Asset Exchanges and the Transactions Demand for Money, 1919–29

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This paper addresses a general theoretical question—the appropriate specification of the transactions demand for money—as well as a particular historical question: what triggered the Great Depression? Theoretically, fluctuations in the volume and value of asset exchanges in secondary asset markets can influence the transactions demand for money independently of real output and interest rates, and ought to be integrated into the analysis of those forces perturbing[1] the demand for money and shifting *LM* curves in the absence of monetary intervention.

Empirically, I demonstrate that, over the years 1919–29, monthly fluctuations in the volume and value of trading on the New York Stock Exchange did influence the transactions demand for money independently of fluctuations in real output and interest rates. Moreover, in the context of relatively slow post-1925 growth rates of monetary aggregates, the unprecedented increase in the volume and value of such trading from the beginning of 1925 to October 1929 had the effect of shifting the *LM* curve persistently to the left. The failure of U.S. monetary authorities to accommodate this surge in transactions demand, a failure unrecognized at the time, was associated with an antispeculative policy that drove real interest rates to very high levels in 1928–29, levels not approached again until the early 1980's. This deflationary impulse, larger than is apparent from a simple examination of monetary growth figures in relation to *GNP* growth, was the proximate cause of the downturn in real activity generally dated from August 1929.[2]

I. Asset Exchanges and the Transactions Demand for Money

The preponderance of transactions in asset markets involves the conveyance or transfer from one individual to another of previously issued securities. This was true in the 1920's and is true today. A certain base level of transactions results from the issuance of new securities, and from life cycle effects, as individuals liquidate their holdings, or rearrange their portfolios at various stages of their careers. But the observed volatility in trading volume in secondary asset markets is largely driven by other forces, forces related to but distinct from those that determine asset prices. At any moment in time individuals have different expectations about the future course of particular asset prices. Such differences themselves may, but do not necessarily, give rise to trades of existing assets. But when these expectations are changing rapidly in different ways for different individuals as the result of new information differentially available, or differently interpreted, increases in trading volume are likely to result. Such trading volume can persist without necessarily giving rise to changes in an asset price index. By contrast, new infor-

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[1]Such fluctuations are analogous in their effects to, but analytically distinct from, volatile shifts in liquidity preference: both types of disturbances may cause the demand for money not to be a "stable function" of a "fairly small" number of variables. It is worth recalling that Milton Friedman came to identify the volatility of Keynes' liquidity preference function, not the proposition that the demand for money was interest sensitive, as the distinctive feature of the Keynesian approach (see his 1966 article, p. 85).

[2]This is a statement about the origin—not the depth or duration—of the Great Depression.

mation, widely available and similarly interpreted, may cause asset prices to rise or fall on very low levels of trading.

In other words, prices in secondary asset markets, unlike prices in commodity markets, do not depend for their maintenance on a continual flow of expenditures. Without such a flow, commodity prices eventually decline because of the involuntary accumulation of inventories that ensues in an environment where production flows are positive and the holding of inventories is costly. No such eventuality necessarily accompanies the cessation or slowing of trading in secondary asset markets. Yet, when expectations differ about the appreciation potential of particular assets, exchanges will take place, sometimes accompanied by and sometimes not accompanied by price changes.

If individuals simply bartered financial assets when they wished to trade them, a transactions demand for money could never arise from such exchanges, but for the same reason money serves as a convenience and temporary repository of value in goods transactions, nonmonetary assets tend to be rendered more liquid before being reconverted to other assets. As a result, in periods of high trading volume, a monetary system may experience (at given interest rates and output levels) an increase in the transactions demand for money, especially in large financial centers such as New York City. Trading volume and value, and the resulting transactions demand for money, can therefore be influenced by forces not directly related to flows of production, income, consumption, and saving, and as a result have great potential to move independently of movements in *GNP* or even the average price level of traded assets.

The possible consequences of such movements have been only infrequently examined in the last half century.[3] These and related issues were discussed extensively during the 1920's within the context of a protracted debate over whether or not stock exchange "speculation" deprived other sectors of the economy of stocks of cash balances and/or flows of saving. Many observers, including influential decision makers in the Federal Reserve System, had an intuitive sense that the existence of the stock exchange, and the call loan market in which funds were lent for the purpose of purchasing securities, "drained" funds from the rest of the economy.[4] But advocates of "absorption" employed impressionistic and sometimes contradictory arguments that left them vulnerable to the criticisms of sophisticated monetary theorists such as Gustav Cassel and Fritz Machlup.[5]

The conclusion that the stock market did *not* absorb cash balances was based on a number of irrefutable logical arguments and scattered bits of empirical evidence. Oppo-

[3]Franco Modigliani, Robert Rasche, and J. P. Cooper (1970) found, but did not report, a very small but positive influence of the value of stock market transactions on the demand for money. This result applied to a regression on quarterly U.S. data from 1955:I to 1966:IV, using a ratio specification. A recent criticism of assuming proportionality between *GNP* and total transactions demand is found in Charles Lieberman (1977), who advocates using total debits, adjusted for currency transactions, as a measure of transactions demand. Two other recent reviewers of research on the demand for money have also noted the potential dangers entailed by the use of *GNP* as a proxy for total transactions demand: "This whole line of reasoning, however, overlooks the large and rapid fluctuations that can take place in the volume of transactions conducted in the financial markets," (David Laidler, 1977, p. 58), and "it is not clear that real *GNP* is a good measure of transactions..." (Steven Goldfeld, 1973, p. 583). Both of these remarks occur in footnotes, however, and are not systematically followed up. Somewhat earlier, Tibor Scitovsky issued a similar warning (1969, p. 39). See also Jacob Enzler, Lewis Johnson and John Paulus, who recognize asset exchanges as possibly influencing transactions demand (1976, p. 269), but empirically are more interested in intermediate goods transactions. Friedman and Anna Schwartz also recognize the possibility that asset exchanges might influence transactions demand (1982, p. 39), although this is not incorporated into their theoretical framework.

[4]See Fritz Machlup (1940, especially chs. 2–4) for a superior although critical introduction to this literature.

[5]For example, the proposition that stock market speculation deprived legitimate commerce and industry of needed capital sometimes coexisted with the proposition that overinflated stock prices made it "too easy" for businesses to raise expansion capital by issuing equities. While these claims can be reconciled by differentiating between those firms that did (because of their size or reputations) and those that did not have access to the stock market, most of the discussion lacked this kind of clarification.

nents of absorption pointed out correctly that purchases and sales of existing securities in secondary markets did not extinguish cash balances any more than did purchases and sales of a rare painting or a loaf of bread. Critics of absorption went on to emphasize the lack of a close connection between asset prices and the transactions balances necessary to sustain them. Although Machlup waffled on this point,[6] he did claim that there could be in principle no limit to the rise in asset prices over time consistent with a given money supply, so long as new information was interpreted similarly by most investors. He neither emphasized nor denied that the opposite extreme was also possible: high levels of trading among individuals with different and changing expectations about the appreciation potential of different securities in the absence of major movements in individual stock prices and their average.

The central issue, recognized as early as 1916 by such German writers as Herbert von Beckerath,[7] and in the 1920's by some of the English and American writers, was whether fluctuations in the volume and value of exchanges of existing securities could have measurable influences on the stock demand for cash balances for transactions purposes. This was never denied as a theoretical possibility. But after extensive debate among monetary theorists in the 1920's, a consensus was reached: such trivial amounts of cash relative to the volume of transactions were involved in the transfer of securities, and the variance in the demand for such balances was so small, due to highly (inexpensively) flexible velocity, that the empirical impact of fluctuations in the volume of asset exchanges on the transactions demand for money had to be insignificant.[8] Even John Maynard Keynes, towards the end of the first volume of the *Treatise*, expressed skepticism as to the empirical importance of a theoretical mechanism he had outlined in some detail at its beginning.[9]

The consensus reached by economists in the late 1920's and early 1930's that fluctuations in asset exchanges had little or no effect on the demand for cash balances has not been systematically reexamined since then, at least insofar as it applies to the 1920's. By the early 1930's, a decade of consistently collected data were available (now assembled in *Banking and Monetary Statistics*, 1976a), but inexpensive statistical techniques for their analysis were not. Applying multiple regression analysis to data from the 1920's, it is now possible to show that over the years 1919–29, the volume and value of trading on the New York Stock Exchange did have an economically important impact on the transactions demand for money in New York and in 100 major commercial and industrial centers, as well as on the demand for more broadly defined national monetary aggregates.

II. Asset Trading and Transactions Demand, 1919–29

According to conventional analysis, the position of an economy's *LM* curve is conditional on a number of parameters, the most important of which are 1) the stock of nominal cash balances in the system, 2) the price level of *GNP*-related transactions, and 3) a given state of liquidity preference. If asset exchanges require fluctuating levels of transactions balances, then at least two additional parameters need to be added: 4) the volume

[6] Compare Machlup "No additional money capital is necessary for a rise in securities prices" (p. 46) with p. 92, where he claims that a lasting stock market boom can result only from inflationary credit supply. Machlup and others dismissed the phenomenon of margin buying as simply an increase in the number of layers of financial intermediation—without real consequence—and pointed to the use of clearance mechanisms and brokerage deposits by regular customers as evidence that velocity was costlessly, or at least very inexpensively, flexible in financial transactions.

[7] "The money which is withdrawn from expenditure on the markets for goods and labour, and used as a unit of account for business on the stock exchange, leads to a temporary reduction in the demand for goods and for labour. That is to say that the money is held up on its way and for the time being can neither be spent nor lent in the economic process proper" (Beckerath, p. 162, cited in Machlup, p. 68).

[8] Machlup (p. 94); Seymour Harris (1933, p. 611); Charles Hardy (1932, p. 167).

[9] Keynes (1934, I. pp. 44 and 249); see my 1983 paper.

of asset exchanges in secondary markets, and 5) the average volume-weighted price of traded assets. A contractionary open market operation, a change in liquidity preference leading to a higher demand for money as an asset, or a surge in the desired level of asset exchanges can now all, *ceteris paribus*, be interpreted as shifting the *LM* curve to the left, resulting in higher interest rates and lower levels of real *GNP* in the short run. Eventually, price declines in *GNP*-related transactions might lead to counterbalancing shifts in both *IS* and *LM* schedules. In most business cycle episodes, however, various kinds of expectational and institutional inertia keep goods and services prices from moving sufficiently rapidly to prevent quantity movements.[10] Such price movements, and their consequences, will be treated in this paper as of a second order of importance.

Two conclusions follow from these assumptions. A major change in the level of asset exchanges must in the short-run result in some combination of (a) nominal money stock changes, (b) interest rate changes, or (c) changes in real *GNP*. Absent accommodation, the effect will be (assuming the change to be an increase) some combination of higher interest rates and lower real output, depending on the shape of the *IS* curve. With total accommodation, nominal money supply would be higher, with unchanged interest rates and real output. How accommodative can we assume the System to have been?

The Federal Reserve System was set up in part to satisfy temporary seasonal variation in the demand for credit or money associated with such events as fall harvests or December retail sales. The effect of the introduction of the System was to reduce substantially the seasonal variability in interest rates that had previously characterized the American economy.[11] Through a combination of open market operations, foreign exchange transactions, and discount window policy, the Fed's operations permitted the nominal money supply to be endogenously determined by allowing the commercial banking system to satisfy, at least in part, the transactions demand forthcoming, at targeted interest rates, during different months.[12]

The Fed's philosophy with respect to cyclical fluctuations in the demand for credit was less clear. Some argued for accommodating all legitimate "needs of trade," while others maintained that the System should tighten up towards the end of an expansion to prevent speculative "overaccumulation" of inventories.[13] In spite of these and other differences, however, there was fundamental agreement within the System on two propositions: first, that the ultimate source of fluctuations in desired money holdings, be they seasonal or cyclical, were fluctuations in real, *GNP*-related activity, and second, that the responsibility given the System to regulate the supply of money entailed a responsibility to safeguard its purchasing power.

This obligation to maintain the purchasing power of money meant that although the System was willing in the short run to accommodate unexpected cyclical as well as seasonal fluctuations in desired money holdings, originating in perturbations in the *IS* schedule or the money demand function, the willingness to make such accommodation could, over time, come into conflict with the implicit longer-run objective. Periodically, the Open Market Investment Committee, consisting in 1929 of five bank governors with the New York governor as chair, responded to current economic conditions including (at least implicitly) observed longer-run changes in the nominal money supply $(M_t - M_{t-1})$ by ratcheting up or down the interest rate/credit conditions targets. Appropriate changes in discount rate and/or open market purchases or sales consistent with these targets were then made.

[10] Examples include overlapping contracts for the delivery of output as well as the purchase of inputs, including labor, or the failure of inflation expectations to adjust downward (upward) until several periods of lower than (higher than) expected inflation have elapsed.

[11] See Friedman and Schwartz (1963, pp. 293–95).

[12] "Transactions demand for money" is used here in the sense of desired money holdings. Such fluctuations could have their origins in the perturbations in the demand for money function (i.e., influences on desired money holdings other than changes in Y or r), or in changes in the flow demand for credit, as reflected in the position of the *IS* schedule.

[13] See Friedman and Schwartz (1963, p. 263). Support for both of these positions is to be found in the System's *Tenth Annual Report*. See Hardy, pp. 79–81.

Ceteris paribus, monetary growth rates would change as a result of such changes. Although primarily concerned with credit conditions and interest rates, policymakers could not help keeping an eye on monetary growth rates, both for what such rates told them about the health of the real side of the economy, and for the warning they might give of longer-run inflationary dangers. Accommodating short-term seasonal or cyclical fluctuations in the desired money holdings was an important objective of the system, but so too was price stability or mild deflation over the longer term, and most central bankers believed the implications of the quantity theory of money: that control of the longer-term growth rate of the money supply in relation to the growth rate of real *GNP* was the necessary means to this end.

In normal times, then, the System can be viewed as having a short-run (accommodative) interest rate target, and a longer-run (less accommodative) monetary growth target, with a feedback mechanism linking the two. The problem was that the late 1920's were not "normal times." In particular, the regressions and simulations discussed below demonstrate that an empirically important increase in transactions demand resulted from the rising volume of asset exchanges in the post-1925 period. Because this increased demand was unrecognized, it short-circuited a feedback mechanism that otherwise would have led to a moderation of the high interest rate policy that pushed the economy into recession in 1929. Before the logic of that argument is developed, however, the influence of asset exchanges on the transactions demand for money must be established econometrically.

The regressions reported in Table 1 test the fundamental empirical question at issue in this paper. Using monthly data, they ask whether, when one holds the level of nominal income and interest rates constant, the level of trading on the New York Stock Exchange exercised a statistically significant and economically important impact on the demand for and holdings of nominal cash balances. Six monetary aggregates serve as the dependent variables in Table I. These include demand deposits in New York City, demand deposits in 100 major centers (excluding New York City), demand deposits in 101 centers (including New York City), currency plus demand deposits in commercial banks ($M1$), currency plus demand and time deposits in commercial banks ($M2$), and $M2$ plus deposits in mutual savings banks and the postal savings system ($M3$). All dependent and independent variables (excluding dummies) have been transformed into natural logarithms to facilitate the calculation of elasticities. Two short-term interest rates are used: that on prime commercial paper, 4–6 month maturity ($PCP46$), and the rate in the call money market for loans on new securities ($CALL$).

Nominal income data is not available on a monthly basis for the 1920's, and three measures have been used to estimate it. One ($YINT$) is a simple linear interpolation from annual data, with endpoints centered in midyear. The second proxy ($YIND$) is constructed using a two-stage procedure. Annual nominal income is regressed on an annual index of industrial production. The resulting regression coefficients are then used to construct predicted monthly income data based on this annual relationship, and monthly seasonally adjusted industrial production data. The third proxy (YM) is constructed by multiplying monthly seasonally adjusted industrial production data times a monthly wholesale price index, less farm products. The choice of income proxy does not materially affect any of the conclusions of the paper. To conserve space, only the results using the third proxy are reported, but regressions have been run using each of the three.

The asset exchange variable ($TRAD1$) consists of the monthly volume of trading on the New York Stock Exchange in millions of shares, round lots times an index of common stock prices (1935–39 = 100). The volume series is based on the Exchange ticker, and excludes odd lots, stopped sales, private sales, split openings, crossed transactions and/or "errors of ommission."[14]

[14] $TRAD1$ is an imperfect estimate of trading value, inasmuch as the weights used in the stock price index may not have reflected the relative trading volumes of different securities. On the trading volume series, see U.S. Bureau of the Census, Vol. II, p. 999, note on series X-531.

Table 1—Demand for Money Regressions, 1919–29[a]

	Log of Lagged Endogenous Variables	Log of Trading Value, NYSE[b]	Log of Nominal Income Proxy[c]	Log of Short-Term Interest Rate: Call Loan	Commercial Paper	Seasonal Dummies: January	August	Constant
Demand Deposits:								
NYC:								
(1) $R^2=.980$, $D\text{-}W=1.87$	.754	.020	.040	−.039		.011	−.020	.180
$\rho=.200$ (2.20)	(17.61)	(5.16)	(2.67)	(−4.81)		(1.70)	(−3.28)	(5.61)
(2) $R^2=.985$, $D\text{-}W=1.85$	.772	.016	.024		−.036	.014	−.018	1.75
$\rho=.264$ (2.99)	(16.14)	(3.94)	(1.47)		(−2.62)	(2.10)	(−2.81)	(4.77)
Outside NYC:								
(3) $R^2=.996$, $D\text{-}W=1.97$	.888	.0077	.033	−.025		.012	−.0034	.832
$\rho=.185$ (2.06)	(50.53)	(4.38)	(4.79)	(−6.42)		(3.76)	(−1.15)	(6.06)
(4) $R^2=.996$, $D\text{-}W=1.97$	.891	.0047	.027		−.039	.013	−.0021	.878
$\rho=.174$ (1.93)	(55.04)	(3.02)	(4.42)		(−7.35)	(4.22)	(−.72)	(6.67)
101 Centers:								
(5) $R^2=.994$, $D\text{-}W=1.83$	.835	.013	.036	−.032		.011	−.010	1.34
$\rho=.164$ (1.73)	(34.76)	(5.83)	(4.44)	(−6.92)		(3.02)	(−2.99)	(6.68)
(6) $R^2=.996$, $D\text{-}W=1.82$	.851	.0087	.026		−.038	.014	−.0093	1.27
$\rho=.267$ (2.95)	(31.11)	(3.73)	(2.84)		(−4.80)	(3.61)	(−2.58)	(5.41)
$M1$:								
(7) $R^2=.9996$, $D\text{-}W=2.19$	.874	.0073	.031	−.015				1.09
$\rho=-.512$ (−6.52)	(50.32)	(5.44)	(5.96)	(−5.80)				(6.94)
(8) $R^2=.9997$, $D\text{-}W=2.19$	.886	.0048	.027		−.023			1.03
$\rho=-.533$ (−7.21)	(56.30)	(3.95)	(5.75)		(−6.67)			(7.08)
$M2$:								
(9) $R^2=.9997$, $D\text{-}W=2.01$	.933	.0069	.020	−.016				.587
$\rho=-.393$ (−4.72)	(118.9)	(6.11)	(5.95)	(−7.71)				(7.84)
(10 $R^2=.998$, $D\text{-}W=2.09$	.941	.0042	.017		−.023			.556
$\rho=-.477$ (−5.92)	(143.2)	(4.48)	(5.76)		(−9.50)			(8.60)
$M3$:								
(11) $R^2=.9998$, $D\text{-}W=2.03$	.944	.0062	.016	−0.14				.505
$\rho=-.404$ (−4.90)	(139.2)	(5.97)	(5.46)	(−7.63)				(7.65)
(12) $R^2=.9999$, $D\text{-}W=2.12$	.951	.0038	.013		−.020			.477
$\rho=-.485$ (−6.08)	(166.8)	(4.38)	(5.18)		(−9.33)			(8.33)

Sources: Federal Reserve System (1976a): Demand Deposits: Tables 49 and 50, pp. 164–74; 196–206; Prime Commercial Paper Rates: Table 120, p. 450; Call Loan Rates, New Loans: Table 120, p. 450; Index of Common Stock Prices: Table 133, pp. 480–81; Volume of Trading on NYSE: Table 135, p. 485. Federal Reserve System (1976b): Seasonally Adjusted Industrial Production: p. S-27. Friedman and Schwartz (1963): $M1$, $M2$, $M3$: Appendix A, pp. 710–12. U.S. Bureau of the Census (1975): Volume and Value of Trading on NYSE, 1935–39, Series X-525—526, Vol. II, p. 1007. U.S. Department of Commerce (1940): Wholesale Prices, All Commodities other than Farm Products, p. 18.

[a] $n=131$ observations (February 1919–December 1929.) The method of estimation was ordinary least squares with first-order autocorrelation coefficient selected by a maximum-likelihood procedure. Durbin-Watson ($D\text{-}W$) statistics are biased towards 2 in such models. However, an approximation of the Durbin h-statistic, $h=(1-d/2)(N/(1-N(\operatorname{var}\alpha)))^{1/2}$, where d is the $D\text{-}W$ statistic, N is sample size, and α is the estimate of the coefficient on the lagged endogenous variable, enables us to reject at the 5 percent level the hypothesis that the errors in the estimated equation are serially correlated. The t-statistics are shown in parentheses. The t-statistic for ρ is to its right.

[b] Trading volume, millions of shares × asset price index (see text).

[c] Industrial production index, seasonally adjusted, × *WPI*, other than farm products, × a scaling factor (.0518) to make estimates comparable to annual *GNP* estimates.

This study employs a widely used, although sometimes criticized,[15] partial-adjustment model estimated through the use of a Koyck transformation. Including the lagged dependent variable on the right-hand side of

[15] See Goldfeld (1973, pp. 581–83). Criticisms center around the proposition that demanders of money never actually hold their desired cash balances, and on the econometric difficulties of constructing a confidence interval around the long-term elasticity estimates.

the equation implies that previous month's cash balances (M_{t-1}) adjusted only partially to current month's desired level (M_t^*). Because regressions are run on demand deposits in New York City as well as in 100 centers outside New York City, this specification facilitates the comparison of the speeds of adjustment of different monetary aggregates.

A maximum-likelihood procedure is used to estimate the autocorrelation coefficient ρ.[16]

In addition to the above mentioned variables, two seasonal dummies were introduced in the demand deposit regressions to deal with systematic variation in the deposit-currency ratio over the year. One might anticipate the need for a positive dummy for December to take account of the large fraction of retail sales that take place during the Christmas season, and the resulting increased demand for money. In the 1920's, however, almost all of the impact of the Christmas season shows up in an increase in the demand for currency, as opposed to demand deposits. It is in January, which typically experiences the largest month-to-month drop in the amount of currency in circulation, that demand deposits rise to unusual levels. As merchants deposit their cash receipts from the Christmas season, and consumers cut back on their currency withdrawals, the deposit-currency ratio rises, and so, temporarily, does the amount of demand deposits. By the end of January, demand deposits begin to fall, as the Fed traditionally contracts the money supply. But average weekly January demand deposits tend to be higher than would otherwise be the case, as the result of this seasonal variation in the deposit-currency ratio. As the regressions show, this increase is statistically independent of variation in the other right-hand variables discussed above. The sign of the coefficient on the August dummy can be explained as the result of a shift in the deposit-currency ratio in the opposite direction.[17]

TABLE 2—LONG-RUN ELASTICITIES OF MONEY WITH RESPECT TO TRADING VALUE[a]

	γ	Long-Run Elasticity
New York City	.246	.081
100 Major Centers	.112	.069
101 Centers	.165	.079
$M1$	.126	.058
$M2$	.067	.103
$M3$	.056	.111

[a]Based on Table 1 estimates. Industrial production index × *WPI* less farm products as nominal income proxy; call loan rate as short-term interest rate.

Note in Table 1 that all the regression coefficients, with the exception of that on nominal income in equation (1), are statistically significant and carry the predicted signs. Regressions including a time trend have been run, but are not reported. Adding a time trend does not greatly change the values or significance levels of any of the reported coefficients, and such a time trend is not itself significant when controlling for the other variables.

Statistical significance is not the same, of course, as economic importance. Table 2 calculates long-run elasticities of money demand with respect to trading value, dividing the estimated coefficient by the implied estimates of γ.[18] Setting aside the combined

[16]See Charles Beach and James MacKinnon (1978). This procedure is a variant on the original Cochrane-Orcutt technique.

[17]For all years except the recession year of 1921, the end-of-month currency in circulation figures are higher for August than July (and continue at higher than average levels throughout the rest of each year). The beginning of these cash withdrawals, in the absence of immediate compensatory accommodation, leads to a drop in the deposit-currency ratio which results in particularly low demand deposit holdings in August, independently of variation in nominal income, trading value, or interest rates. The August effect is weaker than the January effect, and is statistically significant for New York and for the combined regressions, but not for the 100 major centers outside New York. See Federal Reserve System (1976a, Table 110, pp. 410–11).

[18]γ is the complement of the estimated coefficient on the lagged dependent variable: $\ln M_t - \ln M_{t-1} = \gamma(\ln M_t^* - \ln M_{t-1})$, where $\ln M_t^*$ represents desired money holdings. The long-run elasticity of nominal income, calculated using a similar procedure, is considerably less than 1 for all of the monetary aggregates. The main explanation for this is that monthly *GNP* is proxied imperfectly, another way of saying that it is measured with error. This tends to bias downward the estimated coefficient on income. Improvements in transactions "technology" due to experience effects over the decade, during which nominal income trended upward, may also contribute.

demand deposits in 101 centers, one can rank the remaining five monetary aggregates in the order of their cumulative sensitivity to trading value fluctuations, as estimated by long-run elasticity: $M3$, $M2$, demand deposits in NYC, demand deposits outside of NYC, and $M1$. However, the speed of adjustment implied by the coefficient on the lagged endogenous variable tends to rise the more narrowly one defines the monetary aggregates, and is the highest for demand deposits in New York City. Although $M2$ and $M3$ eventually experience a larger percentage increase in response to a given percentage increase in trading value, the impact coefficient is approximately three times larger for demand deposits in New York than it is for any of the Friedman-Schwartz monetary aggregates.

Over the period in question, annual nominal income fluctuated from a low of $69.9 billion in 1921 to a high of $102.1 billion in 1929, while trading value on the New York Stock Exchange fluctuated from an annualized low of $1.6 billion a year (July 1921) to a high of an annualized rate of $97.8 billion (October 1929).[19] Whereas nominal income's 1921 low was 68.5 percent of its 1929 high, trading value's 1921 low was 1.6 percent of its 1929 high. Almost all of the rise in trading value from its July 1921 trough to its October 1929 peak took place in the post-1925 period. One way to consider the economic importance of the Table 2 elasticities is to ask how much the post-1925 growth in asset trading changed money growth rates, as compared with a hypothetical scenario in which interest rate policy and *GNP* growth took their historical levels, but asset trading remained at its pre-1925 levels. The counterfactual posited, therefore, is one in which trading value remained constant throughout the period at the average of its level during the first 72 months of the sample, but interest rates and nominal income had their actual values.

Dynamic simulations of monetary stocks (i.e., simulations in which the lagged dependent variables are simulated rather than actual values) using the regression coefficients reported in equations (1) and (7) were conducted for demand deposits in New York City, as well as Friedman and Schwartz $M1$. These simulations indicate that, absent the post-1925 surge in asset exchanges, average holdings of New York City demand deposits over the 24-month period 1928–29 would have been 20.3 percent lower than they actually were. Holdings of $M1$ would have been on average 17 percent below their actual levels.[20] These results have important implications.

The decision to raise discount rates as a means of controlling speculative activity on the stock market engendered substantial disagreement within the System.[21] Experience in 1920–21 had led to the advocacy of discount policy to control speculation in commodities, where speculation was understood to mean excessive holding of inventory stocks in anticipation of future price rises. Such holdings made an economy particularly vulnerable to downturns in real activity inasmuch as a change in expectations regarding future price levels or rates of increase could rapidly change the stock of involuntarily held inventories, leading to an immediate downturn in production. The sharp rise in the discount rate in January 1920, and the economy's response to it, gave ammunition both to those opposed to such countercyclical policy, who argued that the rise was too severe, and those in favor, who argued that the rise should have come earlier.[22]

In 1928–29, however, debate concerned the use of discount policy to combat speculation not in commodities (whose prices were dropping), but in financial assets, in particu-

[19] These estimates are obtained by taking the minimum and the maximum value of the *TRAD*1 series (constructed by multiplying a common stock price index by the volume of trading), multiplying them by the average price during the base years (1935–39) of the index, ($26.95) and dividing by 100. Average annual stock prices calculated from U.S. Bureau of the Census, Vol. II, p. 1007, Series X-525 and X-526.

[20] New York City demand deposits' actual 24-month average was $5,379 million. The average for the simulation over the same period was $4,286 million. For $M1$, the corresponding figures are $26,300 million and $21,824 million.

[21] Friedman and Schwartz (1963, p. 254).

[22] Friedman and Schwartz (1963, p. 231).

lar, equities. Although there are some similarities between commodity speculation and speculation in equities, the potential effect of such speculation on real activity is more attenuated, and therefore the rationale for attempting to use monetary policy to control it is less compelling. In proposing to use high interest rates to moderate an explosion in asset prices in a deflationary environment characterized by rapid real growth, the System was moving into uncharted waters, a fact recognized both by proponents and opponents of such policy. There were concerns among opponents—in retrospect, legitimate—that such higher rates would adversely affect real economic activity, much as discount rate policy in 1920 had helped plunge the economy into one of the shortest but most severe recessions in U.S. history. However, opponents of higher interest rates did not disagree with proponents regarding the desirability of some Federal Reserve action to deal with developments on the stock market: they simply believed that asset prices could somehow be deflated through the use of direct pressure (selective controls on loans for speculative purposes) without affecting real activity. Moreover, both opponents and proponents lacked an awareness of the additional source of transactions demand resulting from asset exchanges.

A plausible case can be made that this ignorance resulted in a tighter monetary policy than otherwise would have obtained. Suppose there had in fact been no such additional source of transactions demand (or, alternately, no rise in the value of exchanges). The simulations described above indicate that had asset exchanges remained at their pre-1925 level, the Fed would have been confronted, already in 1928, with the beginnings of a fairly precipitous decline in monetary aggregates (or, in the case of the broader aggregates, their rate of growth). One cannot predict exactly what the System's response to this would have been, but there is good reason to believe that such developments would have strengthened the hand of those who opposed the high interest rate policy, and that the policy would have been moderated, thus avoiding, or at least making less severe the downturn, centered in construction and automobiles, that was gathering momentum already in the second quarter of 1929.

In the event, there was a complete failure to understand the nature or dimensions of the transactions demand for cash arising from the rising volume of asset exchanges. One can, with the benefit of hindsight, argue that observers should have been puzzled by the fact that the rise in interest rates in 1928-29 had little effect on monetary growth rates. Optimists apparently looked at this evidence and concluded that, in the context of the Wall Street mania, high interest rates were not adversely affecting the real side of the economy, since holdings of cash balances, which they implicitly assumed to be entirely *GNP* related, continued to grow at approximately the same rate as before, contrary to what one would have expected in more normal times.

Unfortunately, real activity was being adversely affected. The steady growth in monetary aggregates did not, according to these regressions, reflect a steady growth in *GNP*-related transactions demand. The interpretation suggested by these regressions is that the rise in interest rates, as theory predicts, led to a general decline in desired money holdings, but that this decrease was more or less compensated for by the surge in transactions demand coming from the stock market, leaving $M1$, for example, virtually unchanged from September 1925 to September 1929.

III. Further Econometric Issues

If the transactions demand for money were almost exclusively associated with *GNP*-related transactions, then it would be reasonable to speak of a *CPI*, *WPI*, or *GNP* deflator as approximating its "price," and deflate both nominal income and the monetary aggregate by such a index. But, if the argument of this paper is correct and transactions in secondary asset markets exercised a nonnegligible impact on the transactions demand for money, this procedure for generating a series of real cash balances is subject to criticism. The income proxy can be deflated by the *WPI* to give us industrial production, and the trading value index can be deflated

TABLE 3—INSTRUMENTAL VARIABLE ESTIMATES[a]

	Lagged Dependent Variable	Log of Trading value NYSE	Log of Nominal Income ($IND \times WPI$)	Log of Call Money Rate	C
$M1$					
$\rho = -.517\ (-6.619)$	.8924	.0058	.029	$-.014$	.933
$D\text{-}W = 2.128$	(47.75)	(4.016)	(5.212)	(-5.046)	(5.522)
$M2$					
$\rho = -.393\ (-4.71)$	.9427	.0055	.0195	$-.0144$	.5008
$D\text{-}W = 2.087$	(108.9)	(4.296)	(5.468)	(-6.611)	(6.101)
$M3$					
$\rho = -.384\ (-4.600)$	.9522	.0048	.0163	$-.013$	.424
$D\text{-}W = 2.011$	(129.8)	(4.170)	(5.369)	(-6.692)	(5.969)

[a]Instruments include lagged dependent variable, constant, and lagged values of logs of trading value, nominal income, and call money rate. Correction for serially correlated errors has been made.

by the asset price index to give us trading volume, but what is the appropriate deflator to use for the stock of money? That obviously depends on how important is the asset exchange component of the transactions demand for money. The more important this component, the larger should be the weight attached to the asset price index in the monthly composite deflator. Were asset prices and goods prices positively correlated over the period in question, the relative weighting of such price indexes would not be empirically of great concern. But, for the 1920's, a series of real balances calculated using a composite deflator is very sensitive to the weighting procedure used, because monthly goods prices (the *WPI*) and asset prices (a stock price index) were *negatively* correlated ($r = -.384$) over the 132-month sample. Small changes in the prior specification of the weighting scheme will produce major changes in the calculated series of real balances. Moreover, that weighting scheme cannot adequately be specified without first reaching conclusions regarding the fundamental questions at issue in this study. These considerations argue, I believe, for a nominal specification, not because people necessarily suffered from money illusion and exhibited demand for nominal balances, but rather because such a specification permits testing of an important hypothesis in a manner that does not require prejudging the outcome of that test.

Regressions were nevertheless run on New York demand deposits, deflating all nominal variables (demand deposits, trading value, and nominal income) by the *WPI* less farm products. These still show economically important and statistically significant estimates of the elasticity of the monetary aggregate with respect to deflated trading value.[23] However, the results are somewhat weaker, and, as indicated, I do not feel that this procedure is theoretically satisfactory, because it assumes that asset prices have no weight in the nominal balance deflator.

The assumption of monthly interest rate pegging is an abstraction—a defensible one—but nevertheless an abstraction. There are legitimate reasons for worrying about whether disturbances in the amount of nominal balances demanded and supplied were totally uncorrelated with interest rates, or indeed with the other right-hand side variables. Table 3 reports instrumental variable estimates, conducted using a procedure suggested by Ray Fair (1970). The instruments

[23]For the entire sample, the impact elasticity of deflated demand deposits in New York City with respect to deflated trading value = .023 ($t = 2.94$). If one restricts the sample to the 1921–29 period (108 observations), the elasticity estimate and t-statistic are higher: elasticity = .036 ($t = 4.29$). Right-hand variables in the equations were the lagged endogenous variable, the log of deflated trading value, the log of industrial production, the log of the call money rate, and the two seasonal dummies.

include the lagged dependent variable, and lagged values of all other right-hand variables. The estimates in Table 3, designed to correct for possible simultaneous equation bias, do not markedly affect the conclusions of this paper. For example, the elasticity of $M3$ with respect to trading value is .111 using ordinary least squares; the instrumental variable estimates imply an elasticity of .100.[24]

Econometric issues aside, there remain alternate interpretations of these results. There is no necessary connection between the volume of stock market trades and the asset price index, but, as an empirical matter, they were closely correlated in the 1920's ($r = .937$). Given this empirical relationship, one alternate interpretation emphasizes the influence of wealth on the demand for transactions balances. Since wealth grew with the value of securities, these regressions might reflect the fact that people demanded and paid the opportunity cost of carrying higher transactions balances at given (Y, r) combinations, but higher levels of wealth. The statistical results would be due to a spurious correlation of the value of asset *exchanges* with the value of *assets*. A second alternate interpretation argues that the spurious correlation is with the *volume* of exchanges rather than the value of assets. Suppose that a growing volume of asset exchanges reflected increased uncertainty, and that increased uncertainty gave rise to an increased demand for liquidity (shift in liquidity preference). These regressions would then be picking up the fact that the demand for money as an asset, not its demand for transactions purposes, had increased due to increased uncertainty, which also affected the volume of trading.

The best available measure of transactions velocity is the debit-deposit ratio—the ratio of the total monthly flow of debits to deposit accounts to the average stock of deposits held. Both of the above hypotheses imply that high levels of asset trading would have been associated (at any interest rate) with higher holdings of stocks of transactions balances (the denominator of a debit-deposit ratio) without being associated with higher flows of debits (the numerator). Therefore, both of these alternate hypotheses imply that fluctuations in the value of asset exchanges should, *ceteris paribus*, have been *inversely* associated with transactions velocity.

IV. Exchange Trading and Deposit-Turnover Rates

Econometric work on short-term variations in velocity is relatively rare, and that which has been done has primarily considered income velocity as the dependent variable. Such work has concluded that income velocity tends to vary procyclically, and the most widely accepted explanation for this is that interest rates vary procyclically and velocity is positively sensitive to interest rates.[25] Interest rates influence velocity because the higher the rate of return on alternate financial assets, the higher will be the individual and aggregate ratio of expenditures to non- or low-interest-bearing cash balances.[26] This hypothesis should also apply

[24] In recent years, a number of papers have been published utilizing econometric procedures to test for "causality," where the direction of causality cannot be specified on a priori grounds and the assumption of instantaneous joint determination, reflected in the use of simultaneous equation methods, is rejected as inapplicable or unrealistic. The results of such causality tests seem to be quite sensitive not only to the choice of lag truncation, but also to the prefilters applied to the data. Such sensitivity seems to be particularly acute in the case of the Sims tests, although the conclusions of Edgar Feige and D. K. Pearce (1979) cast some doubt on the procedures in general. Nevertheless, I did run a multivariate Granger test on the Friedman and Schwartz $M1$ data, logging and first differencing the logs of all variables, and using lags of 18 months. Two regressions were run, the first including 18 lagged values of the dependent variable, income (YM), trading value, and interest rates (call money rate) and a constant, and the second minus the trading value variables. The F-ratio

$$((RSS - URSS)\cdot(n-k))/(URSS\cdot q) = 2.07$$

where $n = 113$, $k = 72$ and $q = 18$. The upper 5 percent point for $F(18,41) = 1.87$. This result is consistent with the Table 1 results.

[25] Over the 1919–29 period, the monthly prime commercial paper rate is negatively correlated with industrial production, although the call money rate does vary procyclically in this sample.

[26] A second hypothesis, advanced by Friedman, calls less attention to interest rates. During the cyclical up-

to regressions using a measure of transactions velocity.

If the results of Table 1 are to be explained using either of the two alternate interpretations suggested above, one would in addition expect to find a negative coefficient on trading variables in a velocity regression. Such a negative coefficient would result from the posited association of asset trading with a growth in the denominator, but not the numerator of the debit-deposit ratio, due in the first instance to the growth in transactions balances at given (Y, r) combinations related to higher wealth levels, for which asset prices were a proxy, and in the second instance to the growth in the asset demand for money associated with uncertainty (for which trading volume was a proxy). In contrast, if the argument of this paper is correct, velocity should covary positively with the volume of trading on the New York Stock Exchange.[27]

The regressions reported in Table 4 have as their dependent variable the debit-deposit ratio. The regressions are run for New York City, for 100 centers outside New York,[28] and for 101 centers, including New York. All three series exhibit strong seasonal regularity, (generally strongest in the outside New York City series), and six monthly dummies are included to capture these effects. A partial-adjustment model is again estimated, although without an autocorrelation correction in equation (2), where it is not needed. The call loan rate is used as the short-term interest variable, except for the outside of New York regressions, where an equation using the prime commercial paper rate (3) is also reported. As before, instrumental variable estimates, using a procedure similar to that described for Table 3, result in only minor variations in coefficient estimates, and in this case are not reported. Calculations of Durbin h-statistics, conducted as described in the note to Table 1, again reject at 5 percent the hypothesis of serial correlation in the estimated equations.

The results in Table 4 show unambiguously that trading volume as well as interest rates exercised a positive influence on transactions velocity in the 1920's. They also show that the immediate impact of a surge in trading volume on deposit turnover was three to five times higher in New York City than outside of New York City, depending on which of equations (2) and (3) one uses as comparison. The long-run elasticity of deposit turnover with respect to trading volume

swing, he argues, measured income is greater than permanent income (which largely determines the stock demand for money) so that measured income velocity (GNI/M) is high during expansion. Similarly, in the cyclical downturn, measured income is less than permanent income, so GNI/M is low. The stock demand for cash balances is more stable over the business cycle than measured income, leading to procyclical movements in measured velocity. Friedman's hypothesis suggests that income should be positively associated with velocity, independently of interest rates. This hypothesis has been criticized by Laidler on the grounds that transitory increases in income increase wealth, and that "elementary notions" of liquidity preference suggest that money balances might receive a portion of it. See Friedman and Schwartz (1963, pp. 642–43); Laidler (1966, p. 56).

[27] Let η_M = the elasticity of the stock demand for money with respect to trading value, and η_{DEB} the elasticity of the flow of debits with respect to trading values. If $\eta_M = \eta_{DEB}$, then trading value will not affect velocity. Two extreme cases would be (a) $\eta_M = \eta_{DEB} = 0$ and (b) $\eta_M = \eta_{DEB} = 1$. In case (a) neither debits nor deposits held are affected by trading value, and in case (b), equally unrealistic, deposits held rise dollar for dollar with debits. The two alternate interpretations of the Table 1 results discussed at the end of Section II imply that $\eta_M > \eta_{DEB}$, and in particular that η_{DEB} is close to 0. The arguments and evidence of this paper, however, suggest the contrary, that $\eta_{DEB} > \eta_M$, which implies positive elasticity of velocity with respect to trading volume, as Table 4 shows. Nevertheless, the Table 4 results cannot discriminate between $\eta_{DEB} > \eta_M = 0$ and $\eta_{DEB} > \eta_M > 0$. In the former case, that of costlessly flexible velocity in the financial circulation, there would be little reason to expect any impact of trading on the real side of the economy. The arguments of this paper, therefore, depend on both the velocity (Table 4) and the stock demand for money (Table 1) regressions.

[28] Regressions run on data for the 100 centers outside of New York required some transformation of the series presented in *Banking and Monetary Statistics*, because the debit data is reported for 140 centers outside of New York (Table 51), whereas the deposit data is for 100 cities outside of New York (Table 50). However, in Table 55, Federal Reserve Board statisticians have adjusted downward the debit data to make them comparable to the deposit data in order to calculate annual debit-deposit ratios. The implicit annual downward adjustment factors applicable to the debit data were extracted from Table 55 and these annual factors were multiplied by the monthly observations to create a monthly debit series comparable to the monthly deposit series.

TABLE 4—DEPOSIT TURNOVER RATES,[a] 1919–29[b]

Right-Hand Variable	New York City (1)	100 Centers Outside NYC (2)	100 Centers Outside NYC (3)	101 Centers, Including NYC (4)
Log of Lagged	.450	.565	.429	.500
Endogeneous Variable	(8.79)	(11.88)	(7.85)	(10.7)
Log of Trading	.170	.032	.051	.118
Volume, NYSE	(9.39)	(4.19)	(5.78)	(8.79)
Log of Industrial	.156	.051	.103	.070
Production	(2.05)	(2.04)	(3.25)	(1.52)
Log of Prime			.150	
Commercial Paper Rate			(6.84)	
Log of Call	.079	.072		.076
Money Rate, New Loans	(3.06)	(6.36)		(4.49)
Monthly Dummies:				
February	−.11	−.14	−.12	−.122
	(−6.94)	(−13.09)	(−12.04)	(−9.35)
March	.12	.088	.071	.105
	(6.13)	(6.98)	(5.39)	(6.77)
August	−.029	−.044	−.045	−.037
	(−2.05)	(−4.20)	(−4.66)	(−3.06)
October	.073	.086	.080	.079
	(4.42)	(8.05)	(7.76)	(5.93)
November	−.05	−.056	−.047	−.051
	(−2.76)	(−5.25)	(−4.38)	(−3.62)
December	.064	.087	.090	.075
	(3.68)	(8.16)	(8.59)	(5.43)
Constant	−.234	.034	−.174	−.079
	(−1.40)	(.606)	(−2.19)	(−.78)
R^2	.892	.92	.898	.924
$D\text{-}W$	1.88	1.92	1.95	.181
ρ	.508		.203	.325
	(6.08)		(2.22)	(3.52)

Sources: (in addition to those for Table 1): Federal Reserve System, *Banking and Monetary Statistics, 1919–1941* (1976): Debits to Deposit Accounts, Table 51, p. 234; Annual Deposit Turnover Rates, Table 55, p. 254.

[a] The monthly sum total of debits to deposit accounts divided by the average weekly (Wednesday) stock of demand deposits. Debit figures for 140 centers outside of New York City have been adjusted downward to make them comparable with deposit figures (see fn. 28).

[b] $n = 131$ observations (February 1919–December 1929). The method of estimation was ordinary least squares, with first-order autoregressive correction in equations (1), (3), and (4). The t-statistics are shown in parentheses.

displays a similar multiple: .31 in New York City, according to equation (1), vs. .072–.074 outside of New York, according to equations (2) and (3). These results cast doubt on the two alternate explanations considered for the Table 1 results.

V. Conclusions

These findings naturally lead one to ask whether such relationships can be generalized to other periods, and one must move cautiously in extrapolating, without adequate empirical work, an effect that I believe can be convincingly demonstrated for the 1920's. Discussions in this section must be viewed as more speculative than the conclusion reached in Sections II and III. Nevertheless, preliminary results for the entire 1919–41 period (275 observations) do show statistically significant although somewhat smaller elasticities of $M3$ with respect to trading value.[29]

[29] The impact elasticity of $M3$ with respect to trading value is estimated = .002 (t = 2.98) over the entire period. Long-run elasticity = .0525, based on a γ of .0387. The economic history of the 1930's is so unusual, however, that much more empirical work is necessary before meaningful statements can be made about the impact of asset exchanges on the macroeconomic history of that decade.

Analogous mechanisms may today exercise perturbing influences on the transactions demand for money. For example, maturation of large numbers of All-Savers Certificates in October of 1982 was associated with an unexpectedly large increase in monetary aggregates, presumably the result of an accommodated increase in the transactions demand for cash to be used in exchanging these assets for other assets. A plausible demonstration of such effects for the 1920's opens the door to more sophisticated investigations of such possibilities.

Current claims in the 1980's that financial takeovers, such as that of Conoco by Dupont, absorb cash balances have an air strongly reminiscent of the 1920's, both in the quality of the analysis evident, and in the opposition to such ideas generated among monetary economists. Yet, if the arguments of this paper are accepted, one must conclude that proponents of absorption in that earlier decade were partially correct in their intuition, although for reasons they did not always (especially in the United States) articulate well. The same may turn out to be the case with respect to these current discussions. Similarly, this analysis of the 1920's provides a perspective on the influence of international asset exchanges on the transactions demand for dollars, an influence that was underlined by the rise in monetary aggregates associated with the transfer of assets to Iran under the term of the hostage release agreement.[30] More generally, currency substitutability between dollar, mark, and yen may play a role analogous to that of the New York Stock Exchange in introducing instability in the demand for dollar balances in the 1980's.[31]

Setting aside the research opportunities opened up for subsequent decades, this paper does suggest a number of new interpretations of some key aspects of the macroeconomic history of the 1920's. It explains the Friedman-Schwartz puzzling result that income velocity rises hardly at all towards the end of the 1920's, in spite of record high interest rates.[32] It suggests a way of understanding the relationship between trading on the New York Stock Exchange and the downturn in the German economy in 1928, a relation that has been rejected by those who deny that stock market "speculation" could have "absorbed" funds previously loaned in Germany.[33] Finally, it provides some insight into the proximate causes of the downturn in real economic activity in the United States, usually dated from August 1929.

The U.S. monetary authorities allowed the money stock, by any number of definitions, to grow quite rapidly after the recession of 1920–21. The $M1$ stood at \$20.5 billion in January 1922, then rose to \$26.2 billion four years later (September 1925), approximately the same level recorded for September 1929. $M2$ and $M3$ also grew at slower rates after 1926. Beginning in 1925, and picking up steam in late 1927, however, trading volume and value on the New York Stock Exchange began to rise to historically unprecedented levels. Confronted by pressure at the discount window to provide more reserves, the

[30] *Wall Street Journal*, August 17, 1981, p. 20.

[31] I base this remark on discussion with Ronald McKinnon. See his 1982 article.

[32] See Friedman and Schwartz (1963, Chart 16, p. 197). The resolution is that transactions velocity, which was not proportional to income velocity, rose quite dramatically toward the end of the decade, as one might have expected. This emphasis on the potential influence of fluctuations in the transactions-income ratio may also provide insight into a current macroeconomic issue. Many macroeconomists are puzzled by why velocity has grown so slowly since 1981, more slowly than periods in the 1970's characterized by nominal interest rates in the same range (see *Wall Street Journal*, May 24, 1983). The problem again may be that income velocity is not the right variable. The April 1983 *Federal Reserve Bulletin* (p. A-16) indicated that between 1980 and 1982, debit-deposit ratios in all insured banks rose from 198.7 to 324.2, a 63 percent increase in the space of two years. As of February 1983, that figure had risen even further, to 361.3. This evidence suggests that the demand to hold cash balances for transactions purposes may be higher than policymakers would normally expect, given current levels of real output and interest rates, perhaps explaining policymakers' tolerance of a money growth rate exceeding 12 percent (at an annualized rate) in the first half of 1983.

[33] In a recent discussion of this episode Peter Temin briefly entertained the possibility that the "increased volume of activity on the New York Stock Exchange required an increased quantity of money for transactions purposes..." before rejecting it on the grounds that "it is hard to believe [transactions demand] rose very much" (1976 p. 154).

Fed first tried to clamp on selective credit controls, threatening to refuse discount if loans were for "speculative" purposes.[34]

By and large, the System viewed such loans solely with regard to their impact on asset prices, apparently maintaining that asset prices, like goods prices, required a continual flow of expenditures to sustain them. There was little discussion of the possible role played by such credit expansion in satisfying (if this paper is correct) the rise in demand for transactions balances associated with the unprecedented rise in the volume of financial transactions, an accomodation that was essential if such trading volumes were to continue along with normal *GNP* related transactions. Eventually, the System determined that selective controls were arbitrary and discriminatory, and permitted interest rates to rise to very high levels—the only course of action (outside of major institutional changes) consistent with maintaining a policy of virtually no annual growth in *M*1 in the last three years of the decade.

Some corporations benefited from the ability to raise long-term expansion capital cheaply in the inflated stock market. But many other firms and households began to curtail their investment and consumption demand, especially that for consumer durables such as automobiles,[35] thus helping to precipitate the downturn in real *GNP* signified by the drop in industrial output starting in August. It is reasonable to believe that part of this decline was in response to the very high prevailing interest rates. The persistence of those rates, in turn, can be linked to the System's failure to understand the contribution of the rising volume and value of stock trading to the transactions demand for money.[36] It was in this sense, and really in this sense alone, that one can speak of stock market speculation absorbing cash balances, thereby adversely affecting the real side of the economy.

[34] Friedman and Schwartz (1963, pp. 254–66).

[35] See Temin (pp. 64; 171–72) for a discussion of the importance of consumption declines in 1930. However, Temin attributes the decline in consumption to the effect of the stock market crash on household wealth. Yet seasonally adjusted automobile production peaked in June 1929, several months before the crash. I attribute part of the decline in consumer durables production and consumption, as well as the failure of construction to continue to recover after mid-1928, to the tighter credit conditions associated with the Fed's antispeculative policies. See *Survey of Current Business* (January 1930, pp. 2–3, 7, 12, 17, 49, 65). For a more extensive discussion, see my 1984 article.

[36] This argument does not deny the possibility that autonomous forces were generating concurrent contractionary shifts in the *IS* schedule. Nevertheless, high real interest rates prevailing in 1928–29 do suggest that the deflationary impulse came primarily from movements in the *LM* not the *IS* schedule.

REFERENCES

Baumol, William J., "The Transactions Demand for Cash: An Inventory Theoretic Approach," *Quarterly Journal of Economics*, November 1952, *66*, 545–56.

Beach, Charles M. and MacKinnon, James G., "A Maximum Likelihood Procedure for Regression with Autocorrelated Errors," *Econometrica*, January 1978, *46*, 51–88.

Beckerath, Herbert von, *Kapitalmarkt und Geldmarkt*, Jena: G. Fischer, 1916.

Cooley, Thomas F. and Leroy, Stephen F., "Identification and Estimation of Money Demand," *American Economic Review*, December 1981, *71*, 825–44.

Enzler, Jacob, Johnson, Lewis and Paulus, John, "Some Problems of Money Demand," *Brookings Papers on Economic Activity*, 1:1976, 261–80.

Fair, Ray C., "The Estimation of Simultaneous Equation Models with Lagged Endogenous Variables and First Order Serially Correlated Errors," *Econometrica*, May 1970, *38*, 507–16.

Feige, E. L. and Pearce, D. K., "The Casual Causal Relationship Between Money and Income: Some Caveats for Time Series Analysis," *Review of Economics and Statistics*, November 1979, *61*, 521–33.

Field, Alexander J., "Price and Quantity Adjustment in the *Treatise on Money*," working paper, University of Santa Clara, 1983.

______, "A New Interpretation of the Onset of the Great Depression," *Journal of Economic History*, June 1984, *44*, forthcoming.

Fisher, Irving, *The Purchasing Power of Money: Its Determination and Relation to Credit*, *Interest and Prices*, New York: Macmillan, 1911.

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

______, "Interest Rates and the Demand for Money," *Journal of Law and Economics*, October 1966, *9*, 71–85.

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

______ **and** ______, *Monetary Trends in the United States and the United Kingdom: Their Relation to Income, Prices and Interest Rates, 1867–1975*, Chicago: University of Chicago Press, 1982.

Garvy, George and Blyn, Martin R., *The Velocity of Money*, New York: Federal Reserve Bank of New York, 1969.

Goldfeld, Steven M., "The Demand for Money Revisited," *Brookings Papers on Economic Activity*, 3:1973, 577–638.

______, "The Case of the Missing Money," *Brookings Papers on Economic Activity*, 3:1976, 683–730.

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

Granger, C. W. J., "Investigating Causal Relations by Econometric Methods and Cross-Spectral Methods," *Econometrica*, July 1969, *37*, 424–38.

Hansen, Alvin, *Monetary Theory and Fiscal Policy*, New York: McGraw-Hill, 1949.

Hardy, Charles O., *Credit Policies of the Federal Reserve System*, Washington: The Brookings Institution, 1932.

Harris, Seymour E., *Twenty Years of Federal Reserve Policy, Including an Extended Discussion of the Monetary Crisis, 1927–1933*, Vol. 2: *The Monetary Crisis*, Cambridge: Harvard University Press, 1933.

Keynes, John Maynard, "Is There Inflation in the United States?," (1928), in Donald Moggridge, ed., *The Collected Writings of John Maynard Keynes*, Vol. XIII: *The General Theory and After, Part I, Preparation*, London: Macmillan, 1973, 52–76.

______, *A Treatise on Money in Two Volumes*, Vol. I: *The Pure Theory Of Money*, Vol. II: *The Applied Theory of Money*, London: MacMillan, 1934.

______, *The General Theory of Employment, Interest and Money*, New York: Harcourt Brace, 1964.

Laidler, David, "Some Evidence on the Demand for Money," *Journal of Political Economy*, February 1966, *74*, 55–68.

______, *The Demand for Money: Theories and Evidence*, 2d ed., New York: Dun-Donneley, 1977.

Lieberman, Charles, "The Transactions Demand for Money and Technological Change," *Review of Economics and Statistics*, August 1977, *59*, 307–17.

______, "A Transactions vs. Asset Demand Approach to the Empirical Definition of Money," *Economic Inquiry*, April 1979, *18*, 237–53.

McKinnon, Ronald, "Currency Substitution and Instability in the World Dollar Standard," *American Economic Review*, June 1982, *72*, 320–32.

Machlup, Fritz, *The Stock Market, Credit and Capital Formation*, trans. by Vera C. Smith, *Börsenkredit, Industriekredit and Kapitalbildung*, 1931, New York: Macmillan, 1940.

Modigliani, Franco, Rasche, Robert and Cooper, J. P., "Central Bank Policy, the Money Supply and the Short Term Rate of Interest," *Journal of Money, Credit and Banking*, May 1970, *2*, 166–218.

Owens, Richard N. and Hardy, Charles O., *Interest Rates and Stock Speculation*, New York: Macmillan, 1925.

Reed, Harold L., *Federal Reserve Policy, 1921–1930*, New York: McGraw-Hill, 1930.

Reisch, Richard, "Rückwirkungen der Börsenspekulation auf den Kreditmarkt," *Zeitschrift fur Nationalökonomie*, 1929, *1*, 205–21.

Rogers, James H., *Stock Speculation and the Money Market*, Columbia: Lucas Bros., 1927.

Scitovsky, Tibor, *Money and the Balance of Payments*, Chicago: Rand McNally, 1969.

Selden, Richard T., "Money: Velocity of Circulation," in *International Encyclopedia of the Social Sciences*, New York: Macmillan, 1968.

Temin, Peter, *Did Monetary Forces Cause the Great Depression?*, New York: Norton, 1976.

Tobin, James, "The Interest Elasticity of Transactions Demand for Cash," *Review of Economics and Statistics*, August 1956, *38*, 241–47.

______, "Liquidity Preference as Behavior Toward Risk," *Review of Economic Studies*, February 1958, *25*, 65–86.

Warburton, Clark, "The Volume of Money and the Price Level Between World Wars," *Journal of Political Economy*, June 1945, *54*, 153–64.

Federal Reserve System, *Federal Reserve Bulletin*, April 1983, Washington: Publications Services.

______, (1976a) *Banking and Monetary Statistics, 1914–1941*, Washington: Publications Services, 1976.

______, (1976b) *Industrial Production, 1976 Revision*, Washington: Publications Services, 1976.

U.S. Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1970*, Washington: USGPO, 1975.

U.S. Department of Commerce, *Survey of Current Business*, February 1930, *10*; September 1940, *20*.

U.S. House of Representatives, *Federal Reserve Act of 1913, with Amendments and Laws Relating to Banking*, Washington: USGPO, 1966.

Wall Street Journal, August 17, 1981, p. 20; "Velocity Throws the Money Men a Curve," May 24, 1983.