On the Empirical Existence of a Monetarist Steady State

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Among the many competing theories of inflation three have been given much emphasis in the professional literature — the Monetarist model, the Phillips curve model and the Structural model — and the acceleration of inflation in the United States and abroad since the middle to late 1960's has been associated with the ascendancy of the Monetarist school of thought. The most rigorous formulation of the Monetarist framework has been provided by its best known exponent *Milton Friedman* [1970; 1971]. These Monetarist models make a sharp distinction between nominal and real output, assume a process of adaptive expectation formation and produce a steady state solution in the rates of growth of actual and anticipated nominal income and the rate of monetary expansion (contraction). From this result, in combination with the acceleration theorem, follows the policy presricption of a constant rate of growth of the money supply.[1]

This policy prescription, and the intimately related Monetarist explanation of inflation, rely heavily on this particular steady state specification. The primary purpose of this paper is to examine the empirical existence of, or the extent and nature of departure from, the hypothesized monetarist steady state. This is important because real world economies cannot be expected to be continuously in a steady state. Thus for the specified monetarist state to be of any empirical significance the predicted and assumed behavior of certain relevant variables must display a tendency to at least converge onto their steady state values. Furthermore, it is of not inconsiderable interest to know the speed of this convergence.

Our findings show substantial departures from the hypothesized steady state solution. Accordingly, we also comment briefly on the

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[1] Even though there are some differences amongst the proponents of the "monetarist revolution" there is wide agreement on the essential elements of the model. Its key elements are mentioned in (*Friedman* 1971, p. 336) and *Mayer* (1978).

possible theoretical flaws in the Monetarist model which, in combination with some counterfactual assumptions, provide us with some insight into the likely reasons for the absence of a Monetarist steady state. A brief review of *Friedman*'s monetary theory of nominal income is presented in Section I and Section II has the empirical evidence, including a brief critique. Section III summarizes the paper with some concluding comments.

I. Friedman's Monetary Theory

In contrast to the more general Keynesian income-expenditure approach the Monetarist approach to inflation focuses only the supply of and demand for money. The eventual frame of reference is the quantity theory identity which is given a causal interpretation. *Friedman's* position is that in the standard (textbook) income-expenditure model Keynesian theory assumes that the general price level is determined outside the system (price and wage rigidity assumption) and that the quantity theory assumes that real income is determined outside the system (full employment assumption). The latter model is considered valid for long run equilibrium in which variations in the rate of growth of the quantity of money change only the inflation rate but not the growth rate of real output. Both theories are, however, considered inadequate because neither can explain "(a) the short-run division of a change in nominal income between prices and output, (b) the short-run adjustment of nominal income to changes in autonomous variables, and (c) the transition between this short-run situation and a long-run equilibrium described essentially by the quantity theory model."[2] *Friedman* claims his monetary theory of nominal income to be superior to both the income-expenditure and quantity theories for closing the system and for analyzing short period changes.

By combining *Irving Fisher*'s hypothesis concerning the relation between nominal and real interest rates, *Keynes*' assumption that the current long term market rate of interest is determined largely by the rate expected to prevail over a long period, the assumption that the demand for money function is stable, interest sensitive with a unit income elasticity, and that the difference between the anticipated real rate of interest and anticipated rate of growth of real output is exogenous to the model (which is the counterpart of the full employment and rigid

[2] *Friedman* (1970).

price assumptions of the quantity and income-expenditure theories respectively) the essential elements of the *Friedman* model emerge. They are as follows:[3]

(1) $$d/dt\,(DY_t^*) = \lambda\,(DY_t - DY_t^*)$$

(2) $$DY_t = DY_t^* + \frac{1}{1-\lambda\gamma}\,(D\overline{M}_t - DY_t^*)$$

(3) $$DP_t = DP_t^* + \beta\,(DY_t - DY_t^*) + \varphi\,(Q_t/Q_t^f)$$

(4) $$Dy_t = Dy_t^* + (1-\beta)\,(DY_t - DY_t^*) - \varphi\,(Q_t/Q_t^f)$$

A D before a variable represents its proportional rate of growth and a superscript (*) represent its expected value. DY_t is the actual rate of growth of nominal income, Dy_t is the actual rate of growth of real income, DP_t is the actual inflation rate, Q_t and Q_t^f are the actual and full employment levels of real output, $D\overline{M}_t$ is the autonomous rate of growth of the (nominal) money supply, and φ, β, λ and γ are parameters with $\gamma = [(1/v)\,(dv/dr)]$, where r is the rate of interest and v is income velocity.

The equation system is given a causal interpretation and is essentially driven by equation (2) (monetary stimulus) and equation (1) (adaptive expectations). An excess in the (autonomous) rate of growth of money over the expected rate of growth of nominal income causes the actual and expected rates of growth of nominal income to deviate (eq. 2). This increases the inflation rate (eq. 3) as well as the real growth rate (eq. 4). An increase in the capacity utilization rate (Q_t/Q_t^f) increases the inflation rate (eq. 3) and reduces the growth rate (eq. 4). The process of adaptive expectations comes into play (eq. 1) during which DY_t^* increases till a new steady state is reached in which $DY_t^* = DY_t = D\overline{M}_t$, $DP_t = DP_t^*$ and $Dy_t = Dy_t^*$. In order to have a further impact on the real sector "monetary acceleration (or deceleration would have to continue at a gradually increasing rate in order to compensate for the mounting feedback effect" [*Brunner* 1970]. This is the acceleration theorem. The combination of the steady state solution, the acceleration theorem, and the assumed (quantity theory) invariance of economic growth in the long-run to monetary stimuli produce the policy prescription of a constant rate of growth of money.[4]

[3] See *Frisch* (1977) and *Park* (1972) for a more detailed survey of some of the issues; and see *Friedman* (1970 and 1971) for a fuller development of this model.

Hicks [1976] and *Robinson* [1977, p. 1330], amongst others, have expressed reservations about steady state solutions because they are useful "intellectual experiments, which are necessary to sort out the questions involved in analyzing complicated processes" but as a hypothesis "it sinks at the first step" [*Robinson* 1977]. It may be particularly inappropriate to base policy prescriptions on such steady state solutions.

The model outlined above is primarily an empirical model, whose relation to the preceding theoretical analysis is not explicitly stated. It is thus useful to examine the theoretical underpinnings and necessary empirical assumptions underlying the *Friedman* (1970, 1971) models. One has to begin with the quantity theory since the "quantity theory is the most basic component of monetarism" (*Mayer* 1978). Inflation in the quantity theory is determined entirely by the supply of and demand for money. That is

$$DP = (DM^s - Dm^d) \tag{5}$$

where DM^s is the rate of growth of the nominal supply of money and Dm^d is the rate of growth of the real demand for money. Under the assumption of a unit income elasticity of the demand for money equation (5) may be written as

$$DP = (DM^s - Dy) \tag{6}$$

The assumption of a unit income elasticity of the demand for money eliminates the velocity-income relationship and the assumption of a zero interest elasticity eliminates the velocity-interest relationship. Monetarists (modern quantity theorists) now accept that the demand for money is interest elastic. The resulting velocity-interest relationship can, however, only be a short run phenomenon because the assumption of a horizontal *IS* curve ensures that interest-induced velocity growth will be zero in the equilibrium steady state situation (*Friedman* 1968, *Gibson* 1970, and *Moosa* 1979). This assumption is also responsible for the Monetarist claim that fiscal policy per se is impotent because it cannot be velocity-accommodated (through changes in the interest rate) and for a fiscal stimulus to be inflationary it will have to be money-accommodated. Hence, inflation is "always and everywhere a monetary phenomenon" (*Friedman*, 1966).

[4] Note that the adjustment coefficient λ and the response of velocity growth to changes in the interest rate γ appear in the pivotal equation (2) as well as in the velocity equation (11) below.

Monetarists, however, prefer an asset demand specification of the demand for money with permanent (expected) income (or wealth) as the relevant scale variable (*Friedman* 1971). Equation (3) thus becomes

$$DP = (DM - Dy^*) \tag{7}$$

where Dy^* is anticipated real economic growth. Denoting DY^* as anticipated nominal income growth and DP^* as the anticipated inflation rate equation (7) may equivalently be written as

$$\begin{aligned} DP &= DM - (DY^* - DP^*) \\ &= DP^* + (DM - DY^*) \end{aligned} \tag{8}$$

This apparently is the basic idea underlying the model presented in *Friedman* (1971) (and summarized in equations (1) to (4) above). Regardless of the nature of the lag in the effect of money on income positive values of $(DM - Dy^*)$ or $(DM - DY^*)$ would lead to changes in the inflation rate DP, as well as in nominal and real economic growth. However, (through an adaptive expectations process) a steady state will be reached in which $DP^* = DP$, $DY^* = DY$, $Dy^* = Dy$ and $DM = DY = DY^*$ (*Friedman* 1970, 1971). It follows that velocity growth Dv is zero in the steady state and that $DP = (DM - Dy)$.

Friedman has emphasized that changes in money supply growth produce long and variable lagged responses of affected variables but that the demand for money adjusts immediately to changes in the affected variables entering the demand for money function (*Friedman* 1971).[5] However, the variability of these lags, as well as the length of the adaptive expectation process, is implicitly assumed to be finite (bounded) and in particular it is, to a good approximation, assumed to be between four to eight quarters (*Friedman* 1976. In short, DP is equal to monetary stimulus $(Dm - Dy)$ lagged four to eight quarters (*Friedman* 1976).

A less extreme monetarist assumption is that velocity growth is not equal to zero in the steady state but is rather equal to some technologically determined constant (*Seidman* 1979). Combining these assumptions with the additional assumption that active stabilization policy is likely to impair rather than improve the stability of the economy (the acceleration theorem) leads to the constant monetary growth rule. That

[5] *Benjamin Friedman* (1978), for example, argues that Monetarist and Keynesian transmission mechanisms are the same.

is, if steady state velocity growth is a technologically determined constant $D\bar{v}$ then it follows that (non-inflationary) monetary growth DM should be equal to the difference between long run economic growth $D\bar{y}$ and $D\bar{v}$ ($D\bar{y} - D\bar{v}$). If $D\bar{v}$ is equal to zero then DM should equal $D\bar{y}$. Thus, the empirical existence of this monetarist steady state depends on the convergence of velocity growth to either a zero or a (technologically determined) constant value.

Alternative outcomes are, however, possible. A positively sloped *LM* curve and a non-horizontal *IS* curve will produce a velocity-interest relationship, and restore the potency of fiscal policy on prices and/or output by permitting the velocity-accommodation of real stimuli. Furthermore, if the income elasticity of the demand for money is not equal to unity then a positive velocity-income relationship emerges. Formally, if the real demand for money m is specified as

$$m = \alpha \cdot y^{\varkappa} \cdot r^{-\beta} \cdot DP^{*-\varrho} \tag{9}$$

where r is the nominal interest rate and α, $\varkappa$, β, and ϱ are parameters, then the definition of velocity v (equal to y/m) implies that

$$v = \alpha^{-1} \cdot y^{(1-\varkappa)} \cdot r^{\beta} \cdot DP^{*\varrho} \tag{10}$$

That is, $\varkappa \neq 1$ implies a velocity-income relationship and evidence on income economies ($\varkappa < 1$) is now about as compelling as evidence concerning the interest sensitivity of the demand for money (*Goldfeld* 1973, *Moosa* 1977 a and *Laidler* 1978, for example). It is evident from the foregoing analysis that Monetarist and Keynesian positions emanate from the same model, a modified Hicksian construction, with different estimates of the parameters (*Barro/Fisher* 1976, *Modigliani* 1977 and *Arrow* 1978).

II. Empirical Evidence

1. The Results Using M1

We use quarterly U.S. data covering the period 1948.2 - 1975.4 to test some of these predictions. The nominal money supply M is first represented by $M1$ and then by $M2$ and data on both were obtained from the *Federal Reserve Bulletin*. The remainder of the data were obtain from the *Survey of Current Business*. The implicit deflator for gross national product P is used to calculate the inflation rate DP, real income y is measured by the real gross national product, real government expenditures g include federal, state and local government expenditures, real investment expenditures i are represented by the expenditures on gross private domestic investment, v stands for velocity, r stands for the interest rate which is represented by the 90 day Treasury bill rate, and a D before a variable represents its (percent) rate of growth.

We provide below some empirical estimates of the particular (and pivotal) velocity equation implied by equation (2). We also provide some empirical estimates of the phenomenon of stagflation in order to point to a possible internal inconsistency in the model and to emphasize the need to explain the capacity utilization rate in equations (3) and (4); for example, acceleration of inflation is possible if $Q_t > Q_t^l$ even if monetary stimulus, the driving force of the model, is zero. However, it is not the purpose of this paper to examine the acceleration theorem, which is also embraced by many non-Monetarists; at best, it is tangential to the main purpose of this paper. Our empirical method also involves eliminating the "noise" from the data series and then examining, graphically and econometrically, the relation between the drift, trend or systematic components of the different time series. The highly flexible *Almon* (1965) procedure is used to capture the systematic components of the different time series. In particular we use a nine-period (approximately equal to half the average trade-cycle-period) second-degree polynomial with the beginning and end lag points constrained to be zero. The one Almon variable generated is then used as our measure of the systematic component. This use of (Almon) smoothed variables facilitates the graphical part of our analysis by bringing into sharp relief, both with respect to level and movement, the historical relation between the different variables. The use of a polynomial *lag* distribution to capture the systematic component of a time series would seem to introduce some bias into our measure. To the extent that is the case the (lag) bias is identical in all the time series (because of the identical form and length of lag) and this makes them directly comparable. We eliminate the lag bias by working with lag adjusted measures. The lag adjustment (the same for all the variables) was made by finding the highest correlation between the actual and forward-lagged values of the smoothed series.

The efficiency of this approach in capturing the systematic component can be seen for example by comparing the actual and systematic components of the rates of growth of real output. Adopting the convention that a (′) next to a variable represents its systematic component we find that the mean values of Dy and Dy' for the sample period 1948.2 - 1975.4 are 3.50 and 3.49 respectively. The respective values for the inflation rate are 3.24 and 3.23. These values are in accord with the required expected value of zero for the unsystematic components of the different time series. Its usefulness for comparative purposes can be seen by examining the variables in the quantity theory identity $DM' + Dv' = DP' + Dy'$. Observe in Figure 1 that, as required by the identity, when $(DM' - Dy')$ equals zero DP' is equal to Dv'. As an illustration of the efficiency of our adopted approach Fig. A1 in the Appendix plots the values of DP and DP'. The unsystematic components of the different series were characterized by "white noise". Further our overall conclusions were not found to be at all sensitive to the use of alternative lag lengths.

It is important to stress that the Almon technique is not used to generate expectation proxies, as is typically the case, but rather to smooth the time series in order to facilitate a graphical exposition ("and to see what is really happening"). The Almon polynomial is ideally suited for this purpose. This nonstandard use of the Almon filter implies that the standard criticisms levelled at Almon lags do not apply to this paper. Our use is more akin to the use of a simple moving average as a smoothing device. However, unlike the simple moving average technique which assigns equal weights to all the distributed lags our Almon weights lie along a U-shaped polynomial. With the weights being identical on all the variables they become directly comparable.

A Box-Jenkings filter could also have been used. It was in fact tried and, not surprisingly, it yielded virtually identical mean-square-errors and overall conclusions. However, for our particular purpose (namely, a graphical analysis of the time series) the Almon filter is much to be preferred because it yields a smooth time series compared to the jagged Box-Jenkings series. (Plots using the Box-Jenkins filter are available from the author upon request).

It is the primary purpose of this paper to question the assumptions of the *Friedman* model and in particular to question the assumed behavior of velocity growth and of the adjustment coefficient λ which appear in the pivotal equations (1) and (2), which essentially drive the model. We examine first the behavior of velocity growth and then the adaptive expectation mechanism. We also assume that $M1$ is the relevant empirical definition of money. At the end of this section we address ourselves to the issues concerning the choice between $M1$ and $M2$ and how the choice affects our results.

Figure 2 plots the relation between DM', DY', Dv' and $(DM' - DY^*)$. DY^* was estimated using the Box-Jenkins (1976) method of forecasting time series. As is well known, this method is a generalization of the adaptive expectation mechanism used in eq. (1). The specification of the model was ARIMA (1,0,1) which proved to be adequate with respect to standard diagnostic checks. What is striking in Figure 2 is that for almost the entire thirty year postwar period, except for 1970 and 1971, DM' differs from DY' by large margins. The difference between DM' and DY' is identically equal to the rate of growth of velocity Dv', which is required to be zero in the steady state. Hence the Monetarist statement about the steady state is necessarily a statement about velocity growth. Note also that if we substract $D\bar{M}$ from both sides of equation (2) we get

$$Dv_t = \frac{\lambda\gamma}{1-\lambda\gamma}\,(D\bar{M}_t - DY_t^*) \tag{11}$$

It can be seen in Figure 2 that Dv' has been large in both the short and long runs (see also Table 1 for average values of actual variables). Moreover, it was almost never equal to zero, a necessary condition for the Monetarist steady state. There was little apparent tendency for it to even approach zero. Rather, in general, it moved sympathetically, both in the short and the long runs, with the level and movements of real economic growth, which of course did not have a mean value of zero (Fig. 1 and Table 1). Figure A2 in the Appendix plots the values of Dv and $(DM - DY^*)$ and equation (12) is a Cochrane-Orcutt (1949) generalized least squares estimate of equation (11).

$$\begin{array}{llll} (12) & Dv = \underset{(-5.49)}{-0.61}\,(DM - DY^*) & \underset{(1.97)}{+1.15} & R^2 = 0.45 \\ & & & SE = 4.22 \\ & & & DW = 1.99 \end{array}$$

The highly significant (incorrectly signed) negative coefficient in equation (12) suggests that equation (11) is mis-specified. Evidence in (*Goldfeld* 1973; *Moosa* 1977 a and 1977 b, and *Laidler* 1978) shows that to be the case, irrespective of the particular empirical definition of money adopted. Thus, both the short and long run behavior of velocity growth is contrary to the Monetarist prediction.

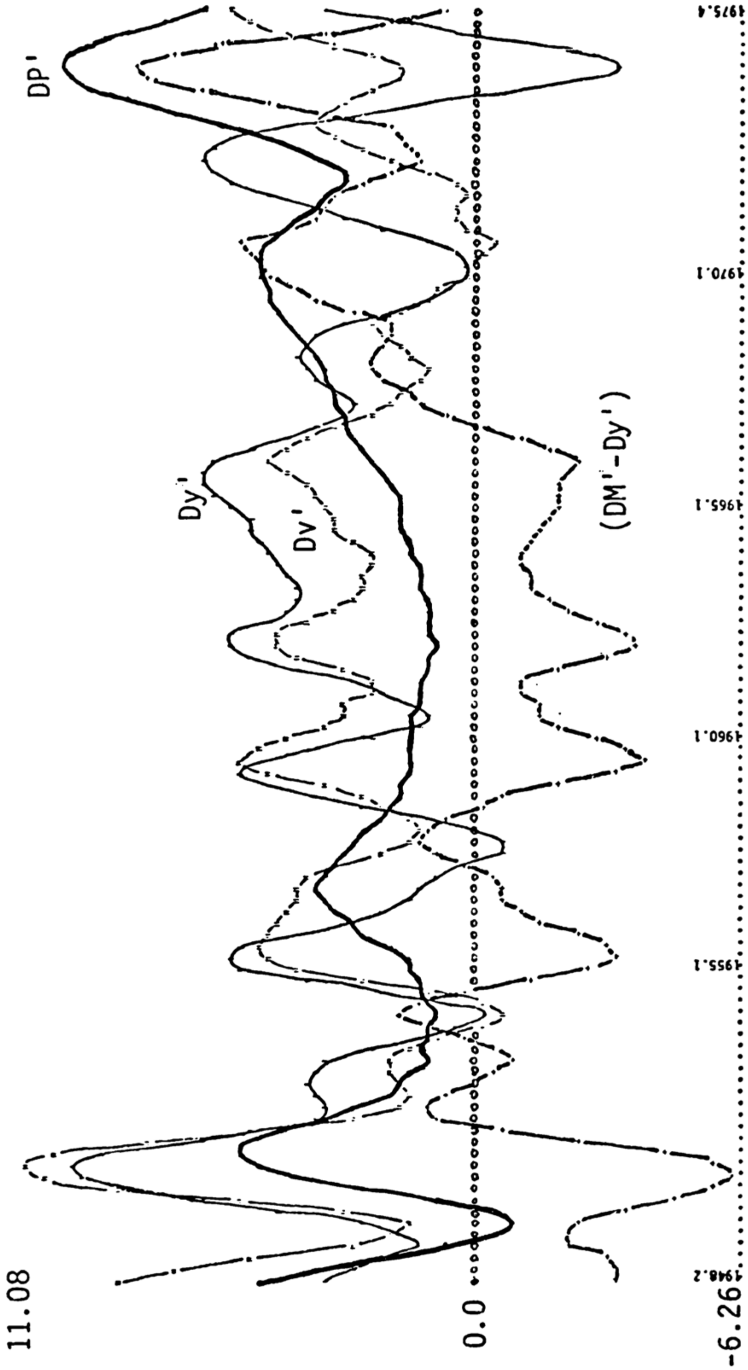

Fig. 1. Variables in Quantity Theory Identity

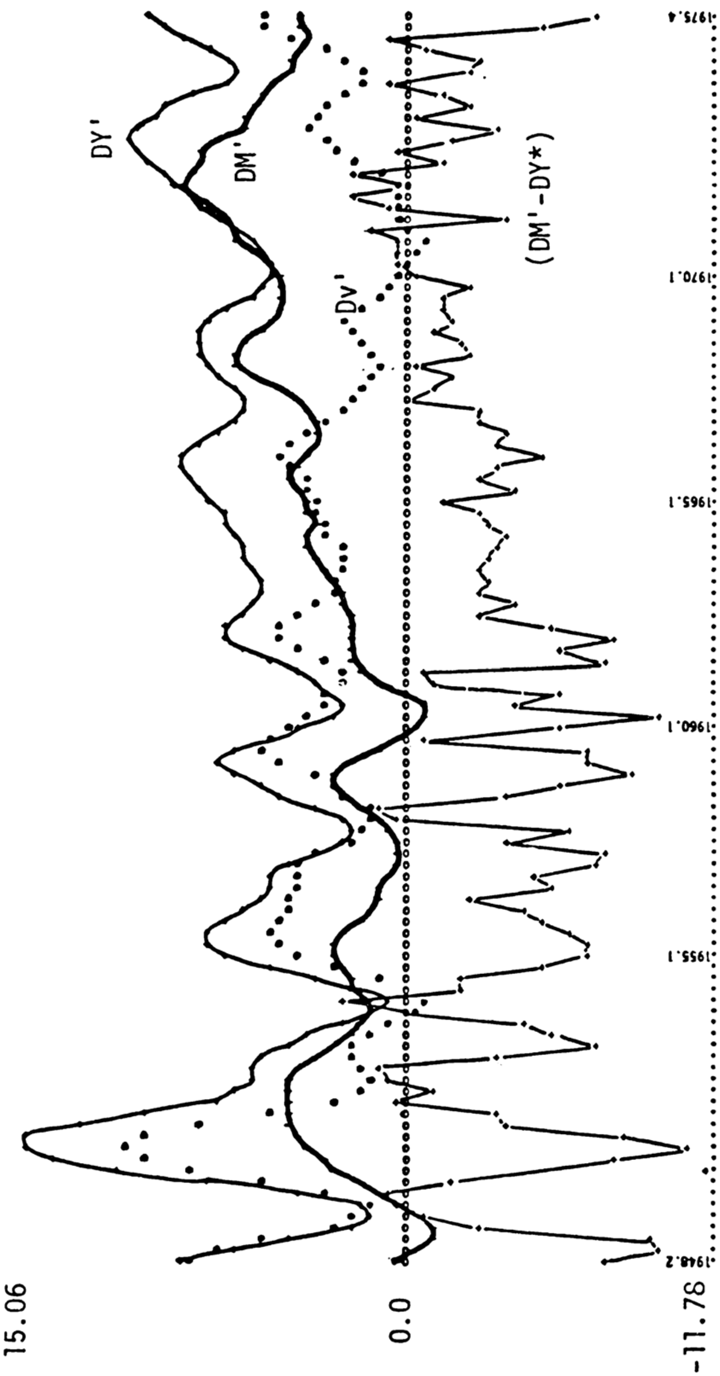

Fig. 2. Monetary Stimulus, Nominal Income and Velocity

For the years 1970 and 1971 DM' is very close to DY'. This could be a state solution due to the working of the hypothesized adaptive expectation process (eq. 1). However, an alternative explanation based on velocity growth is more general and straightforward. Moreover, the reluctance (apparently on grounds of theoretical convenience) of *Friedman* to break down DY' into price and output components may well obscure rather than clarify the issues (see, for example, *Laidler* [1978]).

DY' is equal to $(DP' + Dy')$ and we observe in Figure 1 that for the years 1970 and 1971 DP' declined but Dy' increased (by a larger amount). These movements of DP' and Dy' enable us to explain velocity growth, which provides us with a straightforward explanation of the concidence in the levels of DM' and DY' for these years. Recall that from the quantity when $(DM' - DY')$ is zero so is the rate of growth of velocity Dv'. *Moosa* (1977 b) has shown that it is possible to explain and predict velocity (also the demand for money) quite well when real income (because of the presence of economies of scale in the holding of money balances [*Goldfeld* 1973; *Moosa* 1977 a and 1977 b]), the interest rate (because it is the opportunity cost of holding money) and anticipated inflation (because the nominal interest rate may not rise by the full amount of the increase in anticipated inflation because of the inflation related decline in the real rate of interest and because of possible substitution between money and physical goods) appear as arguments in the velocity (demand for money) equation.[6] For the period 1970.1 - 1972.2 real economic growth Dy' increased and the inflation rate DP' (as well as the nominal interest rate) declined (Figure 1) which respectively put upward and downward pressure on velocity growth Dv' thus accounting for its zero average value and the necessary coincidence in the levels of DM' and DY' (Figure 2). Thus the coincidence between DM' and DY' for even the years 1970 and 1971 can be quite easily explained by the particular behavior of velocity, influenced by price, interest and real income movements. In short, for the entire almost thirty year postwar period a steady state, due to the workings

[6] The R^2 in *Moosa* (1977 b) is 0.996, the correlation and regression coefficients of actual on predicted values is 0.94 and 0.87 respectively and Theil's U statistic has a value of 0.008. Moreover, the income variable performs (explains and predicts) best. (Note that economies of scale in the holding of money balances imply a positive velocity-income relationship which is observed in Figure 1 for both the short and long runs). Adjustment to equilibrium of the demand for money equations is very rapid but also variable, being fully completed in one quarter only during the period of accelerating inflation 1965 .1 - 1974 .4.

of equations (1) and (2), never prevailed even in an approximate form and differed from it in general by large margins. Neither was there a tendency towards convergence to the prescribed steady state value. This was necessarily due to velocity growth taking on large values in both the short and long runs.

The assumption that expectations are adaptive is very reasonable but the assumption of a complete adjustment of expectation of DP and Dy to their actual values is implausible. There is now substantial evidence pointing to the contrary. *Vining* and *Elwertowski* (1976) provide evidence of a positive relation between the relative and general variabilities of inflation. International cross-section data (*Logue* and *Willet* 1976) show that the variance of the inflation rate is correlated with the mean rate of inflation and U.S. time series data (*Moosa* 1978) show that the mean rate of inflation explains between ninety and ninety five percent of the variance of the inflation rate. Moreover, it also is found in (*Moosa* 1978) that the variance of real economic growth explains, with a positive coefficient, almost ninety percent of the variance of the inflation rate with both the variabilities of inflation and economic growth being positively related to the mean inflation rate. This inflation level related increase in their respective variabilities would not only impair the ability of economic agents to be completely successful in attaining the steady state (when $DP = DP^*$ and $Dy = Dy^*$) but would make it increasingly difficult as the (mean) values of DP and, as is empirically the case, also of DY increase. This is also recognized in *Friedman* (1977).

As noted above, the determinants of the rate of growth of velocity are typically assumed (even in *Friedman*'s own prior contributions to the literature) to be quite different from that of mis-specified equation (9), which relies entirely on the adaptive expectation mechanisms pertaining to inflation and economic growth to drive velocity growth to its predicted zero long run steady state value. The evident mis-specification of the velocity equation and the empirical evidence concerning the relations between the means and the variabilities of inflation and economic growth provide good reason to doubt that a zero value of velocity growth is sufficient evidence in support of the assumed power of the adaptive expectation mechanism to completely close the gap between actual and expected values. Even though $Dv = 0$ is made into a necessary condition for the existence of the Monetarist steady state it may not be a sufficient condition because when $Dv = 0$, evidently due to alternative specifications, it is still possible for $DY \neq DY^*$, $DP \neq DP^*$ and $Dy \neq Dy^*$. For example, we have seen that Dv is relatively closer to but still substantially different from zero in the post-1965 period, and we find in the next section that $M2$ velocity growth fluctuates around and very close to its mean value of zero in the post-1965 period, when the steady state was least likely to have existed, because the sharp increase in the inflation level related variabilities of inflation and economic growth can be expected to have made it increasingly difficult to close the gap between actual and anticipated values. Criteria governing the relevant empirical definition of money, the correct specification of the velocity equation, and the form and likely power of the adaptive expectation mechanism are separate, though not necessarily entirely unrelated, issues. However, *Friedman* implicitly treats them as if they are one and the same. For example the price, income and interest rate elasticities of the demand for $M1$ are typically found to be significantly different (1.00, 0.60 and 0.10 respectively).

There is another counterfactual assumption embedded in equations (1) through (4). An increase in monetary stimulus (equation (2)), ceteris paribus, is not only inflationary (eq. 3) but also increases real economic growth (eq. 4). Except for the pre-1955 period the relation between inflation and real economic growth is negative (Figure 1). Using the generalized least squares procedure of Cochrane-Orcutt (1949) equations (13), (14) and (15) respectively provide estimates of this negative relation for the sub-period 1955.1 - 1964.4 when the rate of inflation generally declined, for the subperiod 1965.1 - 1975.4 when the rate of inflation generally increased, and for the (full) period 1955.1 - 1975.4.[7]

$$
\begin{array}{llll}
(13) & Dy' = -\underset{(-9.13)}{1.89}\, DP' & + \underset{(6.32)}{7.59} & R^2 = 0.85 \\
 & & & SE = 0.78 \\
 & & & DW = 1.12 \\
(14) & Dy' = -\underset{(-7.02)}{1.58}\, DP' & + \underset{(5.71)}{14.90} & R^2 = 0.96 \\
 & & & SE = 0.45 \\
 & & & DW = 1.23 \\
(15) & Dy' = -\underset{(-3.69)}{1.46}\, DP' & + \underset{(5.91)}{10.44} & R^2 = 0.90 \\
 & & & SE = 0.67 \\
 & & & DW = 1.14
\end{array}
$$

[7] The low *Durbin-Watson* statistics are apparently due to the use of smoothed series. When unfiltered values were used virtually all traces of serial correlation were eliminated with the coefficients still highly significant though, as is to be expected, the R^2 was reduced to about 0.55.

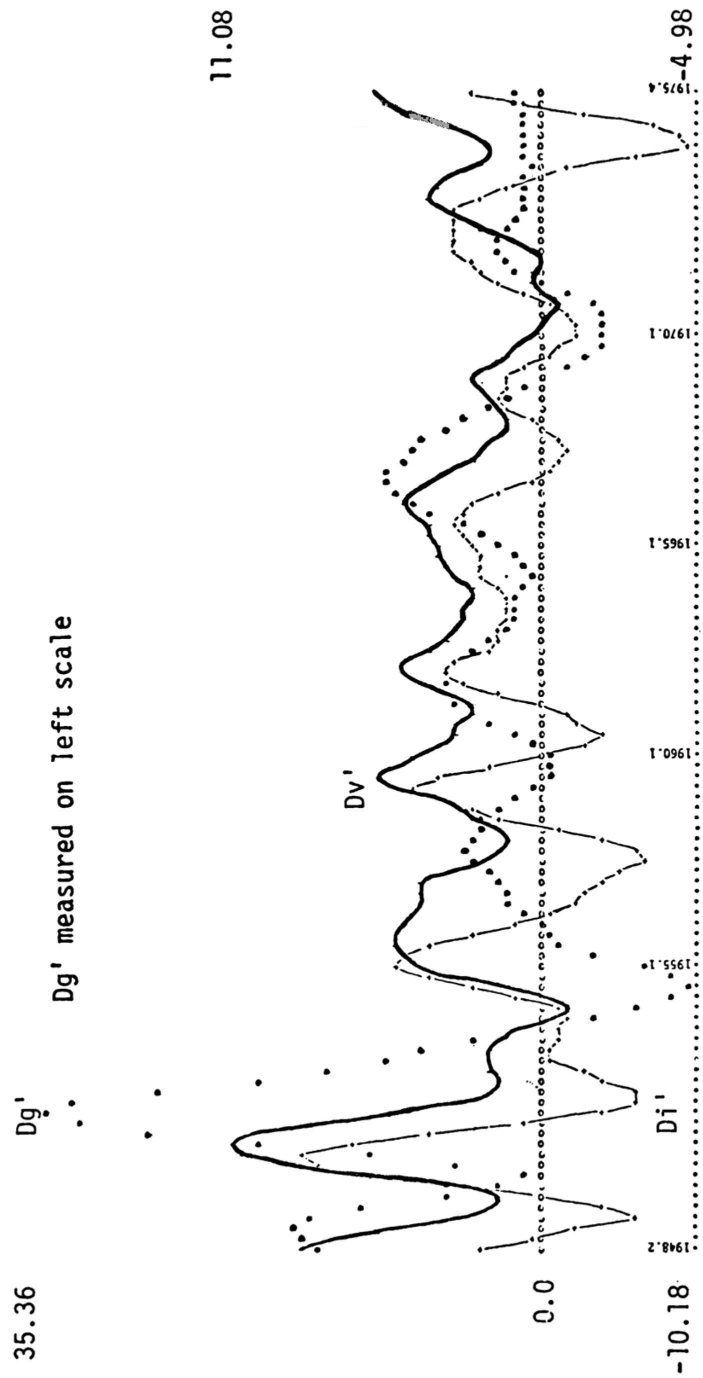

Fig. 3. Velocity, Investment and Government Expenditures

Weintraub (1978) and even *Friedman* (*Friedman* [1978]), for example, have argued that anti-inflationary monetary contractions have been responsible for declines in real output. Figure 4 bears this out. We observe that for most of the Post-Accord period there has been a negative between DP' and DM' in the short-run and a positive relation between Dy' and DM'. The negative (cyclical) relation between DP' and DM' was found to be statistically highly significant. These results can only be reconciled with eqs. (1) through (4) by positing a particular behavior of the capacity utilization rate, which is left unexplained in equations (1) - (4) (or for that matter anywhere else).

Due apparently to the dual assumptions of a "crowding out" effect and of a fiscal-induced inflation being usually money-accommodated fiscal variables do not (directly) appear in equations (1) through (4). But we observe in Figure 1 that for virtually the entire (almost twenty year) period 1948.2 - 1967.4 monetary stimulus ($DM' - Dy'$) was negative but inflation DP' was generally positive. Table 1 presents average values for two sub-periods for the variables mentioned above as well as for the rates of growth of investment expenditures, Di, and government expenditures, Dg (federal, state and local). We notice a positive relation over the two sub-periods between the average values of Dg and Di on the one hand and Dv and Dy on the other. Moreover, Dg, Di and Dv take on relatively higher values in the earlier sub-period. According to *Friedman* (1966, footnote 2) this is evidence of fiscal-induced inflation in the earlier period. However, with an almost consistently large negative value for ($DM' - Dy'$), with an average value of -1.83 over this earlier period, inflation was clearly not money-accommodated. Rather we find a much closer association between inflation and velocity growth (2.09 and 3.92 respectively). The evidence (*Moosa* 1977 b), reported in footnote 5, suggests that this was due to interest- and income-induced velocity accommodation of real stimuli.[8]

It appears that in the earlier period much or most of velocity growth was due to non-monetary influence since ($DM' - Dy'$) was generally negative[9] and a positive ($\cap$-shaped trend) relation is observed for the

[8] Observe the relatively higher values of Dv, Dy and Dr in the earlier period in Table 1.

[9] These restrictive monetary and expansionary fiscal policies also put some pressure on interest rates which evidently (*Moosa* 1979) induced increases in velocity growth in addition to that due to output growth.

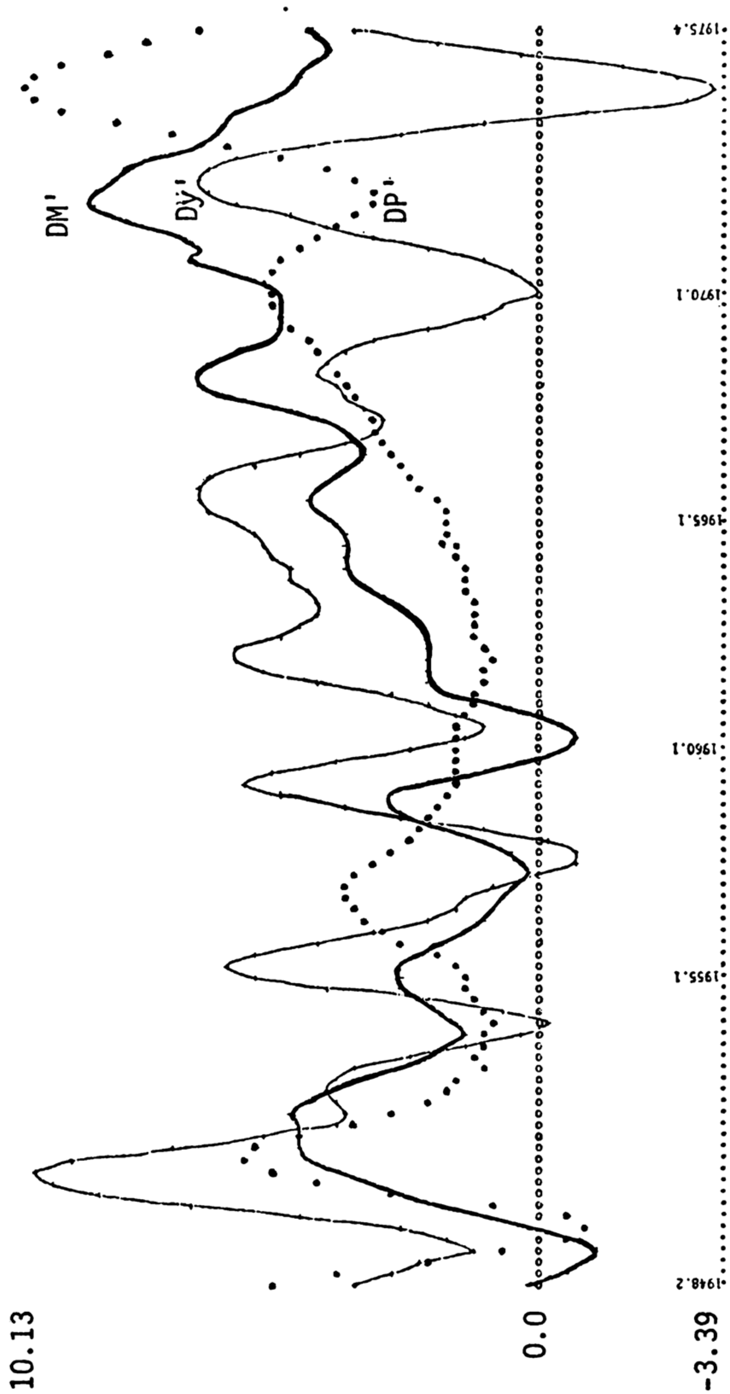

Fig. 4. Money, Inflation and Economic Growth

post-1955 period between Dg', Di', Dv' and Dy' (Figures 1 and 3).[10] There is also a positive association between these aggregates over the two sub-periods shown in Table 1.

Table 1

Average Rates of Growth*

Period	*DM*	*Dv*	*DP*	*Dy*	(*DM* — *Dy*)	*Dg*	*Di*	*Dr*	*DDP*
1948.2 - 1966.4	2.20	3.92	2.09	4.02	— 1.83	6.50	4.37	14.54	— 34.03
1967.1 - 1975.4	6.17	1.88	5.65	2.40	3.77	1.33	0.85	4.68	12.74

* Note that these are averages not of the systematic components of the growth rates but of the actual growth rates. As pointed out earlier the difference is practically zero. *DDP* is a variable not mentioned earlier and it represents the rate of growth of the inflation rate.

Friedman's monetary theory of nominal income is primarily a preferred empirical model for the analysis of the effects of money on nominal income and inflation. In equation (2) monetary stimulus has no liquidy effect (which is counterfactual) but produces a direct income effect. The model sidetracks completely portfolio adjustment effects which most economists, including *Friedman,* accept as central to any theory that attempts to analyze the transmission mechanism of monetary policy. This discrepancy between *Friedman*'s perception of the transmission mechanism and his formal model is interpreted by *Johnson* (1970) as being due to *Friedman*'s contention that monetary influences work through such a complicated, and perhaps unidentifiable, process of portfolio adjustment that his simple empirical approach of attempting to predict something big, such as nominal income, by something, small, such as money, is more reliable than any alternative approach that attempts to specify the intervening (portfolio adjustment) chain of causation.

In such a simple approach the quantity theory velocity function is preferred over the multiplier relationship of the income-expenditure

[10] A regression of Dv' on Dg' and Di' (appearing together on the right hand side) yielded highly significant positive coefficients. The relationship between Dv', Dy' and $D(g+i)'$ is even tighter. A plot of these variables is available from the author upon request.

theory because it is considered by Monetarists to be relatively more stable and less affected by institutional and historical changes than the multiplier relationship. This apparently simple empirical solution runs up against a formidable problem. Monetarists now accept the interest sensitivity of the demand for money (and hence velocity). There is also now substantial evidence (*Goldfeld* 1973; *Moosa* 1977 a and *Laidler* 1978) that velocity also depends on real income. Since velocity growth is the link between monetary stimulus and nominal income change in the pivotal equation (2) the development of both an independent theory of interest rate determination as well as of real income determination is necessary. These, however, are precisely the complications that *Friedman*'s primarily empirical model attempts to sidetrack.

The demand for money function has also turned out to be less stable than hitherto believed (*Slovin* and *Sushka* 1975, *Goldfeld* 1977 and *Moosa* 1977 b); there was a change in the dominant pattern of substitution between money and alternative near-money substitutes due to changes in interest rate differentials following a change in Regulation *Q* in 1962 (*Slovin* and *Shuska* 1975), a shift in the late 1960's due to a widening spread between time deposit rates and money market rates (*Moosa* 1977 b) due apparently to deposit rate ceilings, as well as a shift in 1974 (*Goldfeld* 1977). The demand for money is apparently sensitive to changes in the institutional setting.

2. On the Choice between M1 and M2

The above analysis was conducted unter the assumption that the correct empirical definition of money is $M1$ rather than $M2$, which is *Friedman*'s preference. Figure 5 plots the time series for the rates of growth of $M1$ velocity Dv', of $M2$ velocity $Dv2'$ and of the velocity of the time deposit component of $M2$, Dvt'. Table 2 presents their means and standard deviation for selected subperiods as well as for the full period. Figure 6 reproduces Figure 2 using $M2$ rather than $M1$ and Figure A3 in the Appendix plots the values of $Dv2$ and $(DM2 - DY^*)$.

We observe from Figure 5 that there is a strong positive correlation in the short (cyclical) run between the three velocity measures. However, except for the pre-1954 and post-1970 sub-periods, when the trend relation between Dv' and Dvt' is positive, the two velocity series Dv' and Dvt' have different non-linear trends. We also observe in

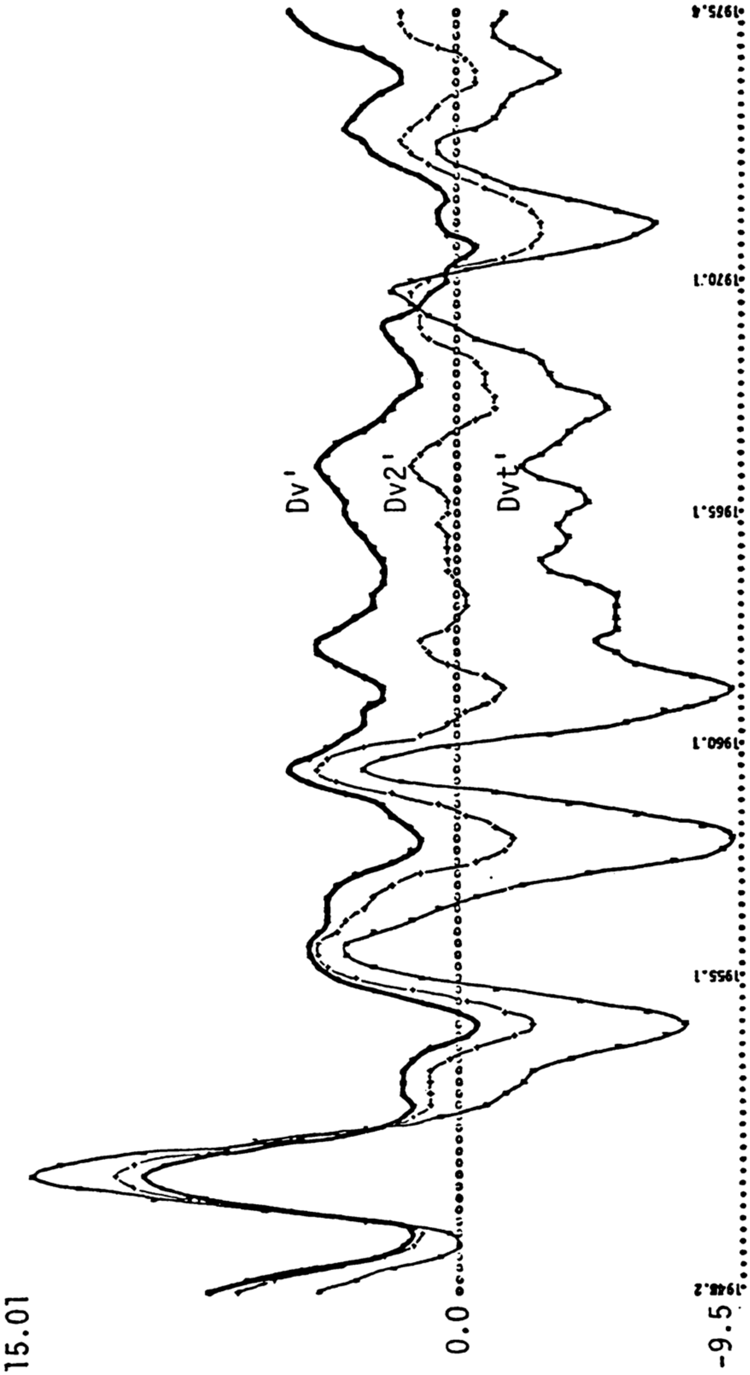

Fig. 5. Components of M2 Velocity Growth

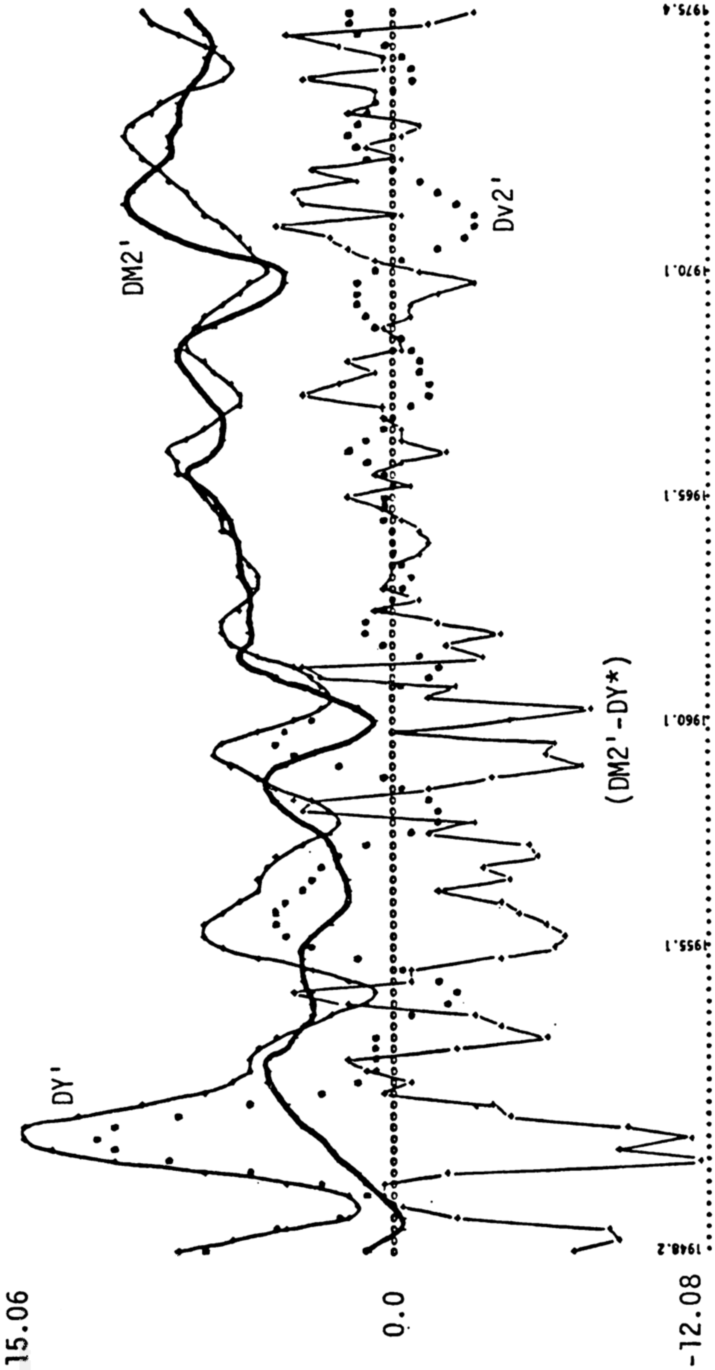

Fig. 6. M2 Monetary Stimulus, Nominal Income and Velocity

Table 2 that *Dvt* has a much higher variance than *Dv* and this accounts for the higher variance of *Dv*2 over *Dv*. An examination of Figure 5 and Table 2 clearly shows that for the pre-1960 period the generally positive value of *Dv′* more than offset the mostly negative value of *Dvt* thus accounting for the generally positive value of *Dv*2. For the post-1960 period the generally negative value of *Dvt* offset on average the generally positive value of *Dv′* resulting in *Dv*2′ fluctuating around and close to its mean value of zero; the particular behavior of *Dv*2′ is the result of the aggregation of the chosen near-money substitute with *M*1.

Table 2

Velocity Growth — Means and Standard Deviations*

Period	*Dv*	*Dv*2	*Dvt*
1948.2 - 1951.4 -	6.92 (7.80)	7.19 (8.23)	8.05 (10.01)
1952.1 - 1960.2	2.94 (4.83)	1.49 (5.49)	— 2.26 (7.85)
1948.2 - 1960.2	4.10 (6.13)	3.15 (6.92)	0.75 (9.74)
1960.3 - 1972.4	2.28 (3.77)	— 0,32 (4.28)	— 3.91 (8.38)
1973.1 - 1975.4	4.04 (4.24)	1.18 (3.67)	— 1.14 (4.43)
1960.3 - 1975.4	2.62 (3.92)	— 0.08 (4.22)	— 3.38 (7.86)
1948.2 - 1975.4	3.26 (5.05)	1.34 (5.77)	— 1.60 (8.96)

* Standard deviations shown in parenthesis.

A simplistic and purely statistical interpretation of the *Dv*2′ behavior would suggest that even if *M*2 is chosen as the relevant empirical definition of money a partial steady state almost never prevailed for the pre-1960 period and the extent of the departure from the (partial) steady state was generally substantial;[11] on the other hand the extent departure from the necessary but partial condition for the steady state zero value of Dv was in general minimal for the post-1960 period. However, even with this purely statistical interpretation of the data a steady state did not prevail on average for the full period (Table 2). Thus even this purely statistical explanation using a particular widened definition of money only partially rescues our particular Monetarist prediction and our conclusion on the existence of a Monetarist steady state, using the partial test of a zero value of velocity growth, does not entirely depend on the choice between $M1$ and $M2$ (because of the generally and substantially positive value of $Dv2'$ for the twelve year pre-1960 period).[12] As in the case of $M1$, the full period generalized least squares estimate of the coefficient of $Dv2$ on $(DM2 - DY^*)$ in equation (16) is negative (incorrectly signed) and highly significant, indicating again that equation (11) is mis-specified.

$$(16) \qquad \underset{}{Dv2} = \underset{(-\,8.50)}{-\,0.79\,(DM2 - DY^*)} \; \underset{(0.43)}{+\,0.20} \qquad \begin{aligned} R^2 &= 0.53 \\ SE &= 4.21 \\ DW &= 1.99 \end{aligned}$$

The issue concerning the proper empirical definition of money is not a trivial one and widening the definition to $M2$ raises a number of questions. The choice of the proper empirical definition of money must ultimately be based on theoretical considerations, and ad hoc inclusions of asset categories into a widened definition, (largely because it yields "more accurate" predictions) must be viewed with considerable suspicion. The partial conformity (of velocity growth) with the partial test of the Monetarist steady state when $M2$ is used may be more apparent than real and there are persuasive (theoretical and empirical) reasons for choosing $M1$ over $M2$. Since equilibrium (long run) real output is left unexplained in the Monetarist model, because of the quantity theory full employment assumption (*Friedman* 1971), and its short run specification (eq. (4)) is (without an explanation of the capacity utilization rate) inconsistent with the evidence, the model essentially becomes a model

[11] The qualification of partial is necessary because, as argued in the previous section, a zero value of velocity growth is a necessary but not a sufficient condition for the existence of the steady state.

[12] An appeal to the "pegging" of interest rates for part of this sub-period cannot account for this result since both the interest rate and monetary stimulus (prices and quantities) appear in equation (11).

of inflation. The observed higher and higher prices registered in the market place were the result of market exchanges (transactions) that could only have (directly or ultimately) been consummated using a medium of exchange. Since time deposits in commercial banks are not a medium of exchange they should be excluded from the definition of money. For the same reasons the near money substitutes of other thrift institutions should not be included in our empirical definition of money. It is also implausible to lump passbook saving accounts of commercial banks with *M*1 (to form *M*2) and to exclude the near-money substitutes of these non-bank financial intermediaries which are their closest substitutes.

Monetarists have chosen to adopt a definition that would serve the purposes of their primarily empirical model namely, the monetary aggregate that best explains and is most stably related to income. However, there are seasons for rejecting this preferred rationale and the evidence we have (see *Moosa* 1977 for references) concerning the intercorrelation of different time series is at best only suggestive and clearly does not unequivocally support the Monetarist preference for *M*2. The evidence we have from dynamic simulation shows that *M*2 yields extremely large errors in long run forecasting tests and easily fails formal stability tests (*Goldfeld* 1973). *Goldfeld* concludes that aggregation inflicts positive harm and more rather than less disaggregation seems to be desirable.

We now have persuasive evidence (*Goldfeld* 1973 and *Moosa* 1977, for example) suggesting that *M*1 balances are held mainly for transaction purposes. It is shown in (*Moosa* 1977 a) that the demand functions for *M*1 and for time deposits of commercial banks and thrift institutions not only display significantly different speeds of adjustment to equilibrium but they also respond to a different set of variables and display significantly different elasticities of response with respect to the same variable. *M*1 and time deposits do not provide a homogenous set of services or predominantly satisfy the same set of motives, thus raising serious questions about the merits of widening the definition of money to include time deposits. A medium of exchange rationale largely explains the demand for *M*1 and a portfolio-balance rationale largely explains the demand for time deposits.

We do not know whether *M*1 and time deposits are homogenous in supply but they evidently are not homogenous in demand. The above noted differences imply a large degree of imperfect substitutability between them thus preventing any meaningful aggregation.[13] The much slower absolute and comparative slowness in the adjustment to equilibrium of time deposits violates one of the key elements of the Monetarist's model namely, "full and instantaneous adjustment of the amount of money demanded to the amount supplied," (*Friedman* 1971). The evidence that a portfolio-balance motive mainly influences the holding of time deposits also makes the use of $M2$ inconsistent with the primarily empirical model which, as noted earlier, omits the intervening portfolio-adjustment chain of causation to produce a direct income effect in equation (2). Finally, the ability of the adaptive expectation mechanism to completely close the gap between actual and anticipated values of inflation and economic growth is just as much in doubt, for the reasons mentioned earlier, when we use $M2$ instead of $M1$, because that ability is independent of the particular choice of the empirical definition of money.

In short, widening the (empirical) definition of money to $M2$ is unjustified and equation (11) remains mis-specified even when money is defined as $M2$. It follows that the closer (approximate) long run correspondence for the post-1960 period between $M2$ monetary expansion and nominal income growth (which necessarily implies an approximate zero rate of growth of velocity) is a discovered "empirical regularity" that is the result of unjustifiable aggregation. Furthermore, this post-1960 zero average value of $Dv2$ still leaves the (adaptive expectation based) assumption of the eventual complete closing of the gap between actual and anticipated values of inflation and economic growth still very much in doubt. Some of the evidence suggests that the Monetarist model (of *Friedman*) may be internally inconsistent (for example, the mis-specifications of equations (3), (4) and (11)) and we cannot infer from the available evidence that this, at best partial predictive success when $M2$ is used as the relevant empirical definition of money, is due to working out of the various hypotheses embedded in the outlined model and a review of the evidence (*Laidler* 1978, for example) is unable to provide empirical support for the parameter values assumed in the *Friedman* models.

[13] For example, if we use the familiar textbook criterion of the greater potency of monetary policy the much higher time deposit interest elasticity and its much slower speed of adjustment to equilibrium imply not only different potencies of $M1$ and $M2$ but also quite different rates of expansion of $M1$ and time deposits in order to bring about a given change in income within a given time period.

III. Summary and Conclusions

Steady state solutions, as *Hicks* and other have noted, are "useful intellectual experiments, which are necessary to sort out the questions involved in analyzing complicated process". We have shown, as other (*Robinson* 1977; *Hicks* 1976) have suspected, that as working hypothesis "it sinks at the first step" and it is thus inappropriate to base policy prescriptions on such steady state solutions. Implicit in the Monetarist steady state solution is the necessary (but not sufficient) assumption of a zero rate of growth of velocity. Implicit also is the assumption that the process of adaptive expectation formation will help produce, this zero rate of growth. We find that the rate of growth of $M1$ velocity was almost never equal to zero, that it did not even display a tendency to converge to a zero or constant value, that it was mostly rather large, and for the almost twenty year period 1948.2 - 1966.4 its average value of 3.92 was considerably larger than the average values of the rate of growth of not only monetary stimulus ($DM - Dy$), equal to $-$ 1.83, but also of monetary growth DM, equal to 2.20. For the $M2$ money aggregate the respective average values of $Dv2$, ($DM2 - Dy$) and $DM2$ were 2.04, 0.07 and 4.10.

The measured presence of significant economies of scale in the holding of $M1$ money balances, which evidently are held mainly for transaction purposes, violates a key Monetarist assumption of a unit income elasticity of the demand for money and produces a positive velocity-income relationship. The velocity equation is neither a numerical nor a behavioral constant (*Goldfeld* 1977), and while the speed of adjustment to equilibrium of $M1$ balances is now found to be quite rapid it is also variable. The velocity equation was shown to me misspecified and its coefficient on monetary stimulus incorrectly signed. These noted differences between the assumed and measured behavior of $M1$ balances appear to partly account for the difference between the actual and predicted behavior of velocity growth (and thus the persistent marked departures from the predicted steady state solution).

Widening the definition of money to $M2$ partially rescues the Monetarist prediction but not the model. The coefficient of velocity growth on monetary stimulus is evidently still incorrectly signed and the available evidence suggests that the closer (approximate) statistical correspondence between the actual and predicted long run behavior of velocity, when money is defined as $M2$ instead of as $M1$, is due to the discovery of an "empirical regularity" that is the result of unjustifiable aggregation and not of the working out of the different hypotheses embedded in the model. Even then, the apparent success (in passing the incomplete test of the steady state) is only partial in that velocity fluctuates close to and around its predicted mean value of zero for only the post-1960 period but not for the twelve year pre-1960 period when non-monetary influences, which are left out of the Monetarist model, were apparently relatively more important (Figure 3).

While defining money as $M2$ partially rescues the Monetarist prediction (of a zero rate of velocity growth in the steady state) it leads to an even greater mis-specification of the velocity equation and the available evidence of marked slowness in the speed of adjustment to equilibrium of time deposits is consistent with another key assumption of the Monetarist model namely, "full and instantaneous adjustment of the amount of money demanded to the amount supplied". In short, since the dynamic demand for time deposits is mainly governed by a portfolio-balance motive widening the definition of money to $M2$ produces an even greater mis-specification of the velocity equation (11) and it highlights yet another inconsistency because a portfolio-adjustment chain of causation is missing in the outlined equation system.

The non-homogeneity of $M1$ and time deposit demands does not permit any economically meaningful aggregation and irrespective of the particular empirical definition of money adopted the assumed power of the adaptive expectation mechanism, which appears in the velocity equation, remains very much in doubt. In the light of this aggregation problem, the noted inconsistencies, and the implausibility of including time deposits in an expanded definition of money when they are not a medium of exchange, the relevant empirical definition of money is $M1$.

Some of the evidence sugggests that the model may be internally inconsistent and the marked differences between the prediction and performance of the empirical Monetarist model, especially when money is defined as $M1$, are apparently due to several counterfactual assumptions that are heavily relied upon to produce the intermediate and steady state results. First, the assumption of the model that monetary stimulus will increase both real economic growth and inflation cannot be supported because economic growth is found to be negatively related to inflation. A reconciliation of this observed empirical relation with the outlined (primarily empirical) Monetarist model requires, at the very least, explanations of the capacity utilization rate and the speeds of adjustment of inflation and economic growth to it, as well as to their expected values. This, however, is not done.[14] Second, the adaptive expectation process cannot be expected to completely close the gap between expected and actual values inflation and economic growth because economic aggregates are not only variable but a systematic positive relation exists between not only the mean and the variability of the inflation rate but also between the variabilities of the inflation rate and real economic growth (*Moosa* 1978) (because of a systematic negative relation between the mean and the variability of real economic growth), and between their respective variabilities and the inflation rate. This makes adaptation increasingly difficult with increasing values of DP_t and DY_t, as also noted by *Friedman* (1977). Third, fiscal variables are completely ignored because of the counterfactual assumptions that if inflation is fiscalinduced it has to be money-accomodated (because velocity growth is assumed to be zero in the long run). We found instead that up to about 1966 inflation was apparently velocity accommodated.[15]

Finally, the rates of growth of interest and output (which have non-zero means) account for virtually all of the explained variation of velocity growth (assumed to be zero in the steady state). This introduces a complication that requires the development of an independent theory of interest rate determination as well as of economic growth, something sidetracked in *Friedman*'s Monetarist model because of the long run full employment assumption. The usefulness of the Monetarist model in explaining the one social goal of price stability is intimately linked to the explanation of the related social goal of real economic growth, which is assumed for the long run and inadequately and incorrectly explained for the short run, and which appears in not only the measure of monetary stimulus, $(DM - Dy)$, but is also a major determinant of velocity growth, Dv, the remaining variable in the quantity identity. Our analysis suggest that not only does the primarily empirical Monetarist model not adequately describe the internal structure of the economy but also that the policy prescription for price stability cannot be relied upon to produce the predicted results for both price stability and for economic growth.

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[14] *Friedman* may have been partly aware of these problems (*Friedman* pp. 224 and 225).

[15] In the Monetarist model of inflation, based as it is on the quantity theory identity, inflation necessarily money-accommodated or velocity-accommodated.

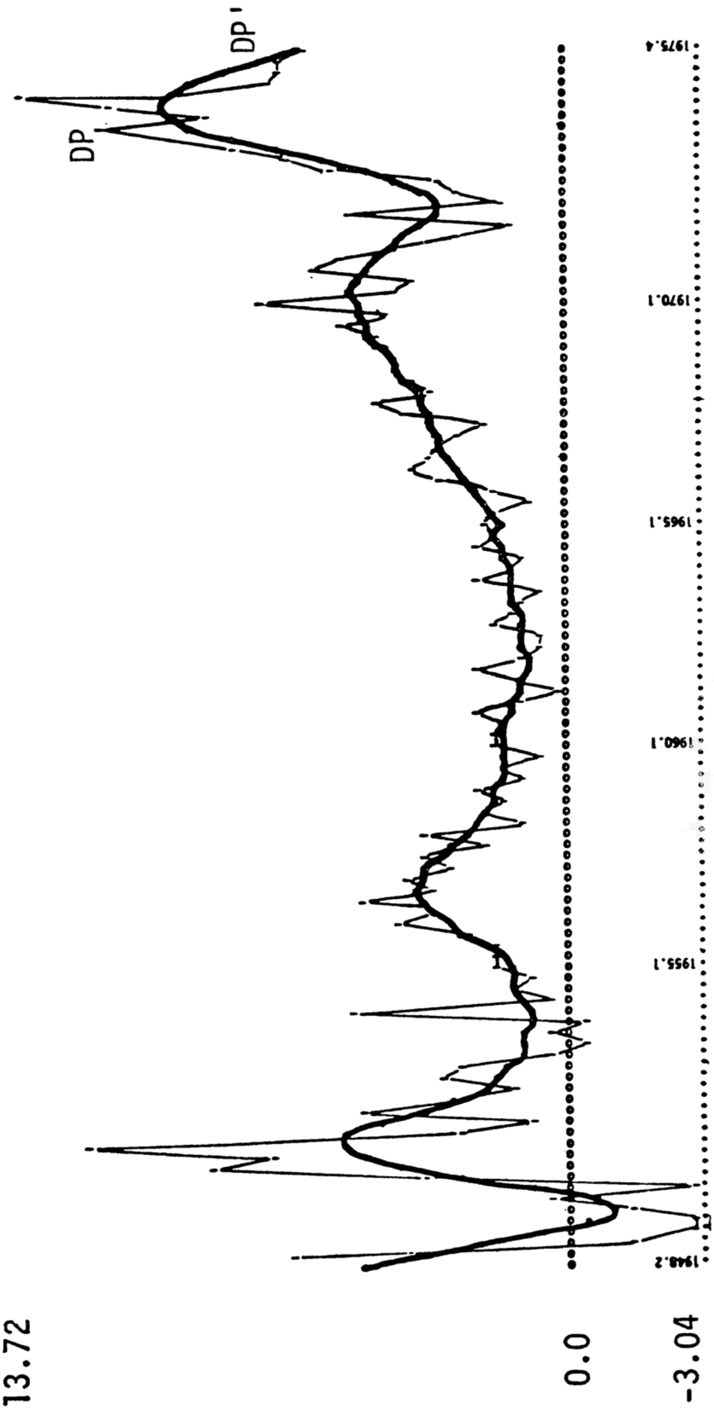

Fig. A1. The Rate of Inflation- Actual and Systematic Components

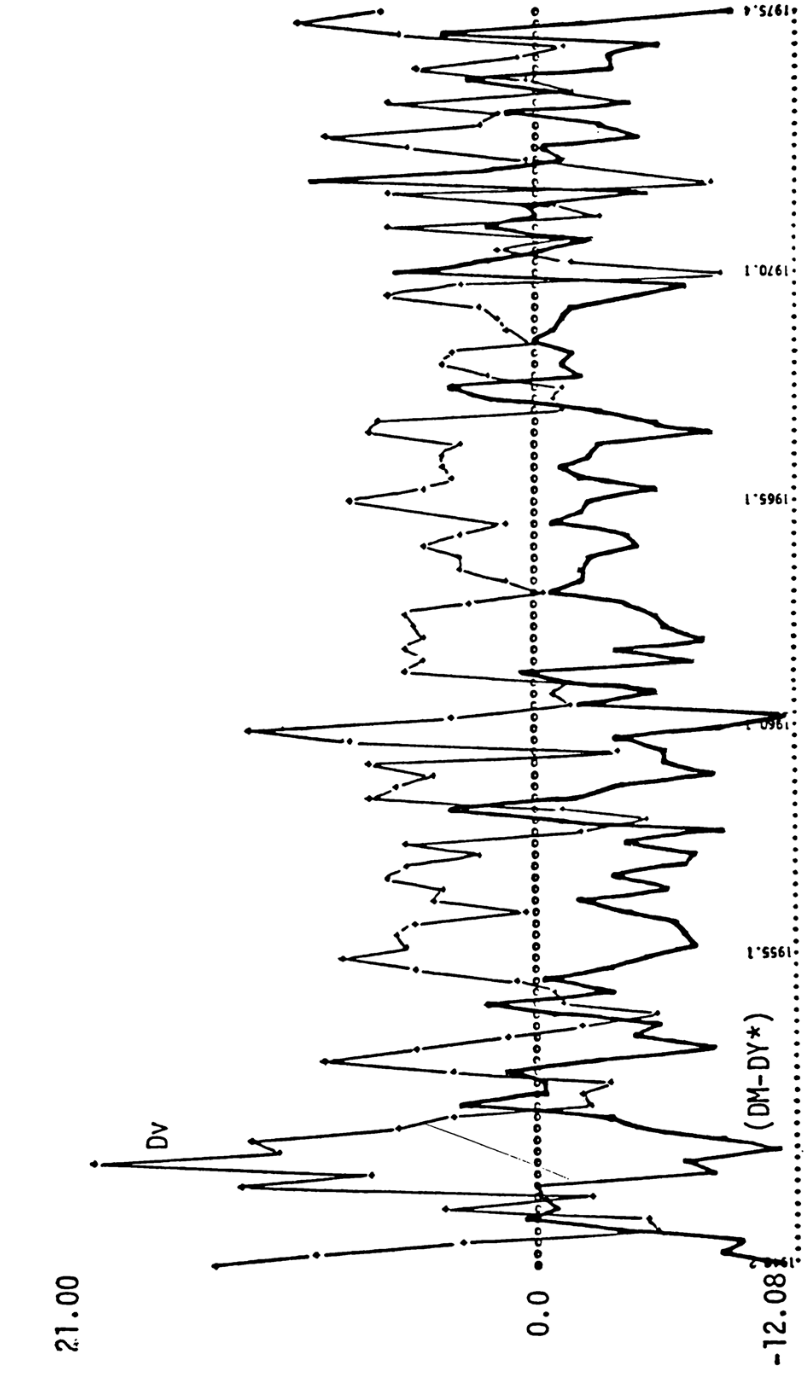

Fig. A2. Monetary Stimulus and Velocity- Actual Values of Money

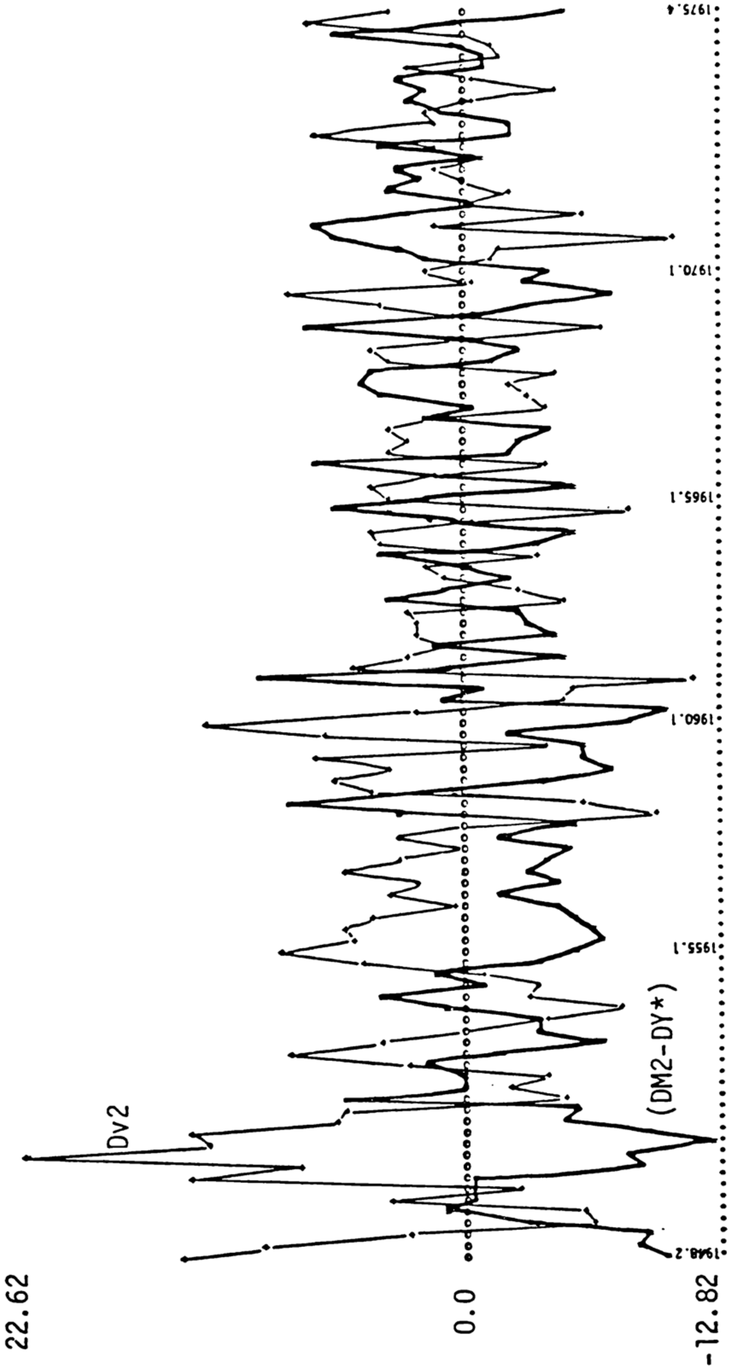

Fig. A3. M2 Monetary Stimulus and Velocity- Actual Values of Money

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Zusammenfassung

Über die Existenz eines monetaristischen Gleichgewichts

Mit der weltweiten Beschleunigung der Inflation während des letzten Jahrzehnts (sie war wahrscheinlich auslösendes Moment) gewann die monetaristische Lehre mehr und mehr an Bedeutung. Monetaristische Modelle unterscheiden streng zwischen nominalen und realen Variablen. In Übereinstimmung mit ihrer klassischen Tradition setzen sie auf stabile Gleichgewichtslösungen für ihre wirtschaftspolitischen Schlußfolgerungen. Folglich erlangen sowohl die Existenz eines stabilen Gleichgewichts als auch die Konvergenz der ökonomischen Variablen (oder das Ausmaß und die Art ihrer Abweichungen von) an ihren stabilen Gleichgewichtswerten mehr und mehr an Bedeutung. Dies trifft besonders zu, wenn die Veränderung der Zeitpräferenz positiv ist. Eine Variable von besonderer Bedeutung ist die Akzeleration bzw. Dezeleration der Wachstumsraten. Und obwohl sich monetaristische Modelle im einzelnen durchaus unterscheiden, lassen sie doch alle, explizit oder implizit, der Akzeleration bzw. Dezeleration der Wachstumsrate eine zentrale Bedeutung zukommen. In einer stabilen Gleichgewichtssituation geht man hierbei von gleich Null oder einer technologisch bestimmten Konstante aus. Im Gegensatz hierzu müssen alternative Modelle beispielsweise von Arbeitslosigkeit, Wirtschaftswachstum oder Inflation explizit oder implizit von nicht-konstanten Werten ausgehen Dieser Beitrag der verhaltensmäßig bestimmten Akzeleration bzw. Dezeleration untersucht unter Anwendung des viel diskutierten Modells von *Friedman* als Ausgangspunkt das stabile Gleichgewicht und die hierzu gehörenden Eigenschaften der Akzeleration bzw. Dezeleration der Wachstumsraten.

Summary

On the Existence of a Monetarist Steady State

The worldwide acceleration of inflation over the last decade has been associated with (and apparently responsible for) an ascendancy of the Monetarist school of thought. Monetarist-inspired models make a sharp distinction between nominal and real variables and rely heavily, in line with Classical tradition, on steady state solutions to draw inferences about economic policy. Accordingly, both the existence of a particular steady state, and the rate of convergence of economic variables to (or the extent and nature of their departure from) their steady state values become of not inconsiderable interest. That is especially the case if the rate of time preference is positive. A variable of particular interest is the behavior of velocity growth. Even though Monetarist models differ in some matters of detail they all, explicitly or implicitly, assign a pivotal role to the behavior of velocity growth. It is assumed to equal zero or a technologically-determined constant in steady state equilibrium. By contrast, alternative models, say of unemployment, economic growth or inflation, explicity or implicity, have velocity growth take on (behaviorally-explained) non-constant values. This paper examines the steady state and related properties of velocity growth by using Friedman's widely discussed Monetarist model as the point of departure.

Résumé

A propos de l'existence d'un équilibre monétariste

Avec l'accélération universelle de l'inflation au cours de la dernière décennie (et vraisemblablement en raison d'elle), la science monétariste a toujours davantage gagné en importance. Les modèles monétaristes distinguent très strictement les variables nominales des réelles. En accord avec leur tradition classique, ils se fondent sur des solutions stables d'équilibre pour énoncer leurs conclusions de politique économique. En conséquence, l'existence d'un équilibre stable comme aussi la convergence des variables économiques (ou l'ampleur et le genre de leur divergence) par rapport à leurs valeurs d'équilibre stable gagnent chaque jour en importance. Ceci est d'autant plus vrai que la variation de préférence temporelle est positive. Une variable d'importance primordiale est l'accélération ou la décélération des taux de croissance. Et bien que les modèles monétaristes se distinguent les uns des autres, ils accordent tous, explicitement ou implicitement, une importance centrale à l'accélération ou à la décélération des taux d'expansion. Dans une situation d'équilibre stable, l'on se base sur une constante égale à zéro ou de valeur technologique. A l'opposé, des modèles alternatifs par exemple de chômage, de croissance économique ou d'inflation doivent explicitement ou implicitement émaner de valeurs non-constantes. La présente étude de l'accélération ou de la décélération à caractère de comportement prend comme base, en exploitant le modèle tellement décrié de *Friedman,* l'équilibre stable et les caractéristiques qui lui appartiennent de l'accélération ou de la décélération des taux de croissance.