

## FRIEDMAN AND THE QUANTITY THEORY

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This paper is based on Friedman [13, 1970] and Friedman [14, 1969]. Much of Friedman's monetary theory has been developed from empirical observations on changes in the monetary stock, prices, nominal and real income, velocity in the U.S. economy from 1867 to 1960 [15]. Observations on these five variables are always discussed by Friedman in the context of the "quantity equation of exchange" (QEE) identity ( $MV=PQ = Y_m$ ) with  $M$ ,  $V$ ,  $P$ ,  $Q$  and  $Y_m$  representing nominal money stock, income velocity, the general price level or price index, real GNP and nominal GNP respectively. Friedman's empirical approach to monetary theory, in fact, is almost entirely based on the refinement of this famous identity.

The  $M$  (nominal money stock) variable can be divided into two portions: (1)  $D$ , the nominal money stock demanded, and (2)  $S$ , the nominal money stock supplied. Friedman has theoretically analyzed both these aspects of  $M$ . His theory of  $D$  (the nominal money stock demanded) is more explicitly stated than his theory of  $S$  (the nominal money stock supplied), however. It has been carefully described in the 1956 article and amplified upon in many textbook.<sup>1</sup> But Friedman's description of how the  $S$  variable is integrated into his theoretical analysis has never been summarized in any convenient source. For example, when should  $S$  be treated as an exogenous policy variable and when should it be treated as endogenous? When  $S$  is exogenous and it varies independently, what changes does it cause? Are these changes felt immediately or over the long run? What causes  $S$  to become endogenous? How does the mode of changing  $S$  affect the economy? When  $S$  increase at various rates, how and why does inflation occur? The answers to these questions comprise the major points concerning the "quantity equation of exchange" (QEE) that Friedman has discussed in his major articles, yet they have largely been neglected by writers on money-policy issues. This may be because they have not been prevented by Friedman in a single source which is convenient to the student of monetary theory, in which they can easily be contrasted and compared. The major purpose of the current paper is to set out for the reader Friedman's answers to these questions and, in doing so, to summarize the major elements in the evolution of Friedman's view of the quantity theory of money. We shall neglect Friedman's view of the relationship between  $S$  and  $V$  in this paper, preferring to analyze this complicated question in a separate study.

### S AS A MAJOR POLICY VARIABLE IN THE SHORT RUN

$S$  is Friedman's major policy variable. Friedman believes [10, pp. 220-225] that there is a

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direct line of causation between  $S$ ,  $P$  and  $Y_m$  in the short run, when changes in the money stock cause changes in "business". This means that  $S$  increasing causes both  $Q$  and  $Y_m$  to increase. Friedman also believes that the same line of causation holds in the long run but that when  $S$  increases, it doesn't necessarily cause  $Q$  to increase. More about the long run analysis later. Friedman's theory of short run policy independence for the money supply is the crux of the applied portion of his empirical monetary theory, so it is worthwhile for us to investigate it carefully. Once more, briefly, it states that the monetary authority can vary the level of economic activity by changing the amount of money in the economy.

### S AS A DEPENDENT ENDOGENOUS VARIABLE

The obvious statement that  $S$  is at least partly an endogenous variable in the short run is in the 1958 article [7, p. 179]<sup>2</sup>:

... the direction on influence between the money stock and income and prices is less clear-cut and more complex for the business cycle than for the longer movements. The character of our monetary and banking system means that an expansion of income contributes to expansion in the money stock, partly through inducing banks to trim more closely their cash reserve position, partly through a tendency for currency in public hands to decline relative to deposits; similarly, a contraction of the income contributes to a reduction or a slower rate of rise in the money stock by having the opposite effects on bank reserve ratios and the public's currency ratio. Thus, changes in the money stock are a consequence as well as an independent cause of changes in income and prices, though once they occur they will in their turn produce still further effects on income and prices.

Some Keynesian economists regard this type of analysis, with the money supply as an endogenous variable to be an improvement over strict monetarism [3, p. 880]:

A fruitful further exchange of ideas will be enhanced, if in his rejoinder, Friedman devotes some space to: a) indicating why his framework, which assumes a completely exogenous money supply is preferable to a Keynesian analysis which, when the finance motive and elasticity properties of money are included, permits money-supply changes to be endogenous under certain circumstances and exogenous in others.

The willingness to realize that  $S$  may be endogenous has caused Friedman to theorize at least to some degree about the idea in economics called "due proportions of money to trade" [7, p. 174]:

The total amount of "work" for the money stock to do, as it were, is doubled, and the same nominal quantity of money could perform the "work" only at lower levels of prices. ... Thus, for price movements, the relevant variable is the stock of money per unit of output, not simply the global stock of money.

The implication of this statement is that there must be a short-run limit to the amount

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of work that a given nominal stock of money can perform and if output increases by enough, a point will be reached when an additional unit of output will not be able to be sold because of a credit shortage and more credit must be created by monetary institutions so that the new output can be sold. Thus, the "proportion of money to trade" has fallen below a minimum limit beyond which it can't go without disrupting the smooth flow of goods in the economy; the amount of "work" that the existing money stock(S) can perform has been maximized in the short run and it can perform no more: new production will then require an increase in the money supply in order to be at profitable prices.

### S AND $Y_m$ OVER TIME

Let us now go back to Friedman's analysis of the framework of operational time and discuss the policy implications of regarding S as an independent, exogenous variable. There is a difference in policy effects which follow from increasing S in the short and in the long run; this difference is most succinctly described by the following [14, p. 217]:

I regard the description of our (monetarist) position as "money is all that matters for changes in real income" an exaggeration but one that gives the right flavor of our conclusions. For the short run [8, p. 138]:

... given a stable demand function for money, measured income will be highly sensitive in short periods to changes in the nominal stock of money — the short run money multiplier will be large and decidedly higher than long run money multiplier.<sup>3</sup>

While, for the long run:

... changes in the quantity of money as such in the long run have a negligible effect on real income, so that nonmonetary forces are "all that matter" for changes in real income over the decades and money "does not matter".

Friedman states that  $Y_m$  always increases when S increases, but, since the short run is greater than the long-run money multiplier, the increase in  $Y_m$  caused by a given change in S is larger in the short than in the long run. Since  $Y_m$  increases in both cases, money is all that matters for changes in nominal income. Increases in Q can be caused in only the short run by increases in S, however. Even though S and Q simultaneously increase in the long run, there is no causal relation between them. Q increases in the long run as a result of "monetary forces" Evidently, Friedman believes that increasing S will cause an increase in Q in the short run as long as less than full employment of resources prevails, while in the long run, such exogenous factors as technical change and population growth will cause the increase in Q; it will not be caused by the increase in S which also occurs.

### THE MODE OF CHANGING S

It has already been shown how Friedman regards S as an important policy variable of his

system; this is why it is usually chosen as exogenous. If we accept the fact that  $S$  is exogenous, it then becomes important to observe the mode of changing  $S$ . Brunner and Meltzer [1, p. 841] note that it is important to distinguish "the way in which the stock of money is changed," and they imply that Friedman has not done this. But, Friedman's article [5]: "Prices, Income, and Monetary Changes in Three Wartime Periods," discusses just such a problem. This article rationalizes why prices increased at successively slower rates in the Civil War, World Wars I and II. Part of the explanation (pp. 164-165) depends on a concept Friedman calls the "inflationary potency of government created money." This item was the largest during World War I because the "expansion ratio of the private commercial banking system" was the largest during its duration compared to the other two wars. Thus, Friedman is focusing not only on deficit spending as a cause to increase  $S$ , but also on the expansionary potential of the private banking system. He implies that if government spending is to be financed by expansionary monetary policy, this should only be done when the inflationary effect will be minimized.

There is another consideration which is related to the mode of changing  $S$ . This is the controversy over whether  $S$  should be changed in an automatic or discretionary fashion during cyclical movements of the economy. This short-run analysis of the changes  $S$  was first described by Friedman [4] in an article in which he proposed that both the federal government and the private commercial banking system relinquish discretionary control over  $S$  in favor of automatic adaptations of  $S$  to changes in business conditions. Friedman justifies the emphasis on automatic changes in  $S$  by making reference to the lag between  $S$  and  $Y_m$ . He believes that a 12-16 months lag exists [9, pp. 247-250] and that it is longer for discretionary than for automatic changes in  $S$  [4, p. 384, see also 7, p. 186 and 12, p. 109].

This analysis . . . suggests that the total lag is definitely longer for discretionary monetary or tax changes than for automatic reactions.

Another reason for automatic  $S$  is to help maintain a stable price level in the economy. This does not mean that prices will stay constant but that they "will behave in a known way in the future" [12, p. 106] or that price changes are fairly steady, moderate in size, and reasonably predictable" [7, p. 184]. If the economy is growing over time, automatic adaptations of  $S$  to  $Y_m$  mean that  $S$  should also be expanding. But prices can be either falling or rising to stimulate economic growth [7, pp. 182-184]; the important thing is that prices change in a moderate and predictable fashion. The implication is that discretionary  $S$  will cause price changes to be arbitrary and unpredictable.

Friedman feels that the monetary authority should avoid the "sharp swings" in policy [12, pp. 109-110] characterized by past performances of discretionary policy such as that exhibited during the "Great Contraction".  $S$  fell slightly over 30% during the period 1929-1933 [11, pp. 89-91] and this was caused by a discretionary policy of the FED [11, p. 90]:

. . . the Reserve System embarked on an active deflationary policy — taking the most extreme deflationary measures in its history before or since. The result was to turn a crisis into a catastrophe.

One way to avoid this problem of improperly timed monetary policy is to the automatic

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method. If both output and population are increasing, this would mean that  $S$  should also increase at a moderate rate in order to keep prices fairly stable. Friedman believes [7, p. 184; 12, p. 109] that the appropriate rate would be 3-5% per year for "currency plus all commercial bank deposits". He does not favor a complete system of automatic adaptations, however: instead, the FED should coordinate its open market operations and the reserves of commercial banks to achieve this target. But the implied emphasis of this policy is on automatism, because [12, p. 109]:

... the monetary authority go all the way in avoiding such swings by adopting publicly the policy of achieving a steady rate of growth in a specified monetary total. The precise rate of growth, like the precise monetary total, is less important than the adoption of some stated and known rate.

Thus, the public could expect that  $S$  would increase in a dependable fashion each year and that prices would be nearly stable because the FED would "automatically" regulate deposits in accordance with the size of the deficit to achieve its stated goal.

## MONEY MARKET EQUILIBRIUM AND INFLATION

There are two major aspects to Friedman's theory of inflation; a comparative statics and a dynamics analysis of the inflationary process. Furthermore, the differences between short-run and long-run inflation are usually discussed together with an under-current theme of inflation described as unanticipated in the short run, more anticipated in the medium run and perfectly anticipated in the long run.

### The Comparative Statics of Inflation — Price Increases are Expected

One of Friedman's major articles [13] describes a very short-run period with  $Q$  constant, but prices would rise by exactly the same rate as the increase in  $S$  in order to maintain monetary equilibrium. This is a comparative static analysis which neglects unexpected price increases and makes the implicit assumption that the community instantaneously keeps its "real balances unchanged" [13, p. 9]. As prices rise, the total additional nominal money supply ( $\Delta S$ ) [13, p. 10]:

... would have to be added to nominal cash balances in order to keep them at the initial one-tenth of year's income. So no real magnitude would be affected.

If we assume the short-run period is long enough so that  $Q$  can increase when  $S$  increase, price would not rise by as much as the nominal money supply, but  $S$  would still completely pass into nominal cash balances when the money market equilibrium was reestablished. Real magnitudes ( $Q, S/P, D/P$ ) would all increase even if stays constant, however, and this would violate the assumptions of the very short-run model described by this article.<sup>4</sup>

We should underline the fact that Friedman's comparative statics analysis of an increase in the nominal money supply, especially when it illustrates a proportional inflation, implicitly assumes

that the increase in  $P$  is expected. If part of this increase were unexpected, it would cause hedging against inflation by the public, or a temporary reduction in  $D$ ; therefore,  $P$  would have to rise more than in proportion to the increase in  $S$  at least initially, until the higher inflation rate becomes expected, in order to reestablish the money market equilibrium. If a proportional increase in  $P$  occurred, an excess nominal supply would persist because of hedging. This more complicated analysis of inflation which considers expectations will be described in the below, when we discuss Friedman's analysis of inflationary dynamics.

We have noted that Friedman discusses inflation in what has been called the "very" short-run period of operational time when no real changes in the economy occur and the short-run period when changes in  $Q$  as well as in  $P$  can occur. The latter period is also distinguished from the former because changes in permanent income begin to occur; these changes not being complete until the long-run period finally arrives. It would be more convenient to refer to these two periods before the long run as: (1) the short run; (2) the medium run, the latter being the period when permanent magnitudes change and when real economic growth can occur.

#### The Dynamics of Inflation — Unexpected Price Overshoots Occur

Friedman supplements his comparative statics analysis of inflation with a dynamics analysis which is supposed to illustrate "the transition between the short run adjustment process and long run equilibrium" [14, p. 227]. However, the present author believes the dynamics analysis not to accurately describe the long run, especially if one believes that "real magnitudes" changes in the long run and that, as Friedman observes: "... changes in the quantity of money as such in the long run have a negligible effect on real income ..." [14, p. 216]. It therefore seems more reasonable to view this analysis as a movement between the short-run and medium-run periods. We pointed out above that Friedman's dynamics analysis of inflation can be more clearly thought of as an unexpectedly high rate of inflation in the short run which can only be corrected in the medium-run period of operational time when inflation becomes anticipated.<sup>5</sup>

The difference between the short-run and medium-run reactions to an increase in the nominal money supply ( $S$ ) should be clarified. During the short run,  $Q$  is fixed and any inflation that occurs is short run,  $Q$  is fixed and any inflation that occurs is unanticipated. Unanticipated inflation causes nominal income ( $Y_m$ ) to increase but this is a "measured", not a "permanent" change. During the medium run,  $Q$  may increase or remain constant, but if it increases, at least part of its increase would be directly caused by  $S$  increasing. Furthermore, the new rate of inflation is at least partly anticipated or expected, causing at least part of the  $Y_m$  increase to be regarded as "permanent".

The format of the money demanded function is responsible for the characteristic phenomenon of Friedman's dynamics analysis of inflation; this phenomenon is called a price "overshoot" [13, p. 12], which means that prices during the "transition" to a new money market equilibrium must rise more than the "continuous increase" in the quantity of money ( $S$ ). The explanation of an overshoot is quite difficult and it has not been carefully given so far in the literature. It is based on the fact that Friedman's money demand function has two major indepen-

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dent variables when inflation is being described: the rate of increase in the price level of nominal income ( $Y_m$ ). During the short run, the first variable predominates; as the price level rises, higher prices are regarded as unanticipated and inflation hedging causes a decrease in  $D/P$ ; inflation is regarded as a tax on real cash balances. Describing a continuous 10% inflation rate, Friedman cites this justification when illustrating an increase in velocity caused by a consumer's attempt to reduce real and nominal cash balances: "Storage and depreciation costs are now ten cents per dollar per year, instead of zero" [13, p. 11]. During the medium-run, when expectations are fulfilled, the rising level of  $Y_m$  becomes regarded as permanent, causing a rise in nominal  $D$  and the negative effect on nominal  $D$  caused by inflation is minimized. The net effect is that the transitional overshoot will be eliminated and the new rate of inflation will correspond to the rate of increase in  $S$ .

## FREDMAN'S MODERN QUANTITY THEORY

The quantity theory is seen by economists as a model which determines prices in the traditional form and nominal income in the neoquantity theory version. Friedman separates out the demand for money by "ultimate wealth holders" and by "business enterprises". The theory for "ultimate wealth holder" is considered initially. Friedman defines this as [6, p. 53]:

$$W = \frac{Y}{r} \quad (1)$$

where  $Y/r$  represents the flow of income divided by the interest rate ( $r$ ). This formulation is used as income and consumption services are the flow which is provided by wealth, with the interest rate ( $r$ ) providing the link between wealth and such income services. This use of wealth in demand for money analysis is probably the most important development in monetary theory since Keynes' General Theory [19, 1962]. Friedman in particular distinguishes non-human wealth, which can be held in assets of varying liquidity, and human wealth.

The rate of return on bonds is in two parts. A bond is a fixed term loan to the government which yields an interest rate ( $r_b$ ), which is determined when the bond is purchased, and a change in its capital gain on a bond is denoted by  $-(1/r_b) \cdot (dr_b/dt)$  where  $1/r_b$  is the price of the bond. When  $dr_b/dt$  is negative, the bond price is rising which requires the use of a negative sign for the whole expression in order that it yields a positive capital gain. The total return from bond holding is therefore:

$$r_b - \frac{1}{r_b} \cdot \frac{dr_b}{dt} \quad (2)$$

A second form of wealth holding distinguished by Friedman is an equity. An equity provides the wealth holder with a stream of income of constant "real" amount. The return on an equity includes a purchasing power clause to maintain the real value of the income stream  $(1/P) (dP/dt)$ :

$$r_e - \frac{1}{r_e} \cdot \frac{dr_e}{dt} + \frac{1}{P} \cdot \frac{dP}{dt} \quad (3)$$

where the subscript e refers to an equity. Wealth held in the form of physical assets yields a return which is in the form of services from the ownership of the assets while in addition the real value of the assets will change as the price level changes. It is this latter element  $(1/P) (dP/dt)$  which is used by Friedman to represent the return from holding such assets. Finally, the return from holding wealth in human form is virtually impossible to define given that such wealth is basically non-marketable.

For "business enterprises", money is like any other productive resource. According to Friedman, the demand for it can be looked at in a very similar way to that for "ultimate wealth holders". However, the wealth term is less meaningful for business enterprises and is replaced by a term for the volume of transactions, while the "catch-all" term u must be broadened. It must include the technological production conditions.

The full demand for money function is therefore:

$$M_d = f \left( \frac{Y}{r}, w, p, r_b, r_e - \frac{1}{r_b} \cdot \frac{dr_b}{dt}, r_e - \frac{1}{r_e} \cdot \frac{dr_e}{dt} + \frac{1}{P} \cdot \frac{dP}{dt}, \frac{1}{P} \cdot \frac{dP}{dt}, u \right) \quad (4)$$

This is simplified to:

$$M_d = f \left( Y, w, P, r_b, r_e, \frac{1}{P} \cdot \frac{dP}{dt}, u \right) \quad (5)$$

The crucial monetarist flavour is given to this general demand for money analysis in the assumptions firstly that the function is homogenous of degree one in prices and incomes and secondly that the function is stable. To develop, Friedman argues that all demand functions are typically specified in real magnitudes, hence [6, p. 58]:

$$f(\lambda Y, w, \lambda P, r_b, r_e, \frac{1}{P} \cdot \frac{dP}{dt}, u) = \lambda f \left( Y, w, P, r_b, r_e, \frac{1}{P} \cdot \frac{dP}{dt}, u \right) \quad (6)$$

Let  $\lambda = 1/P$  then (5) can be rewritten as

$$\frac{M}{P} = f \left( \frac{Y}{P}, w, r_b, r_e, \frac{1}{P} \cdot \frac{dP}{dt}, u \right) \quad (7)$$

The validity of the assumption that the elasticity of the demand for money with respect to the price level is unity, so that a demand for money function expressed in real terms is acceptable, can be tested empirically.

In addition, let  $\lambda = 1/Y$  then (5) becomes,

$$\frac{M}{P} = f \left( w, \frac{P}{Y}, r_b, r_e, \frac{1}{P} \cdot \frac{dP}{dt}, u \right) \quad (8)$$



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Re-arranging (8) and letting

$$V(\quad) = \frac{1}{f(\quad)} \quad (9)$$

$$Y = M \cdot V \left( w, \frac{P}{Y}, r_b, r_e, \frac{1}{P} \cdot \frac{dP}{dt}, u \right) \quad (10)$$

where  $V(\quad)$  is the velocity function and  $V$  is income velocity.

As Friedman argues [6, p. 62] "almost every economist will accept the general lines of the preceding analysis on a purely formal and abstract level". However, the modern monetarist assumes that the demand function for money (i.e., the velocity function) is stable — although the velocity of circulation need not be constant.

### SUMMARY AND CONCLUSION

This paper has examined M. Friedman's view of the modern quantity theory of money by observing the quantity equation of exchange (QEE) and showing how changes in the money stock ( $M$ ) affect real income ( $Q$ ), prices ( $P$ ), and money income ( $Y_m$ ). The money stock concept was divided into money supply ( $S$ ) and money demand ( $D$ ); we focused on  $S$  and showed how it was either regarded as an exogenous policy variable or an endogenous effect of a growing economy which is responding to a credit shortage by expanding  $S$ . The latter emphasis is related to the famous proposition from the history of economic thought called: "Due proportions of money to trade" or the "real-bills doctrine". We then showed that a greater real influence on the economy was exerted than in the long run; while price increases were still caused in the long run by variations in  $S$ ,  $Q$  changes were only caused in the short run. Furthermore, the mode of changing  $S$  influenced the "inflationary potency of government created money" over time control over  $S$  would at least help make inflation occur in a predictable or expected rather than in an unexpected manner.

Of course, no modern description of Friedman's theories would be complete without some discussion of inflation. This has been provided and it has been shown that in order to discuss inflation we must realize that price increases represent an increase in  $S$  which disturbs monetary equilibrium determines the magnitude of inflation. We must therefore closely examine two aspects of Friedman's  $D$  concept; the transaction motive by which increases in  $Y_m$  directly affect  $D$  and the hedging motive by which increases in  $P$  inversely affect  $D$ . Furthermore, adjustments of inflationary expectations over time must be considered in order to show how equilibrium will be reestablished. Both the comparative statics and the dynamics of the inflationary process must also be analyzed.

Friedman's contribution to monetary theory is precisely to draw attention away from the motives that prompt the holding of money and — taking for granted the fact that people do hold

money — to analyse carefully the factors that determine how much money people want to hold under various circumstances. He thus treats the analysis of money in exactly the same way an economist would treat that of any durable good were he asked to construct a model of the demand for it, and in doing so formulates a demand function whose form is dictated by the ultimate aim of testing its predictions against empirical evidence [16, pp. 68-74]. Patinkin argues that enshrined in Friedman's 1956 model deals with the relationship between the stock of money and the stock of other assets [17, pp. 883-905]. As a result, the modern quantity theory involves a complex transmission mechanism with portfolio adjustment amongst a range of assets.

### FOOTNOTES

1. One of the best expositional descriptions of Friedman's demand-for-money function is contained in [18, chapters 9 and 10, pp. 155-196].
2. Friedman's article, replying to Culberston's criticism [2] of this analysis of the lag in the effect of monetary policy, even refers back to his earlier article [14, p. 240]. The 1958 article is the outstanding example in Friedman's writings when he chooses to regard the money supply as partly determined by the price and income levels in the economy and as therefore endogenous. This knowledge is not underlined in his other writings and it is difficult to find it explicitly stated other than in this reference.
3. This point was suggested to Friedman by Gary Becker.
4. This statement illustrates the fact that Friedman's concept of transaction demand for money is "real". Real transaction demand depends on real income; when  $Q$  rises, so does  $D/P$ .
5. See [13]. This article best describes Friedman's dynamic inflationary system. The basic assumption (p. 12) is that "real magnitudes" remain constant. Therefore, the dynamics of inflation process, as Friedman seems to believe.

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