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MONETARY POLICY WITHOUT QUANITY VARIABLES

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ABSTRACT

The collapse in the 1980s of familiar relationships connecting money to either income or prices has thrown into question long-standing presumptions about the appropriate conduct of monetary policy. Once data from the 1980s are included, tests of several kinds -- including simple regression tests, vector autoregressions tests, and tests for cointegration -- all fail to show evidence of properties that would support using money as the central fulcrum of monetary policy. The Federal Reserve System, whether in response to these developments or for independent reasons, appears to have refocused monetary policy onto movements of short-term interest rates. The experience of the 1950s and 1960s suggests that this alternative approach also suffers from potentially serious drawbacks, which little recent research has addressed.

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The collapse of the money-income relationship in the 1980s has thrown into question long-standing presumptions about the appropriate conduct of monetary policy. Before the 1980s economists and policymakers had long debated the role that aggregate measures of money (or credit) should play in the monetary policy process. Although issues of a non-empirical nature were also important in this regard -- for example, the desire for a system under which policymakers could be readily monitored and held accountable -- the central issue was always the stability and reliability of the money-income relationship. Those who believed that it was highly stable typically sought to tie monetary policy more rigidly to fixed money growth targets, while those who doubted this stability sought to base monetary policy not just on money but on other variables too (credit, for example), and in any case to make the connection between policy actions and either money or any other specific variables more flexible.

What was at issue throughout this period, however, was mostly the short-run conduct of monetary policy, and therefore the short-run stability of the money-income relationship: fluctuations from quarter to quarter, or perhaps even year to year. Few economists or policymakers expressed doubts that the money-income relationship was highly stable over a time horizon as long as the average business cycle, and therefore few argued that money growth should not follow a narrowly specified trend over several years taken together. For those who were skeptical that a more activist policy could successfully carry out countercyclical stabilization anyway, the widely agreed upon stability of the money-income relationship over longer horizons led naturally to a fixed money growth policy even in the short run.

The events of the 1980s have been so important for thinking about monetary policy precisely because they have contradicted this more fundamental confidence in the stability of the money-income relationship in the longer run. For the

five years ending at mid 1987, the average growth rate of the M1 money stock was 10.8% per annum -- far above that for any sustained period in recent U.S. experience. Yet inflation has been modest by historical standards, and real income growth for this period as a whole has hardly been extraordinary compared to previous U.S. business cycle expansions. It is difficult to escape the conclusion that, not just for a year or a calendar quarter but over an entire half-decade, money growth has simply been irrelevant to any outcome that matters for monetary policy.

Analogous relationships between income or prices and other financial quantity variables have fared little or no better during this period. Broader measures of money, or the monetary base, or measures of credit have all fluctuated in patterns bearing little visible connection to any plausible objective of monetary policy. As a result, the entire role of such quantity variables in the monetary policy process -- either money or any of the others -- is now practically devoid of empirical support based on recent experience. At the same time, however, no one has satisfactorily outlined an alternative monetary policy framework that does not rely on such variables. The result is a vacuum at the center of the monetary policy process.

I. Money and Income, Money and Prices

One picture and one example from the recent literature are sufficient to place in perspective the collapse of the relationship between money and either income or prices in the 1980s.

First, the picture: Figure 1 plots the ratio of the M1 money stock to nominal GNP for each quarter from 1959:I (when the redefined M1 series begins) to 1987:III. Through 1980:IV the money-income ratio followed the familiar 3% per annum downward trend that practical discussions of monetary policy had come to treat as if it were a natural constant, with a standard deviation around the

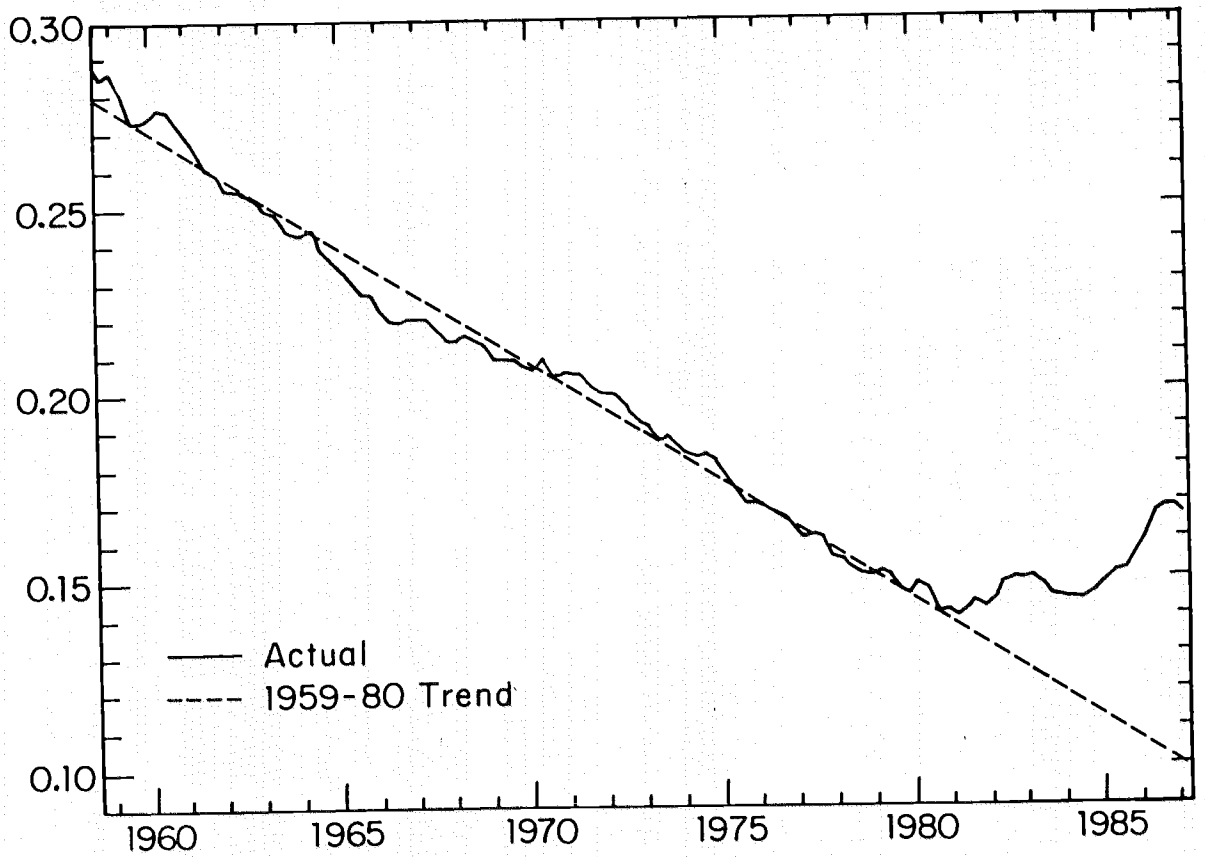

FIGURE 1

MONEY/INCOME RATIO, 1959-1987

trend of only .0044 compared to a 1980:IV value of .1466. Since 1980 the short-run fluctuations have been visibly wider. More importantly, the downward trend has not just disappeared but reversed course. A simple extrapolation of the 1959-80 trend implies a money-income ratio of .0991 by 1987:III. The actual value was .1662, greater by more than 15 standard deviations.

The analogous relationship for credit, the outstanding indebtedness of all domestic non-financial borrowers, has fallen apart just as badly. During 1959-80 the credit-income ratio exhibited a standard deviation of only .0187 (around a negligible and statistically insignificant trend) compared to a 1980:IV value of 1.3782. By 1987:II the gap between the actual ratio and the trend extrapolation was more than 23 standard deviations.

Second, the example: In these same Papers and Proceedings four years ago, Milton Friedman (1984) argued that neither the money-income nor the money-price relationship had broken down after October 1979, when the Federal Reserve experimented with a policy centered on money growth targets. He instead argued that both relationships had continued to hold up if interpreted correctly. For the money-income relationship, Friedman emphasized short-run comovements, focusing on each quarter's income growth and money growth in the prior quarter. For the money-price relationship, he emphasized longer-run comovements, focusing on average inflation over successive two-year intervals and average money growth over the prior two years.

Since Friedman wrote, however, both of the relationships on which he based his arguments have even changed sign. The correlation between the respective growth rates of nominal income and M1 lagged one quarter was .45 during the 1979:IV-1983:IV sample he used. The same correlation computed for 1984:I-1987:II is minus .10. Friedman did not report a correlation for the biennial growth rates of prices and lagged money but simply showed the data for each successive

biennium, beginning with 1973:III-1975:III for the GNP deflator and 1971:III-1973:III for M1. The direction of the change in M1 growth in each of these periods had foretold the direction of the change in inflation in the next, and on this basis Friedman predicted, "The increased rate of money growth in the 1981-83 biennium suggests that we have passed the trough in inflation and that inflation will be decidedly higher from 1983 to 1985 than it was from 1981-83." Instead, inflation turned out to be lower during 1983:III-1985:III than during 1981:III-1983:III, and it was lower still during 1985:III-1987:III despite continued high money growth during 1983:III-1985:III. The correlation computed over the five observations Friedman exhibited was .70. Computed over those five observations and the two more that are now available, the correlation is minus .23.

II. Money and Credit as Information Variables

The breakdown of such simple money-income or money-price relationships casts doubt on the use of money (or credit) as a target of monetary policy in any rigid, mechanical sense. It need not preclude a useful role for such variables in the monetary policy process, however, as long as their movements provide information about subsequent fluctuations of income or prices, or any other outcomes that monetary policy seeks to affect.[1] A policy framework based on aggregate measures of money (or credit) used as "information variables" is more flexible, and hence more complicated and harder to monitor externally, than a framework based on such variables used as policy targets. The greater the extent to which the relationships that connect these variables to income and prices are affected both by other variables (like interest rates) and by stochastic shocks, however, the greater are the relative merits of an information variable approach compared to a simpler targeting approach.

sense. Kuttner and I (1987) have shown that evidence of a variety of forms, connecting money (or credit) to income and prices, has progressively deteriorated since 1979.

Table 1 shows $\bar{R}^2$ statistics for the estimation of "St. Louis" equations relating the quarterly growth rate of nominal income to lagged growth rates of several respective financial quantity variables and the lagged growth rate of high-employment federal spending, over three sample periods.[2] For 1960:II-1979:III -- that is, until the introduction of the new monetary policy procedures -- these equations all exhibit the familiar modest success in accounting for quarterly income growth, with $\bar{R}^2$ values ranging from a low of .23 for the monetary base to high of .32 for M1. Extending the sample to include data through year-end 1986 sharply lowers the $\bar{R}^2$ in each case, however. Dropping the observations from the 1960s eliminates it almost altogether. Not one of these equations for the more recent period exhibits $\bar{R}^2$ even as high as .10.

Table 2 shows F-statistics for tests of the null hypothesis that all of the coefficients on lagged M1 growth are zero in equations from several series of vector autoregressions.[3] As in Table 1, results are shown for each of three sample periods: from the beginning of the M1 series until the introduction of new monetary policy procedures, then through the most recent data available as of the time of writing, and then for the most recent data without the 1960s.

In the context of the information variable approach to monetary policy, the much debated issue of whether statistical experiments like these constitute valid tests of "causality" is beside the point. What matters is simply whether the movements of some financial quantity convey information about future movements of income or prices that is not already contained in observed movements of income or prices themselves. If so, then monetary policy can exploit that information by systematically reacting to observed movements of these variables, regardless of

Table 1

Coefficient of Determination for Nominal Income Equations

	1960:II-1979:III	1960:II-1986:IV	1970:III-1986:IV
Monetary Base	.23	.15	.02
M1	.32	.11	.02
M2	.27	.19	.06
M3	.27	.16	.09
Credit	.28	.10	-.02

Table 2

F-Statistics for Information Value of Money (M1)

	1960:II-1979:III	1960:II-1987:II	1970:I-1987:II
Fiscal Variable Included			
Y	6.16[a]	2.63[b]	1.42
X	1.98	1.91	1.33
P	3.62[b]	.68	.47
Fiscal Variable Included			
Y	5.99[a]	2.83[b]	1.92
X	2.17c	2.21c	1.91
P	3.65[b]	.75	.88

Y = nominal GNP

X = real GNP

P = GNP price deflator

[a]significant at .01 level

[b]significant at .05 level

[c]significant at .10 level

prices themselves. If so, then monetary policy can exploit that information by systematically reacting to observed movements of these variables, regardless of whether this information reflects true causation, reverse causation based on anticipations, or mutual causation by some independent but unobserved force.

As of 1979, the available evidence strongly supported the view that observed fluctuations of M1 in the United States did contain such information about future movements of U.S. income and prices. By contrast, the same experiments carried out with data for the most recent 18 years provide no support for the view that fluctuations in M1 carry information about future income and prices that is not already contained in fluctuations of income and prices themselves. Not one of the F-statistics for this more recent sample is significant at even the .10 level. Once again, what is true for M1 is also true for other money and credit aggregates. The F-statistics for analogous experiments carried out with M2 or credit in place of M1 show the same pattern of changing significance as in Table 2. Not one of the F-statistics for M2, and not one for credit, is significant at the .10 level for the 1970:I-1987:II sample.

Not surprisingly, such findings have prompted a search for ways to "fix up" this form of test of the money-income relationship, just as a much more intensive search, which began even earlier, has sought to fix up the money demand function. Stock and Watson (1987), for example, showed that with the right specification lagged M1 was in fact significant in equations for real income (proxied by industrial production) in tests based on monthly data for 1960:2-1985:12. For a system including money, income, prices and an interest rate, together with a time trend, they reported an F-statistic of 3.04 (easily significant at the .01 level) for the null hypothesis that all of the lagged money coefficients were zero. As Kuttner and I have shown, however, merely extending the sample for this experiment through 1987:9 reduces the F-statistic to 1.80, just barely

significant at the .10 level (p value .0994), and changes Stock and Watson's results for the other systems that they investigated as well.

Table 3 shows that the most recent experience has also eliminated statistical support for the hypothesis that income and money (or credit) are cointegrated. The table shows Dickey-Fuller t-statistics for the null hypothesis of no cointegration between nominal income and each of several financial quantity variables, in the presence of a possibly nonlinear time trend.[4] The results shown are based on quarterly data for three samples, which here differ only in their respective end-points: before the introduction of new monetary policy procedures, before the abandonment of those procedures, and the latest data available as of the time of writing. At least for M2 and credit, the data through 1979:III warranted rejecting the null hypothesis of no cointegration with nominal income at the .05 level. The data through 1982:II did so as well, albeit only at the .10 level. For data through 1987:II, however, there is no evidence of cointegration with nominal income for any of these financial quantity variables.[5]

III. Questions About Monetary Policy Since 1982

If it is difficult to escape the conclusion that financial quantity variables have lost their relevance for monetary policy in the 1980s, it is also difficult to escape the conclusion that the Federal Reserve System has responded to this development by conducting monetary policy primarily with reference to short-term nominal interest rates (and, indirectly, dollar exchange rates). One reason for drawing this conclusion is simply the return to interest rate stability after the Federal Reserve "suspended" its M1 target in 1982. The standard deviation of the month-to-month change in the three-month U.S. Treasury bill rate rose from .42% during 1970:1-1979:9 to 1.54% during 1979:10-1982:9, and then fell to .32% during 1982:10-1987:9. Another reason is that what movements

Table 3

Dickey-Fuller T-Statistics for Cointegration Tests

	1959:I-1979:III	1959:I-1982:II	1959:I-1987:III
Monetary Base	-2.90	-3.03	-0.22[a]
M1	-1.53[a]	-1.61[a]	-0.34[a]
M2	-3.67[b]	-3.40[a,b]	-2.69[a]
Credit	-3.60[b]	-3.28[c]	-0.09[a]

[a] augmented Dickey-Fuller t-statistic

[b] significant at .05 level

[c] significant at .10 level

in short-term interest rates have occurred since mid-1982 have shown little apparent connection to fluctuations of the major monetary aggregates (or credit), or to deviations of these aggregates from the corresponding official target ranges.

The success of U.S. monetary policy in macroeconomic terms during these years notwithstanding, a return to approximately the same monetary framework that the Federal Reserve employed a quarter-century ago should give cause for some concern -- not least because of the systematic errors that the Federal Reserve made under that policy. The extensive analysis of U.S. monetary policy during the first two decades or so following the Treasury-Federal Reserve Accord, including research carried out at the time as well as subsequently, has documented three problems in particular. Each bears renewed consideration now that the Federal Reserve has returned to what amounts to a policy framework centered on controlling nominal interest rates.

First, and most obviously, this framework had no nominal quantity to anchor the price level. Although inflation was not therefore inevitable, there was little protection against it when inflationary pressures intensified in the late 1960s and especially in the 1970s. For some years following Sargent and Wallace's (1975) demonstration that basing monetary policy on nominal interest rates left the price level indeterminate in a model with "rational" expectations and perfectly flexible prices, many economists eschewed analysis of such a policy framework altogether, and concentrated only on policies based on controlling money. As McCallum (1981) has shown, however, even in Sargent and Wallace's model price indeterminacy results only when the central bank takes no account of prices (or any other nominal variable) in choosing the level at which to set interest rates.[6] Especially in a context that allows for rigidities in price setting behavior as well as more realistic representations of expectations, no

one knows to what extent it is practically possible to avoid inflation with a monetary policy framework based on nominal interest rates, or how best to structure such a policy to achieve that end.

Second, once inflation did emerge, Federal Reserve officials (and many other people too) often failed to distinguish nominal from real interest rates. As a result, they often associated higher observed interest rates with a tighter policy stance even when the increase in nominal interest rates merely kept pace with, or even fell short of, rising inflation expectations. In light of the enormous attention subsequently devoted to the distinction between nominal and real interest rates, both in the research literature and at the popular level, it would be surprising to see this mistake repeated in such an obvious way. Nevertheless, inferring "the real interest rate" is hardly straightforward. Expectations of future inflation are unobservable, and different people may hold different expectations anyway. Different people and different institutions also face different tax rates.

Third, there is also substantial evidence that, when U.S. monetary policy relied primarily on nominal interest rates in the past, Federal Reserve officials systematically confused the level of interest rates as the operating instrument of policy with the level of interest rates as an ultimate objective of policy.[7] As a result, they usually delayed too long before raising or lowering interest rate levels, and even then made changes of insufficient magnitude. Although this error too has received enormous attention, more in the research literature than in popular discussions, no one knows whether it is now possible to design a monetary policy framework based primarily on interest rates that can provide adequate safeguards against repeating it. Still less has anyone laid out in any detail what such safeguards might be.

The evidence from recent experience is clear on the potential role of financial quantity variables in the monetary policy process, and it is not positive. Perhaps the time has come for economists to turn at least some of the effort they are now spending on trying to overturn the evidence on these variables toward thinking about how best to conduct monetary policy without them.

Footnotes

1. See, for example, Kareken et al. (1973) and Friedman (1975, 1983).

2. These equations differ from the St. Louis specification only by omitting the contemporaneous value of each independent variable.

3. Each autoregression includes four lags on each variable in the system, plus a constant. All variables are in log differences.

4. The cointegrating equation is in each case $\ln(f_t) = \ln(a+b*t) + c*\ln(y_t) + e_t$ where f is the financial quantity, y is nominal income and e is a disturbance term. The null hypothesis of no cointegration means that e is nonstationary. The values shown are augmented Dickey-Fuller t-statistics in cases in which higher-order autocovariance of e is present, and ordinary Dickey-Fuller t-statistics otherwise.

5. Tests carried out in the forms $\ln(f_t) = a + b*\ln(y_t) + e_t$ and $(f_t/y_t) = a + b*t + e_t$ also show no evidence of cointegration for any of these financial quantity variables in the data through 1987:II.

6. What McCallum actually showed was that taking account of money in setting the interest rate resolves the price indeterminacy. His result readily generalizes to the inclusion of any nominal variable, however.

7. See, for example, Brunner and Meltzer (1964).

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