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Regulation Tomorrow: Toward a New Framework for Competition

By Roger Guffey
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Not long ago, a thoughtful banker spoke on the theme that "banking isn't fun any more." We all know what he meant: the regulatory burden of banks is becoming heavier and seems to be getting in the way of a banker's ability to do the job he wants to do in his community.

More than 15 major new pieces of legislation affecting banks have been sent forth from Congress in just the past decade or so. As a regulator, I am sensitive that we are more or less in the middle—striving to adjust to the constant demands of new legislation while seeking to continue to serve banking effectively. With the onrush of regulations, however, some days it isn't fun any more for the regulators either. But it's not hopeless. There are good opportunities ahead for thoughtful bankers to work with regulators and legislators to develop a financial system that acknowledges the complementary needs of financial institutions and the public. Moreover, the opportunity for all like financial institutions to compete on an equal basis—including S&L's, mutual savings banks, and others—should be the central theme of our mutual efforts. I am convinced that a financial system which permits the principles of the free market to operate, unfettered by oppressive regulation, is the most efficient way to allocate the total financial resources of our nation.

Much of the current regulatory framework is a heritage of the traumatic 1930s, when laws were implemented to restore public confidence in the banking system. These laws emphasized the protection of bank depositors and the prevention of bank failure.

Experience confirms that many of these laws, such as the one creating the Federal Deposit Insurance Corporation, served their purpose well. Other laws, however, written for another time and another purpose, now serve only to reduce competition without appreciably improving bank soundness and safety. A key example is interest payment restrictions on demand and savings deposits, originally designed to prevent "excessive" competition among banks.

The regulatory legacy of the '30s is still with us today. However, recent changes in technology, together with the growing competition from nonbank financial institutions and continuing inflationary pressures, have resulted in strong incentives to alter piecemeal much of this regulatory structure. Although the soundness of our financial system must continue to be of paramount concern, increasing emphasis needs to be given to competitive

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This article is excerpted from an address before the annual convention of the Colorado Bankers Association.

considerations if banks are to compete effectively with other financial institutions and continue to serve the deposit and credit needs of the public. Thus, I believe increased emphasis on enhancing competition should be a primary ingredient of future bank regulation.

PAYMENT OF INTEREST ON DEPOSITS

One major area in which legislative and regulatory reform will significantly increase competition—and ultimately economic efficiency—is the payment of interest on all types of deposits. The regulations on ceiling interest rates and the outright prohibition of interest on demand deposits are rooted in the Banking Acts of **1933** and **1935.** These laws arose out of the dangerously unstable condition of our banking system in the depths of the Depression. Since that time, Congress has extended this ceiling rate authority 13 times, most recently through Title **16** of the Financial Institutions Regulatory and Interest Rate Control Act of **1978** (FIRA), which extends it through **1980.**

In the past few years, pressure has been mounting to eliminate the prohibition against the payment of interest on demand deposits and to phase out what we know as Regulation Q ceilings. These pressures stem from two sources: the rise in the inflation rate, and the public's desire to receive a fair rate of return on deposits. As recently as **1976** the six-month Treasury bill rate was **5.25** per cent, about the same as the Regulation Q ceiling on passbook savings. Since that time, however, the Treasury bill rate jumped to **9.5** per cent in **1979,** while the passbook ceiling rate for commercial banks remained at the **1973** level of **5** per cent until July **1** this year, when it was raised to **5.25** per cent. To compensate for the disparity between market rates and those allowed under Regulation Q, new savings instruments have been introduced. The result has been the slow evolution of a complex array of time and savings instruments with varying interest rates and maturities. These instruments, now in **15** varieties, have confused savers, have led to discrimination among classes of savers, and may have lessened the incentive to save.

Depositors, however, are not the only ones penalized by interest rate ceilings. Regulated financial institutions are also hurt. While financial institutions have experienced increased operating costs associated with the multiple types of instruments available to depositors, they have also suffered serious problems of disintermediation during periods when market rates have risen above those allowed under Regulation Q.

Although some argue that interest rate ceilings are necessary to ensure a source of stable and low-cost funds to the borrowing public, the ceilings have not provided that result. Rather, the flow of funds away from institutions subject to Regulation Q provisions has periodically caused a shortage of funds for borrowers at times when these institutions could not compete with other market rates.

Our recent experience with interest rate prohibitions and ceilings has been less than satisfactory. The problems they have created have led to increased regulatory and legislative efforts to do away with or sidestep them. For example, the NOW accounts permitted in New England and New York provide depositors an interest-bearing transaction account. Automatic transfer services and bill-paying arrangements, until struck down by the U.S. Court of Appeals this past April, provided depositors outside New England and New York with an indirect method of earning a return on demand balances. Currently, bills are pending in Congress which would phase out or abolish interest rate prohibitions and ceilings, and the current Administration has put its support behind a gradual phaseout of all deposit interest rate controls. In my judgment, one result of these trends and developments is that

we are on the threshold of having Federal legislation to authorize NOW accounts for like financial institutions—including banks--on a nationwide basis.

BRANCHING RESTRICTIONS

Another area where legislative and regulatory change is likely to result in increased competition is the further relaxation of branching restrictions on financial institutions.

In recent years, the branching topic has become increasingly important, as technological progress and the growing incursion by other institutions into the traditional banking service areas have required greater competitive flexibility for banking. Advances in electronic payment mechanisms and the sharing of facilities by different banks and other financial institutions have led to the development of statewide and regional electronic transfer systems. With the growth in electronic banking has come an erosion in the importance of political boundaries in governing competitive interaction among financial institutions. Banks have, or soon will have, the capability to serve their customers electronically over great distances. Restrictive state branching laws, which did not anticipate such advances or the ability to perform interstate and even international business through loan production offices or Edge corporations, must adapt if our banking system is to compete effectively with other financial and nonfinancial institutions which are unfettered by such restriction.

To the extent that state branching laws are not sufficiently flexible to allow banks to compete with these new technologies, they will force the creation of innovations to circumvent their restrictions.

In my judgment, technological and competitive considerations will bring increasing pressure for reform in state branching laws. This reform may come in fits and starts, with development of reciprocal branching agreements among states and the linking of EFT systems. But most of us would prefer that reform evolve in a more comprehensive and efficient manner by allowing nationwide linking of electronic systems among many types of financial systems while clearly defining the allowable types of transactions. Such an approach would assure that no state would be left at a competitive disadvantage and would allow financial institutions to plan for the future in a more certain environment.

RESERVE REQUIREMENTS

Another competitive issue is reserve requirements. Member bankers feel strongly that the cost of holding idle reserves has hindered them in competing with nonmember banks and other financial institutions. And as more and more types of institutions begin to offer transaction services, greater attention will have to be focused on establishing equitable reserve requirements. Increasing competition for sources of funds, rapid inflation, and high interest rates have combined to force bankers to take a close look at the cost of membership. Many banks have reacted by withdrawing from the System. From 1945 to 1970 the proportion of U.S. banking deposits controlled by member banks fell from 86 per cent to 80 per cent, and from 1970 to 1979 shrank to 72 per cent, complicating the Federal Reserve's task of implementing monetary policy. Aside from the membership implications of the reserve burden, a number of economists have attacked the present system of required reserves as inefficient, saying it allocates resources poorly. They question whether a desired level of investment in banking can occur relative to other industries if bankers are required to hold a portion of their assets in nonearning balances.

Thus, if our banking system is to be competitive with other financial institutions, both here and abroad, and with other industries, the burden of idle reserves must be

eliminated. As well documented in discussions of the membership issue, lower reserve requirements and/or the payment of interest on reserves are the two primary methods suggested for lessening this reserve burden.

Member bankers may be assured that the Federal Reserve Bank of Kansas City will continue to urge an early resolution of the membership issue and an easing of the reserve burden.

SUMMARIZING THE ISSUES

In summary, we know now that some of the 1930s banking legislation serves only to reduce banking competition without producing any measurable gains in the efficiency of the banking system. Moreover, as a result of restrictions on bank activities and deposit interest rates, and partly as a result of banker attitudes, the role of commercial banks in the financial sector has been gradually usurped by other financial institutions and new credit arrangements. This change has become more rapid since the late 1960s, as the burdens of interest ceilings and reserves have increased with inflation, and technology has fostered new payment practices. Banks have been particularly vulnerable to this combination of circumstances, given the nature of their assets and their special need to attract both deposits and capital.

What concerns me most about the recent financial growth and development outside the banking sector is that it has occurred mainly because banking laws have been too slow to adapt to changing conditions and the demands of the public, and not because banks have lost their desire to deliver financial services in an efficient way. Therefore, bankers and regulators should both have a strong interest in developing and supporting a new regulatory framework which ensures that commercial banks are allowed to offer competitive services to the public. At the same time, that framework must preserve the essential features which contribute to a sound banking system deserving of public confidence.

If we continue to embrace the outdated and largely anti-competitive aspects of the banking laws of the 1930s, the morass of piecemeal, patchwork fixes so characteristic of legislative and regulatory response will continue to hold us back.

Change, and now accelerating change, has brought us a new ballgame. It demands a comprehensive understanding of how the game is to be played, not rules made up as the game goes along. We all should support a fundamental review of the environment in which financial institutions operate and compete today, with a view toward legislating a financial system which recognizes the importance of improved competition and economic efficiency in the financial arena.

As these issues are aired in national forums in the period ahead, I know that thoughtful bankers will continue to draw upon their experience to counsel their lawmakers and regulators. I hope that legislators will consider fully the traditional principles of free enterprise in their decisionmaking. I hope we can establish a financial structure in which all like institutions can compete equitably. Let us have reasonable equity in requirements for capital, liquidity, and taxation. Let the marketplace decide what institutions should provide what services and at what prices.

As change inevitably occurs in banking, and as bankers and regulators join to encourage a responsive regulatory framework for financial institutions, the Federal Reserve intends to support a system that acknowledges the needs of both banks and bank customers.

Inventory Recession Ahead?

By Stephen L. Able and Dan M. Bechter

Business sales have grown faster than business inventories during the current expansion. The resulting decline in the inventory-sales ratio has been viewed as evidence that inventories are now under tighter control than during previous expansions. It is also widely believed that this improved inventory control has reduced the chances that cyclical swings in economic activity will be exacerbated by severe fluctuations in inventory investment.

This article shows that a lower risk of a severe inventory recession does not necessarily follow from improved inventory control. A standard model of inventory investment is used to identify two dimensions of better inventory control: lower inventory-to-sales ratios, and faster adjustments to desired stocks of inventories. Empirical support for the hypothesis of improved inventory control is provided by comparing values of these inventory control parameters, estimated for the post-1975 period, to values estimated for an earlier period. The implications of tighter inventory control for the volatility of inventory investment are then explored. A simulation forecast is used to show that, because the two dimensions of tighter inventory control work in opposite directions as far as the size of inventory adjustments are concerned, better inventory management does not necessarily reduce the chances of a sharp inventory recession in the future.

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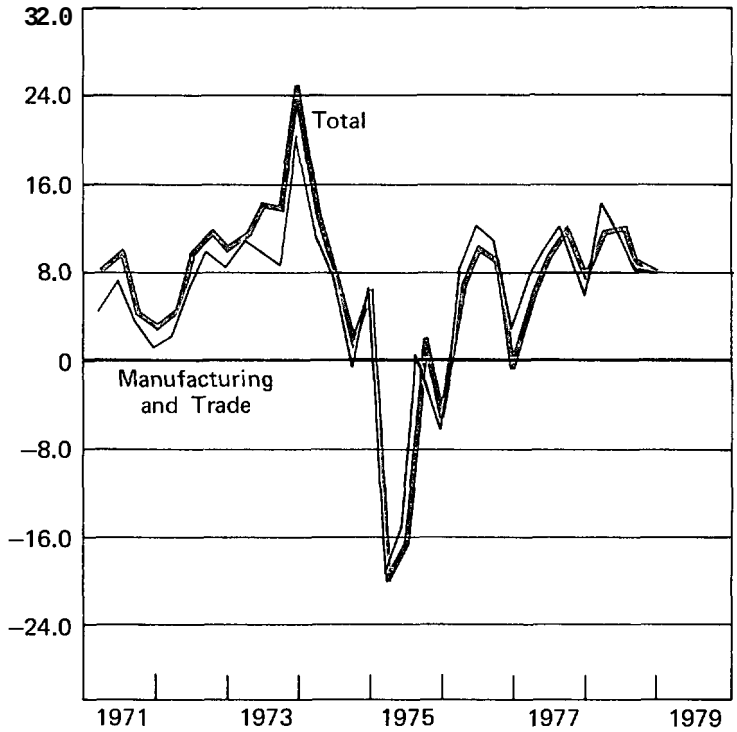
A BRIEF LOOK AT THE BEHAVIOR OF INVENTORY INVESTMENT

The volatility of changes in business inventories has been an important factor in downturns of the economy. When final sales of goods are rising, businesses at all stages of production and distribution usually add to their stocks of inventories, and this accumulation acts to stimulate the economy. But when final sales of goods decline, businesses do not fully replace inventories, allowing them to shrink. As a result, inventory investment switches from being a contributor to being a drag on aggregate demand, further accentuating the size and duration of the fall in output.

The recession of 1974-75 has been considered somewhat atypical, since inventory investment continued positive through all of 1974. However, real inventory investment, although positive, weakened considerably as a source of final demand in 1974, before turning sharply

Chart 1
CHANGES IN BUSINESS INVENTORIES
(In billions of 1972 dollars, at annual rates)



negative in the first half of **1975** (Chart **1**).[1]

This article focuses on inventory changes in manufacturing and trade. As Chart 1 shows, changes in manufacturing and trade inventories account for most inventory investment.' Table **1** shows the close association, in both size and volatility, between changes in total business inventories and changes in manufacturing and trade inventories during **1973-75.** Even though inventory investment is very small relative to gross national product, a swing of $26 billion (from +$16 billion to —$10 billion) in total inventory investment from **1973** to **1975,** and of **$23** billion in manufacturing and trade, accounted for almost **80** and **70** per cent,

[1] Using its survey data on the book value of business inventories, the **U.S.** Department of Commerce makes adjustments for price changes and for differences in business accounting methods to arrive at estimates of the quarterly real stock of business inventories measured in constant 1972 dollars. These quarterly series of inventories in constant dollars are available for various industry classifications.

[2] Five-sixths of total inventory investment in the last 20 years has been in manufacturing and trade. Perhaps more important for purposes of this analysis, virtually no volatility in the inventory investment data is sacrificed by concentrating on changes in manufacturing and trade inventories. Between 1959:1 and 1978:4, two measures of the volatility of inventory investment, the mean absolute change and the standard deviation of the change, show the volatility of inventory investment in manufacturing and trade to be equal to that of total inventory investment, and four times the size of the combined volatility of farm and "other nonfarm" inventory investment, the categories of total inventory investment not included in manufacturing and trade.

Table 1
CHANGES IN GNP AND AGGREGATE INVENTORIES
(In billions of 1972 dollars)

	Gross National Product	Change in Business Inventories	Change in Manufacturing and Trade Inventories
1973	$1,235	$+16	$+13
1974	1,218	+ 8	+ 7
1975	1,202	-10	-10

respectively, of the $33-billion decline in gross national product in those two years.

In the study of the statistical variability of a data series, such as inventory investment, one can make a case for disaggregating the data when the components of the aggregated series are not highly correlated with one another. Low correlations imply that the various components have different explanations. The levels of inventory investment in the manufacturing component and in the trade component are only weakly correlated with each other, and changes in these levels show even less correlation. Thus, separate analyses of manufacturing and of trade inventories appear necessary. On the same basis, disaggregating trade into retail and wholesale components, and disaggregating manufacturing into finished and unfinished goods (materials and goods in process), are also justified by low correlations. Charts 2 and 3 show the diverse movements of these components of inventory investment in recent years.[3]

[3] Further disaggregations are possible and were explored, but for the purpose of this study, they were not considered necessary. Reaggregations also come to mind, such as lumping manufacturers' finished goods inventories with the inventories of retailers and wholesalers, on the grounds that trade inventories are also finished goods. But very low correlations between changes in trade inventories and changes in manufacturers' finished goods inventories argue against such a "total finished goods" approach to explaining inventory investment.

The ratio of combined manufacturing and trade inventories to sales declined sharply from 1975 to 1978. The decline in this inventory-sales ratio lends support to the popular view that inventory control may be tighter now than formerly. When both inventories and sales are adjusted for inflation, however, and when the data are disaggregated along the lines discussed above, it turns out that only in manufacturing has there been a marked drop in the inventory-sales ratio since 1975 (Table 2). Moreover, comparisons with other high-employment years (*e.g.*, 1973) show that current inventory-sales ratios are not all that low for this stage of a business cycle. Nonetheless, much is heard and read about the "lessons" businesses learned from the recession of 1974-75, about the improved technology used in inventory management, and about the greater attention being given to tighter control of inventories. Succeeding sections in this article establish a means for testing the hypothesis of improved inventory control and explore the implications of the test results for inventory investment.

A STANDARD MODEL OF INVENTORY INVESTMENT

Most econometric studies of inventory

Table 2
CONSTANT-DOLLAR INVENTORY-SALES RATIOS FOR MANUFACTURING AND TRADE, SEASONALLY ADJUSTED SELECTED YEARS, 1967-78

	Manufacturing and Trade	Manufacturing	Retail Trade	Wholesale Trade
1967	1.61	1.90	1.42	1.20
1970	1.68	2.07	1.39	1.22
1973	1.53	1.78	1.39	1.17
1975	1.67	2.04	1.36	1.33
1978	1.55	1.77	1.39	1.30

behavior employ the partial stock adjustment framework. On the basis of current and expected future economic conditions, businesses are assumed to determine the stock of inventories they would like to hold in each time period. It is further assumed that firms eliminate only a portion of any discrepancy between desired and actual stocks during any period. The partial stock adjustment model is often expressed by the following equation:

$$(1)\ II = s \bullet (KI^* - KI_{-1})$$

where

II = Inventory investment during the current period,

KI^* = Desired stock of inventories by the end of the current period,

KI_{-1} = Actual stock of inventories held at the end of the previous period, and

s = The fraction of the discrepancy between desired and actual inventory stocks which may be eliminated in a single period.

This equation states that the amount of inventory investment, II, undertaken during the current period is related to the difference between the desired stock of inventories, KI^*, and the actual stock of inventories on hand, KI_{-1}. The larger the fraction, s, the more

Chart 2
CHANGES IN TRADE INVENTORIES
(In billions of 1972 dollars, at annual rates)

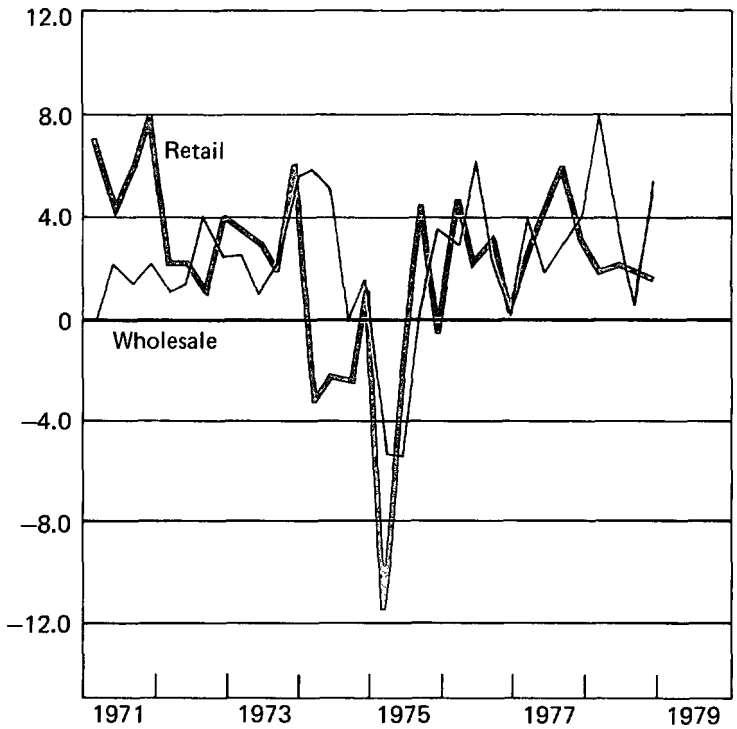
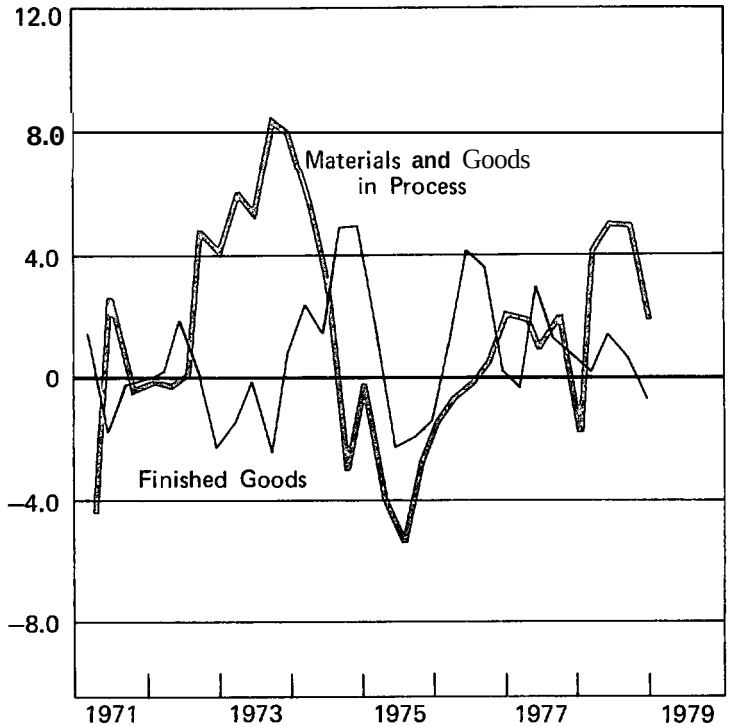


Chart 3
CHANGES IN MANUFACTURERS' INVENTORIES
(In billions of 1972 dollars, at annual rates)



rapidly eliminated is the difference between desired and actual stocks of inventories. Thus, s is also referred to as the speed-of-adjustment parameter in the inventory investment model.

Use of equation 1 for empirical purposes requires specifying the determinants of the desired stock of inventories. Because a number of factors may induce a business enterprise to hold a stock of inventories, a number of variables may be included in an inventory investment equation.

The rationale for holding inventories is that, because the receipt of goods is not likely to be perfectly synchronized with their use and sale, a firm will want to maintain stocks of materials and/or finished goods in order to reduce the likelihood of a disruption in its daily pattern of activity. Also, because production takes time, a manufacturer usually holds a stock of work in progress. The size of the stock of inventories held to satisfy these transactions motives will depend primarily on the firm's anticipated scale of operations, which may be measured by its expected sales. Because expected sales are not observable, actual sales are generally included in an inventory equation instead.[4]

[4] One justification for the use of actual sales is as follows: At the end of a period, a firm wishes to hold a stock of inventories which equals a proportion, i, of the sales expected during the following period. Thus,

(a) $KI^* = i \cdot S^e_{+1}$

where KI* is the desired inventory stock in the current period and S^e_{+1} represents expected sales in the following period. If naive expectations are assumed, that is if expected sales are assumed equal to current sales,

(b) $S^e_{+1} = S$,

A speculative motive for holding inventories may also exist. If a business enterprise expects the price of its product to rise, it may try to increase its product inventories in the current period in the hope of earning a capital gain upon their sale in the future. If a manufacturer expects the price of its inputs to rise in the future, it may hold additional stocks of materials for the same reason. Thus, the desired stock of inventories might be influenced by the expected rate of inflation.

A business firm also incurs costs, such as storage, handling, and financing costs, which must be weighed against the benefits from holding inventories. The higher these costs, the greater the willingness of the enterprise to risk disruption in its daily routine, and the less eagerly will the enterprise speculate in inventory stocks. Therefore, the stock of inventories held by a firm is likely to decline as the cost of holding it rises. The most easily identified cost to the firm is that of financing, which may be represented by the rate of interest on business loans used for accumulating inventories.

Despite the theoretical plausibility of including the rate of inflation and the rate of interest as determinants of the desired stock of inventories, previous empirical studies have generally not found these variables to be significant.[5] This study also failed to uncover a significant relationship between the level of inventory investment and rates of inflation and interest. Therefore, the level of sales was treated as the primary determinant of the desired stock of inventories. This relationship may be expressed by the following equation:

$$\textbf{(2)}\quad KI^* = a + i \bullet S$$

where

KI^* = The desired stock of inventories by the end of the current period, and

S = The level of sales during the current period.

The coefficient, a, measures the average impact of all determinants other than sales on the desired stock of inventories. The coefficient, i, measures the size of the change in the desired stock of inventories which arises in response to a one-unit change in the level of sales. Because it measures the incremental relationship between the desired inventory stock and actual sales, i is referred to as the desired ***marginal inventory-sales ratio.***

When the expression for the desired stock of inventories given in **(2)** is substituted for KI* in (1), the following basic equation for inventory investment is obtained:[6]

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equation (a) may be rewritten as

$$\textbf{(c)}\quad KI^* = i \bullet S.$$

Other, more complicated expectations schemes also allow inclusion of actual sales as a determinant of the desired stock of inventories. See, ***e.g.***, Michael C. Lovell, "Manufacturers' Inventories, Sales Expectations, and the Acceleration Principle," ***Econometrica*** **(July 1961)**, pp. 293-314.

5 For a recent discussion of this topic, see Martin Feldstein and Alan Auerbach, "Inventory Behavior in Durable Goods Manufacturing: The Target Adjustment Model," ***Brookings Papers on Economic Activity, 2***, 1976, pp. 391-93.

6 It is common practice to add other explanatory variables to the basic model in (3) when estimating inventory investment equations. In this study, some of the estimated inventory equations included the change in sales and the level of unfilled manufacturing orders, as well as sales and lagged inventory stocks. For a fairly exhaustive list of potential explanatory variables for use in inventory equations, see Paul G. Darling and Michael C. Lovell, "Factors Influencing Investment in Inventories," ***The Brookings Quarterly Econometric Model of the United States.*** Duesenberry ***et. al.***, ed., pp. 131-62.

$$(3)\ II = s \bullet (a + i \bullet S - KI_{-1})$$

$$II = a' + b \bullet S - s \bullet KI_{-1}$$

where

II = Inventory investment in the current period,

S = Sales in the current period,

KI_{-1} = Inventory stocks in the previous period,

a' = $a \bullet s$,

b = $i \bullet s$,

s = The speed of adjustment parameter, and

i = The desired marginal inventory-sales ratio.

By applying ordinary regression techniques to equation (3), estimates of the speed of adjustment and the marginal desired inventory-sales ratio may be obtained. An estimate of the speed of adjustment is obtained directly from the estimated coefficient associated with the lagged inventory stock. An estimate of the marginal inventory-sales ratio may be obtained indirectly from the estimated coefficients associated with current sales and with the lagged inventory stock.[7] Empirical evidence regarding these inventory control parameters is presented in the following section.

[7] The estimated value of i is obtained from the regression results associated with (3) by dividing the coefficient on sales, b, by the coefficient on the lagged stock of inventories, s.

ESTIMATES OF THE INVENTORY INVESTMENT MODEL

To test the hypothesis that a shift toward greater inventory control has occurred since the 1974-75 period, inventory investment equations based on the model described above were estimated over two different sample periods. The first period, which was selected to identify the characteristics of inventory behavior prior to 1976, includes approximately nine years of quarterly data beginning in the second quarter of 1967 and ending in the fourth quarter of 1975. The second period covers inventory behavior since the first period and includes three years of quarterly data from the first quarter of 1976 through the fourth quarter of 1978.[8]

Four equations were estimated using data from each of the two sample periods: two for inventory investment by manufacturers (one for materials and work in progress and one for finished goods) and the other two for inventory investment by nonmanufacturers (one for wholesale trade and one for retail trade). The estimated coefficients related to the issue of improved inventory control, namely the

[8] Data earlier than 1967 are not available for some of the series. All dollar values were adjusted for inflation (measured in constant 1972 dollars). The choice of sample periods might be criticized on the grounds that the longer, earlier sample period includes periods of both economic expansion and contraction, while the shorter, more recent sample period is one of expansion only. Inferences based on comparisons of inventory control parameters in the two sample periods might therefore seem unjustified. To check for such bias, periods of economic contraction were omitted from the longer sample period, and the equations were reestimated. The estimated values of the inventory control parameters were affected very little. There is no way of knowing whether the inventory control exhibited during the 1976:1-1978:4 expansion will be maintained in the event of a recession. The objective here is not to forecast, but to challenge the conventional view that inventory behavior since 1975 shows a reduced risk of sharp inventory changes in the future.

Table 3
SELECTED ESTIMATION RESULTS FOR THE INVENTORY EQUATIONS

	Marginal Desired Inventory-Sales Ratio		Speed of Adjustment		$\bar{R}^2$	
	1967.2–1975:4	1976·1–1978·4	1967·2–1975:4	1976.1–1978:4	1967:2–1975:4	1976:1–1978:4
Manufacturing: Materials and Work in Progress	.78	.37	.20	.57	.72	.61
Manufacturing: Finished Goods	.22	.26	.11	.57	.15	.57
Retail Trade	1.31	1.60	.52	.32	.47	†
Wholesale Trade	1.60	1.50	.23	.19	.67	†

NOTE: $\bar{R}^2$ is the multiple correlation coefficient adjusted for degrees of freedom.
† The adjusted multiple correlation coefficients for the trade sector fell below 0.

marginal inventory-sales ratio and the speed-of-adjustment parameter, are presented for each of the estimated equations in Table 3, while more complete results are reported in the Appendix.

The results for the trade sector are contrary to the hypothesized improvement in the control of inventories. For both retail and wholesale trade, the marginal inventory-sales ratio is greater in the later period than in the earlier period, and in retail trade, the speed of adjustment to the desired inventory stock is lower in the later period. However, because the trade equations fit the data so poorly over the 1976-78 sample period, it was not believed that a comparison of these results with the earlier periods could be justified.[9] The remaining discussion therefore concentrates on the manufacturing equations.

The estimates in Table 3 suggest that a shift toward greater inventory control by manufacturers has occurred since the end of 1975.[10] For materials and work in progress, the desired inventory-sales ratio is much lower in the later period (0.37) than in the earlier period (0.78). For materials and work in progress and for finished goods, the speed of adjustment is more rapid in the later period (0.57 for both finished goods and work in progress) than in the earlier period (0.11 for finished goods and 0.20 for materials and work in progress).

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9 The multiple correlation coefficient, R^2, is the basic measure of how well an equation fits the sample data. A value close to 1 implies a very good fit, a value close to 0 a very poor fit. It is common practice to adjust the value of R^2 to take into account the number of explanatory variables included in an equation. If both the sample size and the original multiple correlation coefficient are quite small, it is possible for the adjusted coefficient to become negative. The negative values of $\bar{R}^2$ associated with the trade equations thus imply a very poor fit of the sample data.

10 The following discussion is based on the face value of the estimated coefficients. Because of the small sample size associated with the 1976-78 period, statistically significant evidence regarding structural shifts in the inventory equations was neither expected nor found. However, in experiments with other sample periods, the inventory-control parameters did remain reasonably stable, suggesting that the dramatic change occurring in these parameters during the 1976-78 period should be viewed as real.

Despite this evidence of improved inventory control, it is not necessarily true that inventory adjustments are now less likely to exacerbate cyclical swings in economic activity. In the short run, the impact on the level of inventory investment of a lower desired inventory-sales ratio and of a more rapid adjustment to the desired stock may be offsetting. While a lower inventory-sales ratio implies that a smaller decline in the level of inventories will be desired in response to a decline in sales, a higher speed of adjustment implies that more of any desired change in inventories may be achieved in a single period. Hence, a decline in sales may initially lead to a greater decumulation of inventory stocks if inventory control has improved.

An example

A simple example serves to illustrate the combined effect of the two aspects of improved inventory control (see Table 4). To begin with, assume that a business enterprise wishes to maintain an inventory-sales ratio of 2.0 and that sales are projected at 100 units per month. Also assume that the enterprise is currently holding 200 units (200/100 = 2) of inventory, so that the desired and actual stocks of inventories are the same. Finally, assume that the speed of adjustment for the firm is 0.25, so that only one-fourth of any discrepancy which does arise between the desired and actual stock of inventories can be eliminated in a single period. Given this set of assumptions, if sales for some reason were projected to fall to (and to remain at) 96 units per month, the enterprise would wish to reduce its stock of inventories to 192 units in order to maintain its desired inventory-sales ratio (192/96 = 2). Because only a fourth of this discrepancy of 8 units could be eliminated in a single period, inventory investment in the first quarter following the revised sales projection would be negative 2 units (0.25 x 8). In the following periods, inventory investment would be negative 1.5 units (0.25 x 6), negative 1.125 units (0.25 x 4.5), negative 0.87 units (0.25 x 3.375), and so on.

Now assume that a change in inventory management reduces the desired inventory-sales ratio to 1.5, without altering the speed of adjustment. At the initial level of sales, 100 units per month, the firm would wish to hold only 150 units of inventories (150/100 = 1.5), and a reduction in sales to 96 units would reduce the desired stock of inventories by only 6 units (150-144) instead of 8. With the same speed of adjustment as assumed before (0.25), the decline in the stock of inventories in each quarter following the change in the expected level of sales would be less after the change in inventory policy than before. For example, first quarter inventory investment would be negative 1.5 units (0.25 x 6) rather than 2 units as

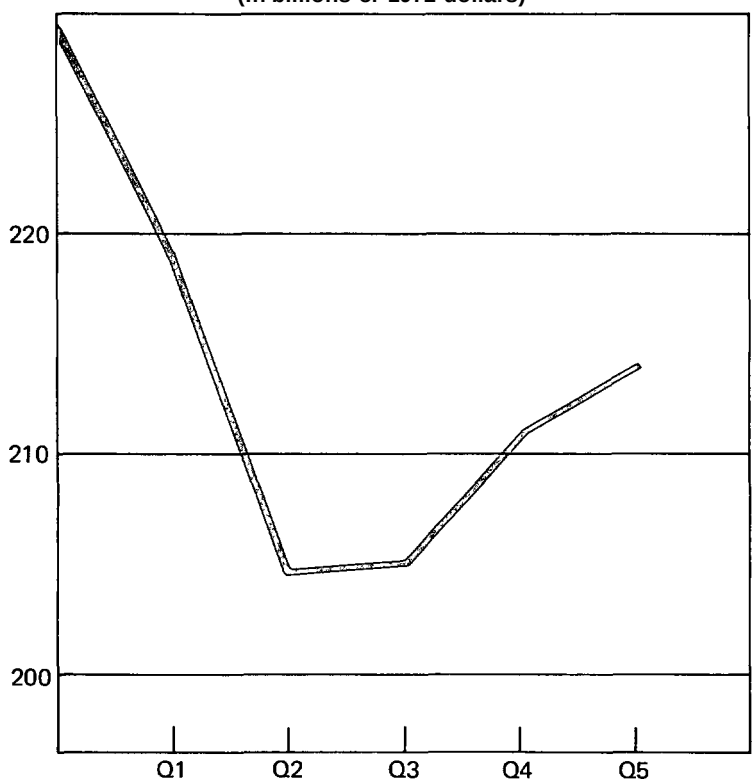
Table 4
IMPACTS OF HYPOTHETICAL CHANGES IN INVENTORY-SALES RATIO AND SPEED OF ADJUSTMENT ON INVENTORY INVESTMENT

	Case 1	Case 2	Case 3
Desired Inventory-Sales Ratio	2.00	1.50	1.50
Speed of Adjustment	0.25	0.25	0.50
Decline in Sales	4	4	4
Decline in Desired Inventory Stock	8	6	6
Inventory Investment Following Decline in Sales			
First Quarter	−2.00	−1.50	−3.00
Second Quarter	−1.50	−1.13	−1.50
Third Quarter	−1.13	−0.87	−0.75

before. In the second quarter, investment would be negative 1.125 units (0.25 x 4.5) rather than 1.5, in the third quarter 0.87 units (0.25 x 3.375) rather than 1.125, and so on. Because inventory investment would be less negative after the change in policy, it would contribute less to a downturn in economic activity signaled by a decline in sales.

Now assume that the decline in the desired inventory sales ratio from 2 to 1.5 is accompanied by an increase in the speed of adjustment from 0.25 to 0.5. The initial conditions remain the same as in the second example above, with sales equaling 100 units and the desired stock of inventories equaling 150 units. The 6-unit difference between the actual and desired stock of inventories resulting from a decrease in sales to 96 units is also the same as in the second example. However, the resulting pattern of inventory investment is not the same. In the first period, after the decline in sales, inventory investment equals negative 3 units (0.5 x 6) after the shift toward improved control, which is greater than the negative 2 units which occurs before the shift. This larger first-period decumulation of inventories occurs despite the smaller total decumulation of inventories needed to maintain the desired inventory-sales ratio, because the more rapid speed of adjustment causes a greater proportion of the needed decumulation to occur in the first period. While the decumulation in

Chart 4
MANUFACTURING SALES PATTERN ASSUMED FOR USE IN INVENTORY INVESTMENT SIMULATION
(In billions of 1972 dollars)



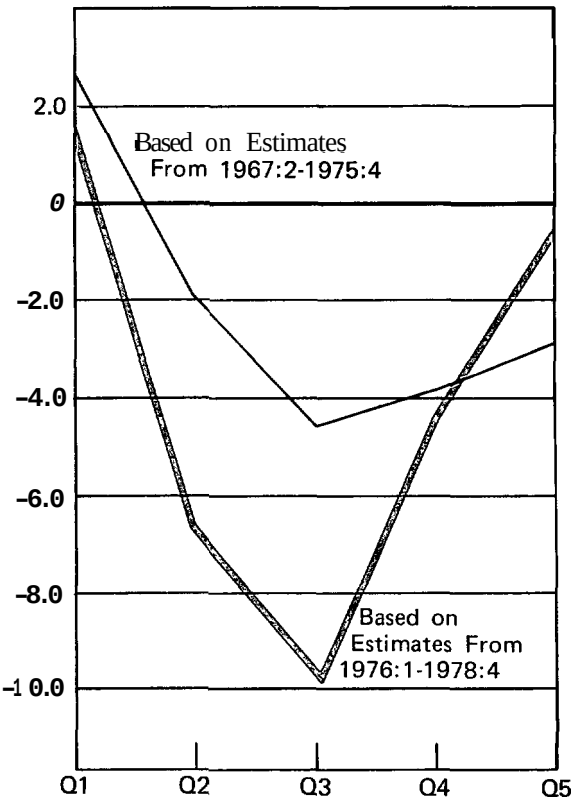
subsequent periods is less than before the shift (see Table 4), the initial impact of the shift to improved control is to make inventory investment more negative than it would have otherwise been, and thus contribute more to the cyclical downturn likely to correspond to the decline in sales.

This example illustrates the conflicting impact of the two aspects of improved inventory control on the size of inventory adjustments made in response to declines in sales. A decrease in the desired inventory-sales ratio implies that a given decline in sales will require a smaller reduction in inventory stocks. An increase in the speed of adjustment, however, implies that a greater proportion of any change in the desired stock of inventories will occur in the periods immediately following a decline in sales. The impact on investment behavior of a shift toward improved inventory control will thus depend upon the magnitude of the shifts in the desired inventory-sales ratio and the speed of adjustment.

A simulation experiment

A simulation experiment was conducted to determine the overall effect on inventory investment of the shift toward improved control implied by the estimates given in Table 3. First, a hypothetical data series for manufacturing sales was constructed, on the basis of an assumed decline and subsequent moderate recovery in the level of sales similar to that which occurred from late **1974** through **1975.** The pattern of the assumed data series is shown in Chart 4. Inventory investment in manufacturing was then "forecast" on the basis of this sales pattern with both the **1967:2-1975:4** and **1976:1-1978:4** versions of the estimated model. The simulated path of manufacturing inventory investment resulting from this experiment is presented in Chart **5,** while Chart **6** presents the corresponding simulated path for aggregate inventory investment (manufacturing plus trade) based upon this same experiment.

Chart 5
SIMULATED INVENTORY INVESTMENT: MANUFACTURING
(In billions of dollars, at annual rates)

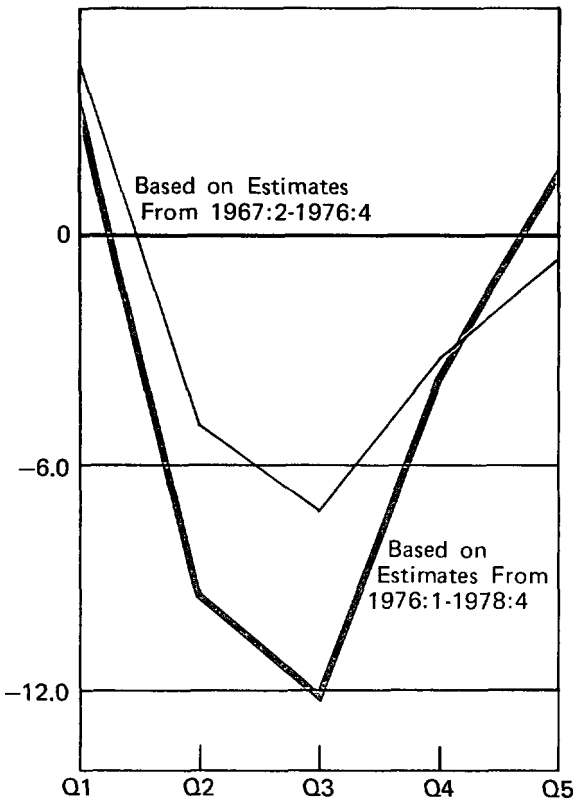


The results suggest that the increased speed of adjustment dominates the reduction in the desired inventory-sales ratio during and shortly following periods of declining sales. Rather than reducing the contribution of inventory adjustments to cyclical downturns, the shift toward greater inventory control implied by the estimated model would appear to have increased this contribution.

CONCLUSION

This study of inventory behavior provides

Chart 6
SIMULATED INVENTORY INVESTMENT: MANUFACTURING AND TRADE
(In billions of 1972 dollars, at annual rates)



empirical support for the popular notion that manufacturers are controlling their inventories more closely than before, even though the post-1975 period is too short to provide definitive statistical evidence of such control. It does not necessarily follow, however, that the chances of large inventory swings have been reduced. While lower inventory-sales ratios, taken alone, do suggest smaller required adjustments in inventories, the ratio of inventories to sales is only one of two important inventory-control parameters. The other parameter is the speed with which businesses make desired adjustments to inventories. The faster this speed of adjustment, the greater the initial change in business inventories. Since the two inventory-control parameters work in opposite directions, the implication of improved inventory control for the business cycle becomes an empirical question. In terms of the overall impact on the size of inventory adjustments, the estimates derived for this study suggests that an increase in the speed of adjustment has occurred which more than offsets the reduction in the inventory-sales ratio. The findings reported in this article therefore do not support the notion that the potential contribution of inventory investment to a cyclical downswing has lessened since 1975 because of improvements in inventory control.

Appendix

Table A.1
SUMMARY OF ESTIMATION RESULTS FOR THE INVENTORY INVESTMENT EQUATIONS
(Sample Period: 1967:2-1975:4)

Inventory Investment in	Estimated Coefficients: Constant	Sales	Change in Sales	Unfilled Orders	Lagged Stock	Implied Marginal Desired Inventory-Sales Ratio	$\bar{R}^2$	S.E	D W.
Manufacturing:									
Materials and	1.36	.159	–	.047	–.204	.78	.720	.506	2.20
Work in Progress	(.9)	(5.6)	–	(3.8)	(-8.6)				
Manufacturing	2.72	.024	–.037	–	–.110	.22	.150	.358	1.84"
Finished Goods	(1.5)	(.9)	(-2.3)						
Distributive Trades:	1.95	.687	–.204	–	–.524	1.31	.474	.628	1.90
Retail	(1.9)	(5.2)	(–2.4)		(-5.4)				
Distributive Trades:	–.14	.366	–	–	–.233	1.60	.668	.347	2.30
Wholesale	(.3)	(8.2)			(–8.2)				

NOTE $\bar{R}^2$ equals multiple correlation coefficient corrected for degrees of freedom. SE equals standard error of estimate. DW equals Durbin-Watson statistic.
'The equation for manufacturers' finished goods was estimated with a correction for first order serial correlat~onThe Durbin-Watson statistic for the original equation was 1 38 and the estimation coefficient of serial correlation equal to .497

Table A.2
SUMMARY OF ESTIMATION RESULTS FOR THE INVENTORY INVESTMENT EQUATIONS
(Sample Period: 1976:1-1978:4)

Inventory Investment in	Estimated Coefficients: Constant	[illegible]	Change in Sales	Unfilled Orders	Lagged Stock	Implied Marginal Desired Inventory-Sales Ratio	$\bar{R}^2$	S E	D W
Manufacturing'									
Materials and	25.92	2.11	–	.073	–.567	0.37	.614	.387	2.06'
Work in Progress	(1.8)	(2.7)		(1.9)	(-7.0)				
Manufacturing:	13.74	.148	.094	–	–.568	0.26	.566	.259	2.22
Finished Goods	(4.0)	(2.0)	(-2.0)		(-3.0)				
Distributive Trades:	-2.35	.508	103	–	–.323	1.57	t	.381	1.73
Retail	(–.5)	(1.3)	(–1.0)		(-1.4)				
Distributive Trades:	.99	.290	–	–	–.189	1.53	†	.597	2.14
Wholesale	(.3)	(.5)			(– 5)				

'The equation for manufacturers' materials and work in progress was estimated with a correction for first order serial correlat~on.The original Durbin-Watson statistic was 2.62 and the estimated serial correlat~oncoefficient was – 3647
†The adjusted R^2's for equations in the trade sector were negative.

The Effect of Money Market Certificates of Deposit on the Monetary Aggregates and Their Components

By ***Scott*** *Winningham*

On June 1, 1978, the Federal Reserve System and other regulatory agencies gave banks and nonbank thrift institutions the authority to issue a new type of time deposit called a money market certificate of deposit. The action was taken to prevent rising market interest rates from adversely affecting the flow of savings into financial institutions. As authorized, MMC's bear a maximum interest rate that changes each week with the average yield on new issues of 6-month Treasury bills, mature in six months, and require a minimum denomination of $10,000. Commercial banks may pay the 6-month Treasury bill rate, and nonbank thrift institutions one-quarter percentage point more.'

This article analyzes the effects of MMC's on the monetary aggregates and their components.= As is well known, the monetary aggregates play an important role in the conduct of monetary policy. The Federal Reserve System regularly establishes ranges for the growth rates of the aggregates that appear to be consistent with the ultimate goals of monetary policy. For this reason, it is important to know how MMC's have influenced the monetary aggregates. The first section of this article provides a framework within which the analysis is conducted. The second section describes the behavior of the monetary aggregates and their components both before and after the introduction of MMC's. The last section presents estimates of the effects on the monetary aggregates and their components of the introductibn of MMC's.

A FRAMEWORK OF ANALYSIS

The effect of MMC's on the monetary aggregates can be analyzed by reference to a short-run model of the demand and supply factors determining the components of the

1 Effective March 15, 1979, the quarter-point interest rate differential between commercial banks and nonbank thrifts was eliminated whenever the ceiling rate is 9 per cent or more. The use of compounding was also prohibited. For more information on these changes in the rules governing the issuance of MMC's, see ***Federal Reserve Bulletin,*** Vol. *65,* No. 3 (March 1979), pp. 247-48.

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2 The monetary aggregates considered in this article are M1, which consists of currency and demand deposits (checking account balances) held by the nonbank public; M2, which is equal to M1 plus time and savings deposits at commercial banks other than large negotiable certificates of deposit at weekly reporting banks; and M3, which is equal to M2 plus time and savings deposits at nonbank thrifts.

aggregates. Traditional theories postulate that the demand for monetary assets depends on real income, prices, and interest rates.[3] As real income rises the demand for monetary assets generally increases, as the public attempts to keep a stable relationship between its money balances and its real income. Rising prices tend to be accompanied by increases in nominal monetary assets as the public seeks to maintain the purchasing power of its money balances. Rising market interest rates, on the other hand, generally result in declines in monetary assets, as the public shifts into alternative financial assets in order to maximize interest income. However, increases in the interest rate on MMC's or other time and savings deposits are associated with increases in some monetary assets, such as MMC's or other time and savings deposits, and with declines in the other monetary assets.[4]

The supply factors affecting the components of the monetary aggregates are those factors controlled mainly by monetary policy. In brief, supply factors depend 'on the actions of the Federal Reserve System in supplying bank reserves or base money. The Federal Reserve System can determine market interest rates by allowing the supply of bank reserves or base money to vary. Under this type of interest rate policy, the quantity of funds held in each monetary asset adjusts according to how the monetary authorities adjust market interest rates.

The process by which demand and supply factors determine the components of the monetary aggregates is illustrated below with a simple set of equations. Equation (1) indicates that the public's demand for real currency balances (CURR/P) depends on real income (INC/P), the interest rate on time and savings deposits other than MMC's (i_{TSD}), the MMC interest rate (i_{MMC}), and the rate of interest on an alternative financial asset (i).[5]

$$(1)\ CURR/P = f(INC/P, i_{TSD}, i_{MMC}, i).$$

Equations (2) through (4) show that the same variables determine the demand for real money balances held in demand deposits, time and savings deposits other than MMC's, and MMC's.

$$(2)\ DD/P = f(INC/P, i_{TSD}, i_{MMC}, i),$$

$$(3)\ TSD/P = f(INC/P, i_{TSD}, i_{MMC}, i),$$

$$(4)\ MMC/P = f(INC/P, i_{TSD}, i_{MMC}, i).$$

The supply factors determining the components of the monetary aggregates are summarized in equation (5).

$$(5)\ BASE = CURR + RES.$$

Equation (5) indicates that the supply of base money (BASE) equals the demand for base money, which consists of the demand for nominal currency balances by the public plus the demand for reserves (RES) by banks. Banks' demand for reserves depends on the public's demand for deposits, the reserve requirements imposed by the regulatory

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3 See, for example, William J. Baumol, "The Transactions Demand for Cash: An Inventory Theoretic Approach," *Quarterly Review of Economics*, Vol. 66 (November 1952), pp. 545-56.

4 The interest rates on the deposit components of the monetary aggregates are subject to ceilings set by the regulatory authorities. The ceiling on demand deposits has been zero since the 1930s. However, the ceilings on time and savings deposits at commercial banks and at nonbank thrifts have increased, although generally not by as much as market interest rates.

5 There are obviously many other alternative financial assets in which the public may consider holding funds, but for the sake of simplicity only one is considered.

authorities, and other factors. The supply of base money depends on actions of the Federal Reserve System. There are two alternative ways of viewing the role of the Federal Reserve System. The System may be viewed as supplying a given amount of base money and allowing interest rates and other variables to adjust.[6] The second alternative, which is adopted in the analysis that follows, views the Federal Reserve as allowing the monetary base to vary in whatever way is necessary to achieve given levels of interest rates and other variables.

Equations (1) through (5) can be used to illustrate how the components of the monetary aggregates are determined by demand and supply factors. For example, suppose that the Federal Reserve System wants to set the market interest rate at 10 per cent. Suppose further that when the interest rate is 10 per cent, the public desires to hold $100 billion in currency, $250 billion in demand deposits, $400 billion in other time and savings deposits, and $100 billion in MMC's. Finally, suppose that banks want to hold $50 billion in reserves, given the public's desired deposit holdings, reserve requirements, and other factors affecting banks' demand for reserves. Then, according to equation (5), the total demand for base money would be $150 billion—*i.e.*, the $100 billion in currency demand and the $50 billion in demand for reserves. Thus, the Federal Reserve System must supply $150 billion in base money to maintain the market rate of interest at 10 per cent. Also, given the $150-billion supply of base money, an equilibrium exists in the market for base money, and the components of the aggregates are determined.

Since these equations determine the components of the aggregates, they also determine the monetary aggregates themselves. For example, the solution for M1 is obtained by combining the solutions for currency and demand deposits. In a similar manner, solutions for M2 and M3 can be obtained as well.

The equations can also be used to show how the introduction of MMC's affects the aggregates and their components. Before June 1, 1978, MMC's were no different from other time deposits of similar maturity, because their interest rates were fixed by effective ceilings set by the regulatory authorities. After June 1, 1978, however, MMC's were distinct from other time and savings deposits because their interest rate ceiling was allowed to vary with a market interest rate—that of 6-month Treasury bills. Equation (6) reflects this change by expressing the MMC interest rate in terms of i, the only market interest rate appearing in equations (1) through (5).

$$(6)\quad i_{MMC} = f(i).$$

Thus, equations (1) through (5) can be used to determine the components and aggregates for the period before MMC's were introduced, and equations (1) through (6) can be used for the period after MMC's were introduced. A comparison of the two sets of solutions allows one to ascertain the effects on the components and aggregates of the introduction and spread of MMC's.[7]

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6 In a short-run analysis such as this, real income and prices are not appreciably affected by changes in market interest rates and base money. Therefore, they can reasonably be assumed as given. The interest rate on time and savings deposits may reasonably be assumed as given at the ceiling rate set by the regulatory authorities. Determination of the MMC interest rate is discussed below.

7 With the introduction of MMC's, individuals no doubt required time to adjust their portfolios to take account of the changed economic environment. This dynamic adjustment process is not captured by the present model. Instead, for simplicity's sake, the present model compares only the equilibrium conditions before and after the

For example, if the interest rate on MMC's is allowed to increase relative to the rate paid on other time and savings deposits, the demand for MMC's would increase, and the demand for currency, demand deposits, and other time and savings deposits would fall. Since MMC's are probably not close substitutes for either currency or demand deposits, a rise in the rate on MMC's would probably decrease only slightly the demand for these two monetary assets. However, since MMC's are close substitutes for other time and savings deposits, a rise in the rate on MMC's would decrease the demand for these deposits more than the demand for currency or demand deposits. On balance, the increased demand for MMC's would probably more than offset the decreased demands for currency, demand deposits, and other time and savings deposits. This is because some of the increased demand for MMC's would reflect a reduced demand for financial assets other than currency and deposits.

The effect of MMC's on the aggregates depends not only on demand factors, but on supply factors determined by the Federal Reserve System. If the System accommodates the introduction of MMC's by not altering its policy toward market interest rates, demand factors would determine the components and aggregates, while the supply of base money would be adjusted to maintain an equilibrium in the market for base money. In this case, currency, demand deposits, and M1 would decline slightly due to a rise in the interest rate on MMC's, other time and savings deposits would probably decrease substantially, and M2 and M3 would likely increase somewhat.

For example, suppose the increase in the interest rate on MMC's results in an increase of $20 billion in the demand for MMC's, and decreases of $1 billion, $2 billion, and $10 billion, respectively, in the demand for currency, demand deposits, and other time and savings deposits. This would imply either an increase or a decrease in the demand for base money, depending on the size of reserve requirements as well as other factors. If the Federal Reserve maintains unchanged market interest rates, the supply of base money would increase or decrease to ensure an equilibrium, and the change in the amounts outstanding of the components would be the same as the change in their demands. Thus, in this particular example, M1 would decline by $3 billion ($1 billion in currency and $2 billion in demand deposits). M2 or M3—depending on whether the above data on MMC's and other time and savings deposits referred to commercial banks or to all financial institutions—would increase by $7 billion ($20 billion in MMC's minus $10 billion in other time and savings deposits minus $3 billion in M1).

On the other hand, the Federal Reserve System may decide not to accommodate completely the introduction of MMC's by allowing base money to vary, instead allowing market interest rates to adjust. These rates may rise or fall,, depending on whether the higher interest rate pn MMC's leads to an increase or a decrease in the demand for base money. For example, suppose, as may be reasonable, that the increase in the interest rate on MMC's leads to an increase in the demand for base money. If the Federal Reserve does not accommodate this increased demand, market interest rates would rise, thereby partly off-setting the increased demand for MMC's and reducing further the demands for currency, demand deposits, and time and savings deposits net of MMC's. Consequently, MMC's

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introduction of MMC's. That is, the model assumes all adjustment has taken place. For this reason, the model is said to be static rather than dynamic. The estimates in section three of the effects of MMC's incorporate some of the dynamic elements involved with the introduction and spread of MMC's.

Table 1
MONEY MARKET CERTIFICATES OF DEPOSIT
(Monthly averages in billions of seasonally unadjusted dollars)

	Net Inflows			Total Outstanding		
	Commercial Banks	Nonbank Thrifts	Total	Commercial Banks	Nonbank Thrifts	Total
June 1978	1.1	3.5	4.6	1.1	3.5	4.6
December 1978	4.6	9.0	13.6	21.4	49.5	70.9
March 1979	4.6	8.8	13.4	38.6	85.1	123.7

SOURCES: Board of Governors of the Federal Reserve System, Federal Home Loan Bank Board, and author.

would increase by less and the other components would decline by more than before. Similarly, there would be a greater decline in M1 and smaller increases in M2 and M3.

Since the effect of MMC's on the aggregates appears to depend on how the Federal Reserve System responds to the introduction of MMC's, it is useful to review the current procedure for implementing monetary policy. Although the Federal Reserve System monitors a number of economic indicators, including bank reserves and base money, the Federal funds rate is the primary day-to-day vehicle of monetary policy used by the System's open market account manager. The Federal funds rate objective is the estimate of this interest rate that appears to be consistent with desired short-run growth rates of the monetary aggregates. If this rate comes under pressure due to MMC's, the immediate response of the account manager probably would be to absorb or add enough bank reserves or base money to hold the funds rate steady. Thus, monetary policy probably would initially be accommodative to the introduction of MMC's. In the longer run, monetary policymakers may estimate to what extent pressure on the funds rate is due to the effects of MMC's and adjust the funds rate objective accordingly. An accommodative policy toward MMC's may be more likely, however, even in the longer run. If so, the introduction and spread of MMC's would be expected to have a relatively small negative impact on the growth of currency, demand deposits, and M1, a somewhat greater negative impact on the growth of time and savings deposits net of MMC's, and positive impact on the growth rates of M2 and M3.

THE BEHAVIOR OF THE AGGREGATES AND COMPONENTS BEFORE AND AFTER THE INTRODUCTION OF MMC'S

This section compares the actual behavior of the monetary aggregates and their components during a 10-month period ending in March 1979 with their behavior during the 10 months immediately preceding the introduction of MMC's. The purpose is to provide information about the impact MMC's have had on the money supply measures.

Table 1 shows that MMC's have increased sharply since their introduction in June 1978. By March 1979, $123.7 billion of these deposits were outstanding. Of this total, $38.6 billion was at commercial banks and $85.1 billion at nonbank thrift institutions.

Table 2 presents the annual growth rates of the components and aggregates over the two 10-month periods. The greatest difference in the component growth rates occurred in time and savings deposits net of MMC's. These

deposits increased at rates of 8.1 per cent at commercial banks and 11.2 per cent at nonbank thrifts between July 1977 and May 1978. After MMC's were introduced, however, these deposits actually declined by 1.0 per cent at commercial banks and 6.6 per cent at nonbank thrifts. Ml's growth rate also declined after the introduction of MMC's as the growth rate of demand deposits declined and the growth rate of currency remained unchanged.

Table 2
GROWTH RATES OF SELECTED VARIABLES
(Seasonally adjusted annual rates)

Variable	July 1977 to May 1978	May 1978 to March 1979
Currency	9.7	9.7
Demand Deposits	7.5	0.3
Time and Savings Deposits:*		
Commercial Banks:		
Inclusive of MMC's	8.1	8.5
Net of MMC's	8.1	–1.0
Nonbank Thrifts:		
Inclusive of MMC's	11.2	10.8
Net of MMC's	11.2	–6.6
Total:		
Inclusive of MMC's	9.8	9.8
Net of MMC's	9.8	4.1
M1	8.0	2.8
M2	8.1	6.1
M3	9.4	8.1
Real Personal Income†	4.3	2.4
Consumer Price Index	7.0	9.8
Interest Rate on Commercial Paper‡	37.7	48.1

*Excludes large negotiable certificates of deposit at weekly reporting commercial banks.
†Real personal income is personal income adjusted to exclude the effect of changes in the consumer price index.
‡The 4- to 6-month prime commercial paper rate is used as a measure of market interest rates.

The growth rates of M2 and M3 also decelerated. The decline in M2's growth rate mainly reflected the deceleration in the growth rate of M1. As Table 2 shows, the growth rate of the time deposit component of M2—time and savings deposits at commercial banks inclusive of MMC's—accelerated slightly. The decline in the growth of M3 was also due to the slower M1 growth rate. There was no change in the growth rate of the time deposit component of M3—time and savings deposits at commercial banks and nonbank thrift institutions inclusive of MMC's.

In some respects, the actual behavior of the aggregates and their components is consistent with what would have been expected following the introduction of MMC's, particularly the sharp decline in the growth rate of time and savings deposits net of MMC's. Moreover, the fact that the growth rate of time and savings deposits inclusive of MMC's did not decline was also to be expected, since the decline in other time and savings deposits was offset by the growth of MMC's.

Certain behavior of the aggregates, however, is not in line with expectations. The analysis of the previous section indicated that MMC's would be expected to result in an acceleration in the growth rate of time and savings deposits inclusive of MMC's, because part of the funds flowing into MMC's would come from assets other than time and savings deposits. That acceleration, though, did not occur. Also, the introduction of MMC's was expected to have only a small negative impact on M1, and not the sharp decline that actually occurred. Moreover, the impact on M2 and M3 was expected to be positive, because the positive impact of MMC's on time and savings deposits was expected to more than offset the negative impact on M1. In general, then, after MMC's were introduced, the growth rates of the monetary aggregates were lower than would

have been expected to result from the introduction of these instruments.

Part of the lower growth rates can be explained by factors other than the introduction of MMC's. For example, Table 2 shows that the interest rate on commercial paper rose at an accelerated pace after MMC's were introduced. As a result, increased market interest rates tended to depress the growth rates of the components and aggregates. The table shows that real personal income decelerated after MMC's were introduced, and this deceleration also tended to decrease the growth rates of the aggregates. On the other hand, the acceleration in the consumer price index tended to increase the aggregate growth rates.

The difference between the growth rates of the aggregates before and after the introduction of MMC's may have been caused by still other factors. Balances in money market mutual funds increased sharply after May 1978, and automatic transfer accounts have grown rapidly since becoming available to household depositors on November 1, 1978. These two competing assets may have drawn funds from some of the components and, hence, may have been partly responsible for some of the behavior of the aggregates shown in Table 2.

ESTIMATES OF THE EFFECT OF MMC'S ON THE AGGREGATES AND COMPONENTS

The purpose of this section is to account more explicitly for how MMC's and other factors may have influenced the aggregates and their components. The method used is first to specify certain equations relevant to the public's demand for the components of the aggregates, and then to estimate the equations through regression analysis.[8]

The regression equations employed are similar to the demand equations presented in the first section of this article. However, some changes are made to facilitate statistical analysis. For example, the general form of the regression equation estimated for currency is as follows:

$$(7)\ CURR/P = f(INC/P, i, ATS, MMC, MMMF, MSHIFT, e).$$

Real income and a market interest rate appear as explanatory variables, as in equation (1) of the first section. However, data limitations prohibit including an interest rate on other time and savings deposits. ATS, MMC, and MMMF are the outstanding nominal balances in automatic transfer accounts, MMC's, and money market mutual funds, respectively. An assumption of this article is that these variables adequately capture the structural shifts that occurred in financial markets with the introduction and spread of automatic transfers, MMC's, and money market mutual funds. Thus, for example, as the public becomes more aware of MMC's, the variable MMC increases and the demand for each component presumably declines. Similarly, an increase in ATS or MMMF is assumed to cause a decrease in the demand for other assets.[9] MSHIFT is included to capture an apparent shift in the demand for

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[8] The regression equations used monthly data through March 1979. The data from April 1979 were not included since they apparently were heavily influenced by seasonal factors having nothing to do with MMC's. For more information on the methodology and results described in the remainder of this section, see Scott Winningham, "The Effect of Money Market Certificates of Deposit on the Monetary Aggregates and Their Components: An Empirical Investigation," unpublished Research Working Paper, Federal Reserve Bank of Kansas City.

[9] In principle, the demand for monetary assets depends on the yields on all competing assets. Thus, the interest rate on automatic transfers, MMC's, and money market mutual funds should be included in the regression equations for the components instead of the outstanding quantities of these competing assets. An increase in any of these interest rates would presumably reduce the demand for each monetary asset. Unfortunately, data on such interest rates are not

Table 3
ESTIMATED CHANGES IN THE COMPONENTS AND AGGREGATES DUE TO THE INTRODUCTION AND SPREAD OF MMC'S
(May 1978 to March 1979)

Components	In Billions of Seasonally Adjusted Dollars	In Percentage Points at a Seasonally Adjusted Annual Rate	T-Statistic
Currency	1.46	1.90	0.66
Demand Deposits	– 3.87	– 1.79	–0.51
Other Time and Savings Deposits at Commercial Banks	–28.31	– 6.99	–1.91
Other Time and Savings Deposits at Nonbank Thrift Institutions	–73.86	–15.14	–4.59
MMC's at Commercial Banks	38.60	n.a.	n.a.
MMCs at Nonbank Thrift Institutions	85.10	n.a.	n.a.
Aggregates			
M1	– 2.41	– 0.82	n.a.
M2	7.88	1.13	n.a.
M3	19.12	1.61	n.a.

n.a. = not available.

money in the mid-1970s,[10] and e is a disturbance term.

Regression equations are also estimated for demand deposits, time and savings deposits net of MMC's at commercial banks, and time and savings deposits net of MMC's at nonbank thrifts. The equations for these other components have the same general form as equation (7) for currency.[11]

Table 3 shows the estimated effect of MMC's on the components and aggregates. The estimated dollar changes of the components are derived using the regression results.[12] Changes

readily available. More importantly, during the time that the public was learning about and adjusting to automatic transfers, MMC's, and money market mutual funds, changes in the interest rates on these competing assets may not have been as important in explaining the demand for them and for the components as would normally be the case. For these reasons, the variables ATS, MMC, and MMMF are included in the regression equations instead of the corresponding interest rates.

10 Several researchers have attempted to account for this "missing money," but with less than total success. See, for example, Jared Enzler, Lewis Johnson, and John Paulus, "Some Problems of Money Demand," Brookings Papers on Economic Activity. No. 1, 1976, pp. 261-80; Steven M. Goldfeld, "The Case of the Missing Money," Brookings Papers on Economic Activity. No. 3, 1976, pp. 683-730; and Michael J. Hamburger, "Behavior of the Money Stock: Is There a Puzzle?" Journal of Monetary Economics. Vol. 3 (July 1977), pp. 265-88. For present purposes it is deemed sufficient simply to include MSHIFT as an explanatory variable. A more rigorous treatment of this apparent shift is of course preferable but is beyond the scope of this article.

11 Automatic transfer balances are deleted from time and savings deposits net of MMC's at commercial banks prior to the estimation of this component's demand equation in order to remove an obvious source of simultaneous equations bias caused by the presence of ATS as an explanatory variable.

12 In general, the regression results have desirable properties. For each component, the estimated partial elasticities with respect to real income and the market interest rate conform to prior expectations regarding sign

in the components resulting from a $1 increase in MMC's can be determined from the estimated coefficients on the variable MMC. Multiplying these amounts by total MMC balances yields the estimated dollar changes in the components. The estimated dollar changes in the aggregates are obtained by adding together the estimated dollar changes in the relevant components. The reported t-statistics in Table 3 are measures of the degree of confidence that can be placed in the estimates. The larger a t-statistic, ignoring its sign, the greater is the degree of confidence. A t-statistic of -2.00, for example, means there is roughly a 95 per cent probability that the estimate is negative.

The estimates in Table 3 suggest that the introduction and spread of MMC's had little effect on either currency or demand deposits. The estimated changes for both components are relatively small. Apparently, the slowdown of demand deposits in late 1978 and early 1979 was largely due to factors other than the introduction and spread of MMC's.

The results in Table 3 also suggest that by March 1979 time and savings deposits net of MMC's were lower by approximately $28 billion at commercial banks and $74 billion at nonbank thrifts due to MMC's. Since these amounts represent about 23 and 60 per cent, respectively, of total MMC balances in March 1979, it appears that more than three-fourths of MMC's may have been drawn from other time and savings deposits. Thus, since demand deposits were apparently little affected by MMC's, perhaps one-fourth or less of MMC balances are "new money" for financial institutions. In terms of rate of change, the introduction and spread of MMC's may have lowered the annual growth rate of time and savings deposits net of MMC's by about 7 percentage points at commercial banks and 15 percentage points at nonbank thrifts between May 1978 and March 1979.

The results for the monetary aggregates follow directly from those for the components. MMC's appear to have had little effect on M1. MMC's probably increased M2 and M3 because the increases in MMC balances more than offset the decreases in other deposits. The estimates in Table 3 suggest that the introduction and spread of MMC's increased M2 and M3 by about $8 and $19 billion, respectively. These amounts represent increases of 1.1 and 1.6 percentage points, respectively, in the annual growth rates of M2 and M3 between May 1978 and March 1979.

SUMMARY

This article has examined the implications of MMC's for the monetary aggregates and their components. The theoretical analysis in the first section of the article suggested that all the components of the monetary aggregates, except MMC's, would decrease due to the introduction of MMC's. The extent of the declines in the components would depend on how closely substitutable MMC's are for these component~. Thus, one would expect MMC's to substantially

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and size and are significantly different from zero. The estimated coefficients on ATS, MMC, and MMMF have the hypothesized signs, except for those on ATS and MMC in the currency equation and on ATS in the equation for other time and savings deposits at nonbank thrifts. The estimated coefficients on MMMF are generally larger in absolute value than anticipated. For example, the results suggest that a $1 increase in money market mutual fund balances reduces the demand for other time and savings deposits at nonbank thrifts by $1.44. Such large coefficients may have been obtained because the variable MMMF captures the effect of factors other than money market mutual funds. Repurchase agreements, for example, have grown in importance over roughly the same period as have money market mutual funds, but their effect on monetary assets could not be accounted for separately due to data limitations. MSHIFT behaves as expected in the equations. Finally, for all of the components, the Durbin-Watson statistics suggest an absence of first-order autocorrelation after prefiltering.

decrease time and savings deposits net of MMC's but only marginally decrease currency and demand deposits. Since M1 consists of currency and demand deposits, M1 would be expected to decline marginally due to MMC's. In contrast, M2 and M3 include MMC's as well as other time and savings deposits. For this reason, there are likely to be offsetting effects of MMC's on these two monetary aggregates. Theoretically, M2 and M3 would probably increase due to MMC's because the MMC balances in these aggregates probably would increase by more than the other components of these aggregates decrease.

The next two sections of the article presented, empirical evidence concerning the effects of MMC's on the aggregates and their components. Section two described the behavior of the components and aggregates before and after the introduction of MMC's. Section three presented estimates of the effects of MMC's based on regression analysis. The analysis yielded results that are consistent with the results suggested by the theoretical analysis in the first section. The results indicated that the introduction and spread of MMC's apparently had little effect on currency, demand deposits, and M1. However, MMC's probably caused time and savings deposits net of MMC's to be substantially lower than they otherwise would have been, but may have increased M2 and M3 somewhat.

Two New Booklets Published

Teenage unemployment has nearly doubled in the last decade, according to Steven P. Zell, a business economist with the Federal Reserve Bank of Kansas City, in his booklet, ***The Growth of Youth Unemployment: Characteristics and Causes.*** Even though the economic recovery has increased employment for all age groups, teenage unemployment rates have reached extremely high levels, especially for members of minority groups.

The sources of growth in teen unemployment, the impact of the minimum wage, and the implications of the findings are discussed in this informative new booklet.

The dramatic rise in the value of farmland in recent years is discussed by Marvin Duncan, assistant vice president and agricultural economist with the Federal Reserve Bank of Kansas City, in Farm ***Real Estate Values: What's Happening and Why.*** The booklet notes that farmland has become an increasingly attractive investment in recent years for both farmers and nonfarmers. Yet virtually all farmland that changes hands each year is purchased by U.S. citizens, and about two-thirds of that by farmers.

The booklet compares the relative importance of various determinants of the value of farm real estate, discusses in detail who is buying the land, and examines how sales are being financed.

Copies of both booklets are available free of charge by writing to the Research Division, Federal Reserve Bank of Kansas City, 925 Grand Avenue, Kansas City, Missouri 64198.

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