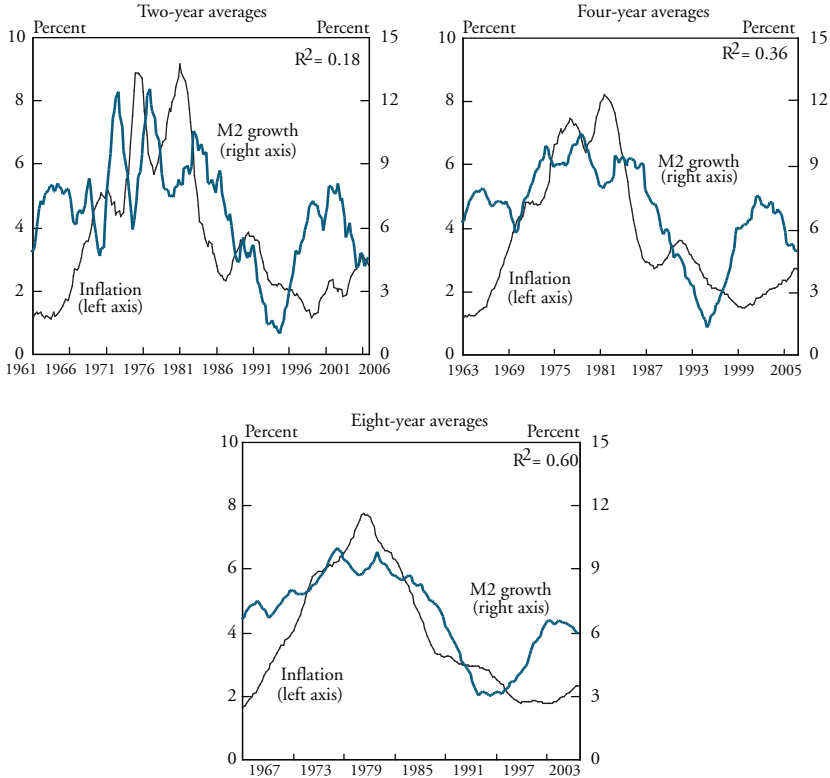
Empirical evidence

Historical differences aside, empirical evidence suggests money is a more useful indicator of future inflation in the Euro area than in the United States. First, over the medium to long run, the correlation between money growth and inflation is greater in the Euro area. Second, the relationship between nominal spending and money growth is more stable in the Euro area than in the United States. And third, unlike in the United States, money growth helps predict inflation in the Euro area in simple regression models. A variety of explanations have been given for these empirical results.

Correlation of money growth and inflation. One reason the ECB relies more heavily than the Federal Reserve on monetary aggregates is that the historical relationship between money growth and inflation has been stronger in the Euro area than in the United States. Although money growth and inflation are correlated over the long run in both the United States and the Euro area, the correlation is higher in the Euro area. In addition, over the medium term, the correlation of money growth and inflation in the Euro area is much higher.

In the United States, the correlation between money growth and inflation is relatively low in the medium term but rises over the longer term. Chart 2 shows inflation and money growth for the United States from the 1960s to 2006 using average growth rates calculated during the previous two-, four-, and eight-year periods.[16] The inflation measure is the annualized quarterly change in the GDP deflator, and the money measure is the annualized quarterly growth rate of M2.[17] Averaged over two years, the relationship between money growth and inflation appears quite weak. The correlation between inflation and money growth indicated by the R^2 statistic in the chart is 18 percent—suggesting that only 18 percent of the variation in inflation over this period is associated with variation in money growth.[18] Moreover, money growth and inflation sometimes move in opposite directions as in the periods 1961-68, 1980-84, and 1996-2006.

The correlation between money growth and inflation rises with the number of years over which money growth and inflation are averaged. Based on four-year averages, the R^2 statistic rises to 36 percent. And, based on eight-year averages, the R^2 statistic rises to 60 percent. Still,

Chart 2
MONEY GROWTH AND INFLATION
IN THE UNITED STATES

Two-year averages

Four-year averages

$R^2 = 0.18$

$R^2 = 0.36$

M2 growth
(right axis)

M2 growth
(right axis)

Inflation
(left axis)

Inflation
(left axis)

Eight-year averages

$R^2 = 0.60$

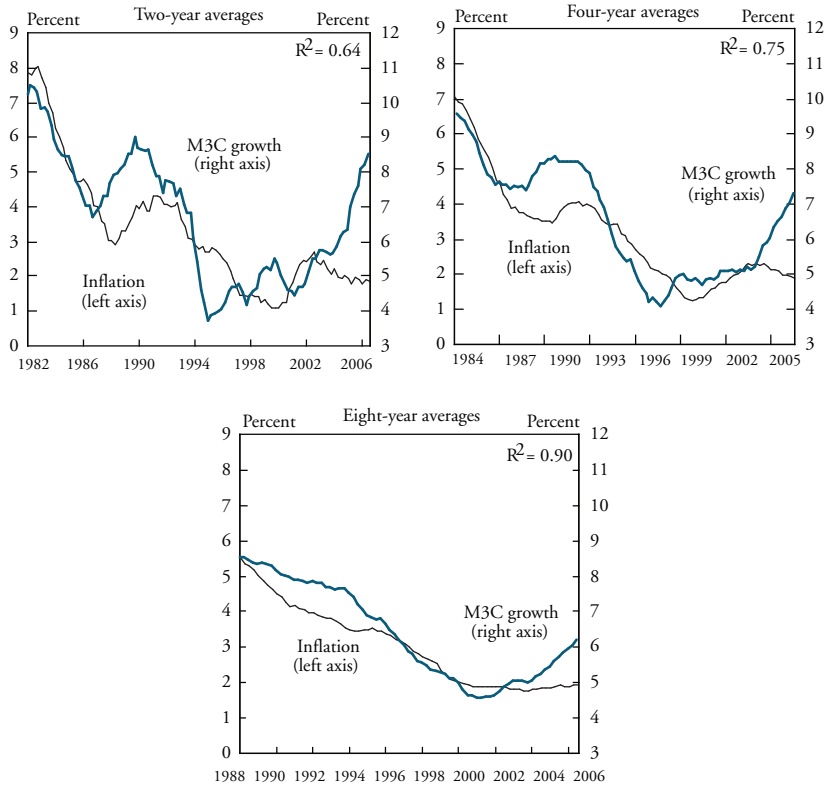M2 growth
(right axis)

Inflation
(left axis)

Note: Inflation is defined using the implicit GDP price deflator (chained).
Source: Bureau of Economic Analysis, Federal Reserve Board of Governors

even with eight-year averages, the period from roughly 1999 to 2006
stands out as one in which money growth and inflation moved in oppo-
site directions.

The correlation between money growth and inflation in the Euro area
is stronger across all time frames. Chart 3 shows inflation and money
growth for the Euro area from the 1980s to 2006 using growth rates calcu-
lated over the same two-, four-, and eight-year periods. For comparability
with the United States, the inflation measure is the annualized quarterly
change in the GDP deflator, and the money measure is the annualized
quarterly growth rate of M3C.[19]   The R^2 statistic for two-year-average

Chart 3
MONEY GROWTH AND INFLATION IN THE EURO AREA

Note: Inflation is defined using the implicit GDP price deflator.
Source: European Central Bank

growth rates of money and inflation in the Euro area is 64 percent—higher than the *eight-year average* growth rates for the United States. In addition, the R^2 statistic rises to 75 percent in the Euro area with four-year averages and 90 percent with eight-year averages.[20]

Stability of the relationship between money and nominal spending. Another explanation for the ECB relying more heavily on money growth than the Federal Reserve is the greater stability of the relationship between nominal spending and money in the Euro area—at least until recently. As discussed in the appendix, nominal spending is by definition the product of the money supply and the average number of times per

year each unit of money is used in the purchase of final goods and services. If this turnover rate of money—the "velocity" of money—is stable and predictable over time, the money stock can be used to predict nominal spending.

From 1980 to 2006, velocity was more stable in the Euro area than in the United States. Chart 4 shows velocity of M2 for the United States (top panel) and the velocity of M3C for the Euro area (bottom panel). In both cases, velocity is defined as (the logarithm of) the ratio of nominal GDP to the respective money supply measure. In the United States, the gradual upward trend in velocity is attributable to financial innovations that have reduced the demand for money over time. In the Euro area, velocity has trended downward. One possible reason for this difference is that financial modernization may have occurred more slowly in the Euro area, allowing wealth effects to dominate the effects of financial innovation (Bordes, Clerc, and Marimoutou). If M3 incorporates monetary assets with similar returns as nonmonetary financial assets, an increase in wealth can lead to increased M3 money holdings and a decrease in velocity.

More important than the slope of the trend in velocity is the stability of the trend. In the Euro area, deviations of actual velocity from trend have been relatively small, at least up until 1999 when the ECB began operations.[21] This relative stability contributed to confidence of monetary policymakers in the Euro area that money growth would be a valuable guide to ECB policy. However, since 2001, there appears to be a marked decline in the slope of trend velocity. The key question is whether this a temporary decline or a permanent shift.[22] Even with this potential shift in behavior, though, velocity has been relatively stable in the Euro area.

In the United States, the velocity of M2 has deviated further from trend than M3C velocity in the Euro area. Since the mid-1980s, these deviations have been quite large by historical standards. (Before then, trend velocity was roughly constant and deviations from trend were relatively small.) In particular, from the mid-1980s through the early 1990s, actual velocity fell below trend. From the mid-1990s to roughly 2000, velocity rose substantially above trend. And, from 2000 to 2006, velocity again fell below trend in the United States.

These large and unpredictable movements in M2 velocity are one key reason the Federal Reserve has deemphasized money in its conduct of monetary policy. They have been caused by the rapid pace of financial

Chart 4
VELOCITY OF MONEY
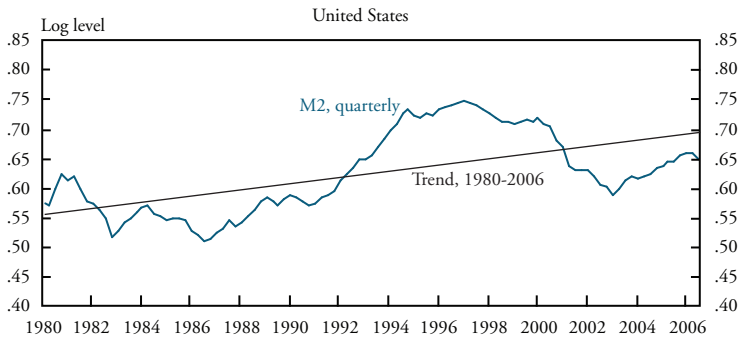
Source: Bureau of Economic Analysis, Federal Reserve Board of Governors, and author's calculations
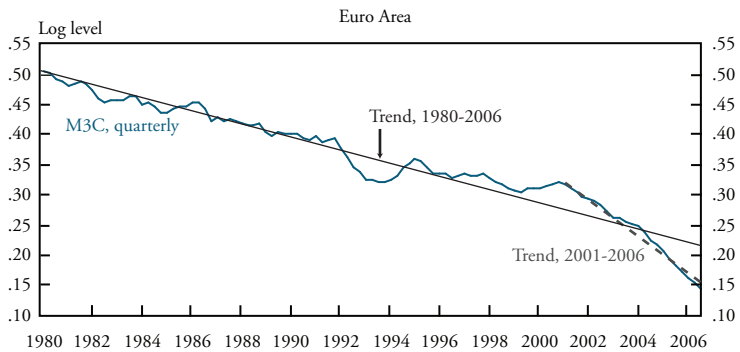
Source: European Central Bank and author's calculations

innovation in the United States, regulatory changes, technological progress, and other special factors such as the large holdings of U.S. currency abroad (Bernanke).

Money as a predictor of inflation. Another reason the ECB finds money more useful than the Federal Reserve is the usefulness of money growth in reduced-form models as a predictor of inflation. As discussed above, the ECB's *QMA* incorporates inflation forecasts from reduced-form models in which money growth is the key explanatory variable. While these models suggest money growth is a significant explanatory variable in the Euro area, application of similar models to the United States shows money to be much less helpful in predicting U.S. inflation.

A simple version of the type of model used by the ECB is a regression of inflation on past inflation and past money growth.[23] On the left side of the equation is the annualized quarterly inflation rate at various horizons into the future. On the right side is a constant, the current inflation rate, and the current quarterly annualized rate of money growth. Inflation is measured by the implicit GDP deflator, and money growth is measured by M3C.[24]

Estimation of this bivariate model shows that money is a significant explanatory variable for inflation in the Euro area at a variety of forecast horizons. The columns of Table 1 report regression coefficients and their standard errors. While the ECB's forecasting exercise generally focuses on inflation at horizons six months or further into the future, Table 1 reports results from regressions explaining annualized quarterly inflation two, six, and 12 quarters ahead. From the early 1980s to 2006:4, shown in the first column, money growth at all three horizons is positively and significantly related to future inflation. This suggests that money growth is potentially useful in forecasting inflation in the Euro area.

However, the usefulness of money as a predictor of inflation appears to have diminished in the 1990s and 2000s. The second and third columns of Table 1 show the same regression results for the respective subperiods of 1991:1-2006:4 and 1999:1-2006:4. For the 1991:1-2006:4 subperiod shown in the second column, money growth is insignificant as a predictor of inflation two quarters ahead and has the wrong sign. At six quarters ahead, money growth is significant, but the size of its coefficient is roughly half as big as for the full sample period. And at 12 quarters ahead, the coefficient is no longer significantly different from zero. For the 1999:1-2006:4 subperiod shown in the third column, the coefficient on money growth has the wrong sign at each of the three forecast horizons (and is significantly negative at two and 12 quarters ahead).[25]

In comparison, money growth has been less helpful as a predictor of inflation in the United States in every sample period since 1980, except potentially at 12 quarters ahead. Table 2 shows the same set of regression results for the United States as for the Euro area, with inflation measured by the U.S. implicit GDP deflator and the money supply measured by M2. In the first column, money growth is statistically significant only at the 12-quarter-ahead forecast horizon. However, the size of the coefficient on money growth is very small—much smaller than the corresponding

Table 1

DOES MONEY GROWTH HELP PREDICT INFLATION IN THE EURO AREA?

Two Quarters Ahead

Explanatory Variables	Period		
	1980:3-2006:4	1991:1-2006:4	1999:1-2006:4
Constant	-.257 (.461)	1.331*** (.412)	3.074*** (.583)
Lagged dependent variable	.697*** (.079)	.509*** (.093)	.011 (.206)
Lagged money growth	.177** (.086)	-.056 (.057)	-.181*** (.057)
R^2	.713	.353	.154

Six Quarters Ahead

Explanatory Variables	1981:3-2006:4	1991:1-2006:4	1999:1-2006:4
Constant	-.384 (.401)	.758* (.392)	2.205*** (.527)
Lagged dependent variable	.411*** (.090)	.215*** (.080)	.123 (.160)
Lagged money growth	.308*** (.068)	.147*** (.052)	-.059 (.068)
R^2	.643	.211	.029

12 Quarters Ahead

Explanatory Variables	1983:1-2006:4	1991:1-2006:4	1999:1-2006:4
Constant	.285 (.330)	1.349*** (.511)	2.780*** (.353)
Lagged dependent variable	.209*** (.078)	.084 (.102)	.020 (.194)
Lagged money growth	.270*** (.067)	.074 (.067)	-.156** (.075)
R^2	.448	.052	.066

* Significant at the .10 level
** Significant at the .05 level
*** Significant at the .01 level

Note: Standard errors (in parentheses) are corrected for serial correlation using the Newey-West covariance matrix.
Source: Author's calculations

Table 2

DOES MONEY GROWTH HELP PREDICT INFLATION IN THE UNITED STATES?

Two Quarters Ahead		Period	
Explanatory Variables	**1980:3-2006:4**	**1991:1-2006:4**	**1999:1-2006:4**
Constant	.788***	1.845***	3.018***
	(.225)	(.265)	(.435)
Lagged dependent variable	.643***	.232**	.051
	(.056)	(.101)	(.138)
lagged money growth	.021	-.049**	-.126***
	(.026)	(.021)	(.027)
R^2	.610	.113	.185
Six Quarters Ahead			
Explanatory Variables	**1981:3-2006:4**	**1991:1-2006:4**	**1999:1-2006:4**
Constant	1.473***	1.652***	2.336***
	(.240)	(.369)	(.306)
Lagged dependent variable	.320***	.125	-.065
	(.043)	(.135)	(.159)
lagged money growth	.034	.039	.041
	(.024)	(.033)	(.042)
R^2	.337	.038	.026
12 Quarters Ahead			
Explanatory Variables	**1983:1-2006:4**	**1991:1-2006:4**	**1999:1-2006:4**
Constant	1.601***	.811***	.803
	(.341)	(.306)	(.605)
Lagged dependent variable	.166***	.364***	.511***
	(.041)	(.107)	(.190)
lagged money growth	.070**	.117***	.102***
	(.033)	(.020)	(.036)
R^2	.211	.294	.376

*   Significant at the .10 level
**   Significant at the .05 level
*** Significant at the .01 level

Note: Standard errors (in parentheses) are corrected for serial correlation using the Newey-West covariance matrix.
Source: Author's calculations

coefficient in the Euro area regression. Similarly for the two subperiods, 1991:1-2006:4 and 1999:1-2006:4, money growth is significant with the right sign only for the 12-quarter-ahead forecasting equation. Also, for both subperiods, money growth is statistically significant for the two-quarters-ahead equation but with the wrong sign.[26]

Taken together, the empirical evidence suggests that money growth has been more closely related to inflation in the Euro area than in the United States. However, in the Euro area, the relationship appears weaker in the period since the ECB began operating than before.

Moreover, as shown in Chart 5, money growth as measured by M3C has consistently exceeded the ECB's reference value of 4 ½ percent since 2001. This overshooting of money growth has not been associated with an acceleration of inflation and has not produced an aggressive policy response. In particular, the ECB only began to tighten policy—as indicated by increases in the interest rate on its main refinancing operations, its principal policy rate—in late 2005. This delayed response of policy to money growth above the 4 ½ percent reference value suggests that the ECB's economic analysis may have dominated its monetary assessment during much of this period. However, when policy was tightened in 2005, ECB President Jean-Claude Trichet said that rapid money growth contributed to the decision to raise rates even when the economic analysis suggested inflation was not a concern (*The Wall Street Journal*). The further acceleration of money growth since 2006 to over 9 percent annually has given rise to debate within the ECB about the future role of money in ECB monetary policy.

Explanations. What accounts for the different empirical relationships between inflation and money growth in the United States and the Euro area, at least up until the turn of the century? Calza and Sousa provide a summary from the literature of possible explanations. First, some of the instability in money demand relationships was unique to the United States. For example, a capital crunch associated with problems in the U.S. thrift industry in the 1990s may have contributed importantly to the instability of money demand in the United States but was not present in the Euro area (Lown, Peristiani, and Robinson).

Second, financial innovation had less impact on money demand in the Euro area than in the United States. For example, financial innovation in the Euro area was more likely to lead to portfolio shifts

Chart 5
MONEY GROWTH AND THE POLICY RATE: EURO AREA
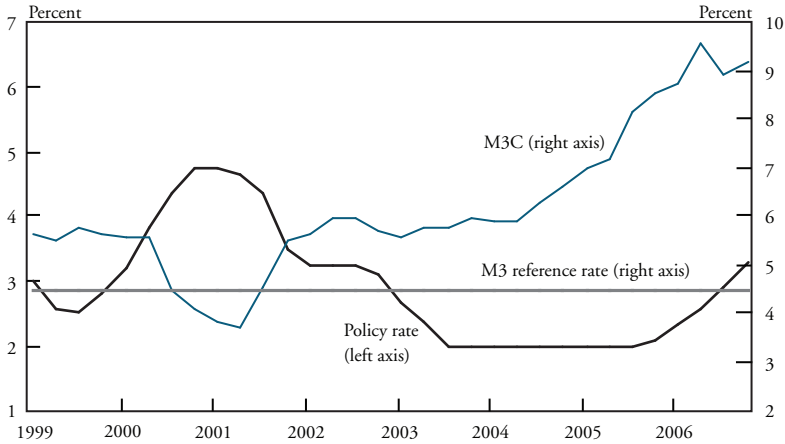
Source: European Central Bank

among instruments that were close to the existing definition of money, allowing national central banks in Europe to redefine their monetary aggregates to account for the sources of instability. In contrast, in the United States, portfolio shifts involved nonmonetary assets such as stock and bond mutual funds. In addition, over this period, in Germany—the largest economy in the Euro area—money demand remained stable. Despite financial innovation, German banks were able to satisfy the public's demand for monetary assets with traditional products, owing in part to the German public's conservative approach to money management. Finally, financial innovation occurred at different times and speeds across Euro area economies, causing shocks to money demand to be less concentrated.

Third, money demand in the Euro area may be more stable because it is an aggregation of money demand in a variety of countries. Aggregate Euro area data involve idiosyncratic and desynchronized shocks from individual countries. These country-specific shocks to fiscal policy, financial regulations, banking structure, and other institutional arrangements may have tended to offset each other, leading to a more stable

area-wide money demand. And Germany's large weight in M3 and the historical stability of its money demand have contributed to the greater stability of Euro area money demand.

III. CONCLUSIONS

The Federal Reserve and the ECB view the role of monetary aggregates in the conduct of policy very differently. For the Fed, the aggregates are just one set of many economic indicators that are monitored for insight into the outlook for economic activity and inflation. For the ECB, the aggregates—M3 in particular—represent one of two pillars of monetary policy. As such, developments with the money supply carry more weight in policy decisions at the ECB than developments with other indicators of the outlook for economic activity or inflation.

This difference in the role assigned to money in monetary policy stems from two related sources. First, as a new central bank, the ECB needed a monetary strategy in place that would give it the inflation-fighting credibility of the national central banks it was replacing. In particular, the ECB wanted to inherit the credibility of the German Bundesbank. Although the ECB chose not to target money growth in the way the Bundesbank did, the ECB strategy preserved a special role for money. Second, as an empirical matter, money growth is more highly correlated with inflation in the medium to long run and a better predictor of inflation in the Euro area than in the United States.

Going forward, the role of money in monetary policy is likely to be continually examined within both the Federal Reserve and the ECB. At the Fed, Chairman Bernanke has said,

> …the Federal Reserve will continue to monitor and analyze the behavior of money. Although a heavy reliance on monetary aggregates as a guide to policy would seem to be unwise in the U.S. context, money growth may still contain important information about future economic developments. Attention to money growth is thus sensible as part of the eclectic modeling and forecasting framework used by the U.S. central bank.

At the ECB, policymakers will need to evaluate recent rapid money growth in the context of future inflation developments. A key question is whether the recent acceleration in the decline in M3 velocity is per-

manent or temporary. If permanent, ECB policymakers may need to reevaluate, and possibly raise, the reference value they assign to M3. If temporary, policymakers will need to determine whether velocity will continue to be affected by temporary fluctuations in M3 that are unpredictable. The emergence of an unstable and unpredictable velocity trend in the Euro area could mean that the ECB would need to move closer to the Federal Reserve in its approach to monetary analysis.

APPENDIX

TWO APPROACHES TO THE ROLE OF MONEY IN MONETARY POLICY

Two different perspectives underlie the differing approaches to money in the conduct of monetary policy. In one perspective, monetary policymakers are viewed as best achieving their long-run inflation goal by determining and achieving an appropriate growth rate for the money supply. In the other perspective, policymakers are viewed as best achieving their inflation goal by setting short-term interest rates to achieve an implicit or explicit inflation objective, without regard to the monetary aggregates. Which approach makes more sense is largely an empirical issue. The usefulness of the monetary aggregate approach depends on the existence of a monetary aggregate with a stable and causal relationship to inflation that the central bank can control over the medium to long run. The interest rate approach requires that policymakers be able to influence expectations of future short-term interest rates and reliably estimate the effect of expected interest rate movements on economic activity and inflation.

The approach with money

In the money approach, the role of money in monetary policy can be described using the "equation of exchange." According to this equation, nominal spending is supported by a given money stock times the velocity of money—the turnover rate of the money supply or, in other words, the average number of times per year each unit of money (dollar or euro) is used in the purchase of final goods and services. In symbols, the equation of exchange can be expressed as follows:

$$P_t Q_t = M_t V_t,$$

where P_t represents the price level, Q_t represents real output, M_t represents the money supply, and V_t represents the velocity of money. Taking growth rates of both sides of the equation yields the following expression:

$$p_t + q_t = m_t + v_t,$$

where lowercase letters represent rates of change of uppercase letters. Thus, p_t represents inflation, q_t represents output growth, m_t represents money growth, and v_t represents the growth rate of velocity.

The equation of exchange—either in levels or growth rates—is an identity. Given a particular measure of the money supply, it defines velocity, which is not independently measured. However, if velocity is stable over time and predictable, then money growth will determine nominal spending growth ($p_t + q_t$). Under this assumption, the equation of exchange becomes an economic theory—the "quantity theory of money." For example, if velocity is constant over time so that velocity growth, v_t, equals zero, then 5 percent money growth will be associated with 5 percent nominal spending growth. Moreover, a pickup in money growth from 5 percent to 7 percent would be associated with a pickup in nominal spending growth from 5 percent to 7 percent.

Over the long run, velocity depends on transactions technologies that determine how much money is required to support a given level of economic activity. For example, if the growing use of credit cards allows a given money stock to support more transactions and a higher level of nominal spending, velocity will increase. If transactions technologies evolve gradually over time, velocity growth is more likely to be stable and predictable.

The long-run relationship between money and nominal spending depends on the long-run stability of velocity. If, in addition, long-run real output growth is stable and predictable, the equation of exchange will determine a long-run relationship between money growth and inflation. Long-run real output growth, or potential growth, is independent of monetary policy and determined by growth in the labor force and growth in productivity. Given a reliable estimate of the economy's long-run growth potential, policymakers can achieve a given long-run inflation objective provided they can achieve a particular, corresponding growth rate of the money supply. This can be seen by rearranging the terms in the growth rate version of the equation of exchange:

$$p_t = m_t - q_t + v_t.$$

Thus, for example, if the economy's long-run real growth rate was 3 percent and velocity growth was zero, a steady 5 percent growth rate of the money supply would be associated with a 2 percent rate of inflation in the long run. A pickup in money growth from 5 percent to 7 percent would then be associated over the long run with a pickup in inflation from 2 percent to 4 percent.

The growth rate of the money supply, in theory, could also help policymakers predict nominal spending growth (p_t+q_t) over the short to medium term, provided velocity growth could be predicted over that time frame.[27] And given a reliable model of how aggregate nominal spending growth is divided between inflation and output growth, policymakers could use money growth to help understand the short- to medium-term outlook for inflation and output.

Translating the money approach from theory to practice requires being able to measure "the" money supply. In practice, central banks have adopted a number of alternative empirical definitions of money. They range from narrow transactions balances held primarily by households such as M1 in the United States to broader aggregates that include savings balances such as M2 in the United States and M3 in the Euro area. None of these empirical measures is perfect, and their associated velocities tend not to be stable over time.

The interest rate approach

At least in the United States, the velocity of money has not proven to be stable and predictable for any empirical measure of the money supply. In the alternative, interest rate approach, this instability is not a problem because policymakers can control inflation through their influence over current and expected future short-term interest rates.

The most basic model, the new-Keynesian model, is based on three equations.[28] First, an aggregate supply equation relates inflation to expected inflation and the output gap—the difference between actual real output and potential output. Second, the output gap is related to the expected short-term real interest rate. Through this equation, monetary policy affects aggregate spending in the economy. And, third, the short-term interest rate is determined by monetary policy through a

simple rule in which policymakers set short-term rates to minimize fluc-
tuations in output from potential and inflation from policymakers'
implicit or explicit inflation objective.

This three-equation model, which forms the basis for many larger
models that central banks use today, determines output and inflation
without reference to the money supply. The central bank provides an
anchor for inflation through its long-run inflation objective and its
commitment to move short-term interest rates to achieve that objective
over time. Thus, while monetary policy is conducted without regard to
the money supply, monetary policy remains essential in the determina-
tion of the long-run inflation rate.

Although the money supply is absent as a variable in the simplest
new-Keynesian models, it is still possible to incorporate a money
demand equation into the model. The standard quantity theory of
money can still hold. However, the money supply is no longer directly
controlled by the central bank.[29] Instead, the evolution of the money
stock is determined by variations in interest rates, output, and the price
level, which, in turn, are determined within the framework of the new-
Keynesian model. Money growth and inflation may still be highly
correlated over time. But to the extent the new-Keynesian view is
correct, money growth will provide no marginal information to policy-
makers about future inflation that is not already embedded in the
observed inflation indicators. As long as reliable statistics on inflation are
available and observable on a timely basis, there is no benefit from track-
ing the money supply.[30]

ENDNOTES

[1]The FOMC's actions and communications also influence the public's expectation of future settings of the federal funds rate which, in turn, can influence long-term interest rates (Kahn 2007).

[2]Until recently, the Federal Reserve compiled and published data on a third monetary aggregate, M3. This aggregate consisted of M2 plus large time deposits, wholesale-type money market mutual fund balances, term RPs, and term eurodollars. However, in March 2006, the Federal Reserve stopped compiling and publishing these data because they were no longer judged to be generating sufficient benefit in the analysis of the economy or of the financial sector to justify the cost of publication. Prior to 1980, the Federal Reserve compiled and published data on as many as five different measures of the money supply.

[3]The Federal Reserve uses a number of models to analyze money growth and its implications for economic activity and inflation. One such model is the Board staff's P* model of inflation. In this model, the price level is assumed to converge over time to P*, the long-run equilibrium price level, which, in turn, is equal to M2 times long-run velocity divided by potential GDP. See Hallman, Porter, and Small for details.

[4]The "Greenbook" is released to the public with a lag of roughly five years. The description of the use of money in the Board staff's economic outlook is based on the most recent publicly available Greenbooks, which are from 2001.

[5]The "Bluebook" is also released with a lag of roughly five years and the discussion here is also based on Bluebooks from 2001.

[6]From 2000 to 2005, the minutes devoted roughly one paragraph to a description of recent developments with respect to one or more monetary aggregates. Before that, the minutes devoted three to five paragraphs to the aggregates.

[7]While statements are currently issued after every FOMC meeting, this has not always been the case. Early on, statements were issued on an ad hoc basis. Later, they were issued whenever the FOMC changed its target for the federal funds rate. Since May 1999, they have been released after every meeting. While the statements do not make references to the monetary aggregates, they have in the past referred to "monetary or financial conditions." This reference, however, applies to money market conditions affecting short-term interest rates, not the monetary aggregates.

[8]Transcripts of FOMC meetings are released to the public with a lag of roughly five years.

[9]The discussion of the use of monetary aggregates at the ECB draws heavily on Fischer, Lenza, Pill, and Reichlin, pp. 2-11.

[10]See Fischer, Lenza, Pill, and Reichlin, Appendix C (pp. 52-67) for a detailed description of models used by the ECB.

[11]This discussion is based on Bernanke. Hafer provides additional detail.

[12]For more detail about the historical behavior of M2, see Ragan and Trehan.

[13]For more details, see Bernanke and the references listed therein.

[14]See Issing for more details on the ECB's choice of monetary strategy.

[15]See Kahn and Jacobson for a discussion of how the Bundesbank conducted monetary policy before the European monetary union.

[16]This approach is the same as Fitzgerald's. Each point in the charts shows the average annual growth rate in inflation or money growth from the previous two, four, or eight years to the current quarter.

[17]M2 is used as the measure of the money supply because it is composed of balances that can be used in transactions or, for the most part, be easily converted to transactions balances. In addition, M2 is broad enough to internalize many portfolio shifts that might result from financial innovation. Finally, M2 is the U.S. monetary aggregate most closely related to the Euro area's M3 and, therefore, the best aggregate to use in a comparison of the United States to the Euro area.

[18]The R^2 statistic can vary from 0 to 1, with 0 indicating no correlation and 1 indicating perfect correlation. Note, however, that correlation does not necessarily imply causation.

[19]Data prior to 1999, when the ECB began conducting monetary policy for the Euro area, are aggregated national data converted into euros at the irrevocable exchange rates applied from January 1999 (except from January 2001 for Greece). Data are from the ECB (M3C) and ECB calculations based on Eurostat data (implicit price deflator). Note that the Euro area data go back only to the 1980s, whereas the U.S. data in Chart 2 go back to the 1960s. Using data from the 1980s for the United States generally reduces the U.S. R^2 statistics.

[20]Some of the U.S.-Euro area differences in the medium- to long-run correlation between money growth and inflation may be attributable to differences in real output growth. Because money growth supports growth in real activity as well as potentially fueling inflation, variation in output growth may obscure the relationship between money growth and inflation (appendix). This issue can be addressed by examining the correlation between inflation and adjusted measures of money growth. The adjusted measures subtract U.S. real GDP growth from M2 and Euro area GDP growth from M3C. For the United States, the adjustment to money growth raises the R^2 statistic between money growth and inflation at all time intervals. The R^2 statistic based on two-year average growth rates rises to 39 percent. The R^2 statistic based on four-year average growth rates rises to 58 percent. And the R^2 statistic based on eight-year average growth rates rises to 75 percent. In contrast, for the Euro area, adjusting money growth for variations in real GDP growth has only minor effects on the correlation between money growth and inflation. The two-year-average R^2 statistic remains the same, the four-year-average R^2 statistic rises slightly, and the eight-year R^2 statistic falls slightly. The Euro area correlations remain high relative to the United States even with the increased correlations in the United States based on adjusted money growth.

[21]Coenen and Vega supply more rigorous econometric evidence to support the stability of velocity in the Euro area from 1980 to 1998. Other studies finding a stable long-run demand for M3 in the Euro area are summarized in Masuch, Nicoletti-Altimari, Rostagno, and Pill. They include Brand and Cassola and Calza, Gerdesmeier, and Levy.

[22]Bordes, Clerc, and Marimoutou present evidence of at least one structural break in the stability of M3 velocity in the Euro area that occurred around 2000-01. They also find evidence of a break around 1992-93.

[23]Gali estimates a similar forecasting equation for Euro area inflation in his discussion of the paper by Fischer, Lenza, Pill, and Reichlin.

[24]The ECB targets the harmonized index of consumer prices (HICP) for the Euro area. Hence, the *QMA* forecasts inflation in the HICP, not the implicit GDP deflator. The analysis here uses the implicit GDP deflator for consistency with the other empirical evidence presented and for comparison with the U.S. experience. Over the medium to long term, however, the two measures of Euro area inflation should move together, and the results reported here appear to be consistent with those of Fischer, Lenza, Pill, and Reichlin and Gali. In addition, while Fischer, Lenza, Pill, and Reichlin use real-time data on M3C, the analysis here relies on the latest vintage of the data. Thus, the results reported here could overstate the usefulness of money in forecasting inflation and setting policy in real time. However, the ECB's real-time assessment of M3C "largely corresponds to the current ECB staff assessment…since the quantified judgmental correction has not changed significantly as new vintages of data have become available" (Fischer, Lenza, Pill, and Reichlin, p. 9). Thus, any bias from the use of the latest vintage of data is likely to be small.

[25]Gali also points out that the regression approach used at the ECB is subject to the Lucas critique. Reduced form forecasting equations are not structural and therefore subject to instability when the monetary policy regime changes or when money demand equations or other structural relationships shift. He also questions the out-of-sample forecasting ability of the reduced form model, noting that while it gets the mean inflation rate "more or less right, it fails miserably at tracking the movements in average six-quarter-ahead inflation: the correlation between the forecast and the realization is slightly negative!"

Hale and Jorda also present evidence on the usefulness of money in forecasting inflation in the United States and the Euro area. They reach similar conclusions to those presented in the text. For the United States, they conclude "there is no predictive power to the monetary aggregates when forecasting inflation" beyond what information is already contained in measures of past inflation, economic activity, and interest rates. For the Euro area, they conclude the evidence is more mixed. "Over some horizons (usually in the short run but not the long run), there appear to be benefits…" (p. 3).

[26]Regressions were also run with inflation and money growth defined as annualized two-quarter, four-quarter, and eight-quarter average rates of change. Results were qualitatively robust to this change of specification. In addition, Fischer, Lenza, Pill, and Reichlin report regression results for the Euro area with multiple lags of money growth and inflation on the right side (using the HICP as the inflation measure).

[27]Over the short run, velocity is less likely to be stable and predictable. In particular, the short-run behavior of velocity depends importantly on interest rates. When market rates rise, the opportunity cost of holding money rises because currency pays no interest and interest rates on transactions accounts at banks lag movements in market interest rates. As the opportunity cost of money increases, individuals economize on their money holdings and velocity increases.

[28]See Woodford for a detailed description of models of inflation determination that exclude money and a discussion of why money need not have a prominent role in monetary policy.

[29]The central bank sets its policy interest rate without regard to the money supply. However, in achieving a target for the policy rate, the central bank engages in open market operations which would affect the supply of reserves and, hence, the money supply.

[30]The money supply might contain useful information, however, if it helped policymakers estimate the output gap in real time.

REFERENCES

Bernanke, Ben S. 2006. "Monetary Aggregates and Monetary Policy at the Federal Reserve: A Historical Perspective," remarks at the Fourth ECB Central Banking Conference on *The Role of Money: Money and Monetary Policy in the Twenty-First Century*, Frankfurt, Germany, November.

Brand, C., and N. Cassola. 2000. "A Money Demand System for Euro Area M3," Working Paper no. 39, European Central Bank.

Bordes, Christian, Laurent Clerc, and Velayoudom Marimoutou. 2007. "Is There a Structural Break in Equilibrium Velocity in the Euro Area?" Les Notes D'Etudes et de Recherche, no. 165, Banque de France, February.

Calza, Alessandro, and Joao Sousa. 2003. "Why Has Broad Money Demand Been More Stable in the Euro Area than in other Economies? A Literature Review," Working Paper no. 261, European Central Bank, September.

Calza, Alessandro, D. Gerdesmeier, and J. Levy. 2001. "Euro Area Money Demand: Measuring the Opportunity Costs Appropriately," IMF Working Paper no. 01/179.

Coenen, Gunter, and Juan-Luis Vega. 1999. "The Demand for M3 in the Euro Area," ECB Working Paper Series no.6., September.

Federal Open Market Committee. 2007. Minutes of the Federal Open Market Committee, May 9.

_____. 2001. Transcript of the Federal Open Market Committee meeting, December 11.

Fischer, B., M. Lenza, H. Pill, and L. Reichlin. 2006. "Money and Monetary Policy: The ECB Experience 1999-2006," Second draft of paper prepared for the Fourth ECB Central Banking Conference on *The Role of Money: Money and Monetary Policy in the Twenty-First Century*, Frankfurt, Germany, November.

Fitzgerald, Terry J. 1999. "Money Growth and Inflation: How Long is the Long Run?" *Economic Commentary*, Federal Reserve Bank of Cleveland, August 1.

Gali, Jordi. 2007. "A Comment on Fischer, Lenza, Pill, and Reichlin's 'Money and Monetary Policy: The ECB Experience 1999-2006,'" January. Paper prepared for the Fourth ECB Central Banking Conference on *The Role of Money: Money and Monetary Policy in the Twenty-First Century*, Frankfurt, Germany, November.

Hafer, R. W. 2001. "What Remains of Monetarism?" *Economic Review*, Federal Reserve Bank of Atlanta, Fourth Quarter, pp. 13-33.

Hale, Galina, and Oscar Jorda. 2007. "Do Monetary Aggregates Help Forecast Inflation?" *FRBSF Economic Letter*, Federal Reserve Bank of San Francisco, April 13.

Hallman, Jeffrey J., Richard D. Porter, and David H. Small. 1991. "Is the Price Level Tied to the M2 Monetary Aggregate in the Long Run?" *American Economic Review*, 81, September, pp. 841-58.

Issing, Otmar. 2006. "The ECB's Monetary Policy Strategy: Why Did We Choose a Two Pillar Approach?" Paper presented at the Fourth ECB Central Banking Conference on *The Role of Money: Money and Monetary Policy in the Twenty-First Century*, Frankfurt, Germany, November.

Kahn, George A., and Kristina Jacobson. 1989. "Lessons from West German Monetary Policy," *Economic Review*, Federal Reserve Bank of Kansas City, April, pp. 18-35.

Kahn, George A. 2007. "Communicating a Policy Path: The Next Frontier in Central Bank Transparency?" *Economic Review*, Federal Reserve Bank of Kansas City, First Quarter, pp. 25-51.

Lown, C., S. Peristiani, and K. J. Robinson. 1999. "What Was behind the M2 Breakdown?" Federal Reserve Bank of Dallas Financial Industry Studies Working Paper no. 02/99.

Masuch, Klaus, Sergio Nicoletti-Altimari, Massimo Rostagno, and Huw Pill. 2003 "The Role of Money in Monetary Policymaking," BIS Papers no. 19.

Meyer, Laurence H. 2001. "Does Money Matter?" Federal Reserve Bank of St. Louis *Review*, September/October.

Poole, William. 2003. "A Monetary Policymakers Perspective," Speech to the Cato Institute Book Forum Celebrating the 40th Anniversary of the Publication of *A Monetary History of the United States, 1867-1960* by Milton Friedman and Anna Schwartz, Cato Institute, Washington, D.C.

Ragan, Kelly, and Bharat Trehan. 1998. "Is It Time To Look at M2 Again?" *FRBSF Economic Letter*, Federal Reserve Bank of San Francisco, March 6.

The Wall Street Journal. 2007. "Euro-Zone Officials Debate Tie Between Money Supply, Inflation," by Joellen Perry, June 12, p. A8.

Woodford, Michael. 2007. "How Important is Money in the Conduct of Monetary Policy?" Centre for Economic Policy Research, Discussion Paper Series no. 6211, March. Paper prepared for the Fourth ECB Central Banking Conference on *The Role of Money: Money and Monetary Policy in the Twenty-First Century*, Frankfurt, Germany, November.