The Demand for Money from the Great Depression to the Present

Arthur E. Gandolfi; James R. Lothian

The American Economic Review, Vol. 66, No. 2, Papers and Proceedings of the Eighty-eighth Annual Meeting of the American Economic Association (May, 1976), 46-51.

The Demand for Money from the Great Depression to the Present

By ARTHUR E. GANDOLFI AND JAMES R. LOTHIAN*

Myths and legends about the Great Depression have dominated the public's perception of the business cycle. They have shaped government policy and, until recently, they have even held powerful sway among economists. In the immediate aftermath of the Great Depression, many economists came to question the fundamental concept of economic equilibrium. Velocity was thought to be highly unstable —as in the case of the "liquidity trap"—so that the quantity of money supplied was consistent with any level of nominal income. In the real sector, there was the frightening specter of underemployment equilibrium. Following a shock to the economy which reduced output and depressed prices, there were reputedly no forces at work that would achieve a return to full employment. What is remarkable about these ideas is that they gained such widespread acceptance in the economics profession despite the absence of any systematic supportive evidence.

As empirical evidence on the economy accumulated, more and more economists turned away from such views. Milton Friedman and Anna Schwartz's explanation of the monetary nature of the Great Depression provided the major stimulus for this reevaluation. Their conclusions were buttressed by the results of other statistical studies which have dealt directly with the 1930's, such as those by Martin Bronfenbrenner and Thomas Mayer, by Allan Meltzer, by Clark Warburton and most recently by Arthur Gandolfi. Their arguments have been given support by the numerous studies of money demand that have demonstrated its essential stability under diverse institutional and economic conditions.

The current recession has led to a renewed concern over economic instability. This concern is evidenced by the resurrection of a whole list of proposals reminiscent of the 1930's—running the gamut from *WPA*-type employment projects to national economic planning. The Great Depression again is pointed to as the premier example of economic instability; the current recession as its second coming. One reason for the persistence of the controversy surrounding the Great Depression lies in the difficulty in testing competing explanations of the behavior of the economy during short historical episodes. The number of truly independent time-series observations is very limited and the degree of collinearity among possible explanatory variables is too high.

Our paper focuses on one of the controversies noted above—the behavior of the demand for money during business contractions. This issue is of particular importance since a stable demand function for money is an essential requirement for a monetary explanation of the cycle. To get around data limitations, which result from the use of time series alone, we use yearly cross-state data for the period 1929 through 1968. This approach increases

* First National City Bank. We are grateful to John Maher for his extremely competent assistance in the preparation and analysis of the data. We also want to thank Thomas K. Barneby, Phillip Cagan, Stanley Diller and Anna J. Schwartz for their comments on an earlier draft and Deborah Wenninger for her programming assistance.

our degrees of freedom and reduces problems of collinearity. It also provides the possibility of reconciling the pre- and post-World War II movements of velocity which have made it difficult to say anything definitive about velocity and the demand for money over short time periods like the early 1930's.[1]

I. The Model and the Data

As a model of the demand for money we assume a fairly standard relationship of the form:

$$ln\,(M/PN) = \beta_0 + \beta_1\, ln\, y_p + \beta_2\, ln\,[(1 + RB)/(1 + RM)],$$

where (M/PN) is per capita real total commercial bank deposits, y_p is permanent per capita real personal income and where the bracketed term is the ratio of the value in the next period of a dollar invested in long-term bonds to the value in the next period of a dollar held as deposits—a measure of the opportunity cost of holding money.

The data we use cover the continental United States and the District of Columbia for the forty years from 1929 through 1968. Real per capita money holdings are estimated by deflating total commercial bank deposits for each state by the national consumer price index and by total state population. In calculating the state permanent income series, we used an exponentially declining weighted average of state per capita personal income with an initial weight of .33 and an allowance for separate state trends in income. The rate of interest paid on deposits was calculated by dividing the total interest paid on deposits, net of services charges on demand deposits, by a weighted average of June and adjacent December deposit figures.

II. Empirical Results

We obtained estimates of the parameters of our money demand function from a wide variety of regressions—individual yearly cross-state regressions and pooled regressions, for the full 40-year period and for different subperiods.[2] We find that on the whole the demand for money has been stable over these 40 years. The standard errors of our regressions show little variation whether we go from period to period or whether we aggregate temporally. And the income and interest rate coefficients obtained from regressions run over the five-year and ten-year subperiods are remarkably stable. These regressions are presented in Table 1.

The income coefficients from the five-year regressions range from 1.20 to 1.42 and, for the 10-year regressions, from only 1.29 to 1.35.[3] Interest rate coefficients indicate an inelastic response of money demand to interest rates in all instances. In the five-year regressions, however, the effect of interest rates on the demand for money is considerably less stable than that of income. The coefficients themselves go from −4.74 to −15.70; the elasticities (estimated at the mean) from −.13 to −.53. But in the 10-year regressions this

[1] Prior to the war, velocity in the United States—particularly that of M^2—trended downward, suggesting to many observers a secular decline. In contrast, the velocity of M^1 increased more or less steadily since 1946, while the velocity of M^2 increased from 1946 until the early 1960's, remaining relatively constant thereafter. Not surprisingly, the bulk of the income elasticities estimated in demand for money studies with postwar data have been markedly lower (.5 to .7) than the longer term estimates (1.0 to considerably above) covering both the prewar and postwar periods.

[2] All regressions which include the years 1929 through 1936 contain current and lagged failure rate variables. For justification of the variables see Gandolfi's earlier paper.

[3] Our finding that the income elasticities estimated cross-sectionally are both stable and greater than unity casts considerable doubt on the hypothesis that the postwar rise has been caused by a decrease in the income elasticity of demand. It implies that the low estimates of income elasticities others have found using postwar data are the results of specification bias rather than any systematic alteration in income elasticity.

TABLE 1—REGRESSIONS OF $ln\ (M/PN)=\beta_0+\beta_1\ ln\ y_p+\beta_2\ ln\ [(1+RB)/(1+RM)]$[a]

Period	β_0	β_1	β_2	SE	$\bar{R}^2$	ϵ_r	Period	β_0	β_1	β_2	SE	$\bar{R}^2$	ϵ_r
1929–33	−2.48	1.30	−14.30	.200	.89	−.44	1929–48	−2.69	1.29	−5.62	.212	.88	−.15
	(9.24)	(35.87)	(5.73)					(19.08)	(75.19)	(3.38)			
1934–38	−2.93	1.33	−4.74	.213	.86	−.13	1949–68	−3.08	1.34	−10.99	.198	.70	−.34
	(10.10)	(36.16)	(1.33)					(14.78)	(48.01)	(8.95)			
1939–43	−2.91	1.34	−15.26	.222	.83	−.35							
	(9.18)	(34.49)	(2.46)				1929–68	−1.94	1.20	−12.97	.212	.87	−.37
1944–48	−3.02	1.34	−9.87	.196	.75	−.24		(22.57)	(101.25)	(14.37)			
	(6.32)	(25.74)	(1.33)										
1949–53	−3.77	1.42	−8.67	.179	.77	−.22	*Yearly Intercepts*						
	(9.42)	(28.30)	(2.02)										
1954–58	−2.69	1.29	−11.64	.192	.68	−.35	1929–68		1.31	−18.80	.198	.80	
	(6.07)	(22.61)	(3.53)						(81.37)	(11.48)			
1959–63	−1.85	1.20	−15.70	.202	.62	−.53	1929–48		1.33	−17.33	.202	.85	
	(3.42)	(18.32)	(4.59)						(68.90)	(7.29)			
1964–68	−2.43	1.26	−11.29	.213	.55	−.39							
	(4.11)	(16.96)	(4.48)				1949–68		1.28	−20.31	.194	.67	
									(41.78)	(9.00)			
1929–38	−2.66	1.31	−11.10	.207	.88	−.32							
	(14.01)	(52.75)	(5.58)										
1939–48	−3.07	1.35	−11.95	.209	.85	−.28							
	(14.33)	(51.88)	(2.68)										
1949–58	−3.12	1.35	−12.68	.186	.73	−.35							
	(10.92)	(36.01)	(5.63)										
1959–68	−2.76	1.29	−12.21	.209	.62	−.42							
	(7.15)	(27.83)	(6.05)										

[a] For 1929–55 bank deposits (as of June 30) came from *All Bank Statistics* and for 1956–68 from the E.4 call reports, both of the Board of Governors of the Federal Reserve System. For 1929–48 interest expenses of banks came from the *Annual Reports* of the Comptroller of the Currency and for 1949–68 from the *Annual Reports* of the Federal Deposit Insurance Corporation. Long-term bond rates came from Standard and Poors, *Trade and Security Statistics;* state population from the *Population Report* of the Bureau of the Census; and both state personal income and the consumer price index from the *Survey of Current Business* of the Bureau of Economic Analysis.

The $\bar{R}^2$ omits the contribution of the yearly intercepts in the last three regressions. The elasticity of the interest rate variable, calculated at the mean, is ϵ_r and the numbers in parentheses are absolute values of t statistics.

variation decreases markedly, with the coefficients ranging from −11.10 to −12.68 and the elasticities from −.28 to −.42. What the pattern of the interest rate coefficients shows is that the exact opposite of the liquidity trap, reputed to have characterized the 1930's, occurred. Interest elasticities fell as the level of interest rates declined.

To analyze further the stability of our estimates we ran separate yearly cross-state regressions for each of the 40 years. In these regressions, both the income and interest rate coefficients varied more widely than in the five-year pooled regressions. Income coefficients ranged from 1.06 in both 1966 and 1967 to 1.50 in both 1950 and 1951, rising fairly consistently from 1.28 in 1929 to the peak of 1.50 and thereafter declining until they reached low points in 1966–67. The interest rate coefficients were even more widely dispersed than the income, ranging from −30.93 in 1967 to 16.98 in 1946.[4]

[4] We suspect, however, that these estimates overstate the true variability in interest rate coefficients. Since the long-term bond rates are the same for all states, variations in our interest rate variable in any one year will be due totally to differences in the rate of interest paid on money in different states. For years in which these differences are small—such as from the mid-1930's to the early 1950's—it will be difficult to obtain good estimates. Accordingly, the pooled regressions may give a more accurate picture, than the yearly regressions, of the effects of interest rates on money holdings.

The differences over time in our yearly estimates of demand functions are reflected further in results of analyses of covariance. For the period as a whole, and for the subperiods 1929–48 and 1949–68, we rejected the hypothesis of homogeneity of the yearly regressions. The F ratios to test the significance of the temporal differences in both slopes and intercepts were 2.27 and 1.54 for the subperiods and 3.02 for the whole period. None of these is of overwhelming magnitude, but they are all statistically significant at the .01 level.

What we want to find out is the source of this apparent instability. We wish to discover first whether it is due to a change over time in the relationship between money holdings and the explanatory variables—a change in the income and interest rate coefficients—or to some purely time-related omitted variable which would show up as a change in the intercepts. More important for the purposes of this paper, we want to know whether the apparent instability is essentially a cyclical or a secular phenomenon.

In answer to the first of these questions we found that we could account for the instability in yearly regressions by changes in intercepts rather than changes in the income and interest rate coefficients. For both of the 20-year subperiods and, more importantly, for the period as a whole the differences in yearly slope coefficients became highly insignificant after we allowed for separate yearly intercepts. The F ratio never exceeded .88 in any of these three instances. We also ran a covariance analysis of the differences between the coefficients of interest rates and income in the 1929–48 period versus the 1949–68 period, after allowing for differences in yearly intercepts within each subgroup. The regressions themselves are presented in the bottom half of Table 1. The visual impression of stability is further confirmed by the statistical tests. The differences in slope coefficients between these two subgroups are insignificant at the .05 level—an F ratio of 1.11.

Covariance analyses performed for the 1930's alone indicated homogeneity of slope coefficients for that decade. For the separate five-year periods 1929–33 and 1934–38 and for the two combined, the yearly income and interest rate coefficients showed no significant differences after we allowed for separate yearly intercepts. When we considered slopes and intercepts together we could not reject the hypothesis of homogeneity for the yearly regressions within the subperiod 1934-38 but could reject it—just barely at the .05 level—for the years within the subperiod 1929–33 and within the whole period 1929–38.[5]

To investigate the source of the instability of yearly intercepts we ran several tests. One was based upon regressions with separate intercepts for reference cycles, measured peak to peak. Comparing these regressions with regressions with single intercepts showed that the cyclical intercepts significantly reduced the unexplained variance for both the whole period and for the two 20-year subperiods analyzed separately. Comparing the regressions with cyclical intercepts with the regressions with separate yearly intercepts showed that the variation within cycles remained significant. However, as Table 2 demonstrates, the greater portion of the variations left unexplained by income and interest rates was among cycles and not within. Judged in terms of the mean square due to regression on the dummy variables for cycles relative to the mean

[5] This instability of the intercepts for the first five-year period differs from the results presented by Gandolfi in an earlier article. The difference is due to differences in the treatment of the two purely temporal variables—the interest rate and the price index. Gandolfi's deflator was implicitly permanent rather than the current prices used here. His interest rate variable was $ln\ (1+RM)$, which allows the effects of changes in the numerator of our expression to be picked up by the intercept.

square due to regression on the dummy variables for years (within cycles), it was almost eight times as great for the full period (1.039 versus .136). Judged in terms of the decrease in residual variances it was twice as great (.004 versus .002). Our conclusion is that the instability that we have uncovered is much more a secular than a cyclical phenomenon.

This conclusion is given further credence by an additional test. When we included a dummy variable for the contraction stage of all reference cycles in the regressions with individual cyclical intercepts, in no instance—in neither the full period nor the two 20-year subperiods—

TABLE 2—COMPARISONS OF INTER AND INTRA CYCLICAL VARIATIONS IN THE DEMAND FOR MONEY[a]

Period	Residual Variance from Regression With			Variations Due to Differences[b]	
	Single Intercept	Cyclical Intercepts	Yearly Intercepts	Among Cycles	Within Cycles
1929–68	.045	.041	.039	1.039	.136
1929–48	.045	.043	.041	.662	.176
1949–68	.039	.038	.038	.135	.082

[a] Data sources are given in Table 1.

[b] The variance among cycles is the difference in the sums of squared errors from regressions with single and with cyclical intercepts and the variation within cycles is the difference in the sums of squared errors from regressions with cyclical and with yearly intercepts, both divided by the appropriate degrees of freedom.

was this variable anywhere near significant. Moreover, its coefficient, which measures the deviation in contractions relative to expansions, was never greater than 1.6 percent. This evidence shows that even though there are significant variations in money demand within reference cycles they are not attributable to the cycle per se. They may merely be an extension of the departures we have observed among cycles.

III. Summary and Conclusions

The stability of the demand for money function is an issue that economists cannot ignore. As long as there exists a stable demand for money function, movements in the supply of money are the crucial determinant of movements in nominal income and prices. Our results, based upon time series of cross-state data, show that money demand has been basically stable both over the whole period we have investigated and in individual years of the decade of the 1930's. And the instability that we did uncover in our estimated demand functions is predominantly secular rather than cyclical. So our results imply that cyclical declines in general—and the Great Depression in particular—neither stem from, nor are aggravated by major structural changes in the demand for money.

Our findings also confirm the efficacy of monetary policy in counteracting substantial cyclical declines. They strongly suggest that, regardless of the initial cause of such a downturn in aggregate demand, changes in money supply can be a useful palliative. The argument by Friedman and Schwartz that the Federal Reserve could have mitigated the severity of the Great Depression seems to us, on the basis of our analysis, to be correct. This does not mean, however, that our evidence justifies continual "fine-tuning." We observe statistically significant short-run departures from our model. Such errors may make countercyclical policy of limited use in anything other than periods of severe economic problems.

Inherent in the Friedman and Schwartz position is the proposition that had the supply of money not been drastically shrunken between 1929 and 1933, the fall in income would have been self-limiting and relatively mild. The alternative explanation, that this decrease in the supply of money was a consequence rather than a

cause of the substantial fall in economic activity, is a logical possibility, but one which we find totally unconvincing. It implies that a fall in the demand for money due, say, to a fall in income will bring about a fall in the supply. There is no obvious reason why this would be the case. To argue so, one would have to demonstrate that the proximate determinants of the supply of money—particularly the deposit-currency and deposit-reserve ratios—are sensitive to the factors influencing the demand. But this argument is inconsistent with the evidence. If demand and supply were interdependent, then in view of substantial differences in conditions of supply over our sample period we would expect to see a good deal of temporal instability in our estimated income and interest rate coefficients. But since that was not the case, we suspect that the degree of interdependence has been small. The evidence accumulated by Phillip Cagan in his analysis of the money supply process leads to the same conclusion. Cagan found that the major movements in the deposit-currency and deposit-reserve ratios during severe reference cycle contractions were the result of panics rather than the falls in economic activity. He concluded further that these panics were themselves episodic and not the products of income declines.

If the influence in the Great Depression ran from income to money rather than the other way around, then it was indeed an historical anomaly marked by fundamental one-time changes in the way the general public and the banking sector formed their preferences. And since we find no evidence of such changes in the overall demand for money we are exceedingly suspicious of the argument that they occurred in these other areas of the economy.[6]

[6] Michael Darby's paper further substantiates this conclusion. He shows that the real sector of the economy had a much greater tendency to move toward full employment in the 1930's than was previously believed.

REFERENCES

M. Bronfenbrenner and T. Mayer, "Liquidity Functions in the American Economy," *Econometrica*, Oct. 1960, *28*, 810–34.

P. Cagan, *Determinants and Effects of Changes in the Stock of Money, 1875–1960*, New York 1965.

M. Darby, "Three-and-a-Half Million U.S. Employees Have Been Mislaid; Or an Explanation of Unemployment, 1934–1941," *J. Polit. Econ.*, forthcoming.

M. Friedman and A. J. Schwartz, *A Monetary History of the United States*, Princeton 1963.

A. Gandolfi, "Stability of the Demand for Money During the Great Contraction—1929–1933," *J. Polit. Econ.*, Oct. 1974, *84*, 969–83.

A. Meltzer, "The Demand for Money: The Evidence from the Time Series," *J. Polit. Econ.*, June 1963, *71*, 219–46.

C. Warburton, *Depression, Inflation and Monetary Policy*, Baltimore 1966.

Standard and Poors, *Trade and Security Statistics*, New York 1974.

U.S. Board of Governors of the Federal Reserve System, *All Bank Statistics*, 1959.

U.S. Bureau of the Census, *Current Population Reports*, Series p. 25, 1956 and various updates, 1957–68.

U.S. Bureau of Economic Analysis, *Survey of Current Business, Supplement: Personal Income by States*, 1956 and various issues, 1957–68.

U.S. Comptroller of the Currency, *Annual Reports*, 1929–68.

U.S. Federal Deposit Insurance Corporation, *Annual Reports*, 1929–68.