# Balbach and Brunner: A Missing Stop on the Road from Warburton to Friedman – Meiselman and St. Louis

Michael T. Belongia
Department of Economics
University of Mississippi
Box 1848
University, MS 38677
mvpt@earthlink.net

and

Peter N. Ireland
Department of Economics
Boston College
140 Commonwealth Avenue
Chestnut Hill, MA 02467
peter.ireland@bc.edu

June 2022

ABSTRACT: "The Relative Stability of Monetary Velocity and the Investment Multiplier in the United States, 1897–1958," by Milton Friedman and David Meiselman (1963), typically is recognized as the original study that used a reduced-form equation to evaluate whether autonomous expenditures or the quantity of money was the dominant influence on aggregate spending. It also provided the foundation for the better-known St. Louis Equation that followed. Missing from this evolution, however, are important precedents by Karl Brunner and Anatol Balbach (1959) and Balbach (1963) that also employed a reduced form framework to offer evidence on the same debate between the Keynesian expenditure theory and the quantity theory of money. Moreover, these authors also investigated whether the demand for money function was stable and inversely related to an interest rate, properties necessary in their reasoning before any more general model of national income determination could be developed. With this foundation, Balbach (1963) then derived a reduced form expression for personal income from an explicit theoretical model and, in its estimation, anticipated and addressed some of the empirical criticisms later directed at the work by Friedman and Meiselman and the early versions of the St. Louis Equation. Taken together, the theoretical and empirical work reported in Balbach (1963) and Brunner and Balbach (1959) suggest these papers are clear antecedents of later reduced form expressions and should be recognized as such.

**Keywords:** St. Louis Equation, monetary policy, fiscal policy, reduced form equation

**JEL Codes:** B2, B4, E3

Acknowledgements: Correspondence may be addressed to the authors at the email addresses noted above. This paper was inspired by a conversation with David Laidler and we are indebted to him both for his suggestion that we pursue the project and his invaluable comments on an earlier draft. We thank Pierrick Clerc, Kevin Hoover, Jerry Jordan, Ed Nelson, Jack Tatom, and two anonymous referees for their many helpful comments on an earlier version of this paper. We also thank Lawrence Ogbeifun for his research assistance.

**A Missing Stop on the Road from Warburton to Friedman – Meiselman and St. Louis**

Milton Friedman and David Meiselman's "The Relative Stability of Monetary Velocity and the Investment Multiplier in the United States, 1897–1958," published in the *Report of the Commission on Money and Credit* (1963), generally is viewed as the original effort to evaluate the relative strengths of autonomous expenditures and the money supply on aggregate activity within a single equation reduced-form framework. This paper was provocative because it challenged the Keynesian orthodoxy of the time by claiming the money supply, and not deficit spending or private investment, was the dominant influence on aggregate activity. The intensity of the debate was reflected by the decision of the *American Economic Review* to devote 100 pages of its September 1965 issue to critical evaluations by Albert Ando and Franco Modigliani (1965), and Michael DePrano and Thomas Mayer (1965), a response to those criticisms by Friedman and Meiselman (1965), and rejoinders to those responses by the authors of the two critiques. Hester (1964) also published an extensive critique of the Friedman and Meiselman paper and some of his main points were addressed in a response by Friedman and Meiselman (1964).

The criticisms were directed to both theoretical and empirical issues. Chief among these were that Friedman and Meiselman had used incorrect measures of autonomous expenditures, the endogeneity of both autonomous expenditures and money had not been acknowledged, and that, by focusing on levels of the data, the estimated reduced form exhibited serially correlated errors. With these issues in mind, Leonall Andersen and Jerry Jordan (1968) modified the equation used by Friedman and Meiselman by replacing consumption with nominal spending as the equation's dependent variable and by combining measures of the money supply and several measures of fiscal actions. They also expressed their equation in first differences to deal with the autocorrelation problem that might affect the results and introduced lags so that the effects of monetary and fiscal actions could be distributed over time. Even after these modifications, however, what became known as the "St.

Louis Equation" encountered criticisms of its own. [1] Nonetheless, throughout this evolution, the results tended to be robust with respect to the assertion that the quantity of money was more closely associated with aggregate spending than fiscal actions and, for that reason, the St. Louis Equation remained a standard model used by monetarists until the late 1980s to examine and predict how actions by a central bank would be likely to affect aggregate activity.

Missing from this story, however, is a set of conjectures by Clark Warburton (1945a) on the relative impacts of fiscal and monetary actions on final spending that later were formalized and examined empirically by Karl Brunner and Anatol B. Balbach (1959) and Balbach (1963). The latter two works not only derived a reduced form equation similar to the familiar ones named above but also stressed that a model for national income determination intended to assess the impact of money on aggregate spending would have to be derived from a model that included expressions for the supply of and demand for money. Without such an explicit connection between the demand for money and an expression for national income, they argued that any empirical attempt to find linkages between some measure of aggregate demand and the quantity of money would be an *ad hoc* exercise. In their view, a stable demand for money function, with a negative association between the quantity of money demanded and an interest rate, represented a "higher level" hypothesis which, if rejected, also would invalidate any tests of hypotheses on the influence of money on aggregate activity. Despite their more solid theoretical footings and explicit attention to money demand as a foundation for the subsequent reduced form spending equation they estimated, however, these earlier papers by Brunner and Balbach (1959) and Balbach (1963) are basically unknown in the literature.[2]

---

[1] Peter V. Bias (2014) presents a chronology of criticisms of the equations estimated by Friedman and Meiselman and by Andersen and Jordan and the authors' responses to them. This survey includes overviews of papers published as recently as 2011 that have re-visited the various controversies surrounding the use of a single equation reduced form equation to estimate the relative importance of fiscal and monetary policy actions on aggregate activity.

[2] Bennett McCallum (1986, footnote 4) mentions Brunner and Balbach (1959) as an "interesting predecessor of the later St. Louis Equation and conjectures that it "probably influence[d] the latter." Robert Rasche (1993) makes a similar connection between the two

Balbach (1963) noted explicitly that the inspiration for his work can be found in Warburton's "The Monetary Theory of Deficit Spending" (1945a) and describes a primary goal of his dissertation as an attempt to re-state Warburton's conjectures about the relative importance of money and government spending on aggregate income within a formal model from which explicit hypotheses can be derived. The earlier 1959 paper, which presents preliminary results from the 1963 study, also can be seen as an extension of Warburton's work from the 1940s. [3] To trace the evolution of single equation expressions that attempted to link both money and some measure of government spending to nominal income, the discussion below first summarizes Warburton's narrative and then presents an overview of the most important features of the two overlooked papers by Brunner and Balbach, and Balbach. Comparisons then are made between these early works and their better-known successors. The conclusion is that the reduced form equation used by Friedman and Meiselman (1963) and the subsequent versions of the St. Louis Equation have antecedents that should take their place as the original reduced form expressions that examine the relative strengths of monetary and fiscal actions.

strands of work. Nonetheless, the lack of general knowledge about these works might be illustrated by noting that Brunner cites the 1959 paper with Balbach only once (in a footnote to an appendix in Brunner (1961a)) and does not cite either work in Brunner (1961b) when part of the discussion is directed to the demand for money as well as a preliminary draft of the Friedman and Meiselman (1963) paper. Brunner (1986) also does not cite either paper in a long survey paper presented at a conference on the fiscal versus monetary policy debate sponsored by the Federal Reserve Bank of St. Louis. It is not clear if he ever cited the Balbach (1963) thesis. Finally, while Brunner is acknowledged by Keran (1969) for comments on his assessment of the St. Louis Equation's performance over a longer time horizon than that considered by Andersen and Jordan (1968), no reference is made in his article to the works by Brunner and Balbach.

[3] Brunner and Balbach were not the only people who saw Warburton's work as something to be extended. In an interview with Balbach, Robert Hetzel (2002, pp. 13 – 14) recounts a conversation he had had with Phillip Cagan. In Hetzel's telling, Cagan recalled meeting with Friedman in 1952 or 1953 about a thesis topic. During this meeting Friedman said, in effect, "Well, you know, everybody thinks this Clark Warburton is a crank but I think we ought to give his ideas a look at and think about them seriously." Lothian and Tavlas (2018) and Nelson (2020, pp. 114 – 120) discuss specifically Warburton's role in the development of Friedman's thinking on monetary economics.

**Warburton's Conjecture**

From the early 1940s through the early 1950s, Clark Warburton published numerous papers on monetary topics including the behavior of velocity, monetary rules, and the effects of money on the price level and business cycle.[4] Thomas Cargill (1979, p. 432) describes Warburton's work as reflecting "an inductive and empirical approach" that was "very similar to the methodology expressed in Friedman's (1953) discussion of positive economics." Characteristic of this work was a narrative explaining why certain relationships between variables should be expected that was accompanied by a set of data tables and plots to illustrate the behavior he had described. In several cases, for example, Warburton illustrated how turning points in money growth would anticipate subsequent changes in nominal spending and, from these presentations, concluded that money was an important determinant of economic activity. His work, however, did not include regression analysis of the type presented by others (e.g. Carl Snyder (1934) and James Angell (1936)). It also should be noted that, while he and other economists had studied the association between money and aggregate activity by the early 1940s, Warburton had not yet extended his work to the broader question of whether some measure of fiscal policy might be more strongly connected to fluctuations in aggregate activity than variations in the quantity of money. On this subject Warburton became an innovator and it is this work that serves as a starting point for the fiscal versus monetary policy debate that evolved over the next three decades. For the discussion that follows, the presentations in Warburton (1945a and 1946b) motivate the subsequent investigations by Brunner and Balbach (1959) and Balbach (1963) which, it is argued, presented statistical evidence on this question prior to the better-known works of the 1960s and 1970s.

[4] Many of these papers are collected in Warburton (1966). The bibliography in Balbach (1963) lists thirty-one papers published by Warburton between 1935 and 1952. Michael Bordo and Anna J. Schwartz (1979), Thomas Cargill (1979, 1981), and George Tavlas (2019) survey Warburton's work with special emphasis on its connections to monetarism. See Paul Trescott (1982) for a survey of early empirical work on the relationship between money and nominal spending and Warburton's place in this literature.

In "The Monetary Theory of Deficit Spending" (1945a) and "A Reply" (1946a) Warburton exhibits the "inductive and empirical approach" described by Cargill by presenting an intuitive theoretical argument that eventually connects the national income stream (value of delivered final goods) to the quantity of money and some notion of government spending. In broad outline, Warburton explains his reasoning as follows:

> "Fiscal policy as an instrument of increasing economic activity is a combination of (1) monetary policy, for any action increasing the volume of money or changing its rate of flow is a type of monetary policy, and (2) production policy, as expressed in the objects of government expenditures. Of these two aspects of fiscal policy, the monetary aspect is by far the more important with respect to the total volume of production or rate of economic activity. In fact, if fiscal policy has no effect on the volume of money or its rate of use in the purchase of products of the economy, the production policy expressed in the objects of government expenditures is a substitution of goods and services ordered by government for goods and services which would be ordered by individuals. Except for a possible effect upon efficiency, the net effect of fiscal policy upon the total volume of economic activity or production is due solely to its monetary aspect.
>
> The effectiveness of fiscal policy as an instrument for increasing economic activity or enlarging the income stream, in order that a condition approaching full use of resources or full employment may be achieved, therefore depends directly upon the effectiveness of fiscal policy as a technique for the exercise of monetary policy." (1945a, p. 75)

After more discussion of how fiscal policy will affect borrowing and spending and a summary of his reasoning under four articulated tenets of how fiscal policy is transmitted in the economy, Warburton states his conclusion as:

> "That is, we have again arrived at the conclusion that it is the monetary expansion accompanying deficit spending or a change in the rate of use of money accompanying its transfer from individuals to government, rather than deficit spending itself, which is of significance in the relation of government financial operations to the size of the income stream." (1945a, p. 80).

In terms of evidence on these propositions, Warburton relies on a chart, reproduced in Figure 1, that displays the data he reports in the text of his paper (1945a, p. 82). The top panel of the figure plots what he calls "the size of the income stream – value of delivered final products" and a measure of money. As shown, the two series appear to move together. [5] The

[5] The top panel of the figure, although based on a different sample period, is similar to one presented by Angell (1936, p. 145) that illustrated a long run relationship between money and nominal income. Angell's discussion, however, noted that it was not possible to conclude from these data a direction of causation between the two variables. Further analysis based on an expanded set of data led Angell (1937) to change his opinion to one where money was the

other two panels of the figure show alternative measures of fiscal actions. The first, shown in the middle panel, is "Income Producing Expenditures that Offset Savings." The second, shown in the figure's bottom panel, is defined as "excess of expenditures excluding debt retirement over revenue" and is referred to in Warburton's table as "Excess of Cash Outgo." The years between 1922 and 1933 do not appear in the bottom panel because Warburton notes they are less than zero. Whereas money and aggregate expenditures appear to move together in the top panel, the data in the two lower panels, in Warburton's eyes, do not appear to be associated with the income stream. From this Warburton draws the conclusion:

> "These data indicate that the facts support the foregoing conclusions, namely, that changes in the size of the income stream are much more closely related to changes in the volume of money, adjusted for the trend in the volume of money held as a store of value, than to the amount of government deficit spending or to such spending plus business spending for capital purposes." (1945a, pp. 82 - 83)

Warburton's narrative and the data shown in Figure 1 are all that is brought to bear on this early inquiry to the fiscal versus monetary policy debate.

**Formalizing Warburton**

The material presented by Brunner and Balbach (1959) and Balbach (1963) overlap to a considerable degree because the 1963 work is a PhD dissertation supervised by Brunner whereas the earlier (1959) co-authored article can be seen as the presentation of some preliminary work from that thesis. Although the results from the earlier paper will be discussed briefly, the dissertation will be the focus of the discussion because it presents a fully formed theoretical model from which the reduced form equation for aggregate spending is derived. The results in the thesis also are based on a revised specification of the reduced form equation used by Brunner and Balbach (1959) that anticipates criticisms later directed at the equations used by Friedman and Meiselman (1963) and by Anderson and Jordan (1968).

---

causal force and that much of the downturn in economic activity between 1928 – 1933 could have been avoided if the money supply had been stabilized.

The first parts of the paper and thesis are presentations of what can be regarded as an enunciation of principles drawn from the philosophy of science. [6] For example, the purpose of the thesis is described as an effort to:

> "…indicate methodological problems existing in the writings of economists of that time…..and to evaluate the implications of the hypotheses, as corrected, as a basis for monetary policy and as a test of hypotheses in other branches of economics.
>
> The plan is (1) to evaluate Warburton's assertions as restated in more rigorous form, (2) to show that these assertions can be derived from a higher level hypothesis, and (3) to analyze the implications of this hypothesis (if true) with respect to monetary policy as they are suggested by Warburton." (Balbach (1963), p. 6).

Balbach (1963, p. 23) also notes, however, that his dissertation is not intended to be a criticism of Warburton and explains that he chose Warburton's work as an example because:

> "The difference between Warburton's assertions and those of many of his contemporaries lies in the fact that he at least made an attempt to test the validity of his assertions by assigning semantic rules to his variables and comparing his predictions with observable events. This attempt in itself was of the utmost importance since it raised meaningful questions and problems for further investigation."

In short, Balbach viewed his thesis as a general examination of research methodology that used a few of Warburton's papers to illustrate his argument. In more basic terms, the fundamental criticism of Warburton was that his conclusions are *ad hoc* assertions based on intuitive reasoning or observed associations in the data rather than being based on a coherent model from which formal null hypotheses can be drawn. [7]

---

[6] In this same spirit, Anderson and Jordan (1968, p.34) devote nearly a full page of their paper to the "the concept of testing a hypothesis" prior to defining variables and estimating their reduced form equation. Hoover (2022) discusses Brunner's philosophy of science in detail.

[7] In subsequent correspondence with both Balbach and Brunner, Warburton made no substantive points on the work. In correspondence (February 14, 1964) with Brunner, however, he did object to the idea that Balbach did not base his study on a full treatment of his other papers or provide an opportunity to review the dissertation prior to its completion. In response, Brunner (March 25, 1964) noted that "I fail entirely to understand why you feel that Mr. Balbach or the thesis committee, lacked 'ordinary courtesy' for the reason you indicated. Once your work is in the public domain, anybody may address himself to it." This correspondence can be found in the Special Collections Library at George Mason University. We thank Brittney Falter for her help in obtaining this correspondence.

After this discussion of scientific principles, Balbach eventually explains how Warburton's narrative and presentations of data might be interpreted:

> "It seems that Warburton is primarily concerned with showing that the demand for cash balances can be measured and is independent of the supply of money, and that money supply is a determinant of national income and/or the price level, implying the effectiveness of monetary policy within the institutional framework of the U.S. economy. A fully implemented hypothesis about the demand for money combined with one about money supply and with an appropriate income model would accomplish the desired results."

Balbach then summarizes his discussion of how Warburton's conjectures might be formalized by saying:

> "The money demand hypothesis is a higher level hypothesis than those put forth by Warburton which, with appropriate modifications could be derived from it. More specifically, to show the effectiveness of monetary policy in the determination of income and the results of the policy in the direction postulated by Warburton, one must establish (1) the relevance of the money supply with respect to income and (2) the proper slope of the demand function for money with respect to its price." (1963, pp. 25 – 26).

More simply, Balbach's point is that a model of national income relevant to testing the relative strengths of money and government spending on aggregate income must be derived from a system that includes a monetary sector, i.e., one that includes functions for both the supply of and demand for money. In this context, testing for the existence of a stable money demand function that includes a negative coefficient for an interest rate is the "higher level hypothesis." Or, alternatively, models of national income can be derived in many ways but, for purposes of testing the importance of money in determining aggregate income, the demand for money must play a crucial role in how the specific national income model is derived. Thus, if a well-behaved money demand function serves as the "higher level hypothesis," its rejection would imply that hypotheses linking money to national income would be based on a model without a monetary sector and, therefore, a model with no role for money to affect aggregate activity. In this context, a reduced form equation that includes the money supply could be estimated but tests of its significance, in Balbach's view, as well as in the reasoning developed in Brunner and Balbach (1959), would be meaningless. Given its importance to the broader inquiry about

money's effect on aggregate income, Balbach devotes 28 pages of the 70 pages in his text to a derivation and estimation of a money demand function.

Having characterized the demand for money as the "higher level hypothesis," Balbach (p. 28) begins with a discussion of the demand for money and its derivation from the optimizing behavior of individuals and firms. Balbach then returns to a formalization of Warburton's intuitive links between money and aggregate spending and states that they are based on three premises. The first is:

$$(1) \quad \frac{P_n}{P_0} = \frac{\left(\frac{M_n^s}{M_0^s}\right)}{\left(\frac{M_n^n}{M_0^n}\right)}$$

Where $\frac{P_n}{P_0}$ is a price index, $\frac{M_n^s}{M_0^s}$ is an index of the "supply" of money, and $\frac{M_n^n}{M_0^n}$ is an index of the "need" for money. [8] This expression states that the relative change in the level of prices is equal to the relative change in the money supply divided by the relative change in the "need" for money. Here, Warburton viewed "the need for money" as one associated with a "need" for transactions.

Warburton's second proposition is about the behavior of velocity, which is expressed by Balbach as:

$$(2) \quad V_t = (1 - 0.015)V_{t-1}$$

This expression for velocity as a simple trend represents Warburton's conclusion (1946b, p. 448), based on observation of the data, that velocity declined at a rate of 1.5 percent per year over a "normal period" of 1923-1928. Noting that this conclusion is based on just six observations, Balbach estimates a regression of velocity on a time trend over a sample spanning 1923 – 1941 using the annual data in Warburton (1946b). He reports the results as (standard error in parentheses):

[8] Here and in equations that follow, definitions of the variables, as they appear in Balbach (1963), are listed in Table 1.

(2a) $V_2 = 2.042 - 0.2574 \times t\text{rend}$
(0.06)

which leads Balbach (p. 16) to conclude that "the outcome of this test does not imply even that the postulated relationship is any better than pure chance."

The last of Warburton's three conjectures (1945a, p. 81) is interpreted by Balbach as:

(3) $\Delta Y_t = k_1 \Delta M + k_2 \Delta G + k_3 \Delta I$

where changes in income ($\Delta Y$) are a function of changes in money ($\Delta M$), changes in government deficit spending ($\Delta G$) and changes in deficit spending by business (investment less savings) ($\Delta I$). Note here that this expression allows a role for both public and private deficit spending to affect aggregate income. For money to dominate deficit spending as the primary influence on aggregate income, estimation of an equation of this form would show $k_1 > (k_2 + k_3)$.

The Demand for Money

With the demand for money taken as the higher-level hypothesis from which sub-hypotheses can be derived, Balbach (p. 55) specifies a money demand function as:

(4) $M_2 = F(r_3, P_1, E_2)$

Where $M_2$ is the Federal Reserve's conventional M2 monetary aggregate composed of M1 plus savings and small time deposits, $r_3$ is the bank rate on loans to businesses, $P_1$ is the wholesale price index, and $E_2$ is an estimate of permanent income. [9] Subscripts are attached to the equation's variables because the author experimented with a number of alternative measures. These included two measures of money, three concepts of the interest rate, two measures of

[9] Considerable discussion in the text, much of which resembles that in Friedman (1956b), is devoted to the theory that leads to a money demand equation of this form. Balbach (1963, pp. 42 – 45) explains that his concept of permanent income and the basis for his estimates of it are based on the discussion in Friedman (1959).

income, and two measures of the economy's equity. Balbach estimated 24 regressions that represented all possible combinations of the equation's four variables and another sixteen regressions that added two alternative measures of the price level to the equation; each regression was of the same log-linear form and differed from the others only in the choice of measures for its variables. All equations were estimated on a sample of quarterly data spanning 1939.1 through 1957.4 and then a "best" equation was identified as the one with the lowest error variance for out-of-sample forecast values over 1958.1 through 1960.4.

The resulting money demand equation (with standard errors in parentheses) was: [10]

$$(5) \quad log\, M_2 = \underset{}{-2.41} - \underset{(0.02)}{0.39\, log\, r_3} + \underset{(0.02)}{1.07\, log\left(\frac{E_2}{P_1}\right)} + \underset{(0.03)}{1.03\, log\, P_1}$$

The author notes that, as the "higher level" hypothesis, this equation must exhibit stability as well as signs on coefficients that comport with theory if a model of national income that includes a monetary sector is to be derived. In Balbach's judgment these conditions are satisfied because the demand curve is negatively related to the interest rate and positively related to the price level and all measures of wealth employed. The estimate attached to the price level, in this equation and in the fifteen other equations reported, is not significantly different from one. In terms of stability, Balbach (p.68) notes that the estimated interest elasticities of demand range from -0.28 to -0.68; although estimated over the same 1939.1 – 1957.4 sample, the different estimates occur because of changes in the specific proxies chosen for the measures of money, interest rate, national income, permanent income, and price level. Finally, Balbach comments that his finding of a significant relationship between the quantity of money demanded and an interest rate is in contrast to Milton Friedman's (1959) argument that the demand for money depends on permanent income alone.

[10] Although not stated in Balbach (1963), the equations are expressed in logarithms to the base ten rather than natural logarithms.

With evidence in support of the higher-level hypothesis in place, Balbach (1963) lays the foundation for the reduced form equation for nominal income with a model composed of six equations. His point is that (p. 61):

> "In short, Warburton is attempting to show that monetary policy is more effective than fiscal, but due to the incomplete implementation of this assertion no conclusions were reached. It can, however, be derived from and be consistent with the money demand hypothesis. The assertion as stated resembles the reduced form of many national income models. In view of the derivation of the money demand function $H_2$, investment cannot be exogenous but other variables can. The simplest national income model that conforms with the preceding interpretation of (3) [Warburton's implied reduced form for aggregate spending as shown in (3) above] and is consistent with $H_2$ [the money demand hypothesis] is the following: [11]

Balbach (1963, pp. 61 – 63) presents his model as follows (using the same notation in his text):

(6) $Y_3 = d_0 + d_1 Y_1$

which relates personal income ($Y_3$) and to Gross National Product ($Y_1$)

(7) $Y_1 = C + I_1 + G_1$

which expresses Gross National Product ($Y_1$) as the sum of consumption ($C$), Gross Private Domestic Investment ($I_1$) and government purchases of goods and services ($G_1$)

(8) $C = a_0 + a_1 E_2 + a_2 r_3 + a_3 M_2$

which expresses consumption as a function of permanent income ($E_2$) the interest rate on bank loans to businesses ($r_3$), and the M2 measure of the money supply. Note that the measure of permanent income, $E_2$, shown in equation (8) appears as the dependent variable in equation

[11] This $H_2$ hypothesis is as follows. Assuming all of society's individual money demand curves can be aggregated, the demand for money can be expressed as: Md = F(P, $r_i$, W, U) where Md is the total amount of money demanded, P is the price of all non-money assets, $r_i$ is the intertemporal rate of substitution, W is the total wealth of society, and U represents society's preferences. See Balbach (1963, p. 31).

(11) below. $E_1$, which is used in some of Balbach's supplementary regressions, is an estimate of permanent income based on GNP.

(9) $$I_1 = b_0 + b_1 E_2 + b_2 r_3 + b_3 M_2$$

expresses gross private domestic investment as a function of permanent income ($E_2$), the interest on bank loans to businesses ($r_3$), and the M2 measure of the money supply.

(10) $$r_3 = c_0 + c_1 E_2 + c_2 M_2$$

relates the interest rate on bank loans to businesses ($r_3$) to permanent income ($E2$) and the M2 measure of the money supply

(11) $$E_2 = 0.4 Y_3 + E_2^*$$

where a measure of permanent income estimated from personal income (rather than GNP as in the case of $E_1$) is related to personal income ($Y_3$) and $E^*_2$ represents the past component of permanent income. [12]

> Balbach (p. 62) summarizes the model as follows:
>
> "Equation (5) [shown above as (10)] is the solution of the monetary subset of the model, using a money demand function in which wealth is stated in nominal terms; equation (6) [ shown above as (11)] is simply a separation of the past permanent income component from the current component. $Y_3$, personal income, was chosen instead of $Y_1$, gross national product, as the income to be predicted in order to eliminate the implicit correlation arising from the use of $Y_1$ and $G_1$, since $G_1$ is part of $Y_1$ by definition."

After solving the model to find an expression for personal income, Balbach (1963, p.63) estimates a reduced form equation over a sample of quarterly data spanning 1939.1 through 1957.4 and reports the results as (standard errors in parentheses):

(12) $$Y_3 = 5.39 + 0.39 M_2 - 0.43 E_2^* + 0.75 G_1 \qquad r = 0.5131$$
$$\qquad\qquad (0.29) \quad (0.10). \quad (0.09)$$

[12] In particular, $E^*_2$ is defined according to equation (11) so that Balbach (1963, p. 44) follows Friedman (1959, pp. 337 – 38) in measuring permanent income as an exponentially-discounted sum of lagged income with a decay parameter of 0.4.

He notes that, in this form, the equation shows the quantity of money does not share a significant relationship with personal income. Balbach also notes, however, that this form of the equation exhibits serial correlation that could affect the relatively large standard error associated with $M_2$ and, perhaps as well, the magnitudes of coefficients associated with permanent income and government spending.

To deal with the serial correlation he re-estimates equation (12) over the same 1939.1 – 1957.4 sample of quarterly data after expressing the variables as rates of change. This modification produces:

$$(13)\quad \Delta\log Y_3 = 0.006 + \underset{(0.12)}{0.62}\Delta\log M_2 - \underset{(0.11)}{0.38}\Delta\log E_2^* + \underset{(0.13)}{0.13}\Delta log G_1 \qquad r = 0.6901$$

which reports that the growth rate of personal income is related positively and significantly to the growth rate of the M2 measure of the money supply and negatively to the past component of permanent income. Although the growth rate of government purchases of goods and services is related positively to the growth rate of personal income, that association is not significant.

Before moving on to the specific results, it is worth noting that Balbach identified a problem with serial correlation and addressed it by estimating his equation in growth rates. Friedman and Meiselman (1963) did not acknowledge the same issue, however, and its existence was one of the criticisms initially directed at their results. And while the original 1968 version of the St. Louis equation was estimated in first differences of levels of the data to address the serial correlation problem, Benjamin Friedman (1977) noted this revised specification was associated with heteroskedasticity in the errors. It was not until Keith Carlson (1978) expressed variables in the St. Louis Equation in differences in the logarithms of the variables and this specification eliminated both the serial correlation and heteroskedasticity problems found in earlier work. In light of this evolution of the subsequent models in response to assorted criticisms, it is noteworthy that Balbach (1963) identified and

adjusted for problems in the equation's error term not fully reconciled by others for another fifteen years.

In discussing the results from equation (13) Balbach [p. 64] notes that the coefficient associated with money growth (0.62) is larger than the coefficient associated with government purchases of goods and services and interprets this as evidence that money's effects on personal income are greater than the effects of fiscal actions.[13] . This result supports Warburton's original notion on the relative influences of monetary and fiscal actions on aggregate spending but now it is the product of a formal model and statistical testing. Second, Balbach notes the unexpected negative sign associated with the past component of permanent income, $E_2^*$. After two pages of derivations, he offers an extended explanation for how this might occur by examining the interplay of the parameter values in the six-equation model detailed earlier. He ultimately offers two explanations for the result. The first is that the response of individuals to the *level* of permanent income might be different from their response to *changes* in permanent income. [14] Second, he notes two different ways that permanent income affects current income: its positive effect on consumption and investment versus its negative effect on interest rates. His conclusion is that a negative coefficient for $E_2^*$ implies that, via interest rates, the magnitude of this variable's effects on consumption and investment is large. [15]

---

[13] M2 and government purchases of goods and services are both measured in billions of dollars. Andersen and Jordan (1968, p. 38) note that comparison of coefficient magnitudes is not appropriate for making this conclusion because "the variables have a different time dimension and are a mixture of stocks and flows." To make what they consider a proper test of the relative impacts of monetary and fiscal measures on nominal income, they calculate "beta coefficients" and come to the same conclusion reached by Balbach.

[14] The editor noted that econometricians today would recognize this distinction within Engle and Granger's (1983) framework of cointegration and error-correction, which models simultaneously both long-run equilibrium relations between the levels of variables and dynamic adjustment reflected in their first differences. Of course, at the time of Balbach's research, the ideas behind the error-correction framework were only just being introduced by Sargan (1964).

[15] One issue equation (13) does not address is the possibility of lagged responses that were examined in an Appendix to the paper by Friedman and Meiselman (1963) and were standard in all variants of the St. Louis Equation.

In sum, Balbach derived a reduced form equation for personal income from a model that had a money demand equation as its foundation. That money demand function revealed a negative and significant association with an interest rate and the estimated reduced form equation showed that money exerted a stronger influence on nominal income than did fiscal actions. The reduced form also was estimated in growth rates rather than levels of data. In this form, Balbach addressed an autocorrelation problem present both in his 1959 paper with Brunner and the later work of Friedman and Meiselman (1963). Expressing the data in growth rates also dealt with heteroscedasticity in the equation's error term that was later identified in the first version of the St. Louis equation. Finally, by estimating the reduced form with alternative measures of fiscal actions, Balbach's results minimized the criticism that they were dependent on particular data choices, another criticism directed at these later works.

**The Brunner – Balbach Results**

As noted earlier, the paper presented by Brunner and Balbach (1959) was published four years prior to the completion of Balbach's thesis. The latter was discussed first, however, because, as a PhD dissertation, it contains a more complete statement of the theoretical reasoning that led to the specification of the reduced-form that linked personal income to measures of monetary and fiscal actions. The thesis also extended and modified results beyond those presented in the 1959 paper.

One difference from the thesis, however, is a discussion very much relevant to the emphasis on the demand for money in Balbach (1963). This discussion describes characteristics that identify a model as "non-monetary," "amonetary," and "monetary." Of these, the first class of models does not contain a variable for the money supply or an interest rate and, in so doing, excludes the possibility that a monetary variable could influence aggregate spending or the price level. An "amonetary" model is described as a non-monetary model augmented by a money demand function where money or an interest rate is taken to be

an exogenous variable. Finally, "monetary" models are defined as those where economic aggregates – typically income or the price level – "cannot be solved independent of monetary variables and a money demand function" (Brunner and Balbach (1959, p. 78)).

To put their work in context, the authors explain that, of nineteen models described in Tinbergen (1954), only three could be described as being "monetary" and even these three are flawed in their eyes as being incomplete or producing counter-intuitive results. Given their perception of the state of macro models as of the 1950s, the motivation for their paper is to present what they regard as a complete and coherent monetary model according to their definitions and then use it to produce some empirical evidence on the model's implications. [16]

Going further into detail about the characteristics of a monetary model, they review conditions set forward in Friedman (1956b, pp. 16-17) and Brunner (1958, p. 522) to define what they call "M-relevance". More specifically, Brunner and Balbach (p. 80) explain:

> "A system is M-relevant with respect to Y according to the definition if Y is causally dependent on M (money) of if both are jointly determined. Similarly, we may characterize an equation as being M-relevant with respect to P or any given measure of aggregate demand. The logical negation of the definiens [sic] supplies a refutation of M-irrelevance." [17]

Having stated these conditions, the authors first investigate, via partial correlation coefficients and regression analysis, whether the demand for money is related negatively to an interest rate and positively to a measure of aggregate demand. Because the results for M2 are little different from those for M1 they report only the latter. Use of M1, three different measures of aggregate demand, and five different interest rates produces thirty partial correlation coefficients, with each calculated for a sample of quarterly data spanning 1939.1 – 1957.4 and two sub-samples

[16] The authors illustrate in their footnote 4 how a quantity-theoretic model can be developed to solve for the same endogenous variables that appear in a Keynesian framework. The set of six equations there differ from the six equations used by Balbach (1963) but they still include a money demand function as one component of the model.

[17] The term "M-relevance" is not used by either Friedman (1956b) or Brunner (1958). Instead, the three conditions set forth by Friedman and extended by Brunner address the issue of "what it means to say that someone is or is not a 'quantity theorist'." (Friedman (1956b) p. 15).

(1939.1-1948.4 and 1949.1 - 1957.4). In most cases, the quantity of money demanded is correlated positively with the chosen measure of aggregate demand and negatively with the chosen rate of interest.

The authors then estimate twenty different regressions for the money demand function that combine M1 with five measures of aggregate demand and four measures of an interest rate. The results in their Table 4 (p. 84) indicate that, in each case, the coefficients attached to the measure of aggregate demand and the interest rate are significant and of the expected signs. Notable here is that these results are contemporaneous with Friedman's (1959) frequently-cited paper on the demand for money but offer strikingly different implications about the significance of an interest rate in a demand for money function. The primary empirical difference between the two studies is the authors' use of quarterly data against the cycle average data employed by Friedman. More substantively, the authors derive a model where an interest rate plays a role and then test the model's implications directly rather than eliminate the interest rate from empirical testing *a priori* -- as Friedman (1959) chose to do -- because plots of its behavior over time with respect to velocity were counter to what one would expect. [18] In any case, because each of the money demand equations exhibits a negative slope with respect to an interest rate, Brunner and Balbach view the key characteristic of a monetary model to have been confirmed and, on this basis, proceed to the estimation of a reduced form equation for aggregate demand.

Instead of repeating the more detailed expressions that lead to this point, their empirical investigation into the relative influences of monetary and fiscal actions on aggregate spending is summarized in two equations. These are:

$$A_t = b_0 + b_1 M_t + b_2 H_t \quad (14)$$

and

[18] The editor noted that these choices reflect an important difference between Brunner's adherence to modern econometric practice and Friedman's attachment to NBER methodologies. Hammond (1996) is devoted to a discussion of Friedman's ideas on research methodology.

(15) $M_t = I_0 + I_1 r_t + I_2 a_t$

where $A_t$ in equation (14) and $a_t$ in equation (15) represent aggregate demand, M represents the money stock, r is an interest rate, and H represents "some combination of government account variables." [19] In their empirical investigation, Equation (14) is estimated with varying combinations of measures for aggregate demand, money, and a fiscal variable. Equation (15) is a money demand function that relates the quantity of money demanded to an interest rate and a measure of aggregate demand. With these general concepts in mind they use six different measures of aggregate demand, three measures of money, seven measures of government accounts, and six variations of an interest rate to estimate different empirical versions of the equations above. [20] Notably different from the later derivations and estimations in Balbach's

[19] With regard to the discussion in the next section, it may be noted that equation 14 takes the same form as the equation specified by Friedman and Meiselman (p. 177) to associate consumption with money and autonomous expenditures.

[20] Although Brunner and Balbach (1959) do not give an explicit rationale for their use of a variety of measures for money, an interest rate, government spending, and aggregate income, Balbach (1963, p. 32) explains the question in this manner:

> "Unfortunately, some of the variables are purely theoretical constructs and others do not exist in specified form, so that time series must be sought to reflect as accurately as possible the variables specified in the theoretical hypothesis. As a result its performance in tests may reflect not the shortcomings of the theoretical hypothesis but the poor choice of time series to reflect the values of the variables involved. To avoid this, several separate hypotheses are tested, each reflecting different time series chosen, and the best one in the sense of its significance and predictive ability will be assumed to be representative of the theoretical hypothesis."

Looking forward, Friedman and Meiselman (1963, p. 181) describe their approach to choice of empirical measures as follows:

> "One simple method is to correlate alternatively defined measures of the independent variable with the dependent variable and then select the concept which yields the highest correlation. The argument for this procedure is that the precise empirical definition of variables should be selected so as to put the theory in question in its best light"

They also go on to note that this criterion has its own limitations, especially with respect to a measure of autonomous spending.

thesis (1963), this first pass at estimating the reduced-form equation was done on levels of the data.

Results for the aggregate demand equation, taking the form of (14) above, are presented in their table 3 (p. 84) for fifteen different versions of the model over a sample of quarterly data that spans 1939.1 through 1957.4, the same sample used by Balbach (1963). They report that the measure of money is significant and positive in all fifteen regressions but that, in seven of the fifteen, the coefficient associated with their measure of fiscal actions is not significant and, in two cases, takes a negative sign as well. In all but one case the coefficient associated with money is significantly larger than that of the fiscal variable. In this last case the coefficient values for the monetary and fiscal variables are almost identical numerically. Overall, on the basis of this evidence, Brunner and Balbach conclude that money exerts a stronger influence on aggregate demand than does fiscal policy. That these results appear to be robust across alternative measures of the equation's fiscal variable is important to note relative to criticisms of the study by Friedman and Meiselman that followed. By choosing measures of fiscal actions based on what theory suggested and then testing the robustness of their model by showing that the results were not dependent on the choice of particular measures for its variables, Brunner and Balbach (1959), as in Balbach (1963), sidestepped, or at least minimized, the criticism that their results were sensitive to measurement.

With respect to subsequent work using reduced form expressions of this form, Brunner and Balbach nonetheless acknowledge statistical problems to be addressed and advise that the results presented "must therefore be understood to be a preliminary survey of the evidential material" (p. 82). In addition to noting the autocorrelation problem dealt with later in Balbach's thesis, they place greater emphasis on "a more serious problem of neglected

---

Although the practice of choosing a specific empirical measure based on a goodness-of-it criterion has been common in choosing one definition of money over another, Mason (1976) describes this practice as an exercise in circular reasoning.

exogenous variables with systematic effects" (1959, p. 82). At the same time, they explain that "while statistical theory does indicate conditions under which the incorporation of an additional exogenous variable will change the previously obtained regression coefficients, there is no basis to expect systematic shifts in coefficients." After citing a result from Wold and Jureen (1953), they conclude: "The upshot for our purposes is that there is no reason to expect a significant shift in the comparative order of magnitude of the regression coefficients under a change in specification." (1959, p. 82). In short, Brunner and Balbach identify the same potential criticism of their work – omitted exogenous variables – later directed to the work of Friedman and Meiselman (1963) and Andersen and Jordan (1968) but then explain why, for the question of whether monetary or fiscal actions have a greater influence on nominal income, any such omissions are not likely to affect the conclusions drawn from the estimated equations.[21]

With this overview in mind, the discussion proceeds to the well-known paper by Friedman and Meiselman (1963).

**Friedman and Meiselman (1963)**

Taking the official chronology at face value, the publication of Friedman and Meiselman's (1963) "The Relative Stability of Money Velocity and the Investment Multiplier in the United States, 1897 – 1958," this paper was published after preliminary work had been reported by Brunner and Balbach (1959) and coincident with the completion of Balbach's (1963) thesis. This, however, would be misleading and, as such, raises questions of whether these works evolved in tandem or whether one takes historical precedence over the others. On this score, Nelson (2020b, pp. 90 - 91) quotes Meiselman as saying that work on the project that resulted in the 1963 paper began "around 1954." It is not known, however, when Brunner

[21] McCallum (1986, pp. 13 -14) derives results that illustrate, although omitted variables may affect how the coefficients are interpreted, they will not affect the substantive results from the estimated equation.

and Balbach began the work that produced their 1959 paper. In 1956, Friedman (1956c) presented an overview of the motivation for the work as well as some "preliminary" evidence in a lecture at Wabash College. Nelson also reports that a twenty-one page preliminary draft, under a different title, was presented on October 27, 1959 to Chicago's Workshop on Money and Banking. Meiselman, in an interview with Robert Hetzel (2007, p. 13) recalls that "clear results" were in hand by 1958 but the time associated with calculation of the regressions by hand delayed publication of the paper until 1963; Niels Thygesen (1977, p. 74) reports that the paper was completed by 1960. Thus, while Friedman presented evidence from some preliminary tables in 1956 and apparently had a more developed set of results to report by late 1959, the Brunner and Balbach paper (1959) was, by then, already in print. Moreover, because so much of the 1959 paper includes discussion and results similar to those presented in the later Balbach (1963) thesis, it would appear that this work also was well underway by the time Friedman presented preliminary results at the 1959 Chicago seminar. [22]

In their discussion of hypotheses Brunner and Balbach (1959) note that Friedman (1956b, p. 16 - 17) established his own conditions for a model that was, in their words, "M-relevant." His conditions, like those expressed by Brunner (1958), involve stable money demand and supply functions that are independent of each other as well as another that maintains the endogenous variables of the system are causally dependent upon a subset of the system that contains the money demand function. The reason for expressing these conditions, according to Brunner and Balbach (1959, p. 81), is that they represent "Friedman's attempt to

[22] It is not clear whether the authors at Chicago were aware of the work being done at UCLA. For example, Friedman's correspondence with Brunner, archived in Friedman's papers at the Hoover Institution, reveals no communication on this work. And while Brunner (1961a) cites the 1959 paper with Balbach, it is not clear whether Friedman and Meiselman considered its implications in what appears to have been, by that time, a project near completion.

find an explication for the notion that 'money matters' independent of the traditional juxtaposition, 'quantity theory' vs. 'Keynesian theory'." [23]

With this in mind, it would seem natural that Friedman and Meiselman would base their empirical work on these principles and work from a framework that included an explicit statement about the demand for money and its role as a "higher level hypothesis." This is not the case, however. Instead, an *assumption* behind their model is the existence of a stable money demand function that is associated with permanent income alone. In part, this assumption can be attributed to the results reported by Friedman (1959) where, similar to Warburton, visual inspection of co-movements in the data led him to conclude that the interest rate was not an important influence on velocity. This conclusion, however, was at odds with contrary evidence available at that time. For example, Brunner (1961a) reported the results of estimating three money demand functions, similar to those discussed by Brunner and Balbach (1959), with each showing a significantly negative coefficient on the interest rate variable. Richard Selden (1956) and Henry Latané (1954) also had published recent studies of money demand that reported a significant role for an interest rate. Thus, in choosing not report any new evidence on the demand for money and not considering, as well, evidence on the demand for money reported by others, Friedman and Meiselman (1963) based their reduced form equation on an assumption that was not supported by evidence available at that time. [24]

---

[23] Recall from earlier discussion that the conditions set forth in Friedman (1956b, p. 15) were directed at the question of "what it means to say that someone is or is not a 'quantity theorist'."

[24] Harry Johnson (1962, p. 357), after noting the absence of an interest rate in Friedman's (1959) study of the demand for money, describes a subsequent problem with interpreting the results in the then forthcoming Friedman and Meiselman paper:

> "These results pose an important theoretical problem since they imply that a change in the quantity of money that has no wealth-effect will nevertheless have an effect on consumption even though it has no effect on interest rates. The difficulty of understanding how this can be prompted the dissatisfaction of Keynes, Wicksell, and other income-expenditure theorists with the quantity theory and provides the hard core of contemporary resistance to it. Friedman and Meiselman's explanation of their results may therefore initiate a new and possibly fruitful debate on how money influences activity."

The assumption that an interest rate was not an important determinant of the demand for money implied, in the context of the IS-LM model, a vertical LM curve such that constant money growth would not create a role for either real shocks or fiscal actions to affect nominal income. Had Friedman and Meiselman first estimated a money demand equation and found that the interest rate was an important variable in the function, as did Brunner and Balbach (1959), Balbach (1963), and authors of many subsequent papers, the acknowledged influence of interest rates on velocity would have forced them to consider how nominal income might be influenced by variables other than the money supply. But, with a specific characteristic of a money demand function assumed, the focus of the empirical exercise conducted by Friedman and Meiselman was one based on a consumption function rather than the demand for money.

Although the two equations presented below ultimately are combined so that the effects of autonomous expenditures and the quantity of money on consumption or aggregate income can be investigated together, their starting relationships are one drawn from the Quantity Theory

(16) $Y = a + V'M$

and one based on the income-expenditure theory

(17) $Y = a + K'A$

where Y represents aggregate income, $V'$ is the marginal income velocity of money, M is a measure of the money supply, $K'$ is the marginal multiplier, and A is autonomous expenditures. In these forms, Friedman and Meiselman pose the question as whether velocity or the multiplier is more stable over time. It also is worth noting that their measure of autonomous expenditures is the sum of government deficits and net private investment and, as such, is not representative of purely fiscal actions as was the case in the work by Brunner and Balbach (1959), Balbach (1963) or the St. Louis Equation.

Because of potential statistical problems created by correlations between aggregate income and autonomous expenditures, one component of income, Friedman and Meiselman

made the decision to use consumption rather than income in the main body of their empirical work. [25] Thus, equations (16) and (17) above are modified and combined so that aggregate consumption (C) replaces aggregate income as the dependent variable. They write this expression as:

$$(18) \quad C = a + VM + KA$$

Friedman and Meiselman present a considerable amount of statistical evidence, using both annual and quarterly data, on whether money or autonomous expenditures exerts a stronger influence on consumption or aggregate income and, in spirit, use an "inductive and empirical approach" similar to the one Cargill (1979) attributes to Warburton. [26] Moreover, a brief comment in a summary of their results appears to support Warburton's contention that, to the extent fiscal actions have any influence on aggregate expending, it is the effect that government deficits have on money creation. [27] Over all, if one were to identify what might be the most important difference between the work done by Warburton and that done by Friedman and Meiselman it is that the former relied on visual associations between series in a figure while the latter added regression analysis to this.

The bulk of results presented by Friedman and Meiselman are based on levels of annual data and the primary focus in the paper's text is on results for the case where consumption,

[25] Recall that Balbach (1963) recognized the same problem and chose to use personal income rather than GNP as the dependent variable.

[26] Cargill (1979) notes that Friedman and Schwartz (1963, p. xxii) acknowledge Warburton's contributions by saying: "We owe an especially heavy debt to Clark Warburton. His detailed and valuable comments on several drafts have importantly affected the final version. In addition, time and again, as we came to some conclusion that seemed to us novel and original, we found that he had been there before." Friedman and Meiselman (1963) also acknowledge (p. 169, footnote 1) that Warburton was one of the few economists to examine the empirical evidence for money's influence on economic activity in the years after the Keynesian revolution. Chow (1970) conjectures that Friedman (1952) "probably marked the beginning of Friedman's effort to use the quantity theory to explain price (and income) changes in preference to the income-expenditure theory" and that, as such, it anticipated the later work with Meiselman.

[27] "Such correlation as there is between autonomous expenditures and consumption is in the main a disguised reflection of the common effect of money on both." Friedman and Meiselman (1963, p. 166).

rather than income, is the dependent variable. The last section of their paper repeats the analysis with income as the dependent variable, looks briefly at the relationships above in terms of first differences, and also uses quarterly data to investigate whether lags of money or autonomous expenditures affect consumption or income. No matter how Friedman and Meiselman examine the data, however, the same conclusion is reached (p. 166):

> "The results are strikingly one-sided. Except for the early years of the Great Depression, money (defined as currency plus commercial bank deposits) is more closely related to consumption than is autonomous expenditures (defined as the sum of net private investment expenditures plus the government deficit)."

Even though the results presented by Friedman and Meiselman are in general agreement with the earlier work of Brunner and Balbach (1959) and Balbach (1963), their analysis differs from the earlier papers in several important ways. First, rather than estimate a money demand function as a first step to examine whether an interest rate exerts a significant influence on the demand for real balances, they assume an interest rate has no role to play. Second, although Friedman and Meiselman present some correlation coefficients in an Appendix to illustrate the associations between alternative measures of their variables, DePrano and Mayer's (1965) most forceful criticism was that Friedman and Meiselman chose their preferred measures on an *ex ante* examination of correlation coefficients rather than theory [28] Third, whereas Balbach (1963) derived an expression for personal income from a formal model, such a derivation was not part of Friedman and Meiselman (1963). Moreover, Friedman himself (1970, 1971) did not present his own derivations for a model of national income until nearly a decade later and both of these efforts received detailed criticism from Brunner and Meltzer (1972). Relevant to the present discussion, Brunner and Meltzer (p. 842) note:

> "One of the more striking features of Friedman's analysis is that in fifty-five pages of text, much of it devoted to short-run or long-run adjustments, the fiscal role of government is mentioned only once and only to be dismissed (1970, p. 217). Changes

[28] For all of the criticisms directed at Friedman and Meiselman for their choice of a measure for fiscal activity, Savin (1978, p. 42) argues that they chose precisely the concept suggested by J. M. Keynes (1936).

in government spending and taxes, apparently have so little effect they can be ignored entirely."

The papers by Friedman (1970) and Brunner and Meltzer (1972) as well as additional critiques of Friedman's paper by James Tobin, Paul Davidson, and Don Patinkin, and Friedman's rejoinder to these commentaries are collected in a volume edited by Robert Gordon (1974). Pierrick Clerc and Michael De Vroey (2018) and Nelson (2020b, pp. 198 – 210) review Friedman's presentation in this volume and the contributed assessments of it.

An important empirical choice also distinguishes the work of Friedman and Meiselman (1963) from Balbach (1963) and the St. Louis Equation that followed it. This is the focus by Friedman and Meiselman primarily on relationships between levels of variables rather than first differences or rates of change to draw conclusions about the relative importance of monetary and autonomous expenditures on either consumption or income. [29] To explain the choice to work with levels of data, Friedman's lecture at Wabash College (1956c) begins with an overview (p. 5) that expressed the Quantity Theory and Keynesian Income-Expenditure Theory relationships in first differences. A few pages later he mentions (p. 7) the ongoing empirical work by members of the Chicago Workshop in Money and Banking and notes that "Since working with first differences, as would be required by the equations in the form initially given, is statistically inefficient, our first step was to express the equations in linear form……"

Whether this was the better empirical choice was examined by N.E. Savin (1978), Charles I. Plosser and G. William Schwert (1978), and A. C. Harvey (1980) where, in all cases, the work by Friedman and Meiselman was used to illustrate the statistical issues involved. Savin (p. 51) concluded that the confidence expressed by Friedman and Meiselman in the one-sided evidence in favor of their results "is unwarranted on economic and statistical grounds

[29] In response to comments made by Hester (1964), Friedman and Meiselman (1964) reported new results based on first-differenced data and the main conclusion of the original paper, that money was more closely correlated with spending than was their fiscal measure, remained.

when the disturbances follow an autoregressive process." [30] Plosser and Schwert (1978, p. 657) argued that "the problem of nonstationary disturbances (possibly in the levels regression) are far more serious than the problems caused by excessive differencing (in the second differences regression, for example.)" Harvey's (p. 718) assessment of the issue was that "it may not always be easy to discriminate between a model in levels with AR disturbances and a first-difference model. However, attempting to discriminate between models on statistical grounds is clearly preferable to taking first differences automatically, since the loss in precision in doing so may be considerable." Overall, these results suggest that the reduced form equation estimated by Balbach (1963) acknowledged and addressed an important statistical question only considered by Friedman and Meiselman (1963) in an appendix to their paper.

Finally, a prominent criticism of the work by Friedman and Meiselman (1963) also would have applied to that done by Brunner and Balbach (1959) and Balbach (1963) as well as the later St. Louis Equation. This is the question of whether a reduced form equation is an appropriate statistical approach to an examination of whether monetary or fiscal actions were the dominant influence on national income or if, instead, a large-scale simultaneous equations model is required. Here, Thomas Mayer (1978, p. 24) explains that, on one hand, a debate about the relative merits of reduced forms and simultaneous equations models involves issues about theoretical econometrics that are "extraneous to the monetarist debate." He also notes that, while Keynesians might prefer large-scale models for their detailed information on how a policy action could affect individual sectors of the economy, monetarists are generally uninterested in these allocative details. [31] In one attempt to address the debate between reduced forms and large-scale models, Bias (p. 8) reports that Edward Gramlich (1971)

[30] Savin (1978, p. 43) also notes that the Durbin-Watson statistic was not reported by Friedman and Meiselman (1963), Ando and Modigliani (1965), De Prano and Mayer (1965), or Hester (1964).

[31] Antonella Rancan (2019, pp. 457 - 458) summarizes Brunner's critique of large-scale models and how, in his view, neglect of theory, reliance on instrumental variables, and frequent revisions of the models "convert[ed] econometric models into computation devices devoid of any informative content."

compared the estimates of multipliers and elasticities from most of the large-scale models that had entered the debate about the St. Louis Equation and found all, except the model used by Ando and Modigliani (1965), had multipliers for the monetary policy variable to be greater than one and, in all but two cases, the multiplier for money was larger than that for the fiscal variable.

**St. Louis Equation (1968)**

The original version of what became known as the "St. Louis Equation" was developed by Leonall Andersen and Jerry Jordan (1968) as an extension of the previous work by Friedman and Meiselman. [32] In a retrospective on this work, Jordan (1986, p. 6) explains that:

> "We considered the AJ article to be a sequel to the FM [Friedman-Meiselman] article. Our purpose was to rigorously formulate potentially falsifiable hypotheses about various macroeconomic policy actions. The article also was an exercise in applying what was then state-of-the-art computerized regression programs using the Almon distributed lag for testing hypotheses."

In an interview with Robert Hetzel (1996, p.2), Jordan said his initial task after joining the staff at the Federal Reserve Bank of St. Louis in 1967:

> "was to continue this Friedman/Meiselman-type debate over the empirical evidence about the relationship between money and economic activity, and also to develop the concept of the monetary base as the way of thinking about the thrust of central bank actions and economic activity…..We viewed it as simply using the latest techniques—the Almon lag regression techniques that had been felt at that time—better computer powers to empirically test a Friedman/Meiselman-type relationship which became known as reduced form tests."

[32] Nelson (2020b, pp. 122 – 129) presents an overview of the relationship between Friedman and the Federal Reserve Bank of St. Louis. It should be noted that Michael Keran (1967) used the basic equations employed by Friedman and Meiselman (1963) not to assess the relative influence of monetary and fiscal actions on spending but, instead, to evaluate the usefulness of those equations for forecasting. The "St. Louis Equation" also is to be distinguished from the eight-equation "St. Louis Model" later developed by Andersen and Carlson (1970), which made an attempt to separate the influences of monetary and fiscal actions on nominal spending into their separate effects on output and prices. Because this model does not include equations for the supply of or demand for money, however, it does not meet the criteria used by Brunner and Balbach (1959) that would characterize it as a "monetary" model.

Although Jordan does not cite this as a motivation for development of the St. Louis Equation, he also notes that many of the criticisms later directed at this work originated from the then ongoing debate about the relative merits of large-scale econometric models versus single-equation reduced forms for the purpose of analyzing fiscal and monetary policy actions mentioned earlier. [33] Finally, beyond what Jordan characterizes as the threat posed by the St. Louis Equation to builders of expensive, large-scale models, its finding that monetary policy actions had a larger effect on nominal spending than did fiscal actions also fueled debate between Keynesian orthodoxy of the time and the nascent monetarist challenge to it. [34]

[33] Rancan (2019) reviews the development of large-scale econometric models during the 1960s and the goals of these projects in contrast to the use of a reduced form expression at the Federal Reserve Bank of St. Louis. A particular difference between the two approaches was the intention of the former to test alternative economic theories whereas the focus of the latter was on the size and timing of fiscal and monetary policy actions on nominal spending. She also notes that, although the St. Louis Equation often is viewed as a successor to the work of Friedman and Meiselman, it shares a closer relationship with the single-equation model used by Brunner and Balbach (1959).

[34] A referee suggested that more detail be provided on connections among Brunner, Balbach, and Jordan as well as any related connections between the early work on a reduced form spending equation at UCLA and the later work at St. Louis. While tempting to make strong connections between the two strands of work, it is not clear whether this is justified. Jordan, for example, was an undergraduate student of Balbach at what was then San Fernando Valley State College, now California State University-Northridge. Balbach then encouraged Jordan to pursue graduate studies at UCLA and helped arrange an appointment for him as Brunner's graduate assistant; see Jordan (2008, pp. 43 - 44). At the completion of his graduate work, Jordan joined the research staff at the Federal Reserve Bank of St. Louis in 1967, began work with Andersen on the St. Louis Equation, and eventually became Director of Research. Balbach came to St. Louis as a visitor in 1971 to conduct research on international trade questions and, after Jordan left the Bank, Balbach became Director of Research in 1975. In that capacity Balbach used projections from the St. Louis Equation to advise the Bank's president prior to FOMC meetings but he had no role in the Equation's earlier development. And while Brunner apparently communicated with Jordan frequently after he was appointed as Director of Research, Brunner never had a formal consulting arrangement with the Bank. Moreover, if Brunner's earlier work with Balbach had any influence on development of the St. Louis Equation, neither the 1959 paper nor Balbach's thesis is acknowledged by Andersen and Jordan (1968). Finally, Brunner is cited for his comments in the acknowledgements for the Anderson and Jordan (1968) article but Balbach is not. Thus, while Jordan could trace his intellectual roots to both Brunner and Balbach, there is little to suggest that the St. Louis Equation was an extension of the earlier work at UCLA. More biographical background on Balbach can be found in Armen Alchian (1993), Michael Bordo and Anna J. Schwartz (2008), the essays collected in *A Tribute to Ted Balbach* (2008), and Balbach's interview with Robert Hetzel (2002).

Although any number of criticisms were directed at the results produced by evolving expressions for the St. Louis equation -- choice of proxies for the variables, questions about the endogeneity of variables, serial correlation or heteroskedasticity in the error term, etc. -- Brunner and Balbach (1959, p. 81) and Balbach (1963, pp. 7 - 8) would emphasize a more fundamental criticism: That the estimated expression for nominal income had not been derived from a model of the supply and demand for money and, as such, appending a measure of money to a reduced form equation for national income determination would not permit valid tests of hypotheses about the relative merits of money and government spending on aggregate income.

If the St. Louis Equation is seen as a natural extension of the earlier work by Friedman and Meiselman, its success might be attributed to empirical choices that addressed many of the criticisms directed at the earlier work. The use of quarterly data and the Almon (1965) lag technique addressed the issue of lagged effects of policy actions dealt with only in passing by Friedman and Meiselman in an Appendix to their paper. By expressing the equation in first differences, Andersen and Jordan also avoided the question of whether serial correlation exerted a significant effect on their results. Still, as noted earlier, the finding of heteroscedasticy in the equation's error term led Carlson (1978) to make the last substantial modification of the St. Louis Equation by expressing the data as first differences of logarithms rather than first differences of levels of the data, a transformation that preserved the significance of money's effect on nominal income after this result had been questioned by Benjamin Friedman (1977).

Even with these modifications to the basic equation estimated by Friedman and Meiselman, the St. Louis Equation still faced considerable criticism.[35] As enumerated by Dallas S. Batten and Daniel Thornton (1986), the equation was said to have excluded

[35] The best known of these probably is Frank DeLeeuw and J. Kalchbrenner (1969). A detailed rebuttal of criticisms directed at the St. Louis Equation is presented by McCallum (1986).

important exogenous variables, suffered from simultaneous equations bias associated with the use of a reduced form equation estimated by ordinary least squares, and as was the case with Friedman and Meiselman, used the wrong variables to represent the relevant fiscal and monetary policy actions. Batten and Thornton addressed each of these issues by performing a variety of statistical tests on the data from the original paper by Andersen and Jordan (1968) paper and concluded that none of the criticisms affected the primary conclusion that the quantity of money was a more important influence on aggregate spending. In addition, they performed tests of Granger causality to investigate the common assertion that the equation's results were due to reverse causation running from income to money and found, instead, causation running from money to income. Coming full circle, the tests supported Warburton's conjecture that variations in money were a causal determinant of income. R. W. Hafer and David Wheelock (2001) reach a different conclusion for the post-1986 period, however, noting that the sharp break in trend velocity that began in the mid-1980s disrupted what had been strong and stable relationships between money and nominal spending.

**Conclusions**

Friedman and Meiselman (1963) built on earlier work by Warburton by calculating correlations and estimating regressions to identify any links between aggregate spending and, in their case, either the quantity of money or autonomous expenditures. The St. Louis Equation that followed was in the spirit of that earlier work and differed primarily in the empirical proxies chosen for the equation's variables, its specification in first differences rather than levels of data, and the use of distributed lags for the equation's explanatory variables. Still, in both cases, the message was that the money supply was a significant driver of aggregate spending whereas autonomous expenditures, deficit spending, or some other measure of fiscal actions was not.

The evolution of work on the relative merits of fiscal and monetary policy on aggregate spending that began with Warburton, however, has not taken note of two important papers that built a more solid theoretical foundation for the better-known reduced form equations developed by Friedman and Meiselman and Andersen and Jordan. These overlooked papers, as well, conducted empirical analyses that avoided many of the primary criticisms leveled at their well-known successors. Beginning with the premise that a money demand function was the foundation for any subsequent derivations that would link money to nominal income, Brunner and Balbach (1959) and Balbach (1963) presented results that showed the demand for money was a stable function of a few variables. In particular, and in contrast to Friedman (1959), the estimated function was negatively related to an interest rate. From this work on the demand for money, which allowed for an upward-sloping LM curve and, hence, a role for fiscal actions to affect aggregate spending, Balbach (1963) used a formal model to derive a reduced form equation similar to those of Friedman and Meiselman and Andersen and Jordan. Anticipating criticisms directed at later work, Balbach (1963) estimated the reduced form relationship between personal income and measures of fiscal and monetary actions with its variables in expressed in growth rates and experimented, as well, with multiple empirical proxies for its variables. Although this work by Brunner and Balbach (1959) and Balbach (1963) is essentially unknown, these papers can be seen as the first and, by comparison, the more rigorous estimation of a reduced form equation that investigated propositions on the relative effects of monetary and fiscal actions on income suggested earlier by Warburton. Moreover, this work also reveals the existence of an active research program on monetary economics at UCLA that coincided with the research being done at the University of Chicago.

**References**


Alchian, Armen A. 1993. “Ted Balbach: An Appreciation.” Federal Reserve Bank of St. Louis *Review* 75 (March/April): xiii – xv.

Andersen, Leonall C. and Jerry L Jordan. 1968. “Monetary and Fiscal Actions: A Test of Their Relative Importance in Economic Stabilization.” Federal Reserve Bank of St. Louis *Review* 50 (November): 11 – 24.

Andersen, Leonall C. and Keith C. Carlson. 1970. “A Monetarist Model for Economic Stabilization.” Federal Reserve Bank of St. Louis *Review* 52 (April 1970): 7 – 25.

Ando, Albert, and Franco Modigliani. 1965. "The Relative Stability of Monetary Velocity and the Investment Multiplier." *American Economic Review* 55 (September): 693-728.

Angell, James W. 1936 *The Behavior of Money: Exploratory Studies*. New York: McGraw-Hill Book Co.

Angell, James W. 1937. “The General Objectives of Monetary Policy.” edited by Arthur Gayer, *The Lessons of Monetary Experience*. London: George Allen and Unwin.

Balbach, Anatol B. 1963. *Demand for Money: Clark Warburton’s Hypotheses Re-Considered.* PhD Thesis, Department of Economics, UCLA.

Batten, Dallas S., and Daniel L. Thornton. 1986. "The Monetary-Fiscal Policy Debate and the Andersen-Jordan Equation." Federal Reserve Bank of St. Louis *Review* 68 (October): 9-17.

Bias, Peter V. 2014. “A Chronological Survey of the Friedman-Meiselman / Andersen-Jordan Single Equation Debate.” *Research in Business and Economics Journal* 10 (October): 1 – 20.

Bordo, Michael, and Anna Schwartz. 1979. “Clark Warburton: Pioneer Monetarist.” *Journal of Monetary Economics* 5 (January): 63 – 91.

Bordo, Michael and Anna J. Schwartz. 2008. “Monetary Economic Research at the St. Louis Fed During Ted Balbach’s Tenure as Research Director.” Federal Reserve Bank of St. Louis *Review* 90 (September/October): 499 – 504.

Brunner, Karl. 1958. "Theory of Inflation and Quantity-Theory." *Swiss Journal of Economics and Statistics* 94 (December): 510-525.

Brunner, Karl. 1961a. “Some Major Problems in Monetary Theory.” *American Economic Review Papers and Proceedings* 51 (May): 47 – 56.

Brunner, Karl. 1961b. “The Report of the Commission on Money and Credit.” *Journal of Political Economy* 69 (December): 605 – 620.

Brunner, Karl. 1986. “Fiscal Policy in Macro Theory: A Survey and Evaluation.“ In *The Monetary versus Fiscal Policy Debate: Lessons from Two Decades*. edited by R. W. Hafer. Totowa, N.J. Rowman and Allanheld: 33 – 116.

Brunner, Karl, and Anatol B. Balbach. 1959. “An Evaluation of Two Types of Monetary Theories.” *Proceedings of the Thirty-Fourth Conference of the Western Economic Association* (September): 78 – 84.

Brunner, Karl, and Allan H. Meltzer. 1972. “Friedman’s Monetary Theory.” *Journal of Political Economy* 80 (September/October): 837 – 851.

Cargill, Thomas F. 1979. "Clark Warburton and the Development of Monetarism Since the Great Depression." *History of Political Economy* 11 (Fall): 425 – 429.

Cargill, Thomas F. 1981. "A Tribute to Clark Warburton: 1896 – 1979." *Journal of Money, Credit, and Banking* 13 (February): 89 – 93.

Carlson, Keith M., 1978. "Does the St. Louis Equation Now Believe in Fiscal Policy?" Federal Reserve Bank of St. Louis *Review* 60 (February): 13 – 19.

Chow, Gregory C. 1970. "Friedman on Money." *Journal of Finance* 25 (June): 687 – 689.

Clerc, Pierrick, and Michel De Vroey. 2020. "Brunner Versus Friedman: Diverging Aspirations for the Monetarist Project." Discussion Paper 2020/27, Université Catholique de Louvain.

DeLeeuw, Frank, and J. Kalchbrenner. 1969. "Monetary and Fiscal Actions: A Test of Their Relative Stability—Comment." Federal Reserve Bank of St. Louis *Review* 52 (April): 6-11.

DePrano, Michael and Thomas Mayer. 1965. "Tests of the Relative Importance of Autonomous Expenditures and Money." *American Economic Review* 55 (September.): 729 – 752.

Engle, Robert F. and C.W.J. Granger. 1987. "Co-Integration and Error Correction: Representation, Estimation, and Testing." *Econometrica* 55 (March): 251-276.

Federal Reserve Bank of St. Louis (2008). *A Tribute to Ted Balbach.* https://files.stlouisfed.org/files/htdocs/conferences/balbach/BalbachBook.pdf

Friedman, Benjamin M. 1977. "Even the St. Louis Model Now Believes in Fiscal Policy," *Journal of Money, Credit, and Banking* 9 (May): 365-67.

Friedman, Milton. 1952. "Price, Income, and Monetary Changes in Three Wartime Periods." *American Economic Review Papers and Proceedings* 42 (May): 612 – 625.

Friedman, Milton. 1956a. *Studies in the Quantity Theory of Money* edited by Milton Friedman. Chicago: University of Chicago Press.

Friedman, Milton. 1956b. "The Quantity Theory of Money: A Re-statement." In *Studies in the Quantity Theory of Money*, edited by Milton Friedman. Chicago: University of Chicago Press: 3 – 21.

Friedman, Milton. 1956c. "The Keynesian Revolution and Economic Liberalism. Lecture, Wabash College. Available on the Hoover Institution website: https://miltonfriedman.hoover.org/objects/57467/the-keynesian-revolution-and-economic-liberalism?ctx=c9346c76-c605-49b2-b7eb-6ab284a5406f&idx=5

Friedman, Milton. 1959. "The Demand for Money: Some Theoretical and Empirical Results," *Journal of Political Economy* 67 (August): 327 – 351.

Friedman, Milton. 1970. "A Theoretical Framework for Monetary Analysis." *Journal of Political Economy* 78 (March/April): 193 – 238.

Friedman, Milton. 1971. "A Monetary Theory of Nominal Income." *Journal of Political Economy* 79 (May): 323 – 337.

Friedman, Milton, and David Meiselman. 1963. "The Relative Stability of Monetary Velocity and the Investment Multiplier in the United States, 1897–1958." In *Commission on Money and Credit: Stabilization Policies*. Englewood Cliffs, NJ: Prentice-Hall: 165–268.

Friedman, Milton, and David Meiselman. 1964. "Reply to Donald Hester." *Review of Economics and Statistics* 46 (November): 369–76.

Friedman, Milton, and David Meiselman.1965. "Reply to Ando and Modigliani and to DePrano and Mayer." *American Economic Review* 55 (September): 753–85.

Friedman, Milton, and Anna J. Schwartz. 1963. *A Monetary History of the United States: 1867 – 1960*. Princeton: Princeton University Press.

Gordan, Robert J. 1974. *Milton Friedman's Monetary Framework: A Debate with his Critics*. Chicago: The University of Chicago Press.

Gramlich, Edward M. 1971. "The Usefulness of Monetary and Fiscal Policy as Discretionary Stabilization Tools." *Journal of Money, Credit, and Banking* 3, Part 2 (May): 506 – 532.

Hafer, R.W. and David Wheelock. 2001. "The Rise and Fall of a Policy Rule: Monetarism at the St. Louis Fed: 1968 – 1986." Federal Reserve Bank of St. Louis *Review* 83 (January): 1 – 24.

Hammond, J. Daniel. 1996. *Theory and Measurement: Causality Issues in Milton Friedman's Monetary Economics*. Cambridge: Cambridge University Press.

Harvey, A. C. 1980. "On Comparing Regression Models in Levels and First Differences." *International Economic Review* 21 (October): 707 – 720.

Hester, Donald D. 1964. "Keynes and the Quantity Theory: A Comment on the Friedman-Meiselman CMC Paper" *The Review of Economics and Statistics* 46 (November): 364-368.

Hetzel, Robert L. 1996. "Interview with Jerry Jordan." Robert Hetzel Oral History Collection.
https://fraser.stlouisfed.org/archival/4927/item/581758/content/pdf/jordan_j_19961219

Hetzel, Robert L. 2002. "Interview with Ted Balbach." Robert Hetzel Oral History Collection.
https://fraser.stlouisfed.org/archival/4927/item/501734/content/mp3/balbach_t_20020512

Hetzel, Robert L. 2007. "The Contributions of Milton Friedman to Economics." Federal Reserve Bank of Richmond *Quarterly* 93 (Winter): 1-30.

Hoover, Kevin D. 2022. "Karl Brunner's Philosophy of Science: Macroeconomics Through the Lens of Logical Empiricism." In *Karl Brunner and Monetarism*, edited by Thomas Moser and Marcel Savioz. Cambridge, MA: MIT Press: 293 -320.

Johnson, Harry G. 1962. "Monetary Theory and Policy." *American Economic Review* 52 (June): 335 – 385.

Jordan, Jerry L. 1986. "The Andersen-Jordan Approach after Nearly 20 Years." Federal Reserve Bank of St. Louis *Review* 68 (October): 5-8.

Jordan, Jerry L. 2008. "Recollections" in *A Tribute to Ted Balbach*. Federal Reserve Bank of St. Louis: 43 – 45.

Keynes, J.M. 1936. "Fluctuations in Net Investment in the United States." *Economic Journal* 46 (September): 541- 547.

Keran, Michael. 1967. "Economic Theory and Forecasting." Federal Reserve Bank of St. Louis *Review* 49 (March): 7 – 16.

Keran, Michael. 1969 "Monetary and Fiscal Influences on Economic Activity-The Historical Evidence." Federal Reserve Bank of Saint Louis *Review* 51 (November): 5-23.

Latané, Henry A. 1954. “Cash Balances and the Interest Rate: A Pragmatic Approach.” *Review of Economics and Statistics* 36 (November): 456—60.

Lothian, James R. and George S. Tavlas. 2018. “How Friedman and Schwartz Became Monetarists.” *Journal of Money, Credit, and Banking*. 50 (June): 757 – 787.

Mason, Will. 1976. “The Empirical Definition of Money: A Critique.” *Economic Inquiry* (December): 525 – 538.

Mayer, Thomas. 1978. “The Structure of Monetarism – I.” In *The Structure of Monetarism* edited by Thomas Mayer. New York W. W. Norton & Company: 1 – 25.

McCallum, Bennett T. 1986. “Monetary versus Fiscal Policy Effects: A Review of the Debate.” In *The Monetary Policy versus Fiscal Policy Debate: Lessons from Two Decades*, edited by R. W. Hafer. Totowa, N.J. Rowman and Allanheld: 9 – 29.

Meltzer, Allan H. 2008. “Ted Balbach: In Memoriam.” In *A Tribute to Ted Balbach*. Federal Reserve Bank of St. Louis: 3 – 13.

Nelson, Edward. 2020a. *Milton Friedman and Economic Debate in the United States, 1932 – 1972, Volume 1*. Chicago: University of Chicago Press.

Nelson, Edward. 2020b. *Milton Friedman and Economic Debate in the United States, 1932 – 1972, Volume 2*. Chicago: University of Chicago Press.

Plosser, Charles I. and G. William Schwert. 1978. “Money, Income, and Sunspots: Measuring Economic Relationships and the Effects of Differencing.” *Journal of Monetary Economics* 4 (November): 637 – 660.

Rancan, Antonella. 2019. “Empirical Economics in Policy Context: The Fed-MIT-Penn Model versus the St. Louis Model, 1968 – 75.” *History of Political Economy* 51 (June): 449 – 470.

Sargan, J.D. 1964. “Wages and Prices in the United Kingdom: A Study in Econometric Methodology.” In *Econometric Analysis for National Economic Planning* edited by P.E. Hart, G. Mills, and J.K. Whitaker. London: Butterworths: 25-54.

Savin, N.E. 1978. "Friedman-Meiselman Revisited: A Study in Autocorrelation," *Economic Inquiry*, 16 (January): 37 – 52.

Selden, Richard T. 1956. “Monetary Velocity in the United States.” In *Studies in the Quantity Theory of Money*, edited by Milton Friedman. Chicago: University of Chicago Press: 179-257.

Tavlas, George S. 2019. “The Intellectual Origins of the Monetarist Counter-Revolution Reconsidered: How Clark Warburton Influenced Milton Friedman’s Monetary Thinking.” *Oxford Economic Papers* 71 (July): 645–665

Thygesen, Niels. 1977. “The Scientific Contributions of Milton Friedman.” *Scandinavian Journal of Economics* 79 (1): 56 – 98.

Tinbergen, Jan. 1954. *Economic Policy: Principles and Design*. Amsterdam: North-Holland.

Trescott, Paul. 1982. “Discovery of the Money-Income Relationship in the United States, 1921–1944,” *History of Political Economy* 14 (Spring): 65 – 82.

Warburton, Clark. 1945a. “The Monetary Theory of Deficit Spending,” *Review of Economics and Statistics* 27 (May): 74 – 84. Reprinted in: Clark Warburton. 1966. *Depression,*

*Inflation, and Monetary Policy: Selected Papers, 1945-1953*. Baltimore: The Johns Hopkins Press: 234 – 257.

Warburton, Clark. 1945b. "The Volume of Money and the Price Level Between the World Wars," *Journal of Political Economy* 53 (June): 150 – 163. Reprinted in: Clark Warburton. 1966. *Depression, Inflation, and Monetary Policy: Selected Papers, 1945-1953*. Baltimore: The Johns Hopkins Press: 125 - 143.

Warburton, Clark. 1946a. "The Monetary Theory of Deficit Spending: A Reply," *Review of Economics and Statistics* 28 (May): 92 – 94.

Warburton, Clark.1946b. "Quantity and Frequency of the Use of Money in the United States, 1919 – 1945," *Journal of Political Economy* 54 (October): 436- 450. Reprinted in: Clark Warburton. 1966. *Depression, Inflation, and Monetary Policy: Selected Papers, 1945-1953*. Baltimore: The Johns Hopkins Press: 144 - 161.

Warburton, Clark. 1966. *Depression, Inflation, and Monetary Policy: Selected Papers, 1945 – 1953.* Baltimore: The Johns Hopkins Press.

Wold, Herman and Lars Jureen. 1953. *Demand Analysis*. New York: John Wiley and Sons.

Table 1. Definitions of Variables Used by Balbach (1963) [36]

$M_1$ = demand deposits of the public held in commercial banks and currency held by the public

$M_2$ = demand and time deposits of the public held in commercial banks and currency held by the public

$Y_1$ = gross national product

$Y_2$ = consumption plus gross private domestic investment

$Y_3$ = personal income

$r_1$ = yield on long term government bonds

$r_2$ = yield on prime commercial paper, 4 – 6 months

$r_3$ = bank rates on business loans

$P_1$ = wholesale price index, all commodities

$P_2$ = consumer price index, all commodities

K = index of industrial production, total

$I_1$ = gross private domestic investment

$I_2$ = gross private domestic investment less net business savings (corporate profit and inventory valuation adjustment less dividends, less corporate tax liabilities)

$G_1$ = government purchases of goods and services

$G_2$ = government purchases of goods and services plus transfer payments

A = reproducible assets of the U.S. economy at current wholesale prices

$E_1$ and $E_2$ are estimates of equity in our economy derived by using GNP and personal income, respectively, and estimating permanent income as described in the text

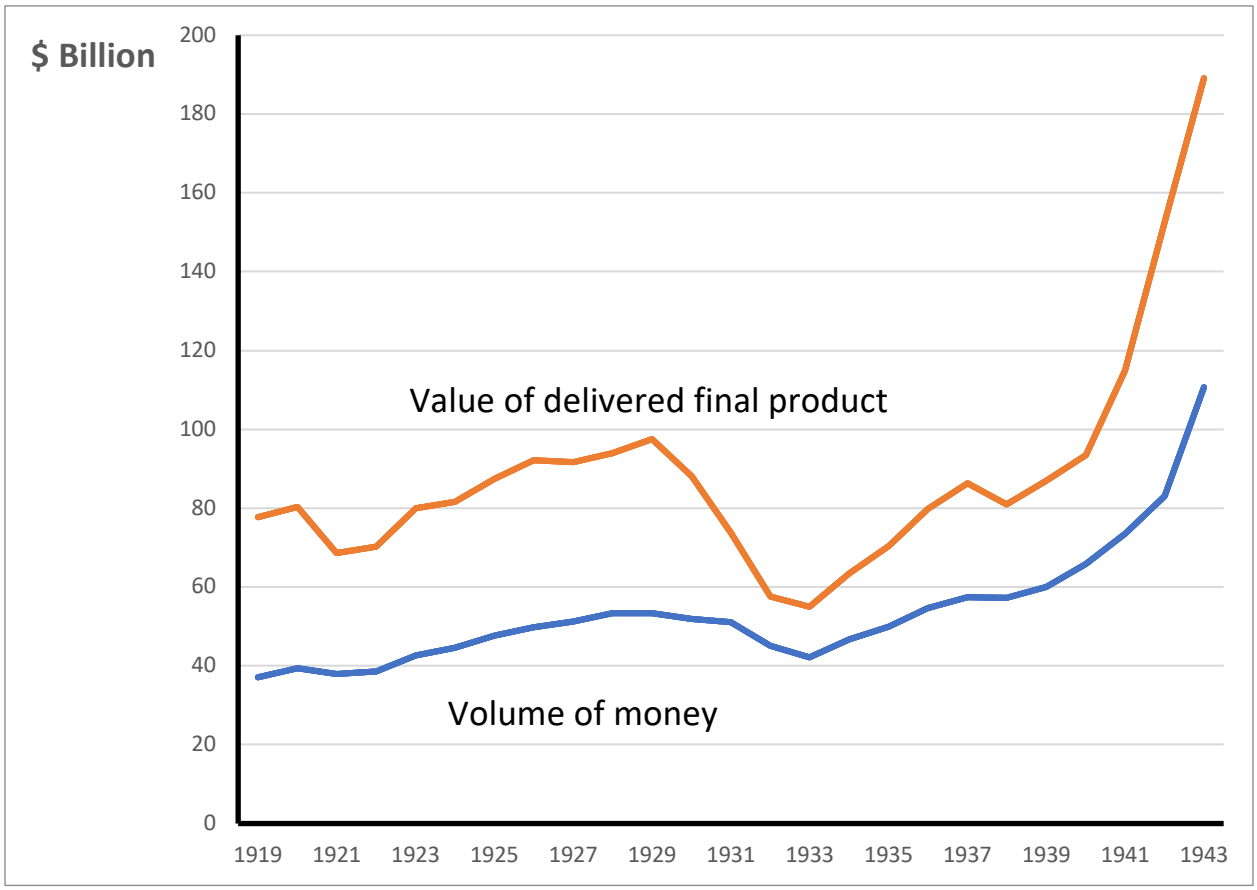
$P_1$' = permanent wholesale price index

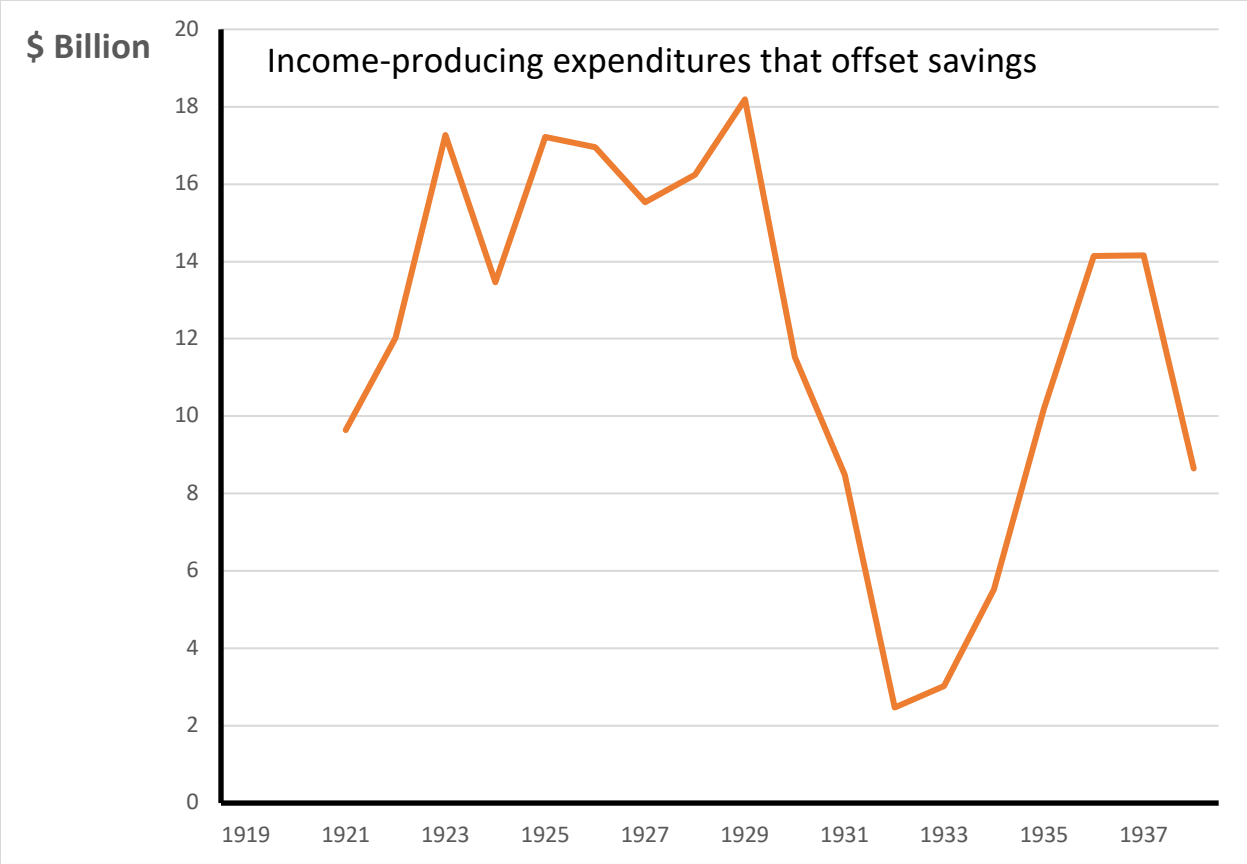
$P_2$' = permanent consumer price index

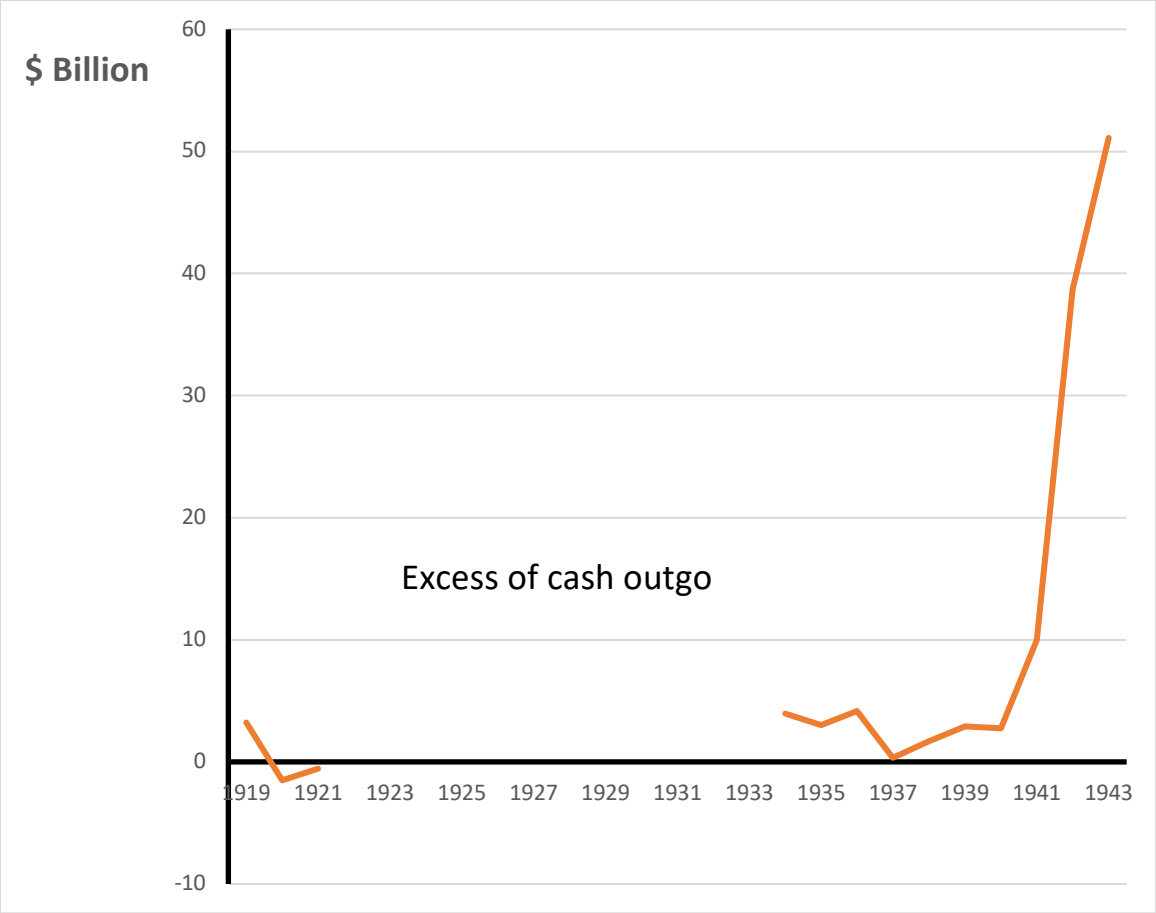
w = GDP divided by r3

[36] Taken from Appendix B in Balbach (1963, pp. 92 – 95). Detail on sources of data and notes on how some series are calculated are not reported here.

Figure 1. Reproduction of Warburton's chart "Size of the Income Stream, Volume of Money, and Deficit Spending (billions of dollars; Warburton (1945a), p. 82)




$ Billion
Income-producing expenditures that offset savings
20
18
16
14
12
10
8
6
4
2
0
1919
1921
1923
1925
1927
1929
1931
1933
1935
1937


$ Billion
60
50
40
30
20
10
0
-10
Excess of cash outgo
1919
1921
1923
1925
1927
1929
1931
1933
1935
1937
1939
1941
1943