# RESERVE ACCOUNT MANAGEMENT BEHAVIOR: IMPACT OF THE RESERVE ACCOUNTING SCHEME AND CARRY FORWARD PROVISION

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# Reserve Account Management Behavior

## I. Introduction

The purpose of the this study is to examine reserve account management behavior to ascertain how desired levels of reserves are determined at the firm level. More precisely, the goal is to discuss the factors impacting the reserve management process, and determine how it is affected by altering the reserve accounting regime.

Elements expected to determine reserve management behavior include the rate of interest (including penalties), carryover provisions, length of maintenance period, length of the lag between the maintenance and computation period (i.e. the role of accounting regimes), and the variance of reservable deposits. Although the theory of reserve management has reached a fairly mature stage of development, related empirical verification has been lacking. Here we use pooled cross section and time series data to test a theory of reserve management behavior. Through this analysis we hope to obtain a better understanding of bank behavior and the desire and ability of institutions to respond to new procedures. It may also provide insights into the ability of institutions to respond to current policy proposals which may impact reserve account balances--e.g., daylight-overdraft restrictions.

## II. Description of Reserve Management Behavior

In deciding on the desired level of excess reserves the reserve manager encounters a classical inventory adjustment problem. The institution attempts to minimize expected costs given reserve balance and deposit flows, opportunity costs, and potential penalty costs. If excess reserves are held, an opportunity cost is incurred, whereas, if reserves are deficient, a penalty

is imposed by the Federal Reserve Bank (FRB). Thus, the level of desired excess reserves depends on the costs of excesses and deficiencies and the variance of deposits, i.e.,:

$$DXR = DXR\ (i,\ p,\ m,\ \sigma_R) \tag{1}$$

where DXR is desired excess reserves, i is the opportunity rate, p is the explicit FRB penalty rate, m is an implicit FRB penalty including required paperwork and administration cost and other non-pecuniary costs incurred when reserves are deficient (Orr and Mellon 1961), and $\sigma_R$ is the variance of the distribution of reserve balances.[1] With the exception of the opportunity rate, all variables affect DXR positively.[2]

The costs incurred by the institution in this situation can be shown graphically as depicted in Figure 1. Any deviation from zero excess reserves results in either an opportunity cost or a penalty charge. The slopes of the lines depict these respective rates and the areas under them the costs. Given uncertain deposit flows, the reserve manager chooses a DXR to minimize expected costs over the range of possible reserve deviations from target. Assuming zero transaction costs to adjust reserves and a symmetric distribution of reserve gains or losses about the desired level, Figure 2 depicts situations where DXR is negative, positive, and zero.[3] The process depicted in Figure 2 can be formalized by deriving expected costs over the range of reserve gains or losses, and deriving the cost minimizing level of DXR, x, i.e. assuming a rectangular distribution of reserve balance deviations from the target level, x, with a range of 2b, the expected costs are

$$E(C) = \int_{x-b}^{o} \frac{1}{2b}\ [m-(p-i)E]\ dE + \int_{o}^{x+b} + \frac{1}{2b}\ (iE)\ dE \tag{2}$$

where E is the actual excess reserves held. Minimizing E(C) generates

$$x = \frac{m+b(p-2i)}{p} \tag{3}$$

An additional element that could affect DXR is the carry over provision. This provision, introduced in 1968 permitted institutions to satisfy reserve requirements by holding an additional plus or minus two percent of the required level of reserves as long as the deviation was offset in the following maintenance period. The Federal Reserve introduced the provision to simplify individual bank reserve management. The provision was expected to be utilized in a "passive" manner to offset stochastic deviations from zero excess reserves. Thus, the bank could place less emphasis on achieving a precise reserve balance and could allocate fewer resources to reserve management.

The carry over provision, however, could also be used aggressively by institutions. The result would be an oscillatory movements between surpluses and deficiencies in an individual bank's successive reserve positions. This occurs for two reasons: (1) the cost of more than offsetting the deficiency or surplus carried forward is essentially zero, and (2) projected changes in future interest rates could make it advantageous to fully utilize the carry over provision, and thereby position the bank to borrow fed funds at a lower rate or to lend additional funds at a higher rate.

The proposition that the cost of carrying balances in excess of those required to offset balances carried forward is essentially zero results from the need to offset carryover in the succeeding maintenance period and the ability to carry forward to the following period. This can be seen by viewing the cost with a carry over provision as depicted in Figure 3 in which a negative position (F) was carried into the current period.

The institution can meet its reserve requirement by holding reserve balances equal to RR+F. If reserves less than RR+F (i.e., required reserves plus the deficiency carried forward) are held, the bank will be deficient and, incur a penalty. However, the institution can carry excesses over RR+F into the next maintenance period, enabling it to hold fewer reserves in that period. As shown by Friedman and Roberts (1983), if the institution decides to do this the cost of holding idle balances is not figured as the foregone interest, but rather the value lost from making the same investment one week later. Since the time horizon is only one week the cost (value lost) is minuscule.[4] Thus, the bank incurs little cost in holding up to 2% of required reserves in excess of F. However, once the 2% is exceeded the opportunity cost again becomes the foregone interest obtainable on alternative investments. Thus,

$$E(C) = \int_{x-b}^{F} \frac{1}{2b}\,[m-(p-i)E + (p-i)F]\,dE + \int_{F}^{F+.02RR} \frac{1}{2b}\,\left[\frac{i^2E}{1+i}\right]\,dE + \int_{F+.02RR}^{x+b} \frac{1}{2b}\,\left[\frac{i^2\,(.02RR) + iE}{1+i}\right]\,dE \qquad (4)$$

and minimizing E(C) generates:

$$x = \frac{m+b(p-2i) + \left(\frac{i}{1+i}\right)(.02RR)}{p} + F \qquad (5)$$

which is greater than the optimal level of balances without the carry forward provision, i.e., the previous level plus $\left(\frac{i}{1+i}\right)$ (.02RR) + F. In deciding on the desired level of excess reserves this 2% range becomes very important.[5]

If a reserve excess was carried forward, the same incentive would exist to more than compensate for the amount carried forward. This situation is

depicted in Figure 4. Here the bank benefits by being able to extend loans one week earlier than would be possible without the carryover provision. Although the benefit is small, the bank will tend to undertake some additional carryover to avoid holding too many idle balances.[6]

While the carry over provision impacts the desired level of excess reserves, the bank may marginally change its behavior, within the limits allowed by the 2% constraint, if projected future rates differ from current levels. Intuitively, if rates are expected to rise in the next maintenance period the bank will be enticed to carry forward larger excesses (smaller deficiencies) to enable it either to lend more or to borrow less in the Fed Funds market at the higher rate. Similarily, projected declines in the rate will encourage banks to carry forward a smaller excess (larger deficiency). Again, however, the magnitude of this behavior is constrained by the 2% carryover limit. Given the ability to carry reserve deficiencies (excesses) forward to the following maintenance period, the expectation that future rates will rise (fall) enhances the oscillations.

The expected cost, if a deficiency is carried forward, given the previous assumptions, and including a projected Fed Funds rate $\hat{i}$ becomes:

$$E(C) = \int_{x-b}^{F} \frac{1}{2b} [m-(p-i)E + (p-i)F]\, dE +$$

$$\int_{F}^{F+.02RR} \frac{1}{2b} \left(i - \frac{\hat{i}}{1+\hat{i}}\right) E + \left(i - \frac{\hat{i}}{1+\hat{i}}\right) F]\, dE +$$

$$\int_{F+.02RR}^{x+b} \frac{1}{2b} \left[\left(i - \frac{\hat{i}}{1+\hat{i}}\right) .02RR + iE - i\,(F + .02RR)\right] dE \qquad (6)$$

and minimizing E(C) generates

$$x = \frac{m + b(p-2\hat{i}) + \frac{\hat{i}}{(1+\hat{i})}(.02RR)}{p} + F \qquad (7)$$

This differs from the previous DXR only in the term multiplied by the 2% allowable carryover. If projected rates, $\hat{i}$, are greater (smaller) than current rates the resulting DXR is easily shown to be larger (smaller). If an excess is carried forward, again, only the Fed Funds term (i.e., $\hat{i}/1+\hat{i}$) changes.

Thus, the theoretical foundation for determining how an individual bank determines its DXR has been developed. The important determinants include the:

a) FRB implicit penalty

b) FRB penalty rate

c) carryover provision

d) variance of reserves and deposits, and

e) projected Fed Funds rate.

These may not impact each bank's behavior in the same manner as only the very largest banks may find it worthwhile to project the future Fed Funds rate and adjust their its carryover decisions. The smallest banks may find that the variance of reserves is such that trying to utilize the 2% carryover is not viable and may minimize cost by continually holding excess reserves. However, changes in any of these elements could impact the reserve management process. In the next section we discuss one additional factor which could affect the level of DXR-- i.e., modifications to the reserve accounting scheme.

## III. Reserve Accounting Regimes

Reserve management procedures have changed periodically with modifications to Regulation D of the Federal Reserve Act. The modifications impact reserve management to the extent that they impact the elements previously discussed. The periods emerging as a result of changes to Regulation D include:

(1) Prior to September, 1968: This period was characterized by contemporaneous reserve requirements. Reserve city banks were required to meet average daily reserve requirements on a weekly basis, and country banks were allowed a two week maintenance and computation period. In actuality, the reserve regime was one with a one day lag since required reserve balances at the close of business on the last day of the maintenance period were to be based on reservable balances at the opening of business on the same day.

(2) September 12, 1968 to February, 1984: During this period Federal Reserve member banks operated under a lagged reserve accounting (LRA) system. The average daily level of reserves held in the current one week period were based on reservable deposit balances held two weeks earlier. Thus, the level of required reserves was known with certainty while legal reserves, because of their stochastic nature, had to be projected based on past experience. A carry over provision was introduced to allow reserve deficiencies or excesses to be offset in the succeeding maintenance period. The carry over was not allowed to exceed two percent of required reserves and could not be carried for more than one reserve period. The maintenance period was also changed to one week for all member banks--eliminating the differential between reserve city and country banks. These changes were expected to reduce uncertainty and to "moderate pressures for reserve adjustments."[7]

(3)February 1984 - current: A new "contemporaneous" reserve accounting regime (CRR) was introduced in 1984. The new characteristics included a longer computation and maintenance period (2 weeks) and a shorter lag (2 days) between the two periods. The carryover provision was temporarily increased to 3% of required reserves, was subsequently lowered to 2-1/2% in August 1984, and returned to 2% in December 1984.

Adjustments to reserve management behavior as a result of changes in the reserve accounting regime will occur if they impact the elements discussed above. Figures 1 and 2 depict the factors impacting the desired level of excess reserves in the pre-1968 period. The introduction of the carryover provision and LRA generated the type of behavior characterized in Figures 3 and 4. Under LRA an individual bank utilizing the reserve management tools available to it will find it profitable to oscillate between reserve surpluses and deficiencies in successive maintenance periods. The extent of the excess or deficiency will depend on the magnitude carried from the previous period and the projected Fed Funds rate in the next week.

Moving to a new reserve accounting scheme may also affect the variance in reserves around the projected level. If we were to compare behavior across institutions we would expect the DXR to be positively related to reserve balance variability. The bank would want to cushion its position to avoid the quantum jump in cost once a penalty is imposed (i.e., m). Banks which can more accurately project their balances will not need as large a cushion. By introducing a two week lag between the maintenance and computation periods, the Federal Reserve hoped it would be possible to decrease variability for all banks. This would occur because banks would know precisely what their required balances were prior to the maintenance period and, thus, would need

only to be concerned with managing reserve balances. Prior to 1968 uncertainity with respect to required reserves also existed.

One of the purposes of moving to a LRA scheme was to simplify the reserve management process by reducing uncertainty in the manner discussed above. However, the effect may have been exactly the opposite. Under LRA, unexpected changes in deposits resulted in the need to offset the change to meet reserve requirements. Under CRR, unexpected deposit changes produced changes in both legal and required reserves. The resulting adjustment which the bank must make would be less than that under LRA because of the cushioning change in required reserves (Gilbert 1973). The impact will be considered in our empirical analysis.

The changes introduced in 1984 with CRR may again impact the level of desired excess reserves. The net result of the changes should be to lower the daily average variance of reserves because of the two week maintenance period, but increase uncertainty with respect to the level of required reserves because of the two day lag. The larger carryover, if used passively, makes it easier to achieve required reserve levels, but also encourages institutions to utilize the provision to generate a cyclical behavior of reserve excesses followed by more than offsetting reserve deficiencies. To the extent that the increased carryover provision and the decreased variability more than offset the decreased certainty concerning required reserve levels, banks would find the cyclical behavior of reserve management even more appealing. Additionally, banks previously not practicing this "fine tuning" of reserves may suddenly find it beneficial and begin utilizing it.[8] The phasing down of the size of allowable carryover (from 3% to 2-1/2%) should dampen the size of the reserve balance oscillations of the cyclical behavior.

The preceding discussion introduces a number of hypotheses, most of which can be empirically tested. The questions to be addressed include: (1) Does cyclical reserve management behavior occur when a carryover provision is in effect? (2) Do projected interest rates influence this behavior? (3) What was the impact of introducing CRR in 1984? and (4) What was the impact of temporarily having a larger carryover provision? Basically, how accurately are banks capable of managing reserve account balances?

## V. Data and Empirical Findings

A linear model describing the reserve behavior as discussed in the preceeding section can be presented as:

$$DXR = \alpha_0 + \alpha_1 (F) + \alpha_2 (OR) + \alpha_3 (EPR) + \alpha_4 (IPR) + \alpha_5 (RD) + \alpha_6 (\sigma_R) + u \quad (8)$$

where

F = carryover from the previous period,

OR = opportunity cost of holding excess reserves,

EPR = explicit penalty rate on reserve deficiencies,

IPR = implicit penalty rate,

RD = projected change in rates between the current and succeeding maintenance period,

$\sigma_R$ = variance of reserves,

u = error term and

$\alpha$'s = the parameters to be estimated.

Given the theory, optimal behavior would be to offset excesses or deficiencies carried forward suggesting that $\hat{\alpha}_1$ should approach -1.0. The penalty rates should impact DXR positively, as should projected increases in future rates and variability in reserve account balances. Higher opportunity

rates should result in lower DXR's. Thus, projected signs are:

$$\alpha_1, \alpha_2 < 0 \quad \text{and} \quad \alpha_3, \alpha_4, \alpha_5, \alpha_6 > 0.$$

To test the hypotheses discussed above, data were collected for 13 midwest commercial banks located in the Seventh Federal Reserve District--all with assets exceeding $400,000,000. The data span the period 1975-1985, thus, incorporating information from both the period of lagged reserve accounting and the period of "contemporaneous" reserve accounting. Data were not available for the earlier pre-LRA period.[9]

Variables used in the empirical analysis were chosen to represent the factors previously discussed and to avoid potential collinearity problems. This is a particular concern with interest rates, thus, the following variables and proxy variables were utilized in the analysis:

F = reserves carried forward

OR = one month T-bill rate in the secondary market,

EPR = the Chicago Federal Reserve discount rate plus 2%,

IPR = the difference between the weekly average Fed funds rate and the discount rate,

RD = the difference between the current Fed funds rate and the one projected for the following maintenance period,

$\sigma_R$ = the relative variation of reserve balances--the coefficient of variation.[10]

Since pooled cross section and time series data were used, equation (8) was estimated using a generalized least squares technique. The procedure assumes a first order autoregressive model where the error terms are both serially and contemporaneously correlated (Parks, 1967). The preferred choice

of a forecasted rate, to generate RD, was not obvious. No direct means of obtaining a forecast equal to those of bank managers is possible, therefore, a number of alternatives were considered. The reported results assumed the bank managers accurately forecasted the future rate. Alternative techniques to derive forecasts generally resulted in similar findings to the extent that they accurately forecasted future rates. Less accurate forecasts generated slightly inferior results.[11] The results from estimates of equation (8) are presented in Table 1. All of the estimates have the expected sign and most are significant at the 5% level. The significance level of the coefficient for the variable depicting the difference between projected and future opportunity rates (RD) fell just outside this range, and is significant at the 10% level. The coefficient on carryover is as projected, suggesting that banks do indeed manage their reserve accounts relatively accurately and utilize the carryover provision in an aggressive manner. That is, they manage their accounts to obtain benefits from this provision instead of using it as a cushion for unexpected account variability. Tests indicate the coefficient is not significantly different from -1.0 suggesting a complete offset of excesses or deficiencies carried into the period. The other variables then impact balances as originally hypothesized.

The impact of moving to a "contemporaneous" reserve accounting scheme can be analyzed by introducing a binary variable for time periods since February 1984. If the effects discussed earlier create sufficient uncertainty, banks can be expected to increase the level of DXR to help avoid unexpected reserve deficiences. Alternatively, if reserve management is actually less difficult under CRR we would expect DXR to actually decrease. This was tested by added the binary variable to equation 1 and reestimating the model. The estimates are presented in Table 2.

The introduction of the binary variable only marginally impacted the results. Although it enters with a negative sign, the t value suggests the impact is not significantly different from zero. Apparently no increased uncertainty was introduced by CRR or it is being captured by changes in the reserve balance coefficient of variation. It may be that reserve managers are actually in a preferred position under CRR, inspite of the fact that they argued so aggressively against it. Attempts to quantify the impact of phasing down carryover between February 1984 and December 1984 proved fruitless. In no case did the inclusion of a binary to account for the beginning of a carryover phase-down period enter significantly or significantly alter the magnitude of the remaining coefficients. Apparently, the sample banks simply continued to fully utilize their allowable carryover, and phased down as the allowable limits were lowered.

## VI. Summary and Conclusions

The purpose of this study was to examine individual firm reserve account management behavior. The costs of holding excess reserves and reserve deficiencies was discussed as was the potential impact of the reserve accounting scheme imposed by the Federal Reserve System. The theory was tested by analyzing pooled data for a number of institutions located in the Seventh Federal Reserve District. The results indicate that penalty and opportunity cost rates do influence the level of reserves as proposed. Additionally, the carryover provision is shown to be fully utilized by the institutions over the 1975-85 period. The coefficient on the level of carryover was not statistically different from -1.0 suggesting an oscillatory pattern of reserves between deficiencies and excesses in successive

maintenance periods. Moving from a lagged reserve accounting scheme to one more contemporaneous was not shown to influence reserve management behavior, i.e., institutions still managed reserve balances quite well with, if anything, lower excess balances. The temporary ability of banks to have larger carryover positions resulted in the full use of the additional allowance. Banks apparently were quite capable of responding to the revised reserve procedures. This may imply that similar capabilities exist to respond to new intra-day reserve account balance restrictions. However, we have ignored any expenses incurred by the institutions to adhere to the new regulation and the adjustments would probably not be without cost.

## Footnotes

[1]The discussion relies on and marginally extends the analysis of Friedman and Roberts.

[2]The analysis is for a lagged reserve accounting scheme. It would be similar for a pure CRR environment where banks would be required to hold sufficient reserve deposits during the same time period (e.g. weekly). However, required reserves (resulting from deposit variability) would not be known with certainty and DXR would be positively related to the variance of the distribution of deposits, ie., $DXR=DXR(\bar{i}, \underset{+}{p}, \underset{+}{m}, \underset{+}{\sigma R}, \underset{+}{\sigma D})$. However, this pure form of CRR accounting has not been in place during the periods considered and, thus, is not considered. The period from which required reserves are based has changed over the period empirically analyzed. During the 1970s it was a one week period beginning two weeks prior to the reserve maintenance period. During the early 1980s this lag was significantly shortened. The differences are discussed later.

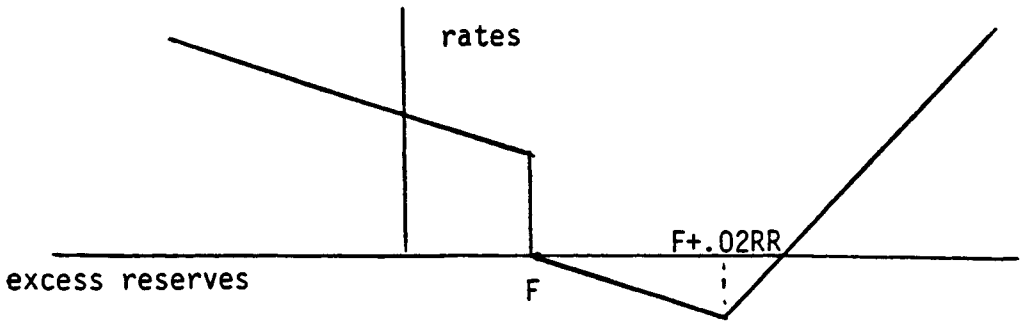
[3]For simplicity, m is assumed to be zero in the graphics.

[4]If FF rates are not expected to change the cost is:

$$((i^2)/(1+i)) \quad \text{(excess reserves)}.$$

[5]The same assumptions are made concerning a symmetric rectangular distribution of reserve deviations from the projected or desired level with a range of 2b.

[6]With the same assumptions as before and with excess balances carried forward, the optimal or DXR becomes $x = \frac{m + b(p-2i) + \frac{i(.02RR)}{(1+i)}}{p} - (F+.02RR)$ again, less than the previous DXR without the carryover. For $\hat{i} > i$ the graphics for a deficiency carried forward look as shown below, thus, encouraging larger DXR balances.



[7]See the Federal Reserve Press Release dated January 29, 1968, requesting comment on the proposed amendment to Regulation D, "Reserves of Member Banks." For an outline of changes introduced by the new reserve accounting schemes see "Law Department-Resources of Member Banks" in the Federal Reserve Bulletin (August 1962) pp. 975-78; and "Law Department-Computation of Reserve Requirements," in the Federal Reserve Bulletin (May 1968) pp. 437-38.

[8]However, the 3% provision was known to be temporary and some institutions may have simply adjusted to the new regime and not extend resources to develop expertise in a system which, after repealed, would not generate the same benefits. If this occurs the projected increased use of the cyclical reserve managing procedure may not materialize.

[9]There were certain maintenance periods during the 1975-85 span for which reserve information was not available for all the institutions considered. Most of these were during 1979.

[10]Goldfeld and Kane (1966) utilized the t-bill rate as an opportunity rate in their analysis of discount window borrowings. T-bill forecasts were also derived as an alternative measure for RD, however, the results from utilizing this alternative measure were not appreciably different. The coefficient of variation was also calculated using alternative time lags (as well as a CV for each bank over the entire period) and the results, again, were not appreciably different. The derivation of the implicit penalty rate assumes the regulator chastises the reserve deficient institution verbally and with paper work to the extent that the total penalty from being deficient is not preferred to borrowing funds in the open market. In reality, the degree of this implicit penalty probably varies according to the institution's frequency of deficiency, thus, this "average" measure may not accurately reflect the penalty for all institutions.

[11]To test the robustness of the results with respect to alternative measures of RD, numerous one step out-of-sample forecast models were developed. A stepwise autoregressive method was utilized as were various ARIMA models. However, it is not obvious that the process embedded in these models resembles that used by reserve account managers. In general, results found substituting RD values from these forecasts produced a slightly less significant coefficient for the implicit penalty rate (our least precise measure since we are assuming it to be the same for each institution) and a positive but insignificant coefficient for RD. However, the impact of the remaining variables was similar. Results found using an ARIMA (1, 1, 0) to generate RD are presented in Table A1 and A2. It appears that to the extent that managers accurately forecast future rates, results in Table 1 and 2 are more applicable.

Figure 1 – Desired Excess Reserve Determination

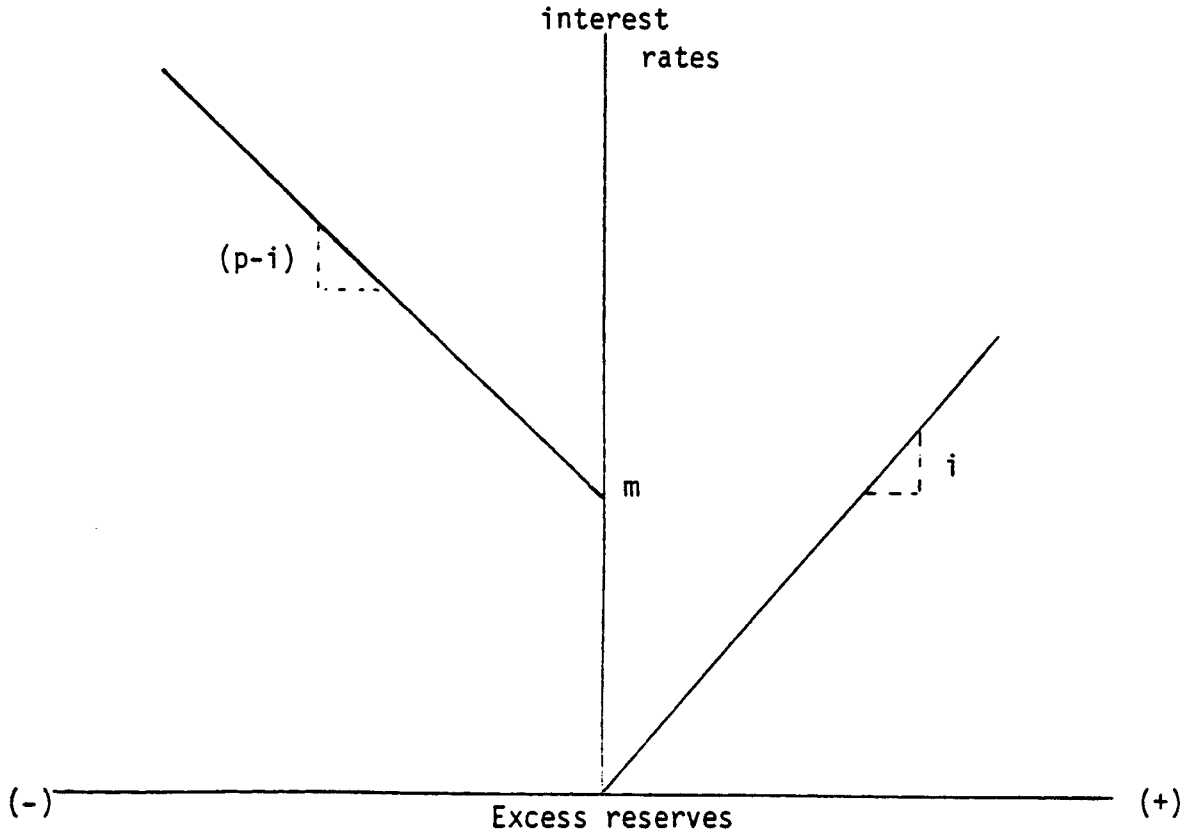
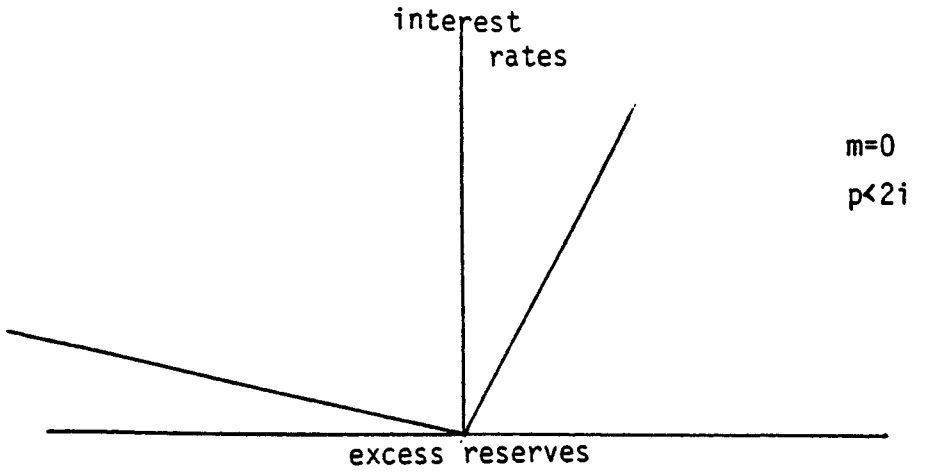
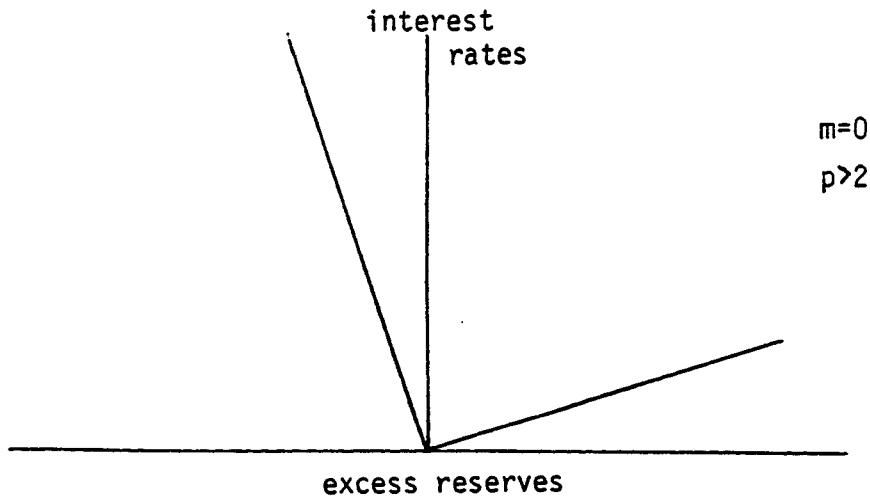


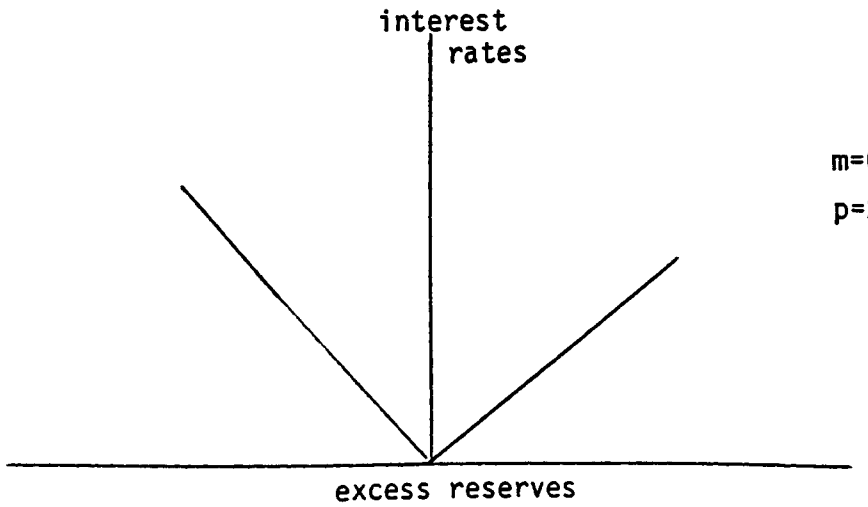
Figure 2 – Alternative Desired Excess Reserve Levels




m=0
p<2i




m=0
p>2i




m=0
p=2i

Figure 3 – Desired Excess Reserves: Negative Carry Over Position in Previous Period

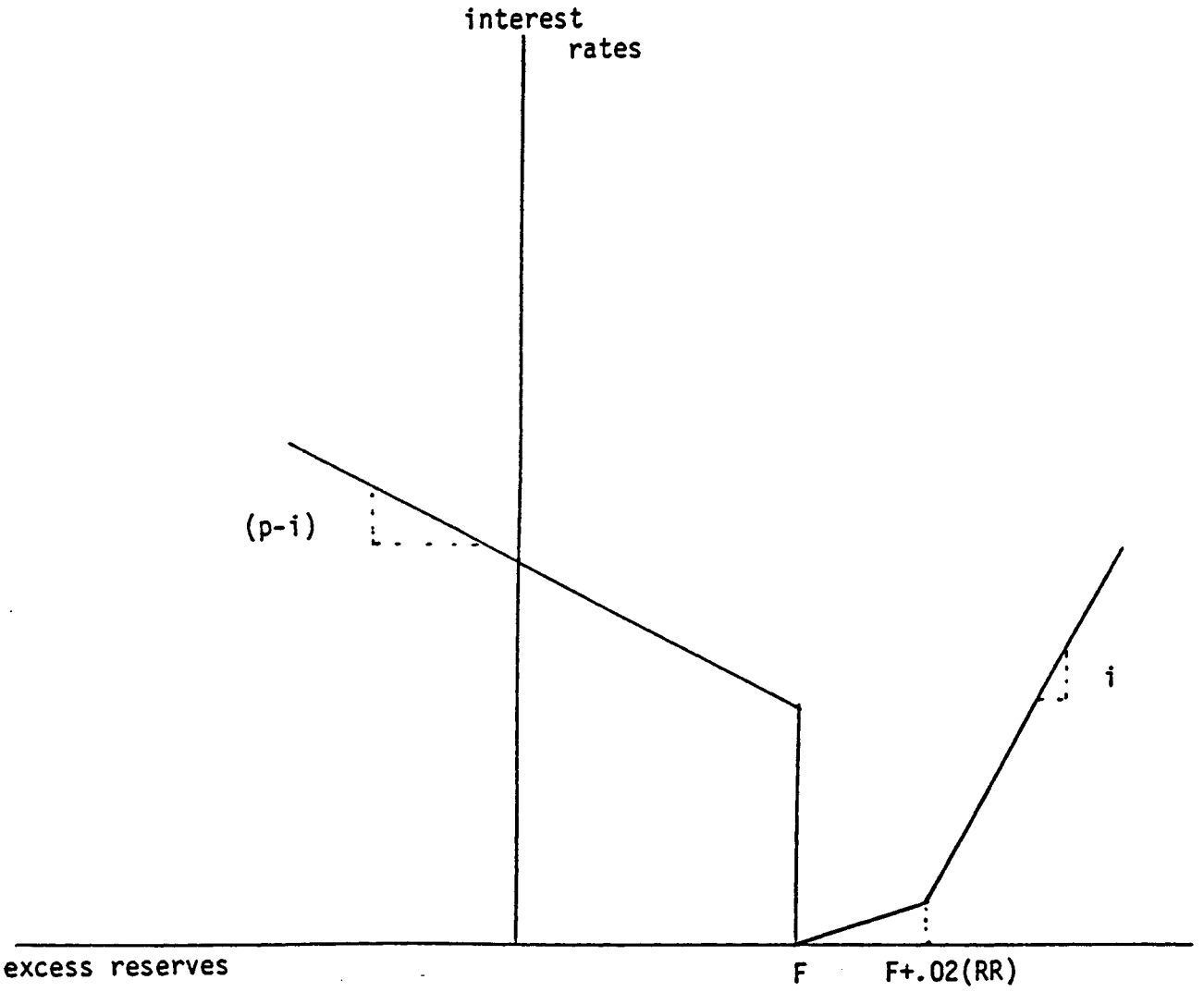


Figure 4 – Desired Excess Reserves: Positive Carry Over Position in Previous Period

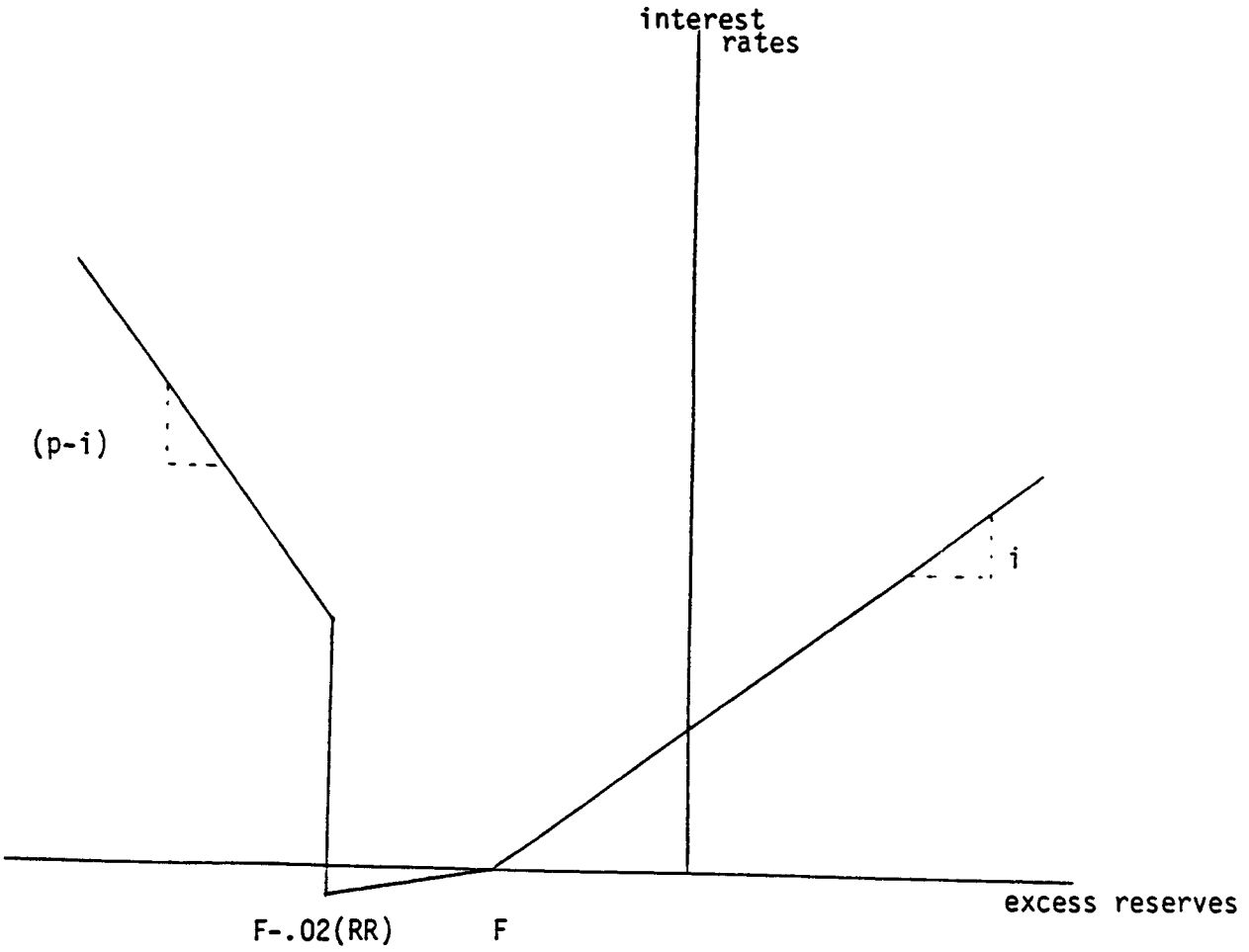


Table 1

Estimates of the Level of Desired Excess Reserves--Pooled Data

| Variable | Coefficient Estimate | Absolute t Value |
|---|---|---|
| intercept | -428.91 | ( 1.1 ) |
| F | -1.03 | (20.8 )* |
| OR | -155.05 | ( 2.7 )* |
| EPR | 117.01 | ( 2.1 )* |
| IPR | 139.37 | ( 2.3 )* |
| RD | 85.34 | ( 1.8 )† |
| $\sigma_R$ | 19.94 | ( 2.3 )* |

n=5577
*Significant at the 5% level or better.
† Significant at the 10% level or better.

Table 2

Estimates of the Level of Desired Excess Reserves as Impacted by 'CRR'

| Variable | Coefficient Estimate | Absolute t Value |
|---|---|---|
| intercept | -406.82 | ( 1.0 ) |
| F | - 1.03 | (20.8 )* |
| OR | -153.45 | ( 2.7 )* |
| EPR | 114.49 | ( 2.1 )* |
| IPR | 140.51 | ( 2.3 )* |
| RD | 86.07 | ( 1.8 )† |
| $\sigma_R$ | 19.87 | ( 2.3 )* |
| CRR | -163.26 | ( .62) |

n=5577
*Significant at the 5% level or better
†Significant at the 10% level or better

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Table A1 (via ARIMA: 1, 1, 0)

Estimates of the Level of Desired Excess Reserves--Pooled Data

| Variable | Coefficient Estimate | Absolute t Value |
|---|---|---|
| intercept | -498.49 | ( 1.4 ) |
| F | -1.03 | (20.7 )* |
| OR | -137.76 | ( 2.3 )* |
| EPR | 116.51 | ( 2.1 )* |
| IPR | 93.65 | ( 1.6 ) |
| RD | 17.94 | ( .07) |
| $\sigma_R$ | 19.11 | ( 2.4 )* |

*Significant at the 5% level or better.

Table A2 (via ARIMA: 1, 1, 0)

Estimates of the Level of Desired Excess Reserves as Impacted by 'CRR'

| Variable | Coefficient Estimate | Absolute t Value |
|---|---|---|
| intercept | -472.40 | ( 1.3 ) |
| F | - 1.03 | (20.7 )* |
| OR | -135.87 | ( 2.2 ) |
| EPR | 114.24 | ( 2.0 )* |
| IPR | 93.92 | ( 1.6 ) |
| RD | 19.96 | ( 0.08) |
| $\sigma_R$ | 18.80 | ( 2.5 )* |
| CRR | -175.20 | ( .07) |

*Significant at the 5% level or better