

A MODEL OF MONEY STOCK DETERMINATION WITH LOAN DEMAND AND A BANKING SYSTEM BALANCE SHEET CONSTRAINT

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I. INTRODUCTION

Recent and proposed changes in the Federal Reserve's monetary control procedures include the shift from a funds rate instrument to a non-borrowed reserve instrument in October 1979, reserve requirement reform embodied in the Monetary Control Act of 1980, and the consideration that has been given to a move from lagged to contemporaneous reserve requirement regimes. Analysis of the impact of such changes requires a sufficiently general model of money stock determination. The "money multiplier" model of money stock determination, for example, is not wholly adequate for explaining and comparing money stock determination under different monetary control procedures. This article offers an alternative model. Although differences in money stock determination are illustrated here for several monetary control procedures, the intent is not to offer a comprehensive analysis or prescription for monetary control but merely to present a framework in which issues affecting money stock determination can be more adequately examined.

The model of money stock determination presented in this article takes explicit account of bank loan demand and the banking system balance sheet constraint. It explains money stock determination for alternative monetary control instruments, namely, funds rate, non-borrowed reserve, and total reserve instruments, and for lagged and contemporaneous reserve requirement regimes. Furthermore, the model explains determination of both "M1" and "M2" type monetary aggregates with the aid of a simple diagram.

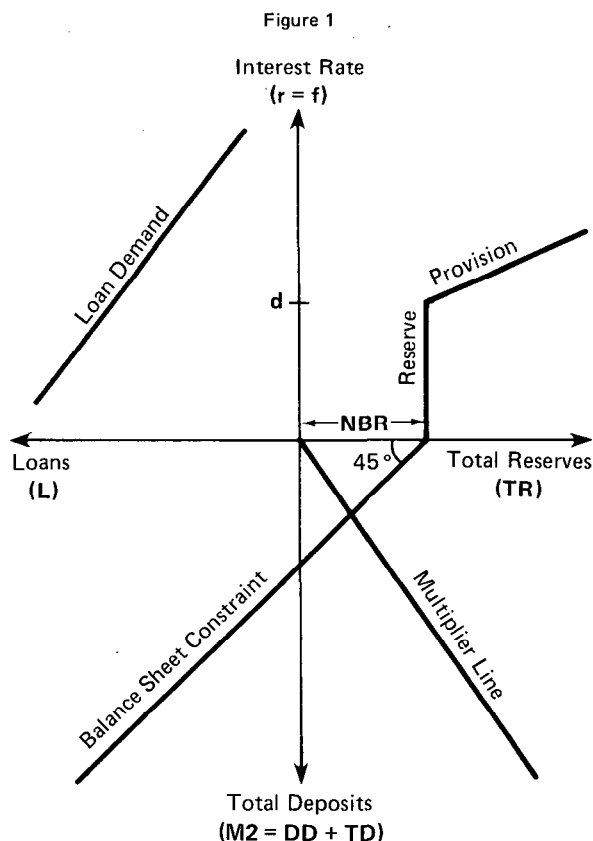
After the initial presentation of the model and its diagrammatic representation, the diagram is employed to illustrate money stock determination for various instrument-reserve requirement combinations. The role of the money multiplier in money stock

determination is highlighted throughout this discussion. The model is then employed to examine the effect of various disturbances on the monetary aggregates with a non-borrowed reserve instrument for both lagged and contemporaneous reserve requirement regimes. The analysis is summarized in the conclusion.

II. THE MODEL

A diagrammatic representation of the model of money stock determination is presented in this section. A complete diagram of the model is shown in Figure 1.¹

¹ The model is summarized in the appendix.



1. The Four Quadrants

Reserve Provision The northeast quadrant contains a reserve provision locus showing the relationship between total reserves in the banking system and the Federal funds rate.² The locus has a vertical and a nonvertical segment because reserves are provided to the banking system in two forms, as “non-borrowed” and as “borrowed” reserves. Non-borrowed reserves (NBR) are supplied by the Fed through open market operations, while borrowed reserves (BR) are provided through the Fed discount window.

The distance between the vertical segment of the reserve provision locus and the vertical axis is determined by the volume of non-borrowed reserves. The reserve provision locus is vertical up to the point where the funds rate (f) equals the discount rate (d) because when the funds rate is below the discount rate banks have no incentive to borrow at the discount window. Formally, if $f \leq d$, then $BR^D = 0$.

Conversely, when the funds rate is above the discount rate banks have an incentive to borrow at the discount window because they obtain a net saving on the explicit interest cost of reserves. This net saving consists of the differential ($f - d$) between the funds rate and the discount rate. Discount window administration imposes a nonpecuniary cost of borrowing that rises with volume; and banks tend to borrow up to the point where the nonpecuniary cost of borrowing just offsets the net interest saving. Consequently, borrowing is higher the greater the spread between the funds rate and the discount rate. That is why the reserve provision locus is positively sloped for funds rates above the discount rate. Formally, if $f > d$, then $BR^D(f - d) > 0$ and $BR^D'(f - d) > 0$.³

Loan Demand The nonbank public's net real demand for loans, L^D , is a decreasing function of the nominal rate of interest, i.e., $L^D(r)$, where $L^D'(r) < 0$.⁴ The nonbank public's net nominal demand for loans is therefore $P \cdot L^D(r)$, where P is the price

level. The loan market is assumed to clear so that the nonbank public's net nominal demand for loans $P \cdot L^D(r)$ equals the nominal volume of loans supplied by the banking system, L . Diagrammatically, the nonbank public's net nominal demand for loans appears in the northwest quadrant of Figure 1, for a given price level, as a decreasing function of the nominal rate of interest, r . The horizontal axis in the northwest quadrant is labeled L , since loan market equilibrium guarantees that $L = P \cdot L^D(r)$.

The loan demand function and the reserve provision schedule are drawn with a common vertical axis because bank arbitrage between Federal funds and bank loans is assumed to keep rates in the two markets aligned. Accordingly, the common interest rate axis is labeled “ $r = f$ ”, indicating the arbitrage activity which links the two quadrants.⁵

The Balance Sheet Constraint The line in the southwest quadrant represents the banking system's balance sheet constraint. In simple form, the banking system's balance sheet looks as follows:

CONSOLIDATED BANKING SYSTEM BALANCE SHEET	
Assets	Liabilities
Loans (L)	Demand Deposits (DD)
Non-borrowed Reserves (NBR)	Time Deposits (TD)
Borrowed Reserves (BR ^A)	Borrowed Reserves (BR ^L)

where

$BR^A \equiv$ reserves obtained from the Fed discount window.

$BR^L \equiv$ corresponding dollar for dollar promise to repay BR^A ; $BR^A = BR^L$.

$DD \equiv$ “checkable” type deposits whose rates of interest are fixed at a legal ceiling.

$TD \equiv$ that portion of total deposits whose rates move with market interest rates.⁶

⁵ In fact, arbitrage does not keep the funds rate perfectly aligned with loan rates. The funds rate is a daily rate while loan rates and commitments in general are made for longer maturities. A loan rate is aligned with an average of anticipated future funds rates over the term of the loan, since the average anticipated funds rate is the anticipated opportunity cost of funding the loan. The funds rate-loan rate spread changes with movements of average anticipated future funds rates relative to the current funds rate.

⁶ Overnight repurchase agreements at banks are essentially “checkable” and pay a rate that moves with the market. Savings and small-time deposits are subject to legal ceilings below market rates. In other words, the distinction drawn between “DD” and “TD” type deposits in the model is blurred in practice.

² Banking system refers to depository institutions in general. Under the Monetary Control Act of 1980, all depository institutions subject to Fed reserve requirements have access to the Fed discount window.

³ See Goodfriend [4] for a detailed discussion of discount window borrowing.

⁴ In this model, portfolio equilibrium is characterized by a loan market equilibrium condition. Alternatively, portfolio equilibrium could have been characterized by a money market equilibrium condition. See Patinkin [7], Chapters IX:4 and XII:4, 5, 6.

In general, real income and real net wealth are arguments in the L^D function. They are ignored in the text.

The constraint implied by the T-account can be written as follows:

$$(1) \quad L + NBR \equiv DD + TD.$$

The balance sheet constraint has a slope of one, since for the banking system as a whole every dollar increase in deposits is matched by a corresponding dollar increase in loans. The intercept on the aggregate deposit axis is NBR because if banks had no loans outstanding deposits would match the volume of non-borrowed reserves.

The Multiplier Line Within the context of this model, aggregate deposits $DD + TD$ represent an "M2" type monetary aggregate, since the $DD + TD$ aggregate includes checkable and time deposits. DD represents an "M1" type monetary aggregate. Formally, for the purposes of this article

$$(2) \quad M1 \equiv DD \\ M2 \equiv DD + TD.^7$$

The multiplier line in the southeast quadrant relates M2 to total reserves (TR). The line passes through the origin because without reserves banks cannot legally hold deposits. The slope of the multiplier line, called the M2-TR multiplier, is

$$(3) \quad m_2 \equiv \frac{M2}{TR}$$

where $m_2 > 1$.

The M2-TR multiplier depends on (1) the nonbank public's portfolio preference for checkable deposits (DDs) relative to time deposits (TDs), (2) the Federal Reserve System's legal reserve requirements on DDs and TDs, and (3) the banking system's demand for excess reserves, i.e., reserves held above legal requirements.

The demand for TDs relative to DDs depends upon the spread between the TD rate and the DD rate. The DD rate is taken to be fixed, while the TD rate is assumed to be competitively determined and to move with market rates. Arbitrage is assumed to keep the interest rate on TDs aligned with the loan

⁷ Currency is ignored throughout, but technically currency in the hands of the public is in both M1 and M2. In addition, M2 includes components which are not liabilities of depository institutions located in the U. S., i.e., overnight Eurodollar deposits held by U. S. residents at Caribbean branches of U. S. banks; and M2 also includes money market mutual fund shares. Finally, not all net depository institution liabilities are in M2. For example, large-time deposits at all depository institutions and term RPs at commercial banks and savings and loan institutions are only in M3. See Simpson [9].

rate, which is assumed to move with the funds rate.⁸ The net effect of these arbitrage assumptions is to enable the model to operate as if there were one interest rate, r .

Given a legally fixed rate on DDs assumed to be below the TD rate, the ratio of TDs to DDs that the public desires to hold depends on r . Formally, the public's portfolio balance function is

$$(4) \quad \frac{TD}{DD} = \rho(r) \text{ or } \frac{M2}{M1} = 1 + \rho(r)$$

where $\rho'(r) > 0$.⁹

A higher r represents a higher opportunity cost of holding DDs relative to TDs, and so is associated with a higher ratio of TDs to DDs and M2 to M1 in the public's portfolio. Hence, $\rho'(r)$ is positive.

Banking system reserve demand equals the sum of required reserves and the demand for excess reserves. Let reserve requirement ratios on DDs and TDs be rr_1 and rr_2 , respectively, so required reserves (RR) can be written

$$(5) \quad RR \equiv rr_1 DD + rr_2 TD$$

where $rr_2 < rr_1 < 1$.¹⁰

Excess reserve demand (ER) is a function of respective deposit levels such that

$$(6) \quad ER \equiv k_1(r) DD + k_2(r) TD$$

where $k_2(r) < k_1(r)$ and $k_1'(r) < 0$, $k_2'(r) < 0$.

The presumption that $k_1(r)$ exceeds $k_2(r)$ implies that the precautionary need for excess reserves is

⁸ Even if loans and deposits were the same maturity, bank arbitrage would not drive loan and deposit rates into equality. Competition and profit maximization imply that the net marginal return on loans equals the net marginal cost of deposits. Formally, this arbitrage condition is written $r^L - c^L = \frac{1}{1-a}[r^D + c^D]$ where $r^L \equiv$ the loan rate, $c^L \equiv$ the marginal cost of loan production, $a \equiv$ the fractional reserve against deposits, $r^D \equiv$ the deposit rate, and $c^D \equiv$ the marginal cost of deposit production. Loan and deposit rates are parameters from the point of view of individual banks.

Note that even without legal restrictions on interest rates, if $a > 0$ then the $r^L - r^D$ spread is positively related to the level of interest rates.

⁹ If either (1) the legal ceiling on the payment of interest on DDs is ineffective or (2) the interest on DDs inclusive of the restricted explicit nominal rate and an implicit payment either through a gift or remittance of some of the cost of account management moves competitively with r , then the ratio of DDs to TDs that the public desires to hold may not be sensitive to r .

¹⁰ Actual reserve requirements are more complicated than those assumed here. See the **Federal Reserve Bulletin** for the current structure of reserve requirements.

greater for DDs than for TDs. Since excess reserves earn no interest, excess reserve demand for given DD and TD levels is negatively related to the interest rate, i.e., $k_1'(r) < 0$ and $k_2'(r) < 0$.

Assume that the reserve market clears, i.e., that total reserve provision equals total reserve demand, so that

$$(7) \quad TR = rr_1DD + rr_2TD + k_1(r)DD + k_2(r)TD.$$

Using equations (4) and (7) to substitute for DD, TD, and TR in (3), m_2 may be written

$$(8) \quad m_2(r) = \frac{1 + \rho(r)}{rr_1 + rr_2\rho(r) + k_1(r) + k_2(r)\rho(r)}$$

where $m_2'(r) > 0$.

The M2-TR multiplier *increases* with a rise in the interest rate. To see why m_2 interest sensitivity is positive, write $m_2 = 1 / [\frac{RR}{M2} + \frac{ER}{M2}]$. A rise in r induces the public to switch from DDs to TDs. Since $rr_1 > rr_2$ and $k_1 > k_2$, this portfolio switch lowers required reserves and excess reserves relative to M2. Therefore, $\frac{RR}{M2}$ and $\frac{ER}{M2}$ both fall with an interest rate rise. In addition, an interest rate rise lowers the k coefficients, i.e., the demand for excess reserves at given DD and TD levels, producing an additional reduction in $\frac{ER}{M2}$.¹¹

Before leaving this section, it can be pointed out that the "money multiplier" model of money stock determination is represented in this model by the M2-TR multiplier line in the southeast quadrant of

¹¹ The M1-TR multiplier is

$$m_1 \equiv \frac{M1}{TR}.$$

Using equations (4) and (7) in the text, m_1 may be written

$$m_1(r) = 1 / [rr_1 + rr_2\rho(r) + k_1(r) + k_2(r)\rho(r)].$$

The sign of the interest sensitivity of the M1-TR multiplier is ambiguous. To see why, suppose the interest rate rises. Both DD and TR could not remain unchanged because the increased demand for TDs relative to DDs would leave reserve demand in excess of reserve supply. Either DD must fall or TR must rise to clear the reserve market, causing the M1-TR multiplier to fall. However, the k coefficients are smaller at a higher interest rate and the reduced demand for reserves from this source may be sufficient to leave reserve supply in excess of reserve demand. In this case, either DD would have to rise or TR would have to fall to clear the reserve market, causing the M1-TR multiplier to rise. The net effect of an interest rate rise on the M1-TR multiplier is therefore ambiguous.

Figure 1.¹² However, in this model the M2-TR multiplier is merely a relation between total reserves and the M2 money stock. The discussion in Section III makes clear that the role of the money multiplier in money stock determination depends on the Fed's monetary control procedure. In particular, the discussion there shows that the money multiplier is not generally a complete model of money stock determination and is actually irrelevant to money stock determination for some monetary control procedures.

2. Federal Reserve Monetary Control Procedure

Determination of the monetary aggregates depends critically on the method that the Fed employs to control the money stock. The instrument of monetary control and the reserve requirement regime are the two most important components of the Fed's monetary control procedure.

Instruments of Monetary Control The instrument of monetary control is the variable the Fed predetermines on an ongoing basis in order to achieve its money stock target. Since October 6, 1979, the primary instrument of monetary control has been non-borrowed reserves. Two important alternative instruments are the Federal funds rate and total reserves.

With a non-borrowed reserve instrument the Fed supplies a predetermined volume of non-borrowed reserves and allows the volume of borrowed reserves and the funds rate to adjust to maintain reserve market equilibrium. With a funds rate instrument, the interest rate is predetermined in each reserve statement period. The Fed supplies whatever volume of non-borrowed reserves is required to maintain reserve market equilibrium at its chosen funds rate. To use a total reserve instrument the Fed could, for example, let the discount rate be a fixed penalty rate slightly above the funds rate. In this setup, discount window borrowing would be negligible, non-borrowed reserves would approximately equal total reserves, and the Fed could supply non-borrowed reserves to achieve a total reserve objective. The funds rate would adjust freely to maintain reserve market equilibrium with a total reserve instrument.

Reserve Requirement Regimes The reserve requirement regime refers to the set of rules imposed

¹² A well-known discussion and application of the "money multiplier" model is found in Friedman and Schwartz' **A Monetary History of the United States**. Appendix B of that volume contains the derivation of money multipliers for a variety of monetary standards. Those multipliers involve essentially the same types of relationships that are embodied in the multiplier line in this model.

on depository institutions under the Federal Reserve's Regulation D by which they are required to hold a fraction of their deposits as reserves. Reserve requirement rules specify the size of the reserve requirement according to deposit type, i.e., DD or TD, as well as the timing of reserve maintenance relative to the reserve statement period for which the required reserves are computed. Money stock determination is discussed in this article for two alternative reserve requirement regimes: lagged reserve requirements (LRR) and contemporaneous reserve requirements (CRR).

The Fed has been operating with LRR since September 1968 and is currently operating with LRR. The LRR rule is summarized as follows:

LRR Reserve requirements for the current reserve statement period are calculated on the basis of deposits held in a previous period.

The lag under LRR means that required reserves are predetermined as banks enter each reserve statement period.

The Fed operated with CRR prior to September 1968 and has been considering its re-implementation. The CRR rule is summarized as follows:

CRR Reserve requirements for the current reserve statement period are calculated on the basis of current deposit holdings.

III. MONEY STOCK DETERMINATION FOR ALTERNATIVE INSTRUMENT-RESERVE REQUIREMENT COMBINATIONS

In this section the model presented in Section II is employed together with various instrument-reserve requirement combinations to explain money stock determination under alternative Federal Reserve monetary control procedures. In general, it is seen that determination of the monetary aggregates differs significantly according to the method of monetary control.

1. A Non-Borrowed Reserve Instrument With Lagged Reserve Requirements Since October 1979 the Fed has primarily employed a non-borrowed reserve instrument with the lagged reserve requirement rules (LRR) currently in effect.¹³ With a non-borrowed reserve instrument and LRR, total reserve demand is essentially predetermined in each reserve

¹³ See Goodfriend [3] for a detailed appraisal of the NBR-LRR monetary control procedure.

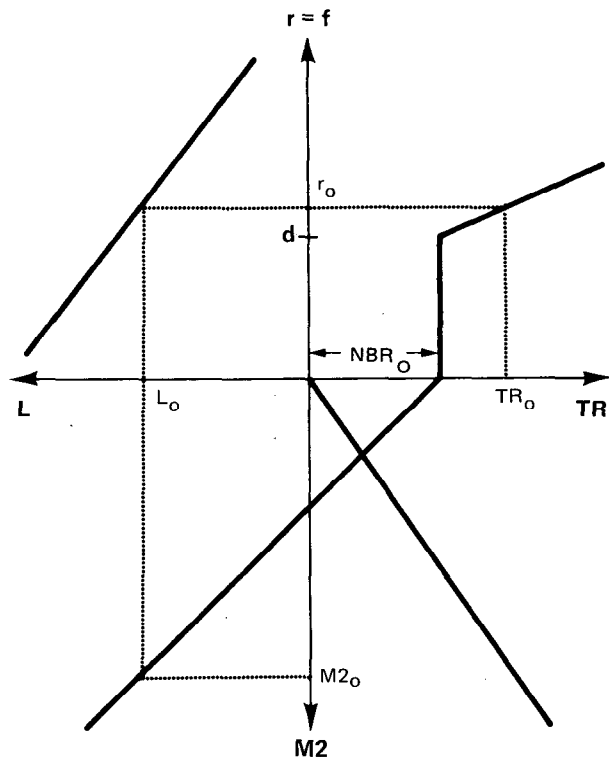
statement period. This is because required reserves are based on deposits in a previous statement period and because excess reserve demand is small and interest insensitive in this operating procedure.¹⁴

With this procedure, the Fed determines the funds rate required to hit its money stock target and then determines a discount window borrowing objective that will produce that funds rate. The Fed forces the banking system to borrow that quantity of reserves at the discount window by supplying only a portion of total reserves demanded as non-borrowed reserves. If BR_0 is the borrowing objective and TR_0 is predetermined total reserve demand, then the Fed supplies NBR_0 such that $BR_0(f - d) = TR_0 - NBR_0$.

This operating procedure is illustrated in Figure 2. Arbitrage brings the loan rate into equality with the funds rate at the desired interest rate, r_0 . Loan volume is determined by the public's demand for loans at the interest rate, r_0 . Finally, the balance sheet constraint indicates the volume of deposits

¹⁴ This is consistent with historical experience since October 1979. However, it should be noted that at very low interest rates, excess reserve demand could become larger and more interest sensitive.

Figure 2
NBR - LRR and $f - LRR$



associated with that volume of loans and the volume of non-borrowed reserves supplied by the Fed. The quantity of total deposits is denoted M_2 . The direction of causation in equilibrium determination is therefore counterclockwise, starting from the predetermined volume of total reserves demanded, TR_0 , moving through r_0 , to L_0 , and finally to M_2 .

Note that under LRR the current volume of deposits is not constrained by current reserves. Required reserves are held after the fact to support deposits held by the nonbank public in a previous period. In short, with a non-borrowed reserve instrument and LRR the M_2 - TR multiplier plays no role in M_2 determination.

Diagrammatically, the multiplier line is irrelevant to the determination of M_2 . M_2 is determined essentially by the demand for borrowed reserves and loan demand, together with the predetermined volume of total reserves demanded, TR_0 , and current non-borrowed reserve supply, NBR_0 .¹⁵

2. A Funds Rate Instrument With Lagged Reserve Requirements The Fed. operated exclusively with a funds rate instrument and lagged reserve requirements from September 1968 until October 1979. Since then, the Fed has continued to operate with a funds rate instrument (together with LRR) whenever it let the funds rate fall below the discount rate.¹⁶

With a funds rate instrument and LRR, total reserve demand is essentially predetermined in each reserve statement period as it is with a non-borrowed reserve instrument and LRR. However, in this case total reserve demand is accommodated by the Fed at a predetermined funds rate. In other words, the reserve provision locus is horizontal at the predetermined funds rate, not vertical and upward sloping above the discount rate as it is with a non-borrowed reserve instrument. Loan volume is determined along the loan demand function at the predetermined interest rate. The balance sheet constraint is anchored at $NBR = TR_0 - BR^D(f - d)$, where TR_0 is the predetermined demand for total reserves. If $f > d$, then borrowing is positive so $NBR < TR_0$; and if $f \leq d$, then borrowing is zero so $NBR = TR_0$. The M_2 money stock is determined by loan volume, the

volume of non-borrowed reserves supplied by the Fed, and the balance sheet constraint.¹⁷

Equilibrium determination with a funds rate instrument and LRR is illustrated in Figure 2. If r_0 is the interest rate predetermined by the chosen funds rate, then equilibrium determination may be traced along the dotted line through L_0 to M_2 as it is with a non-borrowed reserve instrument and LRR. The direction of causation in equilibrium determination is counterclockwise for a funds rate instrument and LRR as it is for a non-borrowed reserve instrument and LRR. Furthermore, the multiplier line is irrelevant to money stock determination with a funds rate instrument and LRR as it is with a non-borrowed reserve instrument and LRR.

3. A Non-Borrowed Reserve Instrument With Contemporaneous Reserve Requirements The Fed has been considering returning to contemporaneous reserve requirements (CRR). If it does return to CRR, the Fed seems likely to retain non-borrowed reserves as the primary instrument of monetary control at least initially. Therefore, it is useful to examine money stock determination with a non-borrowed reserve instrument and CRR.

Under CRR, total reserves are linked to total deposits within each reserve statement period through the M_2 - TR multiplier. This contrasts sharply with LRR where, regardless of the instrument, the M_2 - TR multiplier is irrelevant to money stock determination.

Furthermore, with a non-borrowed reserve instrument and CRR, not only can the interest rate affect M_2 volume through loan demand, but M_2 volume feeds back on the funds rate through the M_2 - TR multiplier and total reserve demand. In other words, the direction of causation in equilibrium determination is not simply counterclockwise as it is under LRR. Rather with a non-borrowed reserve instrument and CRR, loan volume, M_2 , total reserves, and the interest rate are all simultaneously determined.¹⁸ The dashed rectangle in Figure 3 illustrates an equilibrium for NBR_0 of non-borrowed reserves supplied by the Fed. Loan volume, M_2 , total reserves, and the interest rate are simultaneously determined at L_0 , M_2 , TR_0 , and r_0 , respectively.

¹⁵ With an NBR-LRR combination, M_1 is determined from M_2 and r by the portfolio balance function (4), $M_1/M_2 = 1/[1 + \rho(r)]$.

¹⁶ Evidence that this has been the case is presented in Goodfriend [3].

¹⁷ With an f -LRR combination, M_1 is determined from M_2 and r_0 by the portfolio balance function (4), $M_1/M_2 = 1/[1 + \rho(r_0)]$.

¹⁸ With an NBR-CRR combination, M_1 is determined from M_2 and r by the portfolio balance function (4), $M_1/M_2 = 1/[1 + \rho(r)]$.

Figure 3
NBR - CRR

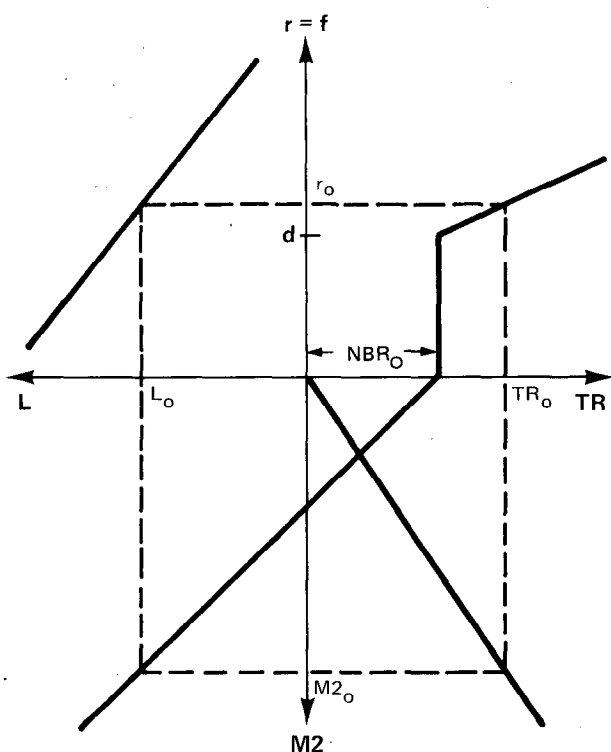
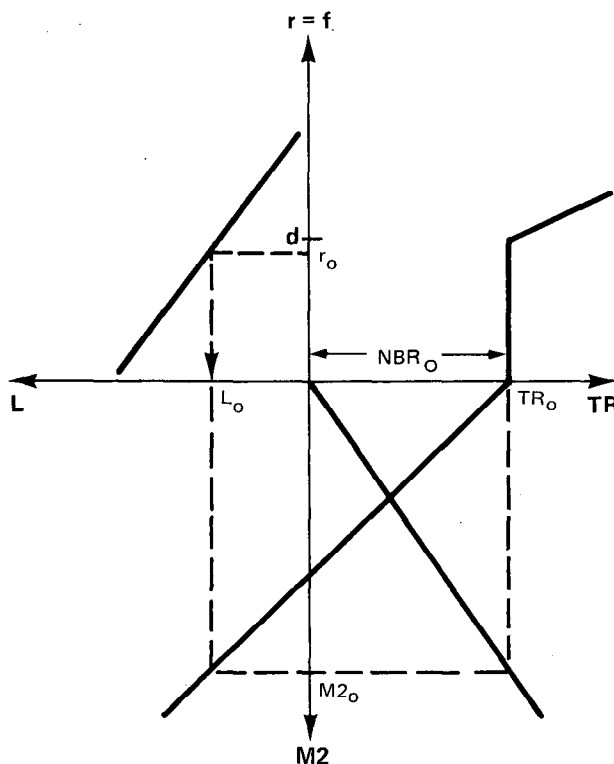


Figure 4
f - CRR
(f < d ⇒ BR = 0)



4. **A Funds Rate Instrument With Contemporaneous Reserve Requirements** Even though the Fed is likely to retain non-borrowed reserves as its primary instrument if it returns to CRR, barring discount window reform it is likely to continue to let the funds rate fall below the discount rate periodically as it has since October 1979 and to employ the funds rate as its instrument in such circumstances. It is therefore useful to examine money stock determination with a funds rate instrument and CRR.

Equilibrium determination with a funds rate instrument and CRR is illustrated in Figure 4. Equilibrium loan volume, L_0 , depends only on loan demand and the interest rate setting, r_0 . The volume of total deposits, $M2$, associated with L_0 depends on the position of the balance sheet constraint. If the funds rate is below the discount rate, as would presumably be the case if a funds rate instrument were employed with CRR, then borrowed reserves are essentially zero, i.e., $NBR = TR$. The balance sheet constraint is anchored at that volume of non-borrowed reserves that satisfies the demand for total reserves to support current deposits. In other words, $M2$ and NBR are simultaneously determined given r_0 and L_0 .

Formally, with CRR and an interest instrument set at r_0 , NBR and $M2$ are simultaneously determined by the balance sheet constraint

$$(9) \quad M2 = NBR + L(r_0)$$

and the $M2$ - TR multiplier relation

$$(10) \quad M2 = m_2(r_0)NBR.$$

The simultaneous solution of these equations yields NBR and $M2$ values

$$(11) \quad NBR = \frac{1}{m_2(r_0) - 1} L(r_0)$$

$$(12) \quad M2 = \frac{m_2(r_0)}{m_2(r_0) - 1} L(r_0)$$

where $m_2(r_0) > 1$.¹⁹

It is useful to contrast the f -CRR combination with $f < d$ to the f -LRR combination with $f < d$. For f -LRR and $f < d$, total reserve demand is accommodated entirely as non-borrowed reserves

¹⁹ With an f -CRR combination, $M1$ is determined from $M2$ and r_0 by the portfolio balance function (4), $M1/M2 = 1/[1 + \rho(r_0)]$.

$$(13) \quad NBR = RR_0 + ER$$

where RR_0 is the predetermined volume of required reserves. For f-LRR and $f < d$, M2 is determined from equation (13) together with equations (4) and (6) in conjunction with the balance sheet constraint (1) as

$$(14) \quad M2 = \frac{1}{1 - \frac{ER}{M2}(r_0)} [RR_0 + L(r_0)].$$

Two points are worth emphasizing in comparing the f-CRR and the f-LRR combinations. First, neither combination allows contemporaneous feedback from M2 to the interest rate through reserve demand.

Second, it is useful to compare how well M2 can be targeted under the f-CRR and f-LRR combinations. To start, rewrite equation (12) describing M2 determination for the f-CRR combination as

$$(15) \quad M2 = \frac{1}{1 - \frac{TR}{M2}(r_0)} [L(r_0)].$$

Now consider M2 determination for the f-LRR combination as described in equation (14). Although RR_0 , the predetermined volume of required reserves under LRR, is known at the beginning of each reserve statement period, the Fed cannot know the nominal volume of loans, $L(r_0)$, associated with a particular interest setting because $L(r_0)$ also depends on the price level which has to be estimated by the Fed when the interest instrument is set.

Suppose that price level estimation error is roughly the same for both instrument-reserve requirement combinations so that $L(r_0)$ is subject to roughly identical error in both cases. The relative precision in targeting M2 then depends on the coefficient preceding the bracketed terms in equations (14) and (15). But $\frac{ER}{M2}$ is smaller than $\frac{TR}{M2}$, so the coefficient in equation (14) is smaller than the coefficient in equation (15). This means that the effect of $L(r_0)$ error on M2 gets magnified for the f-CRR combination relative to the f-LRR combination.²⁰

²⁰ An analogous argument holds for relative M1 targeting error with an f-CRR combination and an f-LRR combination. This is seen by referring to footnotes 17 and 19.

Note that if a funds rate instrument is used with CRR, then both rr_1 and rr_2 should be set to zero to minimize M1 or M2 targeting error.

The comparison of targeting error is relevant to the Fed's possible return to CRR. Specifically, suppose the Fed were to return to CRR, but continue to let the funds rate fall below the discount rate periodically as it has since October 1979, reverting from a non-borrowed reserve to a funds rate instrument in those circumstances. The targeting error comparison indicates that monetary control with a funds rate instrument could be less precise with CRR than with LRR.

5. A Total Reserve Instrument With Contemporaneous Reserve Requirements The Fed moved to a non-borrowed reserve instrument in October 1979 after concluding that the funds rate was an unreliable instrument for controlling the money stock.²¹ However, as has been seen above, the funds rate continues to play a central role as an intermediate target in the monetary control procedure with a non-borrowed reserve instrument and lagged reserve requirements.

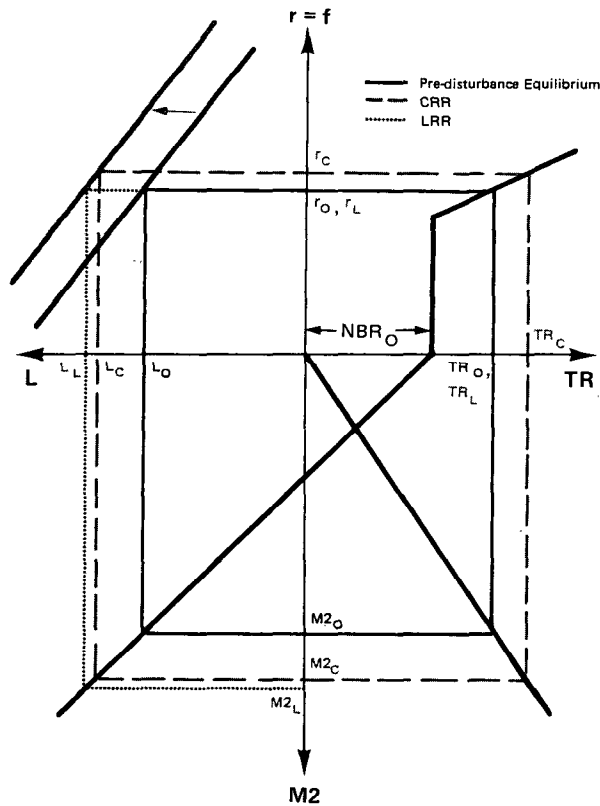
The main virtue of moving to contemporaneous reserve requirements is that it would allow the banking system to bring current required reserves into equilibrium with targeted total reserves. Borrowed reserves would no longer have to be made available to ensure adequate reserve market clearing. The Fed could keep the incentive to borrow at the discount window negative, for example, by making the discount rate a fixed penalty rate slightly above the funds rate. In other words, contemporaneous reserve requirements would make it easier for the Fed to control total reserves.

The major potential benefit of utilizing total reserves and contemporaneous reserve requirements is that such a combination could enable the Fed to target a money stock without concern for loan demand, borrowed reserves, or the interest rate. If the ratio of excess reserves to the targeted monetary aggregate were interest insensitive and reserve requirements were uniformly and solely applied to the targeted monetary aggregate, then there could be a direct and relatively stable link between total reserves and the targeted money stock.²²

²¹ See "The New Federal Reserve Technical Procedures for Controlling Money" [6].

²² A case for strict monetary control with a total reserve instrument and contemporaneous reserve requirements is made in Goodfriend [5].

Figure 6
A LOAN DEMAND SHIFT



under each reserve requirement regime are illustrated in Figure 6. The pre-disturbance equilibrium position is indicated by the solid-line rectangle in the diagram.

Under LRR, the increase in loan demand and matching increase in total deposits have no effect on current reserve demand. Consequently, the loan demand shift affects neither the funds rate nor the interest rate. It follows that the banking system completely accommodates the increase in loan demand which is matched by an equal increase in M2.

Under CRR, the reserve constraint on current deposits means that a loan demand shift does affect the interest rate: any increase in loans is matched by an increase in total deposits which must be supported by additional reserves. The resulting upward pressure on the funds rate and thereby on r restrains the increase in loan volume. Under CRR, the impact of the disturbance is distributed among all the variables because of this type of feedback. The result is that M2 expands less under CRR than under LRR, and r rises more.²⁵

²⁵ The analysis for M1 goes as follows. M1 is related to M2 and r by portfolio balance, $M1/M2 = 1/[1 + \rho(r)]$. Since the loan demand shift causes r and M2 to move in the same direction, the direction of effect on M1 is am-

2. A Discount Rate Adjustment An increase in the discount rate, undertaken by the Fed to contract the money stock, is illustrated in Figure 7 as a vertical shift in the demand schedule for borrowed reserves.

Under LRR, banking system total reserve demand is predetermined at TR_0 . The current volume of borrowed reserves equals the difference between TR_0 and the volume of non-borrowed reserves currently supplied by the Fed, NBR_0 , i.e., $BR_0(f - d) = TR_0 - NBR_0$. Since neither TR_0 nor NBR_0 changes as a result of the discount rate increase, the volume of discount window borrowing, BR_0 , remains unchanged as well.

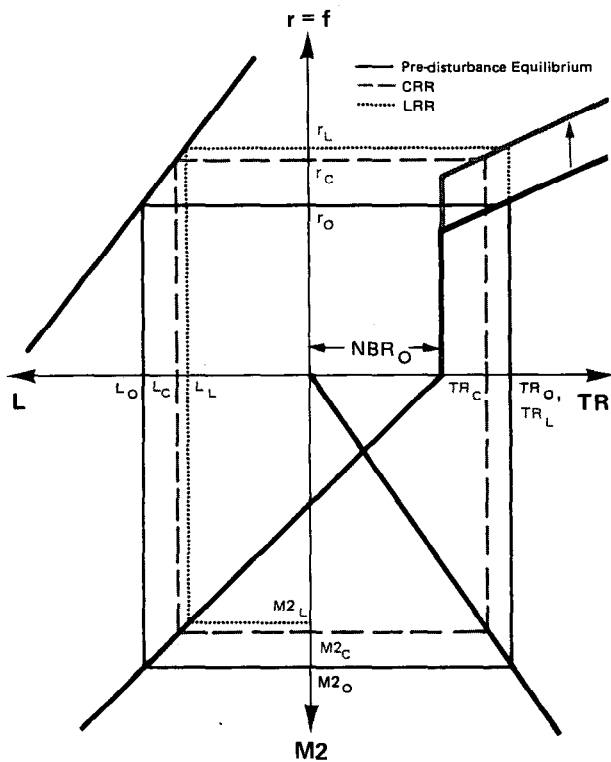
The unchanged volume of borrowed reserves demanded drives the funds rate up by the amount of the increase in d , maintaining the $f - d$ spread at the level consistent with BR_0 . The higher cost of Federal funds leads the banking system to contract loans until the interest rate on loans rises to the level of the funds rate. The contraction in loans is matched by a fall in total deposits, i.e., in M2.

The key to understanding the difference between adjustment to a discount rate increase under LRR and CRR lies in what happens to the $f - d$ spread. As explained above, under LRR the $f - d$ spread remains unchanged. However, under CRR the $f - d$ spread falls. To see why, suppose that under CRR the funds rate rose by the full amount of a discount rate increase so that borrowed reserves and hence total reserves in the banking system remained unchanged. The higher interest rate would reduce the volume of loans demanded and would, in turn, reduce total deposits and total reserve demand. Since reserve provision would not have changed, an incipient excess supply of total reserves would exist at an unchanged $f - d$ spread. It follows that the funds rate must rise *less* than the discount rate for the reserve market to clear. Similarly, the funds rate could not remain unchanged or fall because such an outcome would be associated with an incipient excess demand for total reserves. Hence, under CRR the funds rate rises but by less than the discount rate increase. To summarize, the interest rate rises and M2 falls in response to a discount rate increase under either reserve requirement regime, but the changes are smaller under CRR than under LRR.²⁶

biguous. Furthermore, the magnitude of M1 response to a given loan demand shift with an NBR instrument could be either greater or smaller under CRR than under LRR.

²⁶ M1 also responds less under CRR than LRR.

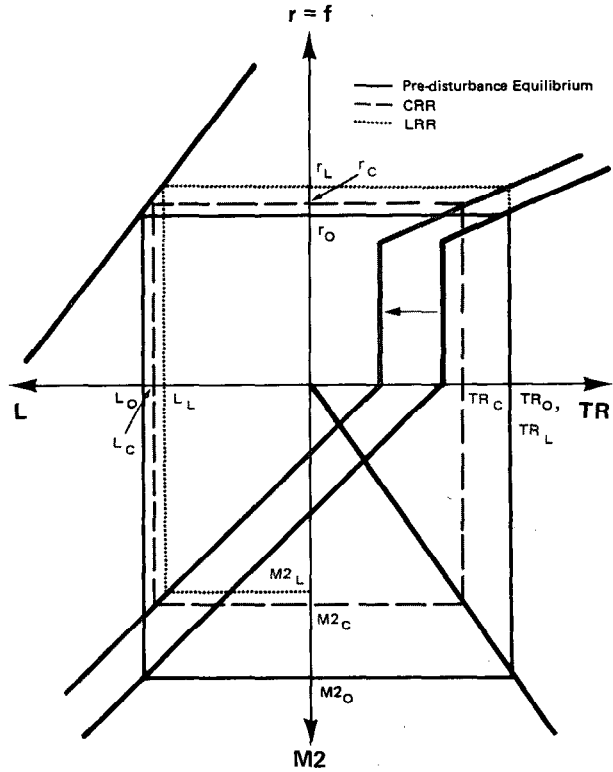
Figure 7
A DISCOUNT RATE ADJUSTMENT



3. **An Open Market Operation** An open market sale of securities by the Fed, undertaken to reduce non-borrowed reserves and contract the money stock, is illustrated in Figure 8 as a leftward shift in the reserve provision schedule. As the public draws down its deposits to pay for securities purchased from the Fed, the banking system loses non-borrowed reserves. Diagrammatically, the balance sheet constraint line shifts upward by the amount of the non-borrowed reserve drain.

Under LRR, banks borrow in the funds market and at the discount window to replace the lost non-borrowed reserves in order to satisfy predetermined total reserve demand, TR_0 . The incipient excess demand for total reserves drives the funds rate up and thereby raises the $f - d$ spread. The reserve market comes into equilibrium at an $f - d$ spread high enough to raise discount window borrowing sufficiently to fully offset the initial non-borrowed reserve drain. The higher funds rate leads the banking system to contract loans until the interest rate on loans rises to the level of the funds rate. Banking system assets contract by the sum of the reduction in both loan volume and non-borrowed reserves.

Figure 8
AN OPEN MARKET OPERATION



Equilibrium is therefore reached at a higher interest rate and lower M2.

Under CRR, as illustrated in Figure 8, the interest rate rises and M2 falls but neither responds as much as under LRR.²⁷ This is because with CRR the M2 reduction also reduces total reserve demand so that a smaller funds rate rise clears the reserve market. The smaller interest rate rise produces a smaller contraction in both loans and M2 with CRR as well.

4. **An M2-TR Multiplier Shift** As can be seen in equation (8), the M2-TR multiplier can shift due to a revision of reserve requirements, a change in excess reserve demand, or a change in the demand for TDs relative to DDs.

For example, consider money market funds (MMFs). For the purpose of this discussion, MMFs may be assumed to sell shares to the public and purchase banking system TDs. MMFs essentially reduce the public's cost of holding TDs, so MMFs are presumed to raise the ratio of TDs to

²⁷ M1 also responds less under CRR than LRR.

aneous reserve requirements. Furthermore, determination of both "M1" and "M2" type monetary aggregates has been explained with the aid of a simple diagram.

Determination of the monetary aggregates has been shown to depend critically on the method of monetary control employed by the Fed. In particular, the discussion has shown that the money multiplier is not generally a complete model of money stock determination and is actually irrelevant to money stock determination for some monetary control procedures. Specifically, the money multiplier is irrelevant to determination of the monetary aggregates if lagged reserve requirements are in effect. On the other hand, the money multiplier can be a complete model of targeted money stock determination if contemporaneous reserve requirements are in effect, total reserves are the instrument of monetary control, required reserves are uniformly and solely applied to the targeted monetary aggregate, and the ratio of excess reserves to the targeted monetary aggregate is interest insensitive. With contemporaneous reserve requirements and either a funds rate or a non-borrowed reserve instrument, however, the money multiplier is necessary but not sufficient to explain determination of the monetary aggregates.

If the Fed does move to non-borrowed reserves with contemporaneous reserve requirements, it is likely to let the funds rate fall below the discount rate periodically and to employ the funds rate as the instrument of monetary control in such circumstances as it has since October 1979. A comparison of money stock targeting error for f-LRR and f-CRR combinations has indicated that monetary control with a funds rate instrument could be less precise with contemporaneous reserve requirements than with lagged reserve requirements.

The model has been employed to examine the impact of four disturbances on the monetary aggregates with a non-borrowed reserve instrument under lagged and contemporaneous reserve requirements. The NBR-LRR and NBR-CRR combinations have been examined in detail because the Fed is currently employing non-borrowed reserves with lagged reserve requirements and has given serious consideration to utilizing non-borrowed reserves with contemporaneous reserve requirements. The four disturbances examined were (1) a loan demand shift, (2) a discount rate adjustment, (3) an open market operation, and (4) an M2-TR multiplier shift. The M2 money stock was found to respond less under CRR than under LRR to the first three disturbances. The M1 money stock was found to respond less under

CRR than under LRR to a discount rate adjustment and an open market operation. However, relative M1 response to a loan demand shift was found to be ambiguous. Furthermore, whereas both monetary aggregates are insulated from a multiplier shift under LRR, neither is insulated from a multiplier shift under CRR.

Loan demand disturbances, multiplier disturbances, and problems associated with the funds rate falling below the discount rate could be reduced if appropriate reserve requirement and discount window reform were to accompany a move to contemporaneous reserve requirements. For example, if the discount rate were made a fixed penalty rate slightly above the funds rate, then borrowed reserves would be small and the Fed could supply non-borrowed reserves to achieve a total reserves objective. If, in addition, reserve requirements were uniformly and solely applied to the targeted monetary aggregate, and the ratio of excess reserves to the targeted monetary aggregate were interest insensitive, then there could be a direct and relatively stable link between total reserves and the targeted money stock. In short, with a total reserve instrument and contemporaneous reserve requirements the Fed's money stock targeting procedure could be well-insulated from loan demand, multiplier, borrowed reserve, and interest rate disturbances in general.

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APPENDIX

The model is summarized as follows:

Reserve Market Equilibrium

$$TR \equiv NBR + BR$$

$$BR = BR^D(r - d)$$

$$\begin{cases} r > d \Rightarrow BR^D(r - d) > 0 \text{ and } BR^{D'}(r - d) > 0 \\ r \leq d \Rightarrow BR^D = 0 \end{cases}$$

$$TR^D \equiv RR + ER$$

$$RR \equiv rr_1 DD + rr_2 TD$$

$$rr_2 < rr_1 < 1$$

$$ER \equiv k_1(r)DD + k_2(r)TD$$

$$k_2(r) < k_1(r) \text{ and } k_1'(r), k_2'(r) < 0$$

$$TR = TR^D$$

Loan Market Equilibrium and the Balance Sheet Constraint

$$L = P \cdot L^D(r)$$

$$L^{D'}(r) < 0$$

$$L + NBR \equiv DD + TD$$

Portfolio Balance and The Money Multiplier

$$M1 \equiv DD$$

$$M2 \equiv DD + TD$$

$$\frac{TD}{DD} = \rho(r)$$

$$\rho'(r) > 0$$

$$\text{or } \frac{M2}{M1} = 1 + \rho(r)$$

$$m_2(r) \equiv \frac{M2}{TR}$$

$$m_2(r) = \frac{1 + \rho(r)}{rr_1 + rr_2\rho(r) + k_1(r) + k_2(r)\rho(r)} \quad m_2'(r) > 0$$

FORECASTS 1982

Roy H. Webb

The views and opinions set forth in this section are those of the various forecasters. No agreement or endorsement by this Bank is implied.

Forecasters are displaying a surprising degree of unanimity on the economic outlook for 1982. Based in part on the scheduled reduction of marginal income tax rates, 13 of 14 forecasters surveyed in early January anticipated strong growth of production and

trade after the first quarter of the year. Moreover, all see lower inflation rates during the year. Even if such relatively optimistic predictions are realized, however, the economy would only partially recover the output losses of recent years.

Tables I and II display median values of the forecasts surveyed. Highlights from the tables are discussed below as they relate to the economy's recent performance, the accuracy of last year's forecasts,

Table I

RESULTS FOR 1981 AND TYPICAL FORECASTS FOR 1982

	Unit or Base	Preliminary 1981*	Forecast 1982**	Percentage Change	
				Preliminary 1981/1980	Forecast 1982/1981
Gross national product	\$ billions	2,922.2	3,150	11.3	7.8
Personal consumption expenditures	\$ billions	1,858.1	2,027	11.1	9.1
Durables	\$ billions	232.0	251	9.5	8.1
Nondurables	\$ billions	743.4	795	10.0	7.0
Services	\$ billions	882.7	982	12.4	11.2
Gross private domestic investment	\$ billions	450.6	469	14.0	4.0
Fixed investment:					
Nonresidential	\$ billions	327.1	351	10.5	7.3
Residential	\$ billions	105.3	109	0.1	3.6
Change in business inventories	\$ billions	18.2	8	—	—
Net exports	\$ billions	23.8	15	—	—
Government purchases	\$ billions	589.6	639	10.3	8.4
Federal	\$ billions	228.6	255	14.9	11.6
State and local	\$ billions	361.1	384	7.5	6.3
Gross national product (1972 dollars)	\$ billions	1,509.6	1,514	1.9	0.3
Corporate profits after taxes	\$ billions	129.8	129	-1.7	-0.9
Private housing starts	thousands	1,086.6	1,195	-15.9	10.0
Domestic automobile sales	thousands	6,163.1	6,644	-5.9	7.8
Rate of unemployment	percent	7.6	8.4	—	—
Industrial production index	1967 = 100	150.9	151.8	2.7	0.6
Consumer price index	1967 = 100	272.4	294.2	10.4	8.0
Producer price index (finished goods)	1967 = 100	269.7	287.0	9.8	6.4
GNP implicit price deflator	1972 = 100	193.6	208.1	9.1	7.5

* Data available as of January 1982.

** These data are constructed using preliminary 1981 data and the median annual percentage change forecast for each category. Since the annual percentage change is calculated from yearly average values, it will not equal the average quarterly change that could be computed from Table II.

Table II

TYPICAL QUARTERLY CHANGES FORECAST FOR 1982

(Percentage Changes at Annual Rates Unless Otherwise Noted)

	Forecast 1982*			
	I	II	III	IV
Gross national product	5.1	10.1	12.2	12.0
Personal consumption expenditures	9.7	8.3	10.5	12.0
Durables	12.1	10.4	22.5	19.1
Nondurables	6.2	7.3	8.2	9.1
Services	10.3	10.9	10.6	11.4
Gross private domestic investment	-11.7	12.1	23.4	19.5
Fixed investment:				
Nonresidential	3.6	6.9	12.4	13.5
Residential	-1.3	38.8	43.9	36.2
Changes in business inventories**	-5.4	2.4	9.0	13.9
Government purchases	6.7	6.1	8.3	10.9
Federal	6.8	8.0	10.0	15.8
State and local	7.6	6.0	5.3	7.2
Net exports**	21.7	18.0	19.0	18.0
Gross national product (1972 dollars)	-1.0	2.7	4.9	4.8
Corporate profits after taxes	-2.3	18.3	29.5	22.3
Private housing starts	12.5	18.6	8.8	10.6
Domestic automobile sales	9.1	7.4	7.6	3.1
Rate of unemployment†	8.6	8.6	8.4	7.9
Industrial production index	-3.2	4.8	9.3	6.3
Consumer price index	6.4	7.3	7.8	8.0
Producer price index (finished goods)	7.4	6.7	8.3	8.5
GNP implicit price deflator	7.0	7.1	6.8	7.4

* Median quarterly percentage change forecast for each quarter for each category.

** Quarterly levels, billions of dollars, annual rates.

† Quarterly levels, percent.

and predicted actions by government agencies. Some difficulties of using economic forecasts are then discussed in the final section.

The median forecast sees a cyclical recovery beginning in 1982. Real GNP is projected to grow at a 4.1 percent rate in the last three quarters, following a 1.0 percent decline in the first quarter. Tax rate reductions are expected to boost total personal consumption expenditures by 10.1 percent, with consumer spending for durable goods expected to rise at a 15.9 percent rate over the year.¹ While some

recovery is forecast for residential construction, the predicted 28 percent growth for 1982 is actually quite modest in light of that industry's depressed condition in late 1981. Nonresidential fixed investment is anticipated to grow by 9 percent over the year, only slightly ahead of inflation, while state and local government spending at the end of 1982 is projected to be only 6.5 percent above the late 1981 level.

The anticipated pattern of GNP growth, however, is reminiscent of the forecast for 1981. At that time, there were no forecasts (in the 17 surveyed) of even a 0.5 percent GNP growth rate in the first quarter. Indeed, the median forecast was for zero growth, in contrast to the 8.6 percent rate of growth that did occur. And not only were there no forecasts

¹ Growth rates "over the year" are from the fourth quarter of the preceding year to the fourth quarter of the year being forecast. They will thus differ from changes in the yearly average values presented in Table I.

for the recession that began in the summer, but the median forecast was for 3.6 percent real growth during the final six months. Thus while the median forecast correctly predicted positive real growth for the year as a whole, both the small magnitude and the quarterly pattern were surprises for the forecasters.

Should the median forecast for 1982 be realized, the economy in many respects will remain well below its potential. If industrial production, for example, were to grow at the predicted 4.2 percent rate, it would end the year below its value in January 1979. And housing starts, at 1.45 million units forecast, would not approach the 2 million unit level that was last attained in November 1978. Also, the unemployment rate of 7.9 percent projected for the last quarter of 1982 is well above the "natural rate" (often estimated in the neighborhood of 6 percent, a figure last seen in December 1979). More examples could be provided, but the main point should be clear: after three years of virtual stagnation, the anticipated economic growth in 1982 is but a small step toward full recovery.

Further disinflation is predicted for 1982. The GNP deflator and the consumer price index are forecast to rise by 7.1 percent and 7.4 percent during 1982, respectively, compared with increases of 8.6 percent and 8.9 percent in 1981. Both rose more slowly than anticipated in 1981; median forecasts were for 9.1 percent growth by the deflator and 10.7 percent by the CPI. Those overestimates were consistent with the tendency of forecasters to underpredict changes in inflation rates, as they did in such recent episodes as the 1973-74 acceleration of prices, the 1976 decline of inflation, and the sustained increase in inflation from 1977 to 1980. If that tendency toward underprediction recurs, inflation should decline more than the forecast 1.5 percent.

Several factors are noted by forecasters with respect to the inflation outlook. For one, the Federal Reserve allowed monetary growth to be unexpectedly low in 1981 (no forecaster in the survey anticipated a shift-adjusted growth rate as low as the actual 2.1 percent) and the Fed is expected to keep monetary growth relatively low in 1982. Some forecasters also mentioned the low degree of resource utilization, most notably high unemployment as a factor moderating wage growth. Favorable trends in energy and food markets are also foreseen. However, the projected increase in aggregate demand in the last half of 1982 is reflected in an inflation forecast for the last half that is well above the first two quarters.

More details of the median forecast are contained in Tables I and II. In addition, this Bank publishes

the booklet *Business Forecasts 1982*, which is a compilation of business forecasts with names and details of the various estimates. As such, it contains considerably more information than this brief summary. Readers may find, however, that at some point they receive more forecast information than they are able to readily use. It may not be easy to decide what information is relevant and then to integrate that information with other knowledge so as to improve anticipations of future economic conditions. A perspective for studying forecasts may therefore be of help; for that reason, one is outlined below.

EVALUATING ECONOMIC FORECASTS

When confronted with economic forecasts, potential users often react in opposite ways, either taking them too seriously or ignoring them altogether. The view taken here is that neither extreme is tenable. For while it is true that it is virtually impossible to forecast the future with complete accuracy, it is also true that even a forecaster whose record shows obvious errors may still provide projections containing useful information. That said, however, it should be noted that the task of extracting useful information from forecasts is far from trivial. These issues are explored below.

At first glance it is easy to overvalue forecasts. Since they are normally stated as point estimates and are often advocated with a good deal of authority, a natural inclination is to treat these numbers as having the same precision as others that are often encountered. A little experience, however, demonstrates that forecasts can be very imprecise. Table III, for example, presents median forecasts and actual outcomes for representative variables from recent editions of this Bank's annual *Business Forecasts* publication. The average magnitude of the forecast error in each case is a sizeable fraction of the variable that was forecast.

When predictions fail to approximate actual outcomes, some observers proceed to summarily reject all forecasts. As *The Wall Street Journal* [5] recently put it, "[W]e see no reason to defer to them [econometric models] on anything so complicated as an economy. . . . [W]e are not going to take economic predictions about the day after tomorrow as more than food for reflection." Similarly, as the chief executive of one large company said about economists' predictions [1], "I go out of my way to ignore them."

Although the temptation to ignore forecasts may be strong, it is another matter to propose a better

Table III

MEDIAN FORECASTS

	Real GNP (Percent Change)			Inflation Rate (GNP Deflator)			Treasury Bill Rate		
	Actual	Predicted	Error	Actual	Predicted	Error	Actual	Predicted	Error
1971	4.7	3.8	1.0	4.7	3.6	1.1			
1972	7.0	5.6	1.4	4.3	3.2	1.1			
1973	4.3	6.0	1.7	7.0	3.3	3.7			
1974	-2.7	1.2	3.9	10.1	5.5	4.6	7.3	6.0	1.3
1975	2.2	-0.6	2.8	7.7	7.1	0.6	5.7	7.1	1.4
1976	4.4	6.0	1.6	4.7	5.4	0.7	4.7	7.1	2.4
1977	5.8	5.0	0.8	6.1	5.7	0.4	6.1	5.8	0.4
1978	5.3	4.2	1.2	8.5	5.9	2.6	8.7	6.5	2.1
1979	1.7	1.5	0.2	8.1	7.1	1.0	11.8	8.1	3.7
1980	-0.3	-0.8	0.4	9.8	8.2	1.6	13.7	8.6	5.1
1981 (preliminary)	0.7	2.4	1.7	8.6	9.1	0.5	11.8	10.8	1.0
Average Error			1.5			1.6			2.2
Root-Mean-Square Error			1.8			2.1			2.6

Predictions are from *Business Forecasts*, published annually by the Federal Reserve Bank of Richmond. The error is the absolute value of the difference between predicted and actual values (although calculations use several decimal places, rounded values are presented in the table). The root-mean-square error is the square root of the average squared error. Real growth and inflation are from the fourth quarter of the previous year to the fourth quarter of the stated year. The Treasury bill rate is the average value in the fourth quarter.

strategy for making decisions in an uncertain world. Individual households, firms, and government bureaus must act on the basis of their anticipations of future quantities to be exchanged and future prices for transactions in commodity, labor, and financial markets. Each individual decision-maker could, of course, form such anticipations in a haphazard, unsystematic manner. But many individuals have found that systematic study can improve the quality of forecasts. In forecasting, as in most productive activities, there are potential gains from specialization and exchange. That a \$100 million forecasting industry has developed and prospered should therefore not be surprising, past errors for every individual forecaster notwithstanding.

In fact, the large number of forecasters and the quantity of data that each generates can make it difficult for potential consumers of forecasts to condense the information flow to a usable volume and then employ that information to make better decisions. An obvious strategy is to identify a particular forecaster that has been especially accurate in the past and hope that his future results are as good. This, however, is not as easy as it sounds. On the contrary, identifying a superior forecaster is itself a formidable task.

Difficulties in Identifying a Superior Forecaster

One difficulty is that users will seldom agree on the exact criteria for ranking forecasters. Different users, of course, require forecasts of different variables. And superiority in forecasting one variable does not necessarily carry over to other variables. Even users interested in one particular variable may find different error measures most relevant to their own needs. For example, one user might prefer a low average error, whereas another might prefer a low probability of an especially large error. Still another might prefer a low probability of "turning point" errors. (A turning point is the time at which a growing variable begins to decline or vice versa.)

Even if there were agreement on a particular error measure for a particular variable, it is not clear that current data could support a meaningful ranking. One problem is that different forecasters have excelled at different times in the past. In addition, there is little agreement on what constitutes a statistically significant difference in forecasting records (that is, what can be judged with a certain degree of confidence to be real performance differentials rather than mere chance). Stephen McNees [8, 9] has studied in depth the problem of identifying superior forecasts and presents valuable data for the interested reader.

Reducing User Uncertainty Another approach is to adopt the philosophy that the primary purpose of a forecast is to reduce the user's uncertainty. This approach explicitly recognizes that not only are users never completely uninformed about past trends, but also that they can never be perfectly certain about future events. Accordingly, the first step in employing this approach is to examine a user's initial knowledge and specify his initial uncertainty. The next step is to then use available forecasts to reduce that uncertainty. Henri Theil [10] has examined both problems and presents a discussion of these issues with several specific, detailed examples.

Taking the easier problem first, a user's existing knowledge about future movements of one particular variable can be described by the best point estimate he could make together with an estimate of that forecast's precision.² ("Precision" is defined as the reciprocal of the standard deviation of the *ex ante* distribution of forecast errors; thus that definition and the informal meaning coincide, in the sense that the greater the precision of a forecast, the greater the likelihood that the realization will be within a given distance of the forecast.) Thus when comparing forecasts, the one that could best lower uncertainty would be the one that had the highest probable precision accompanying the point estimate. Equivalently, a forecast could be presented as an interval centered on a point estimate together with a statement of the probability of the realization lying outside that interval. Presented this way, less uncertainty would be represented as a narrower predicted interval.

Characterizing Uncertainty: An Illustration As an example of how uncertainty could be characterized in a particular case, suppose that before consulting a forecaster, a user's best estimate of inflation over the next four quarters would be the inflation rate experienced over the preceding four quarters for which data are available. Using the root-mean-squared (RMS) error (that is, the square root of the average squared error) from a sample of previous

² It may be objected that many people do not have the information to make such a forecast. However, it is not necessary to have much information in order to make judgments on relative likelihoods, which can be equivalent to a subjective probability distribution (see, for example, Morris DeGroot [3]). Hence it is likely that a cursory inspection of newspapers or television news would permit at least a very imprecise forecast.

Table IV

ESTIMATED PRECISION OF SEVERAL FORECASTING METHODS

	RMS Error, Percent	Precision
Method of forecasting inflation		
Extrapolation of past inflation rate	2.7	0.37
Median forecast	2.1	0.47
Lagged money growth rate	1.3	0.74
Method of forecasting real GNP growth		
Always predicting trend rate (3.4%)	2.8	0.35
Median forecast	1.8	0.53

Forecasts are for percentage increases, fourth quarter to fourth quarter, 1971 to 1981.

forecasts as an estimate of the standard deviation of the current forecast error,³ the precision of that method is shown in Table IV.

As Table IV indicates, simple extrapolation of past inflation provided relatively imprecise forecasts. Table IV also shows that one could have done better, since the median forecast⁴ (reported in Table III) would have provided forecasts that were about 30 percent more precise. But extrapolation may not be the best technique at a user's disposal and thus may be too easy a comparison. As Robert Hetzel [6] has noted, inflation can be easily forecast by using

³ It should be noted that the RMS error of a small sample of forecasts gives a fairly crude estimate of future precision. In order to make rigorous probability statements it would be necessary that forecast errors be independent, identically distributed random variables with zero mean. These stringent assumptions are clearly not fulfilled by existing forecasts. First, one presumes that forecasters learn from experience and improve their models over time, thus contradicting the underlying assumption of an unchanging distribution of forecast errors. But any uncorrected flaws in forecasting procedures can cause forecast errors to recur over time, violating an assumed independence of successive forecasts. Also, the assumed zero mean may also be questionable. However, while the historical RMS error cannot be used to generate rigorous probability statements about the reliability of current forecasts of future conditions, in the author's view it does provide a useful starting point, especially in the absence of better information from forecasters themselves on probable future precision.

⁴ The optimal method of combining information from several forecasters is an interesting, unresolved puzzle. The median forecast is used in this article primarily for its simplicity.

lagged growth of the money supply (M1). By estimating inflation over an interval as equal to money growth two years earlier, one can construct a record of simulated inflation forecasts⁵ that performed relatively well. As shown in Table IV, from 1971 to 1981 the simple money growth prediction would have increased forecast precision by about 50 percent relative to the median forecast.⁶

Another example is shown in Table IV. If a user's best estimate of real GNP growth had been the historical trend rate of growth, then the median forecast would have raised that user's forecast precision by about 56 percent.

These examples show that receipt of a forecast can considerably lower uncertainty relative to an alternative such as extrapolation or use of the historical trend. But individuals may employ other methods that have such a degree of prospective accuracy that a typical forecast would not reduce uncertainty. Thus the examples illustrate the importance of careful examination of existing information before attempting to determine the value of economic forecasts.⁷

Providing Estimates of Forecast Precision Although forecast precision was estimated in Table IV by looking only at recent forecasts and the actual outcomes, other information could also be useful. To illustrate, note that the economic environment can change so as to alter the predictability of economic events. Forecasters of interest rates, for example, have found their task more difficult since the October 1979 change in Federal Reserve operating proced-

ures. Thus a statement on the anticipated precision of interest rate forecasts might well give more weight to post-October 1979 data than would a mechanical calculation of RMS errors over a longer time-span. Individual forecasters, with detailed knowledge of the strengths and weaknesses of their own methods, would arguably be in the best position to make such subjectively adjusted estimates of future precision. Therefore it is possible to imagine forecasters providing both point estimates and estimates of the precision of their forecasts.

If forecasters were to estimate both future values and their forecasts' precision, then forecasts would for the first time be verifiable. Point estimates by themselves are not verifiable since practically every forecast is wrong (that is, the realized value is not equal to the forecast value). But since an estimate of precision would also imply a confidence interval attached to a forecast,⁸ evaluating a forecaster's record would be straightforward. For example, if 50 percent of actual values fell outside a particular forecaster's published 95 percent confidence intervals over a reasonably long time, further forecasts would be highly suspect.

If estimates of precision would indeed be useful, why do not forecasters generally provide such estimates?⁹ There are at least two relevant considerations. First, while proper verification of a forecaster's product would require a reasonably long sample period, consumers might choose among forecasting services on the basis of a fairly small number of forecasts. Thus a good forecaster could lose customers if his forecasts were off-target simply due to a run of bad luck. Secondly, it was noted above that a comparison of past forecasts with realized values is only a starting point for assessing the probable accuracy of current forecasts. A more complete method for estimating a forecast's probable precision has been used by Ray Fair [4]. The price of additional completeness is a set of more complex procedures which, although feasible, would certainly increase the cost of providing forecasts. Consequently, reasonable

⁵ Since this technique was proposed partly on the basis of its performance over a segment of the sample period, it cannot be regarded as a true *ex ante* forecast.

⁶ Due to a suspicion that taking the median of a changing, unscientifically selected collection of forecasts might itself lead to poor results, the record of a single major forecaster was also examined. That suspicion was not confirmed as that forecaster made slightly less precise inflation forecasts than the median forecast presented.

⁷ This article has viewed forecasts as unconditional statements regarding future conditions. However, some forecasts are presented as statements of the future provided that a specific condition is fulfilled. An example of such a conditional forecast would be a projected inflation rate between 5 and 7 percent if M1 grew between 3 and 5 percent. While a reliable conditional forecast could be especially useful for some decision-makers, the reliability of existing conditional forecasts has not been proven. Perhaps the most obvious use of conditional forecasts is in formulating national economic policy. It turns out, however, that such forecasts have often proved highly misleading. Robert Lucas [7] has explained why conventional methods cannot provide reliable conditional forecasts for government policymakers.

⁸ Assuming that *ex ante* forecast errors are unbiased and identically normally distributed, there would be a 95 percent probability that the difference between realized and actual values would be no larger than 1.96 times the reciprocal of a forecast's true precision.

⁹ Some forecasters do provide a limited amount of information relating to precision. Such estimates are typically for a small number of variables, few time periods, and are not prominently displayed. The large majority of forecasters, however, do not make even such a limited effort.

estimates of the demand for routine but careful analysis of forecast precision may well indicate that introduction of such a costly and risky product is not currently justified.

Conclusion The foregoing discussion provides an approach to using economic forecasts that evaluates a forecast by the extent to which it can reduce users' uncertainty about future economic conditions. While a thorough examination of the subject is beyond the scope of this article, an example was given that

illustrates how estimates of a forecast's value will critically depend upon the knowledge held by a user prior to receipt of a forecast. In addition, the importance of a forecast's prospective precision was emphasized. Besides its value in reducing an individual forecast consumer's uncertainty, such an estimate of precision would make forecasts verifiable. Although final judgment on the value of forecasts is not attempted in this paper, it is hoped that some readers will have a new perspective on evaluating forecasts for their own purposes.

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THE AGRICULTURAL OUTLOOK FOR '82

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The U. S. Department of Agriculture's top level economists analyzed this year's prospects for the nation's agriculture, and the implications for retail food prices, at the 1982 Agricultural Outlook Conference early last November. A brief rundown of the outlook, as they saw it then, shapes up this way.

There is little encouragement in the 1982 outlook for the nation's farmers at this time. Consumers, however, are apparently assured of abundant supplies of food at prices moderately higher than in 1981.

While there are many uncertainties in the outlook, there is currently little evidence that 1982 will be a good year for farm income. This prospect comes on the heels of two consecutive years of disappointing net farm income. Many farmers, as a result, have developed serious cash-flow problems and have had to borrow heavily against their equity.

Going into 1982, supplies of farm products are likely to continue large relative to demand in both domestic and world markets. Farm prices are expected to remain under pressure, at least through midyear. Moreover, a sharp rebuilding of stocks is indicated.

Barring unexpected weather developments, the most important variable in the agricultural outlook for 1982 is probably the performance of the domestic and world economies. While there are still some clouds in the picture, economic activity abroad should increase somewhat this year. Growth of around 2 percent, with most of the pickup likely in the second half, is indicated in the developed countries.

Some improvement in economic activity here in the United States is also indicated for 1982. Expectations are that the present recession will not be very deep or very long. Growth in GNP will likely amount to about 2 percent for the year as a whole, with the strongest performance also coming in the second half. Real disposable income per capita should increase about 2 percent, again largely in the second half, lending some strength to demand for farm products.

Little Improvement in Farm Income Likely The nation's farmers have experienced two consecutive years of unfavorable net farm income and are faced with prospects for little improvement in farm income in 1982, particularly during the first half of the year. Current forecasts suggest no improvement in crop and livestock prices over 1981 levels, at least through midyear. Larger marketings of both crops and livestock are indicated, however. Farm cash receipts, as a result, may record a modest 4 to 6 percent increase in 1982. While moderate gains in crop receipts are indicated during the first half of the year, returns in the second half will be determined largely by the size of 1982 crops.

Modest gains over last year are anticipated in receipts from beef cattle, hogs, soybeans, fruits and nuts, and possibly food grains. Somewhat larger increases are indicated for corn and broiler receipts. Returns from tobacco and dairy products may hold near the 1981 level. But vegetable receipts, particularly from potatoes and dried beans, may decline slightly.

The rise in farm production expenses last year was the smallest since 1977, and further slowing seems likely in the year ahead. Reflecting some moderation in the underlying rate of inflation, price increases of farm inputs, especially those for energy-based inputs such as fuel, fertilizer, and chemicals, should also begin to moderate. Because of the squeeze on farm income during the past two years, farmers' use of inputs will probably not increase significantly. Farm production expenses in 1982 therefore may rise only 6 to 9 percent, compared with 9 percent last year. An increase of this magnitude would be the smallest year-to-year advance in farm production expenses

since 1975. But despite the expected moderation, farm production expenses will likely rise as much or more than cash receipts, pointing to a continued squeeze on net farm income in 1982.

Expectations for the costs of farm-origin inputs in 1982 point to little or no change in feed costs, a slower rate of gain in seed costs, but a significant increase in expenses for both feeder cattle and feeder pigs. As noted earlier, the growth in expenses for inputs of nonfarm origin is expected to moderate this year, provided there are no unforeseen disruptions in the Mideast. Slower rates of increase are indicated not only for fuel, energy, and fertilizer costs but also for pesticide and other agricultural chemical expenses and for the costs of labor.

What are the prospects for interest expenses? Last year total interest costs on real estate and non-real-estate debt jumped nearly 20 percent over those in 1980. With this increase, interest expenses now make up about 13 percent of farmers' total production costs as against around 7½ percent ten years ago. Current indications are that with moderation, or even some decline in the nominal interest rate on farm loans in 1982, the average rate on total debt outstanding will continue to increase because new loans carry a higher rate of interest than the loans retired. The higher average interest rates, combined with a continued rise in total farm debt outstanding, point to further substantial increases in farmers' total interest expenses in 1982.

Generally, farmers' cash costs have risen faster than their farm cash receipts during the past two years, resulting in dramatic declines in both cash incomes and in net farm incomes. While there are many uncertainties in the farm income picture for 1982 at the present time, it seems likely that farmers' cash income may fall another \$1 to \$3 billion. Declines in net farm income after inventory adjustment could be even greater.

Export Outlook Uncertain Although surrounded by considerable uncertainty, the outlook for U. S. agricultural exports in fiscal 1982 is currently expected to total about \$45.5 billion.¹ Export value, at this level, would be 4 percent above fiscal 1981 and at a new high for the thirteenth consecutive year. While export volume may rise about 10 percent to

¹ The outlook for agricultural exports has become even more uncertain than it was at the time of the Outlook Conference last November. The U. S. Department of Agriculture, as of mid-February, indicated that the value of U. S. agricultural exports and imports may decline in fiscal 1982.

around 180 million tons, lower prices anticipated for grains and oilseeds will be partially offsetting. The value of agricultural imports will probably remain at \$17 billion, same as last year. Should these indicated export and import values be realized, the agricultural trade surplus could exceed \$28 billion, up from \$26.6 billion last year.

Three factors, together with a generally sluggish worldwide economy, dampened foreign demand for U. S. farm products last year and will most likely continue to affect agricultural trade in fiscal 1982. These factors are: high interest rates; the stronger dollar, which made U. S. farm exports more expensive in foreign markets; and increasingly restrictive world market conditions.

Nonetheless, there are a number of positive elements in the fiscal 1982 agricultural export picture. Foremost, perhaps, are the abundant exportable supplies of most commodities at lower prices; heightened grain import needs, particularly in the Soviet Union and India; and moderate gains in foreign production of oilseeds, especially soybeans. Furthermore, the Department of Agriculture, with the full support of the administration, has launched a vigorous effort to expand new markets, maintain old markets, and to meet foreign competition effectively. The first step in this direction was taken last April 24 when the President lifted the partial embargo on sales of farm products to the Soviet Union.

Much of the expansion in U. S. exports this year will be in shipments of wheat, feed grains, and soybeans. Wheat exports may be at a record level, almost one-fifth above last season. Exports of cotton may also rise about one-fifth. Larger shipments of tobacco, fruits, nuts, and vegetables are also indicated. Exports of livestock, poultry, and their products are another bright spot in the overall agricultural trade picture, with shipments expected to rise from \$4.2 to \$4.8 billion, or about 14 percent.

Record-large farm exports to the Soviet Union are indicated for fiscal 1982. Shipments to the centrally planned countries, in fact, may rise \$1 billion, or some 17 percent over a year ago. The developing countries have constituted a growing market for U. S. exports in recent years and are likely to continue to boost their share of the total. While agricultural exports to the developed countries—Western Europe, Japan, Canada, and Oceania—may not match the \$21 billion in fiscal 1981, they are expected to continue large, accounting for 45 percent of total shipments. But sluggish economies in many developed countries are limiting exports despite lower prices for feedstuffs and wheat.

Farm Finance Outlook Net incomes of the nation's farmers have varied significantly over the past two years. Generally, crop farmers have fared better than livestock producers. Because of this income variability, the financial positions of farmers at the beginning of 1982 also varied widely. Some farmers are well established, have a large equity base, and need minimal credit. Others are overextended on debt.

Net income is but one measure of economic conditions in the agricultural sector, however. Proprietors' equity is another important measure. While net farm income has fallen substantially over the last two years, equity per farm has risen 25 percent.

Many farmers also have significant amounts of off-farm income. More than 60 percent of total farm family income in 1980, for instance, came from off-farm sources.

On balance, however, many farmers have developed serious cash-flow problems over the last two years and have been forced to borrow heavily against their equity to finance farm operations. In attempting to cope with their cash-flow problems, these farmers have assumed more debt, rescheduled debt payments, and postponed large capital expenditures. While high interest rates and depressed farm prices have tended to reduce the demand for farm loans in recent months, total farm debt has almost doubled in the last five years, becoming a major source of rising cash-flow problems. Farmers who have been faced with two years of restricted cash flow are finding it increasingly difficult to service existing debt. Besides, many who have deferred capital expenditures during this period now find that their machinery and equipment need to be replaced.

While indications point to increases in delinquencies, defaults, and foreclosures in 1982, the percentage of farm borrowers facing such problems is expected to remain low. The major exception seems to be at the Farmers Home Administration (FmHA) where delinquencies on farm loans are up sharply. Some farmers with cash-flow problems are expected to avoid delinquency or default by refinancing.

Farm borrowers who are highly leveraged—those who have little or no equity in their land and equipment to support more debt—will experience the most difficulty in borrowing money this year. Moreover, commercial lenders most likely will no longer be able to transfer problem borrowers to the FmHA as they have in past years. Some commercial lenders may thus be forced to foreclose on borrowers who are in severe financial trouble.

Qualified farm borrowers should continue to find ample credit available in 1982. Fund availability will likely vary by type of lending institution, however. In addition, the availability of credit through merchants and dealers may also expand. But should the farm real estate market remain sluggish and lenders become less willing to extend credit secured by farmland, the availability of credit could become a greater problem for some farmers.

Interest rates on farm loans may decline at some lending institutions and rise at others. There are indications suggesting that for the first time in five years, the interest rate advantage the Farm Credit System has had over other lenders will be reduced.

Food Prices to Moderate Further Retail food prices moderated last year, and some further moderation is anticipated for 1982. The current outlook suggests that retail prices for all food may average from 5 to 9 percent higher than in 1981, but a gain of about 7 percent is most likely. Such an upturn would compare with the indicated 8.2 percent rise last year and would represent a significant decline from the double-digit increases in 1978 and 1979. Biggest gain, probably around 8 percent, is expected to be in prices for food consumed away from home in restaurants, cafeterias, and fast-food establishments. Grocery store food prices may average in the neighborhood of 5 to 8 percent above 1981, but current expectations suggest an advance of around 6 percent. Such an increase would compare with a gain of 7.8 percent last year.

Rapidly rising food marketing costs, probably on the order of 8 to 10 percent, are expected to provide most of the impetus for higher food prices in 1982. Most of the increase in food marketing costs will likely come from higher charges for labor, packaging materials and containers, and transportation. Nevertheless, slowing inflation and high unemployment, together with a less rapid rise in energy prices, suggest a slowdown in selected components of food marketing costs.

By contrast, the farm value of domestically consumed foods may show only a modest increase over last year, probably on the order of 1 to 4 percent. The large supplies of farm foods will keep farm-level prices low, thus tempering the rise in grocery store food prices. Most livestock foods, with the exception of pork, will be abundant, moderating price gains for these foods. The smaller indicated pork production, however, could lead to increases of double-digit proportions in the prices of ham, sausage, pork chops, and other pork products.

Record wheat and rice crops, large soybean and peanut crops, large carry-overs of vegetable oils, and a continued recovery in world sugar cane production will keep prices for these products low. A large potato crop will reduce prices for fresh vegetables. Moreover, retail price increases for processed fruits and vegetables may prove to be moderate because of large carry-over stocks of canned fruit and greater production of frozen orange juice concentrate. Higher grocery store prices are likely for both fresh citrus and noncitrus fruit, however, because of smaller harvests.

Food consumption per capita is expected to rise slightly in 1982, primarily because the larger production of cereals, beef, dairy products, and fresh vegetables will temper the rise in grocery store food prices. The larger consumption, combined with the smaller rate of increase in food prices, implies that real per capita expenditures on food purchased for home use will probably remain about the same as last year's level.

Outlook Highlights for Commodities What are the prospects for the major money-making commodities produced by Fifth District farmers? Summaries of the Department of Agriculture's forecasts for 1982, presented below in capsule form, provide some indications.

Tobacco: A bumper tobacco harvest, improved leaf quality, stronger demand, and average prices well above a year earlier characterized the tobacco situation last fall. With the larger crop and beginning stocks up fractionally, supplies are about 5 percent above a year ago. Loan holdings have been reduced considerably, however.

The size of the 1982 tobacco crop will depend in part on the Department of Agriculture's decisions regarding quotas. The basic marketing quota for flue-cured tobacco, announced December 1, was set at 1,013 million pounds, the same as last year. Over-marketings will reduce the basic quota by about 32 million pounds, however, putting the effective national quota in the neighborhood of 980 million pounds. This figure would compare with 1981's effective quota of some 1,112 million pounds. Quotas for other kinds of tobacco will be announced later.

U. S. tobacco trade prospects point to small gains in total disappearance (domestic use plus exports). Domestic cigarette output and sales may increase slightly, despite continued antismoking publicity. Tobacco export prospects also look better because of the improved quality of last season's large crop.

Foreign demand for U. S. leaf will continue to be affected, however, by such factors as higher export prices, less favorable foreign currency exchange, and competition from lower cost producers.

Soybeans and Peanuts: The outlook for soybeans in 1981-82 is dominated by larger supplies and lower prices. Supplies, in fact, are only fractionally below the record level of 1979-80. With this season's larger supplies and lower prices, total usage of soybeans is expected to rise almost 10 percent above a year earlier. But despite the stronger domestic crush for oil and exports, a record carry-over equal to 21 percent of total usage would remain.

Soybean prices are projected to fall sharply, primarily as a result of this season's larger supplies and declining oil and meal prices. Prices at the farm are expected to average from \$5.50 to \$7.00 per bushel, down from an average of \$7.61 last season. Lower corn prices will also tend to keep soybean prices down.

The projected export demand for soybeans and soybean products indicates that the U. S. will increase its share of world soybean trade in 1981-82, regaining some of the market lost last year. The U. S. share of world soybean exports is expected to reach 80 percent, for example, compared with 76 percent a year ago.

With last year's sharp recovery from 1980's drought-reduced peanut crop, U. S. peanut production was just 2 percent short of the record-large outturn in 1979. Since peanut supplies this season are 28 percent larger, food use is expected to rise as retail prices of peanut products slow. Last season, use of peanuts in all food categories was lower, and retail prices of peanut butter and other peanut products rose substantially.

This season's larger supplies also point to the likelihood of an increase in peanuts crushed for oil. By the same token, peanuts available for export will likely rise. The export volume is not expected to reach the 1979-80 level, however.

Many peanut producers contracted a portion of their 1981 crop at premium prices above the support level. But because of the large output, a significant share of the crop will probably sell close to the support price. Farm prices could average around 23.7 cents a pound, or slightly under the 1980-81 figure.

House-Senate conferees, after much debate, agreed to make several changes in the government peanut program for the 1982-85 crops. The basic structure of the program was preserved, however.

Cotton: With last season's sharply larger cotton crop and the likelihood of only modest improvement in demand, ending stocks next August 1 could increase sharply to about 5.4 million bales. Cotton prices have trended downward in response to the much larger 1981 crop and slow textile mill activity. Because of the significantly lower cotton prices, deficiency payments will likely be made to growers. Such payments are made to growers participating in the cotton program if the national average farm price of cotton in calendar year 1981 is below the target price of 70.87 cents per pound. The payment rate is the difference between the target price and the average U. S. farm price, regardless of the price an individual farmer received for his cotton.

The combined domestic mill use and exports of U. S. cotton this season are expected to rebound moderately from last season's depressed levels, probably reaching 13.0 million bales. The anticipated growth in cotton disappearance in 1981-82 reflects the much larger supplies of cotton and the continued favorable cotton price competitiveness in both domestic and foreign markets.

Domestic mill use of cotton in 1981-82 may total 6 million bales. While up slightly from last season, the rate of growth in cotton mill use this year will be determined to a great extent by the state of the nation's economy. Consumer spending on nondurables has been aiding cotton consumption, however.

Export prospects for the 1981-82 season are much brighter than in 1980-81 and may total some 7 million bales, nearly 20 percent above last year's level. Much of the anticipated increase can be attributed to the fact that U. S. cotton is competitively priced in world markets.

Looking ahead to 1982-83, current expectations point to little change in U. S. supplies of cotton but moderate increases in both domestic mill use and exports. With this set of circumstances, stocks of U. S. cotton could decline slightly from the anticipated beginning level of 5.4 million bales.

Poultry and Eggs: Lower feed costs and somewhat higher prices will probably improve the returns of poultry and egg producers in 1982. The likelihood of a continued rise in costs other than feed will offset some of the decline in feed costs, however.

Broiler producers are planning to limit the increase in production to about 1 percent over 1981. This slight gain in broiler output, coupled with anticipated strong export demand, is expected to strengthen prices. While broiler prices may remain slightly weaker than in 1981 during the first half of the year,

prices are likely to strengthen in the second half as the economy begins to respond to the midyear tax cut.

Stocks of frozen turkeys were expected to remain burdensome at the beginning of the year, probably continuing large into the first quarter. Turkey prices as a result will likely be depressed throughout the first half of the year. Despite much lower feed prices, returns to producers can be expected to be unfavorable. With this situation, hatchery activity will probably be reduced, leading to a decline in turkey production of from 4 to 6 percent in 1982. Should production be cut back as expected, cold storage turkey stocks would likely be much lower than last year and help to support prices in the second half.

Because of unfavorable returns during most of 1980 and 1981, egg producers have been reducing the number of replacement pullets added to the flocks for at least a year. Replacement pullets will probably continue below last year's reduced level through the first quarter. Egg production for the year as a whole may thus be about the same as that in 1981, or perhaps a little under last year's level. If output is reduced during the first half, egg prices may rise slightly. Some further improvement in prices may occur in the second half if the economy improves as anticipated and demand for high-protein foods increases.

Meat Animals: Lower feed costs, moderating interest rates, and considerably improved forage conditions will help hold down production costs for cattle producers in 1982. Beef production rose slightly last year, and a further increase of 3 to 4 percent is likely this year with most of the rise coming in the second half. Fed cattle prices are expected to show only modest improvement over last year's average. Feeder cattle prices may show a little more improvement, however, as production costs decrease. These developments are likely to improve feedlot demand for replacement cattle. Stocker operators with good forage supplies for overwintering programs may provide strong competition for cattle feeders, however.

The larger feed supplies can also be expected to give pork producers a break on production costs in 1982. Cutbacks in pork production of 4 to 6 percent are indicated, with the largest declines coming in the first half; second-half output may be near that of a year earlier. Pork output at this level would still be relatively large in view of the anticipated supply of both beef and poultry and consumers' purchasing

power. Hog prices are expected to strengthen in 1982, but the rise will be limited by large total meat supplies and continued weakness in the general economy. With the possibility of improving consumer incomes in the second half, however, hog prices would be expected to rise modestly from the level in the first half.

Dairy Products: The dairy outlook for 1982 is still uncertain because of Congress' long delay in completing new farm legislation. Both the Senate and House have passed legislation to hold the milk support price at the current \$13.10 per hundred-weight through the 1981-82 marketing year. The agreement ends there, however.

The number of milk cows continues above a year ago, and a sizable number of replacement heifers are available to enter the milking herd. While gains in output per cow could slow as older cows are culled from the herd, total milk output in 1982 may be about the same as last year's record production. Increased output during the first half will most likely be offset by reduced production later in the year. Dairy farmers can expect only small gains in milk prices, probably on the order of 1 to 2 percent above 1981.

Commercial use of milk in 1982 may rise slightly, particularly if the support price is not increased. But disappearance will probably not keep pace with expanding output through next spring, indicating that large government purchases will continue heavy.