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AN ANALYSIS OF CERTAIN ASPECTS OF THE FEDERAL RESERVE SYSTEM PAYMENTS MECHANISM PROGRAM

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By

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1973

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ACKNOWLEDGMENTS

I am indebted to the Wagnall's Memorial Scholarship Fund, Lithopolis, Ohio; The Board of Governors of the Federal Reserve System; and the U.S. Postal Service, whose financial support have contributed greatly toward my academic progress, and to the latter two institutions for enlightened personnel policies which made time available for work on this study.

On the staff of the Federal Reserve Board, I am particularly grateful for the assistance of Mr. Joseph Morrissey and Mrs. Ann Hankinson in the collection, assimilation and processing of data. Messrs. Hubert White and Roy Fauber also contributed significantly in providing critical sounding boards for developing ideas.

I wish to express appreciation to Dr. David Cole, Dr. Wilbur Rapp, and Dr. Ernst Baltensperger for patience and expertise, as well as constructive criticism in the development of this study. Special thanks go to Professor Cole for his competent administration of this project from a distance of several hundred miles.

Particular thanks go to my sister, Mrs. Robert Tice, who not only accepted the unpleasant task of typing, but also provided much needed editorial advice.
Above all, I am grateful to my wife, Becky, without whose encouragement, patience, understanding, and unselfish support this project would have been impossible.
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PUBLICATIONS


# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>ACKNOWLEDGMENTS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ii</td>
</tr>
<tr>
<td>VITA</td>
<td>iv</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vii</td>
</tr>
</tbody>
</table>

Chapter

I. DESCRIPTION, PURPOSE AND DATA. ........................................ 1

- The Federal Reserve Program
- Purpose and Objectives
- Direct Cost Effects
- Correspondent Banking Effects
- Structural Implications of the Amendment to Regulation J
- Data
- Justification
- Limitations
- Outline of the Study

II. SURVEY OF THE LITERATURE ............................................. 30

- Operational Studies
- Correspondent Banking
- Banking Industry Structure
- Summary and Conclusions

III. DIRECT COST EFFECTS FOR TRANSIT CHECK PROCESSING ............... 67

- Overview
- Selection of Representative Group
- Cost of Transit Processing at Commercial Banks
- Tests of Hypotheses
- Marginal Cost Calculations
- Net Transit Volume at Respondent Banks
- Federal Reserve Costs
- The Baltimore RCPC
- Lewiston RCPC
- Windsor Locks RCPC
- Cleveland RCPC
- Interpretation
IV. IMPLICATIONS OF REGIONAL CHECK PROCESSING CENTERS FOR CORRESPONDENT BANKING RELATIONSHIPS.............. 107
  Check Flow Adjustments
  Balance Requirement
  Profitability Impact
  Unit Balance Requirements
  Reserve Requirements
  Earnings Rates
  Interpretations

V. EXPECTATIONS FROM REGULATION J .............. 131
  Analysis
  Interpretation
  Conclusions

VI. SUMMARY AND CONCLUSIONS AND RECOMMENDATIONS... 152
  Direct Cost Effects
  Indirect Correspondent Banking Effects
  Profitability and the Regulation J Amendment
  Considerations for Further Research
  Conclusions and Recommendations

APPENDIX
  A. .................................................. 165
  B. .................................................. 166

SELECTED BIBLIOGRAPHY. ............................ 167
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Federal Reserve Regional Check Processing Centers, March 30, 1973</td>
<td>72</td>
</tr>
<tr>
<td>2.</td>
<td>Distribution of Computed Commercial Bank Marginal Cost of Transit Processing (Functional Cost Banks, 1970)</td>
<td>83</td>
</tr>
<tr>
<td>3.</td>
<td>Computations for 1973 $V_n$ at Baltimore Clearing Center</td>
<td>90</td>
</tr>
<tr>
<td>4.</td>
<td>Estimated Aggregate Savings for Check Processing, Baltimore Center Area, 1973</td>
<td>91</td>
</tr>
<tr>
<td>5.</td>
<td>Estimated Aggregate Savings for Check Processing, Lewiston Center Area, 1973</td>
<td>93</td>
</tr>
<tr>
<td>6.</td>
<td>Adjusted $S_d$, Lewiston Center, 1973</td>
<td>94</td>
</tr>
<tr>
<td>7.</td>
<td>Estimated Aggregate Savings for Check Processing, Windsor Locks Center Area, 1973</td>
<td>96</td>
</tr>
<tr>
<td>8.</td>
<td>Estimated Aggregate Savings for Check Processing, Cleveland Center Area, 1973</td>
<td>98</td>
</tr>
<tr>
<td>9.</td>
<td>Ratio of Net Local Volume from Respondents to New RCPC Volume, RCPC Cases</td>
<td>102</td>
</tr>
<tr>
<td>10.</td>
<td>Distribution of Demand Deposits Between Member and Nonmember Participating Banks, Selected Areas as of 12-31-71</td>
<td>116</td>
</tr>
<tr>
<td>11.</td>
<td>Distribution of Demand Deposits Between Member Bank Respondents, Selected Areas as of 12-31-71</td>
<td>116</td>
</tr>
<tr>
<td>12.</td>
<td>Reserve Requirements and Demand Deposit Distribution for Participating Nonmember Banks, Selected Areas as of 12-31-71</td>
<td>117</td>
</tr>
<tr>
<td>13.</td>
<td>Computed Earnings Rates for Member Respondent Banks, Selected Areas, by Demand Deposit Size</td>
<td>118</td>
</tr>
<tr>
<td>Number</td>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>--------</td>
<td>----------------------------------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>14</td>
<td>Computed Earnings Rates for Nonmember Respondent Banks, Selected Areas, by Demand Deposit Size</td>
<td>119</td>
</tr>
<tr>
<td>15</td>
<td>Aggregate Balance Requirement for Displaced Check Collection Services, Baltimore Area Banks, 1973 Volumes</td>
<td>120</td>
</tr>
<tr>
<td>16</td>
<td>Computations for $S^Q_1$, Baltimore Area Banks, 1973 Volumes</td>
<td>121</td>
</tr>
<tr>
<td>17</td>
<td>Computations for $S^T_1$, Baltimore Area Banks, 1973 Volumes</td>
<td>121</td>
</tr>
<tr>
<td>18</td>
<td>Aggregate Balance Requirement for Displaced Check Collection Services, Lewiston Area Banks, 1973 Volumes</td>
<td>124</td>
</tr>
<tr>
<td>19</td>
<td>Computations for $S^Q_1$, Lewiston Area Banks, 1973 Volumes</td>
<td>124</td>
</tr>
<tr>
<td>20</td>
<td>Computations for $S^T_1$, Lewiston Area Banks, 1973 Volumes</td>
<td>124</td>
</tr>
<tr>
<td>21</td>
<td>Aggregate Balance Requirement for Displaced Check Collection Services, Windsor Locks Area Banks, 1973 Volumes</td>
<td>125</td>
</tr>
<tr>
<td>22</td>
<td>Computations for $S^Q_1$, Windsor Locks Area Banks, 1973 Volumes</td>
<td>125</td>
</tr>
<tr>
<td>23</td>
<td>Computations for $S^T_1$, Windsor Locks Area Banks, 1973 Volumes</td>
<td>125</td>
</tr>
<tr>
<td>24</td>
<td>Aggregate Balance Requirement for Displaced Check Collection Services, Cleveland Area Banks, 1973 Volumes</td>
<td>126</td>
</tr>
<tr>
<td>25</td>
<td>Computations for $S^Q_1$, Cleveland Area Banks, 1973 Volumes</td>
<td>126</td>
</tr>
<tr>
<td>26</td>
<td>Computations for $S^T_1$, Cleveland Area Banks, 1973 Volumes</td>
<td>126</td>
</tr>
<tr>
<td>27</td>
<td>Comparison of Value of Compensation and Cost of Check Clearing Services, Annual Basis, 1973 Estimated Values</td>
<td>129</td>
</tr>
<tr>
<td>28</td>
<td>Distribution of Number of Banks by Size, Federal Reserve Membership and Payment Status, as of December 31, 1971</td>
<td>133</td>
</tr>
</tbody>
</table>
29. Computations for Ratio $E_{d/d}$ for Member Banks by Size and Payment Status, as of December 31, 1971. 138

30. Computations for Liquidity Ratio for Member Banks as of December 31, 1971. 142


32. Computations for Liquid Investments Ratio for Member Banks as of December 31, 1971. 143

33. Computations for Liquid Investments Ratio for Nonmember Banks as of December 31, 1971. 143

34. Computations for Average Return Ratio for Member Banks as of December 31, 1971. 144

35. Computations for Average Return Ratio for Nonmember Banks as of December 31, 1971. 144

36. Computations for Average Yield Ratio for Member Banks as of December 31, 1971. 145

37. Computations for Average Yield Ratio for Nonmember Banks as of December 31, 1971. 145

38. Computations for Profitability Ratio for Member Banks as of December 31, 1971. 146

39. Computations for Profitability Ratio for Nonmember Banks as of December 31, 1971. 146

40. Results of Hypothesis Testing Ratio. 147
CHAPTER I

DESCRIPTION, PURPOSE AND DATA

In January, 1970, the Federal Reserve System embarked on a program to substantially alter the process of effecting payments among commercial banks in the United States. The program was begun on an experimental basis at the Baltimore branch of the Federal Reserve Bank of Richmond; but by the end of 1972, it had reached national scope, affecting virtually every bank in the country. The program was two pronged, involving the establishment of Federal Reserve Regional Check Processing Centers (RCPC's) throughout the country and an amendment to Federal Reserve Regulation J, which specifies the conditions under which Federal Reserve banks collect checks.

The Federal Reserve Program

On June 17, 1971, the Board of Governors of the Federal Reserve System issued a statement of policy on the payments mechanism. In that release the Board stated that it considered, "Increasing the speed and efficiency with which the rapidly mounting volume of checks is handled . . . a matter of urgency." The Board called on Federal Reserve banks to implement "structural changes in the present check
clearing system," that would "result in faster, more convenient and more economical banking services to the public."
The policy statement, further, called for establishing "regional clearing facilities" to accomplish this purpose.\footnote{Statement of Policy on the Payments Mechanism, Board of Governors of the Federal Reserve System, Washington, D.C., June 17, 1971.}

On February 2, 1972, the Board added operational substance to the earlier policy statement by releasing a set of operating guidelines, \"... to be used by Reserve banks in establishing Regional Centers for overnight processing and settlement of checks.\" The accompanying press release stated that the Board, \"expected that the new check clearing system will result in the majority of the 62 million checks written daily by Americans being cleared and paid by the opening of business the day following deposit of a check.\"\footnote{Federal Reserve Press Release, dated February 2, 1972.}

An operational description of Regional Check Processing Centers is contained in the section of this chapter entitled, \"Direct Cost Effects,\" below. In general, however, they are intended to reduce the aggregate cost of check collection by eliminating redundant processing, and reduce the time required to collect checks through overnight processing.

In a statement accompanying the Board's Guideline Statement, the Federal Reserve System Steering Committee on
Improving the Payments Mechanism commented that "the nation's check payments system should evolve in a manner that will achieve overall efficiency, taking into account both public and private costs." The RCPC program was described as a step in this evolutionary process.

Between February, 1972, and March, 1973, the Federal Reserve banks responded to the Board's statements of policy and guidelines by implementing Regional Check Processing Centers in twenty-two locations. These were in addition to centers already in operation in Baltimore, Miami and Denver.

The second phase of the Federal Reserve program, the amendment to Regulation J, was intended to speed the flow of funds from the bank on which checks are drawn to the collecting bank. Prior to this amendment, banks that were neither members of clearinghouses in Federal Reserve office cities nor participants in RCPC's were permitted to defer payment for checks written by their customers and presented by a Federal Reserve bank for one business day. The Regulation J Amendment eliminated this deferment privilege.

In announcing its intention to amend Regulation J in a press release dated March 27, 1972, the Board of Governors stated:

In considering these proposals, particularly the proposed change in the check collection procedure, two things should be kept in mind:

First, the proposed new check collection procedures would eliminate approximately $2 billion in "float" arising out of the present practice which involves country banks paying for checks presented by the Federal Reserve in funds that are not available until the next business day after presentment of the checks.

Second, the proposed revision of check collection schedules is an integral step in the movement being fostered by the Federal Reserve, in cooperation with the commercial banking system, to increase the efficiency of the payments system in the face of the rapidly rising volume of checks.4

On June 21, 1972, the Board adopted amendments to Regulations D and J, slightly modified from the March proposal, to become effective September 21, 1972. In the public statement announcing the adoption, the Board reiterated its belief that the amendment to Regulation J would lead to a "more efficient" payments system.5

Prior to September 21 a group of 34 California banks sought to enjoin the Federal Reserve System from implementing its Regulation J amendment through a court order. The Federal Reserve System agreed to withhold implementation pending judicial review, in lieu of a temporary restraining order. The basis for the suit was an assertion that the Federal Reserve Banks are not authorized to impose their regulations on nonmember banks.

In subsequent hearings on motions for temporary and permanent injunctions the court found that Federal Reserve

banks are impowered to specify the conditions under which they will collect checks, and that banks which provide checks to their customers containing Federal Reserve assigned routing symbols implicitly agree to Federal Reserve bank check collection conditions. Banks have the option of not utilizing Federal Reserve assigned routing symbols. For many years non-par banks have taken this option and the Federal Reserve Banks do not collect such checks. The delayed Regulation J amendment became effective November 9, 1972.

It is clear from these statements that the objective of the Federal Reserve System in its check payments mechanism program was to reduce the aggregate cost of the check collection network. It is also clear that as a matter of policy the Federal Reserve System was not concerned with the distribution of check collection costs between the public and private sectors.

At a press conference held March 27, 1972, to announce a proposed amendment to Regulation J, George W. Mitchell, member of the Federal Reserve Board of Governors, stated that with the RCPC program and the amendment to Regulation J, the Federal Reserve has done all that it can for the check. 6 The Regulation J amendment went into effect November 9, 1972,

6Although this statement was made at the press conference, it was not part of the official press release and did not appear in the accounts of the conference in the financial press.

**Purpose and Objectives**

The purpose of this study is to evaluate the Federal Reserve System's payments mechanism program. If, as Governor Mitchell has stated, the Federal Reserve System has done all that it can for the check, it is appropriate at this time to evaluate what has been done. The evaluation is based on the Federal Reserve System's stated objective of reducing check collection costs as well as potential secondary effects on correspondent banking relationships and the distribution of profits among commercial banks.

In accordance with the overall purpose of evaluating the Federal Reserve program, this study has three specific objectives. First, it is an objective of this study to ascertain whether the Federal Reserve RCPC program is meeting its stated objective of reducing the direct cost of check collection. The approach utilized to achieve this objective is to analyze in detail the operations of four representative Regional Check Processing Centers. The schema developed for the analysis is described in the section of this chapter entitled, "Direct Cost Effects," below; and the analysis is described in Chapter III.

The second objective of this study is to estimate the impact of the Federal Reserve RCPC program on interbank balances and on the distribution of benefits, if any,
between correspondent banks as a class and respondent banks
as a class. In attempting to achieve this objective,
national average earnings and pricing data are applied to
volume and deposit values of banks in the four RCPC areas
selected for analysis of direct cost effects. The analyt­
ical schema is described in the section of this chapter
entitled "Correspondent Banking Effects," below, and the
analysis is contained in Chapter IV.

The third objective of this study is to estimate
the effect that the November, 1972, amendment to Regulation
J will have on the distribution of profits among commercial
banks. Because requisite data describing the flow of check
values among banks are not available, it is necessary to
approach this objective by measuring past differences in
profitability between deferred payment and same-day payment
banks. The approach used in measuring those differences is
described in the section of this chapter entitled "Structural
Implications of the Amendment to Regulation J," and the
analysis is contained in Chapter V.

Direct Cost Effects

The Regional Check Processing Center program is the
Federal Reserve System's approach to reducing the direct
cost of check collection. The concept of an RCPC is to
eliminate redundant check processing and duplication of
effort by establishing near-midnight deposit deadlines for
local checks and permitting all participating banks to
deposit checks directly with the Federal Reserve facility. In the absence of an RCPC, deposit deadlines for local checks are typically 4:00 p.m. and only member banks are permitted to deposit with a Federal Reserve bank.

The actual flow of checks between the bank of first deposit and the paying bank appears to have remained essentially unchanged between 1952 and 1970. Studies of the check collection industry in 1967 by Fenner and in 1970 by Cox found similar patterns of check flow to those described in the industry-wide study by Wurts in 1952. The pattern of check collection discovered was essentially as follows.

Small banks received checks as deposits from customers and, after separating checks drawn on accounts in their own bank (home debits or on-us items) forwarded their transit checks to a larger, regional correspondent bank for collection. The respondent banks typically did not separate checks payable locally from those payable at some distance.

Correspondent banks which typically were members of city clearinghouses and of the Federal Reserve System would separate out home debits and sort the remaining, or transit, items as to collection channel. Checks payable at other clearinghouse banks would be sorted by paying bank and

---

exchanged directly in the clearinghouse. Checks payable at other banks within the same Federal Reserve territory were presented directly to the paying bank or deposited with the local Federal Reserve office for collection.

Checks payable at banks in a remote Federal Reserve territory were sent to a correspondent bank in that territory or deposited with the local Federal Reserve office. The decision criteria for selecting the appropriate channel of collection were the cost of processing, the cost of shipping, the length of time required to gain available funds and the average dollar value of checks payable at various locations.

The Federal Reserve RCPC program anticipated reducing the cost of collecting checks deposited and payable within relatively large areas surrounding regional financial centers. Under the February, 1972, guidelines the size of the area served by an RCPC is to be determined by transportation and processing times.8

The anticipated savings were expected to result from two factors. First, in the absence of a regional center many checks that were deposited with a respondent bank were channelled through a correspondent and on to the Federal Reserve. In bypassing the correspondent the center eliminates a commercial bank handling and reduces the aggregate cost of collecting the checks.

The second factor relates to the checks that clear through an RCPC that would not enter the Federal Reserve System if the center did not exist. This "new" volume consists of three components.

The first component was the volume for which a noncollecting bank was the bank of first deposit. Without a center these items would have been deposited by the respondent with a collecting bank correspondent, and subsequently presented for payment by the correspondent. For these items the aggregate cost effect is the difference in unit cost of processing between the regional center and the collecting bank multiplied by the volume of such items.

While it is not necessarily the case that Federal Reserve Regional Centers and correspondent banks would have different costs for processing and collecting checks, it is not unreasonable to believe that they might. Factors that would contribute to cost differences are: (1) differences in time patterns for receipt and dispatch of checks, which affects capacity requirements; (2) differences in sorting patterns for distribution of transit checks, which affects the efficiency of utilization of computer equipment; and (3) differences in transportation arrangements for presenting checks.

The second component of "new" volume was the volume of items deposited in a respondent payable at its correspondent. For these items a center adds an additional handling; that is, the checks now go through the RCPC rather than
directly to the paying bank. Under the assumption that no significant savings occur in home debit processing because of a center, the cost to the Federal Reserve of processing these items tends to increase the aggregate cost of check collection.

The third component of "new" checks to the Federal Reserve was the volume of items that would be collected directly by the bank of first deposit if a regional center did not exist. With the establishment of a center, such items are routed through the RCPC (exclusive of continuing local clearings). While there may be limited savings to commercial banks due to a reduction in the number of end points for sorting, it is clear that a cost increase results from routing these items through the Federal Reserve. The increase amounts approximately to the processing cost to the Federal Reserve.

For the purpose of evaluation, the anticipated cost savings may be structured in a schema as follows:

**Define:**

- $V^j_i = \text{Volume of items of type } i \text{ first deposited in bank class } j$
- $MC^B_t = \text{Marginal cost of transit processing for commercial banks}$
- $MC^F_t = \text{Marginal cost of transit processing for Federal Reserve regional centers}.$
- $S_d = \text{Total direct cost savings}$
superscripts on $V$

$r$ = respondent or noncollecting bank

$c$ = correspondent or collecting bank

none = total volume of that class

subscripts on $V$

$n$ = new items to the Federal Reserve System

$o$ = items payable outside the regional clearing area

$a$ = items previously handled by the Fed after passing through two banks

$ho$ = home debit at the respondent's correspondent

$t$ = total transit volume

$l$ = items payable within the clearing area

Thus, savings may be defined as

$$S_d = v^r_n (MC^B_t - MC^F_t) + v^a (MC^B_t) - v^r_{ho} (MC^F_t) - v^o_n (MC^F_t)$$

(It should be noted from the above discussion that $v^r_n$ does not contain $v^r_{ho}$.)

Combining terms, gives:

$$S_d = MC^B_t (v^r_n + v^a) - MC^F_t (v^r_n + v^r_{ho} + v^o_n)$$

but, the second term in parentheses in (2) equals total "new" volume to the Fed, that is:

$$(v^r_n + v^r_{ho} + v^o_n) = v_n$$

so, equation (I-2) may be simplified as:

$$S_d = MC^B_t (v^r_n + v^a) - MC^F_t (v_n)$$

That is, direct cost savings equal the marginal processing cost to banks times the items that now avoid redundant handling, minus the cost to the Fed of handling new volume.
Further, since the volume of items now avoiding double handling equals total transit volume at respondents minus "new" items to the Fed and nonlocal items:

\[ V_a = V^F_T - V^F_n - V^F_o - V^F_{ho} \]  \hspace{1cm} (I-5)

then, adding \( V^F_T \) to both sides of (I-5) shows that the first term in parentheses in (I-4) is equal to total local transit volume at respondent banks.

\[ (V^F_T + V_a) = (V^F_T - V^F_o - V^F_{ho}) = V^F_T - V^F_{ho} = (V^F_T)^* \]  \hspace{1cm} (I-6)

so that a computational formula for total direct cost savings may be stated as:

\[ S_d = MC^B (V^F_T)^* - MC^F (V^T_n) \]  \hspace{1cm} (I-7)

where \((V^F_T)^* = V^F_T - V^F_{ho}\)

Chapter III of this study applies this schema to a sample of existing RCPC's to evaluate the performance of the Federal Reserve System in meeting its cost reduction objective. The analysis consists of estimating values on the right hand side of (I-7) to solve for an estimate of \( S_d \).

**Correspondent Banking Effects**

From the previous section it is clear that the success of the Federal Reserve System in meeting its cost reduction objectives is dependent on the ability of the RCPC's to attract the direct deposits of respondent banks. In so doing the Federal Reserve is offering without charge a service that has traditionally been sold to respondents by...
correspondent banks. Essentially, the Federal Reserve is monopolizing a market that has traditionally been supplied in the private sector.

Respondent banks pay for correspondent-provided check collection services by maintaining a balance sufficient to permit the correspondent's investment earnings to cover the price of the service. If the respondent is able to acquire check collection services from the Federal Reserve without charge, it may reduce its balance with the correspondent, or if it is restricted from doing so by state reserve requirements, it may purchase other services of equivalent value.

Assuming respondent banks do shift deposits of local items to the Federal Reserve RCPC, correspondents lose the earnings from investment of interbank balances, either directly or in the production of other services. The offset to this loss is a reduction in the cost of processing local transit items that would otherwise be deposited.

It is possible to evaluate these two indirect effects of the establishment of RCPC's in the following framework.

Define:

\[ B = \text{Collected compensating balance required by correspondent} \]

\[ P = \text{Unit price of check processing for respondents} \]

\[ K_1 = \text{Earnings rate applied by correspondent to investable balances for determining balance requirement} \]

\[ K_2 = \text{Average before tax earnings rate on investable funds by correspondent} \]
\[ K_3 = \text{Average before tax earnings rate in investable funds by respondent} \]

\[ r_1 = \text{Reserve requirement applied by correspondent to collected balances for determining balance requirement} \]

\[ r_2 = \text{Marginal reserve requirement rate for correspondent} \]

\[ r_3 = \text{Marginal reserve requirement rate for respondent} \]

Other symbols as defined in the previous section.

The correspondent states his price for check collection services to his respondent banks in terms of a compensating balance. The correspondent's long run requirement is that his revenue cover his costs. That is,

\[ K_2 (B - r_2 B) \geq C \quad \text{or} \quad B \geq \frac{C}{K_2 (1 - r_2)} \]

where \( C \) is total cost including return to capital.

In stating his price, however, the correspondent is free to adjust \( K \) and \( r \) to make them appear more palatable. Further, check processing services are typically stated in terms of unit prices, \( P \), which gives the correspondent additional flexibility in stating balance requirements as long as the following condition is met.

\[ B = \frac{P \cdot V}{R_1 (1 - r_1)} \geq \frac{C}{K_2 (1 - r_2)} \]

In competitive markets it would be expected that the inequality would become an equality.

The respondent does not observe "\( C \)" in the market and must accept or reject \( \frac{P}{R_1 (1 - r_1)} \) as the unit balance requirement for check collection services. Since it is known that respondents do purchase check collection services
from correspondents, a profit maximizing assumption for respondents is that they will hold as little as they can get away with in compensating balances. That is, for respondents the objective is

\[ B \leq \frac{P \cdot V^r_I}{K_1(I-r_1)} \]

Because there is only one point of intersection between the two objectives, at

\[ B = \frac{P}{K_1(I-r_1)} V^r_I, \quad \text{(I-8)} \]

that is the expected result. As a practical matter it is not likely that this condition exists every day, but since deficient and excess balances can be adjusted over time, it is not unreasonable to expect that Equation (I-8) holds on average over time.

The correspondent bank does not reduce its cost by the entire amount of \( V^r_I \), because it still must process its own home debit portion, even though those items are received from a new source (the RCPC). The correspondent loses income from investing the investable balance at its earnings rate, \( K_2 \), not at its allowed rate, \( K_1 \). Thus the correspondent indirect savings from the RCPC may be identified as:

\[ S^c_I = MG^B \cdot (V^r_I)^n - K_2 B (1-r_2) \quad \text{(I-9)} \]

and the indirect savings to respondents is

\[ S^r_I = K_3 B (1-r_3) \quad \text{(I-10)} \]

Chapter IV of this study analyzes the net impact of RCPC's on the correspondent-respondent relationship by estimating the appropriate values to solve equations (I-9)
and (I-10). The analysis is restricted to a representative group of RCPC areas. Selection of the representative group is discussed in Chapter III.

**Structural Implications of the Amendment to Regulation J**

Prior to the November 9, 1972, amendment to Federal Reserve Regulation J, banks that did not participate in clearinghouses or regional clearing arrangements in Federal Reserve office cities deferred payment for checks presented by Federal Reserve banks for one business day. Such banks are known as "country banks." Clearinghouse banks ("city banks") have for many years paid for checks presented by the Federal Reserve on the day of presentment.

The amendment to Regulation J revoked the deferment privilege of country banks by requiring all banks to pay for their checks on the day of presentment. This revocation should be expected to have resulted in a shift of investable funds among groups of banks.

For any individual Federal Reserve office it is possible to identify five classes of checks for collection purposes. It is useful to describe the five classes in order to describe the effects of the Regulation J amendment on various bank groups.

1. **Same zone "city" checks** are checks drawn on clearinghouse or regional center banks local to the Federal Reserve office in question. Such checks were paid for on
the day of presentment before the Regulation J amendment and, therefore, were not affected. Deposit deadlines at Federal Reserve offices for such checks are typically near midnight for regional center checks and near 6:00 a.m. for clearinghouse items.

2. **Same zone **"country" checks** are the checks for which the Federal Reserve office in question is the last collecting bank, and which held deferred payment status prior to the amendment to Regulation J. The typical deposit deadline for such items is 4:00 p.m.

Prior to November 9, 1972, Federal Reserve offices received payment and passed credit for same zone country checks on the second business day after the day of deposit. Under the amended regulation, payment and credit have been advanced one day.

3. **Inter-district one day city checks** are items payable at "city" banks in other Federal Reserve office cities that are sufficiently close to the office in question that checks can be transported, presented and paid for on the day following deposit at the first Federal Reserve office. The Regulation J amendment did not affect the one day deferment of these items.

4. **Inter-district two day city checks** are identical to the third class above, except that the cities in which the paying banks are located are too far distant to present
the checks on an overnight basis. The Regulation J amendment did not affect the payment or credit date for such items.

5. Inter-district country checks are checks drawn on country banks in other Federal Reserve territories. Although, prior to the 1972 amendment to Regulation J, Federal Reserve banks required three days to collect inter-district country checks; since 1952, the Federal Reserve System as a matter of policy has passed credit to depositing member banks for such items on the second business day after deposit. The one additional day required for collection generated Federal Reserve float.

The amendment to Regulation J reduced collection time for inter-district country checks from three days to two, but the Federal Reserve banks have not altered their deferment schedules for such items. The result, therefore, has been to reduce Federal Reserve float, and funds availability to collecting banks has not been affected.

From the standpoint of commercial banks, then, the 1972 amendment to Regulation J had the following effects.

1. All country banks pay for checks drawn by their customers and presented by the Federal Reserve one business day earlier than before. This fact tends to reduce investable funds to country banks.

2. All banks receive credit one day earlier for checks drawn on country banks located in the same Federal
Reserve territory and collected through the Federal Reserve System.

Although Federal Reserve Bank records would indicate the gross loss of funds for each country bank due to the Regulation J amendment, the complexity of check collection arrangements prohibits the computation of net losses and gains. Smaller country banks that deposit their transit items with a correspondent for collection are the ultimate beneficiaries of much of the earlier availability on same zone country items, but data are not available to permit segregation of the funds made available earlier by bank of first deposit.

The published studies of the check collection industry and interviews with commercial bankers indicate a large variance in the ratio of same zone country checks to total transit value among country banks. Further, there exists a wide range of accounting practices among correspondent and respondent banks with a resulting wide range of impact and conceptualization of the impact of the Regulation J amendment. Consequently, it is not feasible to measure the shift in available funds due to the Regulation J amendment in a manner that is meaningful for evaluation of the impact on the structure of the industry.

It should be expected that, relative to city banks, banks that are able to pay for their customers' checks on a deferred basis would be more profitable, *ceteris paribus*, for two reasons. First, and most apparent, by deferring
payment country banks should have had more funds available to invest per dollar of demand deposit than banks that paid on the day of presentment.

Second, deferred payment status allows the paying bank an additional business day of reaction time for portfolio adjustments. Thus, it would be expected that deferred payment banks would hold less liquid, higher yielding assets as a liquidity reserve so that average return on earning assets would be higher than for city banks, other things equal.

The first effect was tested in this study by comparing the ratio of earning assets attributable to demand deposits to total demand deposits between city and country banks of like size. The second effect was tested by comparing a series of income and asset relationships between city and country banks of like size. The analysis is contained in Chapter V.

**Data**

This section describes the data utilized in the study. Methodology for analysis of cost effects, indirect correspondent balance effects and Regulation J effects are contained in Chapters III, IV, and V, respectively.

**Check volumes**

Check volume data are required for estimation of values for (I-7), (I-8), and (I-9). The particular volumes
required are $V_1^p$, the locally payable transit volume deposited in respondent banks, and $(V_1^p)^*$, the $V_1^p$ net of such checks that are payable at the correspondent of the bank of first deposit, $V_{ho}^p$.

If all respondent banks in an RGPC area were to take advantage of the free service being offered by the Federal Reserve, then the volume of RGPC area checks deposited with the RGPC by respondent banks would correspond identically to $V_1^p$. To the extent that respondents do not take advantage of the free service and continue to deposit local transit items with their correspondent, that volume will show up at the Federal Reserve as new volume, $V_n^p$, or as old volume, $V_a$, or it is collected outside the RGPC.

In order to utilize a survey of RGPC deposits by respondent banks as an estimate of $V_1^p$, it is necessary to determine whether measurement errors due to continued correspondent deposits impair the estimate of savings, $S_d$. First, the RGPC is neutral with respect to items included in continuing correspondent deposits that are collected outside the RGPC, $V_{ho}^p$ and clearinghouse checks, so that such checks would not impair the estimate.

Second, if such items come to the RGPC as $V_n^p$ they tend to increase check collection costs and the schema treats $V_n$ in this way, so that measurement would not be impaired. Finally, if such continued deposits have historically been redeposited at the Federal Reserve bank and continue to be so deposited, they are included in $V_a$. 
and the RCPC is neutral with respect to the cost of collection. The measurement equation (I-7) is neutral with respect to $V_a$.

It may be concluded, therefore, that continued correspondent deposits do not violate the adequacy of equation (I-7) to measure direct cost savings. It may also be concluded that a survey of respondent bank deposits of RCPC area items at the RCPC provides an estimate of $V^F_1$ satisfactory for deriving a solution to equation (I-7). Therefore, the estimate of $V^F_1$ utilized in the study was an annualized value for a one-week survey of local volumes deposited at the four RCPC's selected as a representative group.

The values for $V^F_{hc}$ came directly, as a percentage of deposits of local respondents, from a 1972 survey of commercial banks in the areas analyzed. The survey form and list of respondents utilized in this study are attached as Appendixes A and B, respectively.

The values utilized for $V_n$, new volume at Federal Reserve offices due to the establishment of an RCPC, came from estimates of such volume developed by Federal Reserve bank officers and included in proposals for RCPC's submitted to the Board of Governors. The estimate of $V_n$ for the Baltimore center was based on a projection of the historic growth pattern of volume as described in Chapter III.
Costs

The Federal Reserve cost data utilized in this study came from two sources, the proposals submitted by Federal Reserve banks to the Board of Governors for establishment of RCPC's, and the Federal Reserve Functional Expense Report, an internal System document.

The commercial bank cost data utilized in this study were from the Federal Reserve Functional Cost Analysis Program. Despite certain limitations of these data for certain types of studies, they have considerable appeal for this study.

First, only the costs of large correspondent banks are considered in this study, so the small bank bias of the FCA data file is not restrictive. Only the costs of banks with over $50,000,000 in demand deposits are utilized.

Second, the interest of this study is in the direct variable cost of check processing, not fully burdened or total cost. The FCA participating banks identify direct costs by category and by function.

Third, FCA participating banks report demand deposit activity for the same period that they report costs. This enables the avoidance of uncertainty that would result from estimating volumes independent of costs.

The FCA file utilized in this study is the report for the year 1970. Although data for 1971 and 1972 have been collected by the Federal Reserve, they have not been edited,
and as such they contain duplications and keypunch errors so as to make them unacceptable for this study.

**Correspondent pricing**

Under the auspices of the Federal Reserve Bank of Kansas City the Federal Reserve System in July, 1972, surveyed the pricing practices of 85 large correspondent banks in all areas of the country except the Sixth and Tenth Federal Reserve Districts. All 85 banks are included in the largest 125 banks by size of deposits due to other banks as of December 31, 1971. The results of the survey were reported by Robert Knight of the Federal Reserve Bank of Kansas City in October, 1972. The values for \( P, r_1, \) and \( K_1 \) were taken directly from Knight's reported survey results.

**Additional sources**

In addition to the sources described above, Chapter V of this study utilized the Statement of Income for the year, 1971, and the Statement of Condition (Call Report) as of December 31, 1971. These reports are collected on a regular basis from all insured banks by the FDIC.

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Justification

The Federal Reserve System is a self-budgeting congressional agency with considerable autonomy. The Congress, through the Federal Reserve Act of 1913 with subsequent amendments, has delegated to the Federal Reserve System the constitutional authority for managing the country's money supply. In addition, the Congress has assigned numerous other duties to the Board of Governors and to the System.

The exclusive franchise to manage the money supply provides the Federal Reserve System with a substantial portfolio of interest-bearing U. S. Treasury obligations. Although the interest on the Federal Reserve System's portfolio represents an allocation of tax revenues, it is also income to the Federal Reserve. The Federal Reserve System returns its "profits" to the Treasury, but the System's budget is not subject to pre-expenditure review by the Congress. Thus, the Federal Reserve System is in the position of spending tax receipts without direct legislative allocation.

In the absence of either hearings or legislation relating to the Federal Reserve payments mechanism program it may be assumed that the Congress is in agreement with the stated objectives. Nevertheless, the Congress has the responsibility and the public has the right to evaluate the performance of the Federal Reserve System in attempting to
achieve its objectives. This study is designed to fill the requirement for evaluation of Federal Reserve performance in the payments area.

There are additional areas of public policy to which this study relates. First, in the Regional Check Processing Center program, the Federal Reserve System may be absorbing a larger share of the cost of sorting checks. To the extent that such a practice may lead in the direction of developing a controlled public utility or a Federal Reserve monopoly in the field of payments processing, this issue is of considerable public concern.

Second, the actions taken by the Federal Reserve during the period studied may significantly affect the distribution of investable funds among classes of banks. Because of the degree of regulation of commercial banks, a product of state and national legislation, it must be assumed that the existing structure of the industry, that has resulted from the regulation, is desired by the various legislatures. Therefore, actions by the Federal Reserve System that affect the industry structure are potentially disruptive of legislative objectives.

This study does not address these questions of public policy. The study does, however, provide a basis for evaluating the performance of the Federal Reserve System in light of these and other policy issues.
Limitations

This study is limited by the absence of perfect data. The limitations are particularly apparent in the routing and volumes of checks and the cost of processing checks in commercial banks.

Utilization of Functional Cost Analysis banks for commercial bank cost data is problematical because of the opportunity for inconsistency in reporting practices among banks. What some banks may include as overhead may be included as direct costs by others. There is considerable leeway in interpretation.

A second problem for the analysis due to the necessity of depending on FCA data is the opportunity for inconsistency in reporting volumes. Banks are requested to estimate if volumes are not known. It is likely, however, that this problem is minimized by restricting the use of FCA data to large banks.

A third limitation of FCA data is its questionable representativeness. Because check processing technology is widely shared through equipment manufacturers and trade organizations, however, this limitation is not likely severe. That is, the cost functions for large banks are expected to be similar.

The absence of detailed volume and routing data for transit check collection particularly limits the ability to analyze the effects of the Regulation J amendment. The
value of checks paid for earlier because of the amendment
could be determined by analysis of Federal Reserve Bank
presentments. It is not possible to determine the distri-
bution of earlier credit among banks, however, because it is
not feasible to identify the bank of first deposit for
checks deposited with the Federal Reserve. It is neces-
sary, therefore, to estimate the effects of the amendment by
comparing past performance ratios.

Outline of the Study

The balance of this paper proceeds as follows.
Chapter II contains a survey of relevant literature with a
discussion of the findings that relate to this study and the
gaps that this study attempts to fill. Chapters III, IV,
and V contain the analyses of direct cost effects, indirect
correspondent banking effects and the impact of the
Regulation J amendment, respectively.

Each of these chapters contains a conclusions section
which interprets the analysis of that chapter independent of
the other effects. Chapter VI discusses the combined
effects and develops overall conclusions regarding the
propriety of the Federal Reserve payments mechanism program.
CHAPTER II

SURVEY OF THE LITERATURE

The purpose of this chapter is to describe previous work related to this study in order to identify gaps in the literature of the banking industry that this study attempts to fill, and in order to validate certain assumptions upon which various facets of the analysis are based. Because this study is concerned with a unique phenomenon, the Federal Reserve Payments Mechanism Program, there are no previous studies sufficiently similar to provide guidelines for the analysis. There have been, however, numerous studies of the banking industry related to the general subject matter of each of the three parts of this analysis that provide a basis upon which this study is built.

The balance of this chapter is divided into four sections. The immediately following section, entitled "Operational Studies" discusses a series of studies that have described the check collection industry, including the operating costs of check collection.

The immediately following section discusses the relevant literature relating to the correspondent banking industry. The literature discussed relates primarily to
the role of check collection in the correspondent banking relationship.

The third section is titled "Industry Structure." This section describes the development of banking industry structure theory to its current state, and discusses the problems involved in developing such a theory.

The final section of this chapter discusses the links between this study and the existing literature and the gaps that this study attempts to fill. The section also discusses the rationale for the analytical approach taken in this study in comparison with related studies.

Operational Studies

This section discusses five studies of the check collection process that were undertaken to provide a basis for designing improvements in the flow of payments. The time period covered by those studies is 1952 to 1972.

The initial modern effort to describe the check collection network on a national scale was jointly sponsored by the American Bankers Association, The Association of Reserve City Bankers and The Conference of Presidents of the Federal Reserve Banks. The study, which was based on a July, 1952 survey of 770 banks representing 52 per cent of all bank deposits as of June 30, 1952, and all Federal Reserve offices, had the following objective, "... to determine whether fundamental improvements could be made in current check collection methods and practices, with a view
to increasing the speed and efficiency of check collection in the interests of the banking system and the general public.\textsuperscript{1}

The report of the study committee, which is usually referred to as the Wurts Report after the committee chairman, described the typical check collection and payment procedures for five size groups of banks, and distinguished between reserve city banks and country banks. The committee concluded that inefficiencies and delays resulted from overuse of the correspondent banking system for checks payable near the bank of first deposit and underuse of the correspondent system for checks payable in other Federal Reserve districts.

In the former case, instances were cited in which the bank of deposit and the paying bank were located within walking distance but the checks traveled several miles to a correspondent then to the Federal Reserve Bank and back to the paying bank, while they might have been exchanged directly. In the latter case many checks traveled circuitous routes through the Federal Reserve System rather than directly through the correspondent system. For example, a check deposited in Columbus, Ohio, payable in Indianapolis might have traveled from Columbus to the Cleveland Federal Reserve Bank then to the Chicago Federal Reserve Bank and finally to

the paying bank. If the check were sent directly to the Indianapolis bank, two processing banks and at least two days could be eliminated from the collection flow.

The Wurts committee recommended that clearinghouses be expanded in area and participants to include more banks in existing clearing arrangements and that clearinghouses or direct exchange of checks be implemented in areas where they did not previously exist. The second recommendation was for the Federal Reserve banks to accept deposits directly from nonmember banks to avoid redundant handling of checks. Finally, the committee recommended that banks utilize correspondents for collecting interdistrict checks to a greater extent.

The committee expressed the opinion that implementation of its recommendations would not affect correspondent relationships significantly, nor did they believe that resultant faster presentment and payment would alter the relative earnings or the competitive position of affected banks. These opinions were not based on analysis of the data.

Because of disagreement among the sponsoring agencies on the second recommendation, the report was neither widely distributed nor implemented on a systematic national basis. The Federal Reserve Regional Check Processing Center Program did effectively institute the first two recommendations sixteen years later.
By 1966, considerable interest had been generated in the banking community in the possibility of replacing checks with electronic fund transfers (EFT). George W. Mitchell, member of the Federal Reserve Board, spoke on the topic at the 1965 convention of the American Economics Association, and various Federal Reserve and trade publications discussed the subject in a rather matter-of-fact manner.

In light of this thinking the Subcommittee on Improving the Payments Mechanism of the Conference of Presidents of the Federal Reserve Banks commissioned the Stanford Research Institute to conduct a study of the availability of cost savings in an EFT system, in early 1966. The SRI study included a survey of all Federal Reserve offices and seventy-three large commercial banks in an effort to identify the flow of payments and the cost components.

With respect to the flow of checks the SRI report indicated that the pattern had not changed significantly from that found by the Wurts committee fourteen years earlier. With respect to costs, SRI applied weights to

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volumes in a manner similar to the Federal Reserve Functional Cost Analysis Program in order to estimate the aggregate cost of the check collection process to the banking industry. The study did not consider differences in cost elements for different categories of checks. The resulting estimate of $2.3 billion total cost to the banking system equates to approximately thirteen cents per average check on a fully costed basis.

During 1967, the Bank Administration Institute (BAI) and the Research Institute of the Illinois Institute of Technology (IITRI) jointly conducted two surveys of processing steps and check flows in the check collection network. The first survey was of a general nature and included eighty-two banks ranging in size from less than ten million dollars in total deposits to over one billion. The second survey collected highly detailed data from six large banks in five cities.

These surveys led to the production of three documents. The first, entitled "Design of a Communications System for Interbank Information Exchange," was a communications system design document for developing a national information exchange network. That document is of little interest to this study because of the breadth of the subject matter considered.

The second document, which was released in 1969 and entitled *An Electronic Network for Interbank Payment Communications*, attempted to refine the results of the first study by defining the communication problem to include only the exchange of payments data. The 1969 report also contained cost estimates for both check and EFT processing.

The third report was released in 1970 and entitled, *The Check Collection System: A Quantitative Description*. This report contained detailed value and volume check flow distributions. The flow patterns reported were substantially similar to those that had been reported by SRI and by the Wurts committee. Neither of the earlier studies included dollar value distributions.

The cost estimates in the 1969 "Electronic Network" report were based on applying standard costs developed by the BAI over a period of time to the processing steps identified in the survey. The resulting estimate for direct cost of transit check processing was $0.0137 per check. The costing process excluded overhead costs.

During 1969, the American Bankers Association formed a policy level committee of commercial bankers, named the Monetary and Payments Systems (MAPS) Committee, to

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6*Bank Administration Institute, An Electronic Network for Interbank Payment Communications* (Chicago: Bank Administration Institute, 1969).

investigate the implications of checkless banking for the banking industry. The committee in turn created four task forces for Operations Technology, Marketing, Economics, and Legal/Legislative matters.

The Operations Technology task force commissioned Arthur D. Little (ADL), a management consulting firm, to study the existing check payments system, "to determine whether the present system is capable of being sustained in an operationally sound condition until 1980." 8

The ADL staff studied operating procedures in detail in fifty-two commercial banks and fifteen Federal Reserve offices located in sixteen financial centers. Additionally, 188 banks in smaller communities were surveyed in a more general manner. The surveys were conducted during April and May, 1970, with all participating banks larger than 25 million dollars in total deposits.

The ADL report contained direct, unburdened cost estimates for various check processing functions. An approximation of the cost of checks may be obtained by summing proof and encoding, and transit processing to get $0.0142 per item. This value is difficult to compare directly with the BAI estimate above because functions are defined somewhat differently. The ADL figure does not identify separately costs for receiving and initial

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processing, but appears to include the costs in the proof and encoding function. The relative order of magnitude is, however, similar, and seemingly comparable.

One result contained in the Arthur D. Little report that was assumed by earlier studies but not treated analytically was the existence of limited scale economies in check processing. This result was achieved by plotting reported total cost for all banks reporting against check volumes processed.

The most recent research published on check processing costs was the result of what has become known as the Atlanta Payments Project. During 1970, the Federal Reserve Bank of Atlanta sponsored a massive data gathering and analysis project at the Georgia Institute of Technology. The original project had the objective of defining the existing payments system in detail, including the retail level, for the purpose of designing a replacement EFT system, for the Florida, Georgia two-state area. Support of the project has subsequently been taken over by the large Atlanta banks and the system under design is for the Atlanta area only.

The results of the Atlanta studies have been published in two multi-volume reports. The first report, released in 1971 and entitled Phase I-II Report: Research on Improvements in the Payments Mechanism, contained flow of payments descriptions and attitude surveys for banks,
individuals and firms. The flow of checks after deposit in a bank was not found to differ from the 1952 Wurts results.

The "Phase III Report," released in 1972, contained cost estimates and system design specifications for an automated clearinghouse for the electronic transfer of funds among banks. The Atlanta approach to check processing cost computation was at variance with the approach taken in the studies discussed above, and is not consistent with the approach taken in this study.

The Atlanta group defined a set of cost modules and computed the fully burdened cost of each. The five large Atlanta banks were used as a sample group and adjustments were made within the banks to insure uniformity in reporting. As a result the report defines two classes of transit items with different costs.

Transit items received from the nonbank public were calculated to cost $0.1055 per check. Transit items received from another bank for collection cost $0.0268 per check. These costs were on a fully allocated basis.

The Atlanta project team was able to work in depth with the five sponsoring banks and as a result it is likely that their results are the most complete and consistent of

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9Paul Han, Phase I-II Report: Research on Improvements in the Payments Mechanism (Atlanta: Georgia Tech Research Institute, Georgia Institute of Technology, 1971).

all processing cost studies. Because their cost modules included both branch costs and overhead, however, utilization of the Atlanta cost results as estimates of available savings from switching to an alternative payments system requires an assumption that sufficient check volume would be avoided to reduce the number of branches and avoid overhead costs.

This study assumes that the flow of checks after first deposit will be altered by Regional Check Processing Centers, but it does not assume that the need for branches will diminish; nor is it assumed that volume reductions will be sufficient in large banks to avoid overhead costs. Therefore, the Atlanta cost results are not considered applicable to the problem at hand.

Correspondent Banking

Correspondent banking relationships have been subjected to considerable analysis within the Federal Reserve System, especially at the Federal Reserve Bank of Kansas City; but have received limited academic attention outside that sphere. The Federal Reserve publications treat correspondent banking services almost as a distinct product line, whereas others apparently do not distinguish banking services on the basis of class of customer. The following paragraphs are intended to indicate the role of the traditional correspondent banking system in check collection.
Of the approximately 21.5 billion checks written in the United States in 1970\textsuperscript{11} about 20 per cent or 4.3 billion were payable at the bank of first deposit,\textsuperscript{12} and about 6.8 billion were collected by Federal Reserve banks.\textsuperscript{13} Of the remaining 10.4 billion checks, about 60 per cent were presented directly to the paying bank either through clearinghouses or informal agreements. The remainder were collected through correspondent banking networks in which a large bank serves as a clearing center for its smaller respondents.\textsuperscript{14}

This figure, 4.2 billion checks for 1970, understates the importance of correspondent relationships for check collection, however, because many of the checks presented through clearinghouses and Federal Reserve banks were earlier deposited with correspondents by other banks. It has been estimated that, on the average, a check presented by a Federal Reserve bank has passed through 1.3 collecting commercial banks.\textsuperscript{15} No comparable data are available for

\textsuperscript{11}Edward Cox, \textit{The Outlook for the Nation's Check Payments System}, p. 4.

\textsuperscript{12}Fenner, \textit{The Check Collection System}, p. 19.


\textsuperscript{14}Fenner, \textit{The Check Collection System}, p. 19.

\textsuperscript{15}Ibid., p. 18.
clearinghouses. Thus, it must be concluded that correspondent relationships are a very important part of the payments process.

The importance of correspondent relationships to individual banks varies considerably. At one extreme is the National Stockyards National Bank of National Stockyards, Illinois, for which balances due to other banks constituted 86.8 per cent of total deposits on September 30, 1970.\textsuperscript{16}

For large New York banks correspondent balances comprise about 20 per cent of total deposits, but for large banks in other major cities the percentages range generally between 5 and 10 per cent.\textsuperscript{17} For all banks in the United States demand balances due to domestic banks on June 30, 1970, were $22.8 billion or 5.2 per cent of total deposits of $436.7 billion.\textsuperscript{18}

The importance of correspondents for check collection also varies, but this apparently varies with bank size. The BAI found that banks with under $10 million in total deposits collect almost 95 per cent of their transit checks through correspondents while the comparable figure for banks larger than $1 billion is less than 14 per cent.\textsuperscript{19} Services


\textsuperscript{17} Ibid., pp. 49-60.


\textsuperscript{19} Fenner, \textit{The Check Collection System}, p. 21.
provided by one bank for another are generally not paid for on a fee basis. Rather, compensating balances are employed for remuneration. The correspondent bank providing services calculates an "investable balance" in the following way.

From the respondent's gross balance the portion of uncollected checks is deducted, i.e., the amount of deposits represented by items still in the process of collection. From this "collected balance" the correspondent deducts its reserve requirement to determine the amount of funds available for investment.

Although banks are not permitted to pay interest on demand deposits explicitly, an earnings rate is applied to the investable balance to determine the gross value of the deposit to the correspondent. From the gross earnings figure is deducted the sum of prices for services performed. The result is an estimate of the profit earned on the account.

Over a period of time correspondents require that earnings credits be at least equal to the account service charges. Respondents attempt to maintain their balances so that the earned credit does not exceed charges.

Correspondent pricing policies have been studied in detail at the Federal Reserve Bank of Kansas City, especially by Robert E. Knight. During July, 1971 and July, 1972, Knight surveyed banks from the largest 125 in terms of deposits due to domestic banks, requesting account analysis
formulae for correspondent accounts. The 1971 survey resulted in 88 usable responses, and the 1972 survey provided 85.

Knight reported the 1971 survey results in the third part of a three part review of correspondent banking, in December, 1971.20 The 1972 results were released in a speech given in October, 1972.21

In his 1971 article Knight introduced the concept of unit balance requirements to avoid the comparison difficulties faced when banks offer higher or lower earnings rates and adjust prices or reserve requirements to compensate. This technique and Knight’s 1972 survey results are utilized in the analysis contained in Chapter IV. Knight’s analysis and conclusions are discussed below.

Katherine Finney’s 1958 book, Interbank Deposits, provides an overview of correspondent banking relationships during the period 1934 to 1954. Despite the age of the study, in light of more recent findings confirming constancy of check flows over time, Finney’s work has relevance to this study.


Although Finney listed and described twenty-three distinct services provided to respondents, she pointed out the Wurts study finding that of 14,189 commercial banks in 1952, 10,872 did not send any items to Federal Reserve banks.23 This, she concluded, indicated a heavy reliance on correspondents for check collection.

In attempting to determine the geography of interbank relationships, Finney utilized semi-annual call reports from 1934 to 1954. She plotted balances due from banks at country banks and demand balances due to banks at Reserve city member banks on the same scale, and found the pattern of fluctuation to be virtually identical. She then achieved a similar result comparing plots of balances due from banks at Reserve city member banks with demand deposits due to banks at central Reserve city member banks.24

From these plots Finney concluded that smaller country banks maintained their active or working balances with city banks in nearby financial centers and larger city banks maintained active balances in national financial centers.25

Finney analyzed the process by which member banks adjusted their asset portfolios in response to reserve

23Ibid., p. 4. The reference is to Wurts, "Study of Check Collection System," p. 33.

24At the time of Finney's study, New York and Chicago were designated central Reserve cities and were not included as Reserve cities in the study.

requirement increases during the period studied. In the earlier years of the period higher reserve requirements were almost totally offset by reductions in interbank balances. In later years, however, additional reserves were supplied by a reduction in securities holdings, primarily U. S. Government obligations. Noting that balances due from banks at country banks declined, relatively, from 30 per cent of demand deposit liabilities in the mid 1930's to 13 per cent in the early 1950's and that Reserve city banks experienced a similar decline from 30 per cent to 7 per cent, Finney concluded that the adjustment to increased reserve requirements is further evidence that, "... correspondent balances have fallen to a kind of minimum needed for day to day transactions." Finney's findings indicate that smaller respondent banks tended to hold working balances with correspondents in their own trade area and that these respondents likely maintained their balances near the level required to compensate for services purchased. These findings are essentially the assumptions upon which the analysis of indirect correspondent banking effects in Chapter IV are based.

During the 1960's the number of bank mergers and the acquisitions of bank holding companies grew spectacularly. This movement toward concentration in banking aroused

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26 Ibid., p. 94.
27 Ibid.
considerable interest in the Committee on Banking and Currency of the United States House of Representatives. During 1963 that Committee's Subcommittee on Domestic Finance authorized two studies of the correspondent banking industry. The Committee wanted to ascertain the status of the correspondent banking industry because of its relevance to legislative decisions on such matters as merger and acquisition legislation. Portions of each study are relevant to this study.

The House Committee reports provided very little analysis; but instead, concentrated primarily on presenting data collected in the two surveys. The two sections of interest here are entitled, "A Report on the Correspondent Banking System," and "Correspondent Relations: A Survey of Banker Opinion."

The former section indicated not only that for smaller respondents the bulk of check value was collected through the correspondent system, but also that for banks over $100,000,000 in deposits over forty per cent of value was collected through correspondents. Of the responses to the question: Why are correspondents preferred to the Fed? the study's author stated:


29 Ibid., Section 3, p. 14.
Perhaps the most important of the reasons listed above is that "the Fed does not perform the same short haul services." This suggests that the Fed has concentrated on long-haul services. This division of labor is, of course, consistent with the size distribution of preferences . . . . since small banks are most apt to handle local money transactions and large banks long-haul transactions. 30

It should be clear from Chapter I that it is in the area of "short haul" services that the Federal Reserve BCFC program is expected to have its effect. The House, "Report on the Correspondent Banking System" implies that if the Federal Reserve does improve collection of local items, it should expect to take check collection business away from correspondent banks.

The Survey of Banker Opinion31 indicated almost universal support for the check collecting services of correspondents. Responses to the opinion questions were categorized as: "replies expressing unqualified approval of the present operation of the correspondent banking system," and "replies in which reservations are expressed concerning the present operation of the correspondent banking system." In the second category of the responses reported, no bank under fifty million expressed dissatisfaction with correspondent check collection services. In general, those banks that did find some fault with correspondent relationships praised the clearing services provided.

This result indicates that, at least as of 1963, respondent banks were satisfied with the level of service

30 Ibid, p. 20. 31 Ibid., Section 1.
being provided for collection of checks by correspondents, and were not demanding improved clearing services from the Federal Reserve. Thus, it does not appear that the Federal Reserve RCPC program was motivated by a demand on the part of respondent banks for improved check collection services.

The Federal Reserve Bank of Kansas City published two studies of correspondent banking relationships in its Monthly Review during 1965. The earlier article, entitled "Correspondent Banking," analyzed the portion of total services sold by banks of various sizes that were purchased from other banks. The second study, "More on Correspondent Banking," attempted to estimate the importance of correspondent balances to the profitability of the depository bank.

In the first study two functions were estimated with linear regression analysis, balances due from banks as a function of total deposits and operating revenue as a function of total deposits. Estimated operating revenue was taken as a measure of total sales. The level of correspondent services purchased was approximated by applying a market based earnings rate to the estimated values of balances due from banks.

Total sales were found to be a constantly rising function of total deposits, but the level of correspondent

services purchased rose for banks with less than $26 million in deposits and declined for larger banks. Sales divided by deposits rose over the range studied (0.5 million to 35 million), but services purchased divided by sales and services purchased divided by deposits declined throughout.33

The authors did not attempt to determine the types of services that were purchased by banks of various sizes, but rather, concluded that the results indicated the existence of economies of scale from specialization by larger banks. It is interesting to note that this finding is consistent with a contention of the Arthur D. Little report that banks smaller than $25 million do very little of their own check sorting but that banks over that size find it economical to do so.34

As is pointed out by the authors, the analysis in "More on Correspondent Banking" was based on precarious assumptions, and it should be noted that the article was motivated primarily by a desire to test methodology and spur discussion. Under an assumption that specific earning assets were directly related to specific classes of liabilities, linear regression was utilized to estimate the relationship between net operating earnings and three

34 Edward Cox, The Outlook for the Nation's Check Payments System.
liability classes among Tenth Federal Reserve District banks with at least $5 million of due to banks during the period 1962-1964. The three liability classes were Interbank Demand Deposits, All Other Demand Deposits, and Time and Savings Deposits.

The derived coefficients estimated the marginal rate of return from the three deposit classes. The authors concluded that, at the margin, Interbank Deposits are significantly more profitable than the other two deposit classes. The conclusion from this result would be that any event that resulted in a substantial reduction in the level of interbank balances would be significantly detrimental to the profits of correspondent banks.

Neither the assumptions nor the conclusions of the "More on Correspondent Banking" article are convincing. First, there is no evidence that investment opportunities available to correspondent banks are superior to those available to non-correspondents of similar size. Second, while it is generally accepted that the structure of bank asset portfolios is influenced by the volatility of deposits, it is more likely that it is total deposit volatility rather than that of particular deposit categories that is important. Further, there is no evidence that

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correspondent banks have less variance in total deposits than non-correspondents: in fact, the reverse is likely.

Third, there is the question of correlation versus causation. It would not be surprising to find that banks with a higher proportion of correspondent liabilities offer a wider range of services and, therefore, have higher net operating earnings.

Because of these considerations, the approach taken in Chapter IV of this study for assigning earnings rates to interbank balances is not consistent with the approach taken in "More on Correspondent Banking." Rather, the earnings rates utilized in the analysis are average returns on earning assets.

In a study published in 1970, Robert Lawrence and Duane Lougee attempted to shed new light on the nature of correspondent relationships. They utilized data from FDIC Call Reports and Folk's Bank Directory for banks located in Colorado, New Mexico, and Wyoming for the study. Linear regression was used to analyze the relationship between the number and dollar amount of correspondent accounts and a series of independent variables.

Bank size was found to be the key variable for explaining the total number of correspondent accounts, the number of accounts outside the trade area and the total

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balance due from banks. Other factors found to be significant were the ratio of demand deposits to total deposits and the distance of the bank from the major commercial center.

Lawrence and Lougee also found that virtually every bank had an account in the regional financial center (Denver) but that only banks of over $50 million in deposits were likely to hold balances in other areas. This finding substantiated the conclusions of both Finney[^37^] and the House of Representatives study[^38^]. This result, while tending to substantiate the other findings is of limited applicability here because no attempt was made to identify the nature of services purchased, by location.

Finally, in late 1972, Robert Knight of the Federal Reserve Bank of Kansas City analyzed correspondent banking transactions in the Tenth Federal Reserve District and in the Baltimore-Washington and Miami RCPC areas to identify in general terms the likely effect of the Federal Reserve RCPC program on interbank balances[^39^]. Based on Tenth District transactions Knight concluded that "the maximum decline in

[^37^]Finney, Interbank Deposits.

[^38^]U.S. Congress, Reports on Banking Questionnaires.

principal correspondent accounts of small banks would average about 50 per cent for rural banks with deposits under $10 million and over 70 per cent for other banks.\(^4^0\)

Knight pointed out that the computed reductions related to book balances due from banks at the respondent and not collected balances on the books of the correspondent. Percentage reductions in collected balances would be substantially lower because a substantial portion of computed reductions were the result of expediting collection time.

Knight also pointed out that his estimates were of maximum reductions possible, and he did not consider state reserve requirements as a restriction. He concluded that the correspondents face a severe challenge to offer sufficient services to maintain respondent balances because of the RCPC program.

**Banking Industry Structure**

In 1970, the Economics Task Force of the American Bankers Association MAPS Committee commissioned three faculty members of Northwestern University to analyze the likely impact of payments mechanism changes on the structure of the banking industry. In their report to the Economics Task Force the authors, Jacobs, Hoag, and Lerner.

\(^4^0\)Ibid., p. 17. Emphasis is the author's.
interpreted their assignment as describing the banking system at a point in time when checks have been virtually eliminated; and as such, they did not consider the transition path from 1970 to that future date. 41

It is interesting to note that, despite the array of services offered by commercial banks, the authors concluded that payments system considerations alone would dictate that smaller banks will become service outlets for larger institutions either as captives, due to the cost of electronic equipment, or as merged branches. 42 This conclusion was based on an assumption that it would be uneconomical for smaller banks to maintain electronic communication equipment, and the expectation that large banks would possess the requisite equipment. It is not clear from the paper how these factors differ from the existing situation in which respondents purchase payments processing services from correspondents but are typically not captives.

In ignoring the transitional period between the existing situation and a remote checkless world, the Jacobs, Hoag, and Lerner paper leaves a gap of substantial proportion. While the authors' conclusions may in time be proven valid, it is likely that the structure of the banking


42Ibid., p. 48.
industry twenty years hence will be the cumulative result of an evolutionary process rather than the result of one change in the processing of payments.

The 1972 Regulation J amendment was billed by the Federal Reserve as one step in the evolutionary process toward widespread electronic payments. The role of that regulation in bringing about a world such as envisioned by Jacobs, Moag and Lerner, has been debated in the trade press but has not been subjected to detailed analysis prior to this study. It is interesting to note that the discrepancy between deferred and immediate payment status has existed for many years without economic consideration of its effect on the structure of banking.

Because both deferred and immediate payment banks were to be found in size groups up to $400 million in demand deposits, the amendment to Regulation J cannot be considered to be strictly a small bank-large bank issue. Yet, prior to November, 1972, deferred payment banks tended to be smaller rural banks and immediate payment banks tended to be large city banks, and if country banks tend to lose earning power while city banks tend to gain, and if it were demonstrated that natural scale economies existed in banking, it must be concluded that the Regulation J amendment moves the banking industry toward the Jacobs, Moag, and Lerner description.

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The issue of natural economies of scale, however, is not completely clear. It has been demonstrated that, due to the nature of the banking firm, economies of scale should be expected. The expected scale economies relate to spreading risk over a large number of depositors and assets, so economies should be expected to diminish as the insurance principle diminishes at the margin.

The empirical studies that have been concerned specifically with the existence of economies of scale have been universally plagued by definitional problems. Because of the multiproduct nature of the banking firm, two problems arise. First, it is difficult to relate specific costs to specific outputs because of overlapping functions. Second, it is difficult to compare institutions because they may differ significantly not only as to uses of funds but also as to sources.

The early studies ignored these problems and took a straightforward approach. Studies by Alhadeff and by

44 The initial article in this vein was: Francis Y. Edgeworth, "The Mathematical Theory of Banking," Journal of the Royal Statistical Society, LI (March, 1888). The concept has been extended recently, however, by Ernst Baltensperger, "Economies of Scale, Firm Size and Concentration in Banking," and "Costs of Banking Activities--Interactions Between Risk and Operating Costs," Journal of Money, Credit, and Banking, Vol. IV, No. 3 (August, 1972), pp. 467-88 and pp. 595-611, respectively.

Horvitz essentially plotted total earnings against total operating expenses for a range of bank sizes. Effectively, these studies were measuring whether gross operating margins increase, relatively, with size. Both studies concluded that significant scale economies exist up to 25 to 50 million dollars in total deposits and beyond 200 million dollars in deposits, but that banks achieved very few economies between 50 and 200 million dollars.

Gramley, studying banks in the Tenth Federal Reserve District, and Schweiger and McGee, studying Chicago banks, rejected the operating margin approach of the earlier studies and utilized linear regression analysis to measure the relationship between operating costs and total assets. The results of both studies roughly substantiated earlier conclusions. Gramley's sample did not contain any large banks but both he and Horvitz found significant economies of scale up to approximately 50 million dollars in total assets. Failure to deal with the multiproduct problem meaningfully however, leaves the conclusions of the studies somewhat questionable.


47 Lyle E. Gramley, A Study of Scale Economies in Banking (Kansas City, Mo.: Federal Reserve Bank of Kansas City, 1962). Monograph.

Greenbaum attempted to solve the multiproduct problem by grouping each type of asset into one of sixteen categories and developing an index of total output by estimating the yield on each class through a linear regression equation. Greenbaum's index of output was the sum of yields weighted by the asset categories. The index was used to explain operating costs.

Greenbaum, like others, found significant scale economies for relatively small banks but, unlike others, he found increasing cost per output unit for very large banks. This U-shaped cost curve implied an optimum bank size.

The U-shaped cost curve has not been found in other studies, and Greenbaum has not published his data for examination by others. Further, Greenbaum apparently ignored the fact that any given value for his "index" could be achieved by essentially an infinite number of combinations of yields and asset values.

Benston rejected the idea of a single index of output and attempted to relate specific costs to a series of functions or output classes. The six functions defined


by Benston included demand deposits, time deposits and six asset classes. Uniquely Benston used the number of accounts rather than the size of accounts as a measure of output.

By utilizing the number of accounts rather than the dollar size as a measure of output, Benston concluded that the conclusion of previous authors, that scale economies existed, was somewhat illusory. He found limited scale economies in direct costs. Although Benston's sample did not include any banks larger than $55 million in total deposits, Bell and Murphy utilized an identical technique on a larger sample of banks ranging up to over $800 million in deposit size with similar results.51

Benston's interest in the question of the appropriate measure of economies of scale related to the issue of whether scale economies exist in banking, per se; or whether, if they exist they are the result of regulation that, for example, permits larger institutions to make larger loans. In a 1972 review article,52 Benston combined his earlier results with those of Bell and Murphy and concluded that the estimated overall elasticity of operating costs, with respect to output of 0.93, does indicate


economies of scale, per se. These observed economies were not found to exist in all banking functions, nor does Benston believe that they are sufficiently large to dictate a public policy of encouraging increased concentration in banking.

It would appear that at this stage of development of the theory of the banking firm, general agreement has been reached on the existence of economies of scale in banking up to the size of $25 to $50 million in total assets. Beyond that level the issue remains in question, but Benston's finding of scale economies in numbers of accounts and at least a solid theoretical expectation of economies in size of accounts indicates that further sophistication in the field will likely lead to consensus in the direction of Benston's most recent statement.

**Summary and Conclusions**

The literature discussed in this chapter ranges from operational orientation to theoretical. The major findings described are summarized and discussed in order.

**Operations**

The operational studies have indicated that the flow pattern of checks remained virtually unchanged from the early 1950's until at least the implementation of the Federal Reserve Regional Processing Center program. The
pattern found was that described in Chapter I of small banks depositing transit checks with large correspondents who collected the checks directly or forwarded them to the Federal Reserve or still other correspondents.

As discussed in Chapter I, Chapter III of this study analyzes the cost implications of redirecting this check flow to bypass the correspondent as the bank of second deposit. Under the RCPC program small respondents are induced to deposit directly with the Federal Reserve facility.

The cost findings of the operational studies indicated that direct marginal costs in the area of $0.01 to $0.015 should be expected for check processing. The variance results in definition of direct costs. The Atlanta study$^{53}$ indicated that cost savings in the order of $0.03 per check are available for eliminating checks deposited by respondent banks.

The Atlanta cost calculations were based on fully burdened processing functions and cannot be considered as marginal costs. It would appear that a substantial relative volume of checks would have to be eliminated from a bank in order to achieve unit cost reductions of the order of magnitude computed by the Atlanta group.

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$^{53}$Lipis, Phase III Report.
Although economies of scale in check processing were assumed in the BAI studies, they were addressed directly by Cox in the operational study group. Cox concluded that limited scale economies were available in check processing for large volume banks. This issue is also analyzed in Chapter III.

**Correspondent banking**

It is reasonable to conclude from the literature of correspondent banking that check collection services have traditionally played a very important role in the correspondent relationship. Knight speculated, quite reasonably, that check collection services may have initially been the basis for the development of the compensating balance approach to payment.

The long term continuation of the practice as well as the House of Representatives study indicated a high degree of satisfaction among bankers with the correspondent check collection network. By altering the flow of checks the Federal Reserve System should expect to significantly alter the respondent-correspondent relationship in check collection.

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54 Penner, The Check Collection System.

55 Knight, "The Impact of Changing Check Clearing Arrangements."

56 U.S. Congress, Reports on Banking Questionnaires.
Structure

With respect to banking structure it should be recognized that the possibility exists that expenditures to meet capital equipment requirements may in the foreseeable future lead toward a high degree of concentration in the banking industry. While the question of the existence of constantly increasing economies of scale is still somewhat in doubt recent literature indicates that such may well be the case. It is conceivable that the type of economies of scale foreseen by Jacobs, Moag, and Lerner have occurred over the last ten years due to the capital requirements for check processing and other such computerized financial services.

It is interesting to note that the differences that have existed in the manner and time of payment between deferred and immediate payment banks have universally been ignored in banking structure studies. It is reasonable to believe that the results of empirical studies, especially those of Alhadeff and Horvitz, were biased by the deferred payment situation, especially because of heavy weighting of smaller banks by deferred status and the high incidence of immediate payments among larger banks.

The analysis contained in the succeeding three chapters is built upon the body of literature discussed in this chapter. As indicated in Chapter I, the schema utilized for evaluating the cost effectiveness of Regional
Check Processing Centers assumes an initial check collection pattern such as that described by Wurts and verified by Fenner, by Cox, and by Han. Additionally, Chapter III contains processing cost estimates that permit testing the conclusions of Cox and of Benston relative to the source and existence of scale economies in bank demand deposit processing.

Chapter IV may reasonably be construed as an analytical extension of previous work done by Robert Knight in evaluating the potential effect of Regional Centers on interbank balances. The analysis by Finney and the House of Representatives surveys permit the conclusion that RCPC's were not brought about by an absence of, or a dissatisfaction with, check clearing services offered by correspondents. Rather, the centers must be required to stand alone on the basis of their ability to reduce check clearing costs.

A continuing question exists as to the desirability of increased concentration in the banking industry, both as a matter of economic efficiency and as a matter of public policy. Jacobs, Moag, and Lerner concluded that, from the standpoint of economic efficiency, payments mechanism considerations will lead toward increased concentration; and others have, at the very least, found no refutation for such a conclusion.
Certainly, if the checking system is replaced on a widespread basis, the time pattern of change will affect the structural consequences. In attempting to ascertain the profitability implications of the 1972 Regulation J amendment, Chapter V provides a basis for previewing that time pattern.
CHAPTER III

DIRECT COST EFFECTS FOR TRANSIT
CHECK PROCESSING

Overview

The purpose of this chapter is to establish a basis for evaluating the Federal Reserve System's success in achieving its objective of reducing the overall cost of check collection through the establishment of Regional Check Processing Centers (RCPC's). The RCPC program involves a major Federal Reserve commitment and is the mainstay of the System's efforts to achieve "faster, more efficient and more economical banking services to the public."1

The approach taken in establishing a basis for evaluation was to analyze individually, and in detail, a representative group of regional centers in order to draw conclusions relative to the overall program and to identify the characteristics required for the program to achieve its objective. Individual center analysis was preferred to aggregate analysis because negative savings at a particular location may be offset by positive savings at another.

invalidating net results. Because the differentiating characteristics of regional centers are few in number it was decided that a small representative group would satisfactorily represent the entire program.

From the schema developed in Chapter I it was determined that direct cost savings, as defined in equation (I-7), may be computed by solving for the values in equation (I-7), as follows:

\[ S_d = MC_t^B \cdot (V^R_1)^* - MC_t^F \cdot V_n \]  

(I-7)

where

- \( S_d \) = Total direct cost savings from transit check processing
- \( MC_t^B \) = Marginal cost of transit processing in large commercial banks
- \( (V^R_1)^* = V^R_1 - V^F_{ho} \)
- \( V^F_1 \) = Transit volume payable within the defined RCPC area (local checks) and deposited in a smaller, respondent bank
- \( V^F_{ho} \) = The volume of \( V^F_1 \) that is payable at the correspondent of the bank of first deposit
- \( MC_t^F \) = The marginal cost of transit processing in Federal Reserve RCPC's.
- \( V_n \) = The volume of the class of checks that are collected through an RCPC but would not clear through the Federal Reserve in the absence of the center (i.e., "new" checks to the Federal Reserve).

This chapter describes the estimation of the values in equation (I-7).
Selection of Representative Group

In selection of a representative group of regional centers, the first step was to identify the characteristics that may differentiate the centers and to identify which of these characteristics affect the values in equation (1-7). Next, the list of existing centers was reviewed to select a representative group.

Federal Reserve Regional Check Processing Centers may be classified according to the following characteristics:

1. Volume of checks handled.
2. Location: on-premise at a Federal Reserve office or at a remote site (off-premise).
3. Banking structure of the area served.
4. Operating characteristics (i.e., second or third generation computer equipment).
5. Area of the country.

The first item, volume of operation, clearly relates to the purpose of the analysis of identifying the characteristics of a successful RCPC program. It was deemed desirable, therefore, to view the range of size.

The second characteristic would also be expected to differentiate between regional centers. This is true because of the opportunity to share resources and overhead among departments of an existing office, whereas such an opportunity does not exist at a specialized check processing center.
Although, intuitively, it would seem that the existence or prohibition of branching would affect transit volumes and, thus, the requirements for regional processing centers, earlier research has indicated that this is not the case. In an analysis of factors influencing variation of transit volumes among banks, dummy variables representing both limited and statewide branching were found to be not significantly different from zero.²

Item number four, operating characteristics, is somewhat questionable as a selection criterion, as it is likely redundant with check volume. Although there is a range for decision, the nature of the check processing operation dictates, generally, that third generation computers are more efficient for large volume operations and second generation systems are more efficient for smaller volumes. This is the case because of larger data retrieval requirements for balancing and reconciliation in large volume operations.

The region of the country was not considered to be a significant characteristic, in view of the other criteria. This was the case primarily because operating technology is widely shared throughout the industry, and all Federal Reserve Banks operate under a uniform set of policy guidelines.

Table 1 lists the Federal Reserve Regional Check Processing Centers in operation as of March 30, 1973, with indications of the relevant characteristics. The list omits the check processing operation at the Federal Reserve Bank of Philadelphia which is referred to by that bank as an RCPC, but which is not consistent with the Board's guidelines. From this list the following selections were made.

Lewiston, Maine, was selected as representative of a small RCPC. It was considered as particularly relevant to evaluation of the program because, while it is atypical, it represents a class of center that could easily proliferate. That is, there are a limited number of large financial centers in the United States, but a substantial number of trade areas, comparable for the purposes at hand to the state of Maine.

Beyond selection of Lewiston as representative of small RCPC's, it was decided to analyze Windsor Locks, Connecticut, as representative of larger, off-premise facilities, and Cleveland, Ohio, as representative of larger on-premise operations. Additionally, it was decided to include Baltimore, Maryland, in the analysis because that RCPC has been in operation since January, 1970, and the results were expected to serve as a benchmark for evaluating the validity of the findings at the other locations.
<table>
<thead>
<tr>
<th>Location</th>
<th>Date of Beginning</th>
<th>Estimated Average Daily Volume</th>
<th>Estimated Average &quot;New&quot; Volume</th>
<th>Banking Structures On or Off Premise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lewiston, Maine</td>
<td>9-72</td>
<td>200,000</td>
<td>100,000</td>
<td>S off</td>
</tr>
<tr>
<td>Windsor Locks, Conn.</td>
<td>1-73</td>
<td>1,021,000</td>
<td>621,000</td>
<td>S off</td>
</tr>
<tr>
<td>Long Island, N.Y.</td>
<td>9-72</td>
<td>506,000</td>
<td>275,000</td>
<td>L on</td>
</tr>
<tr>
<td>Buffalo, N.Y.</td>
<td>10-72</td>
<td>274,000</td>
<td>50,000</td>
<td>L off</td>
</tr>
<tr>
<td>Cleveland, Ohio</td>
<td>1-73</td>
<td>1,600,000</td>
<td>720,000</td>
<td>L off</td>
</tr>
<tr>
<td>Columbus, Ohio</td>
<td>10-72</td>
<td>580,000</td>
<td>316,000</td>
<td>L off</td>
</tr>
<tr>
<td>Baltimore, Md.</td>
<td>1-70</td>
<td>1,469,000</td>
<td>340,000</td>
<td>S on</td>
</tr>
<tr>
<td>Atlanta, Ga.</td>
<td>9-72</td>
<td>765,000</td>
<td>314,000</td>
<td>L on</td>
</tr>
<tr>
<td>Birmingham, Ala.</td>
<td>9-72</td>
<td>276,000</td>
<td>79,000</td>
<td>L on</td>
</tr>
<tr>
<td>Jacksonville, Fla.</td>
<td>9-72</td>
<td>362,000</td>
<td>249,000</td>
<td>N on</td>
</tr>
<tr>
<td>Nashville, Tenn.</td>
<td>9-72</td>
<td>117,000</td>
<td>12,000</td>
<td>L on</td>
</tr>
<tr>
<td>New Orleans, La.</td>
<td>11-72</td>
<td>192,000</td>
<td>65,000</td>
<td>L on</td>
</tr>
<tr>
<td>Chicago, Ill.</td>
<td>4-72</td>
<td>1,010,000</td>
<td>120,000</td>
<td>N on</td>
</tr>
<tr>
<td>Des Moines, Iowa</td>
<td>11-72</td>
<td>586,000</td>
<td>236,000</td>
<td>N off</td>
</tr>
<tr>
<td>St. Louis, Mo.</td>
<td>9-72</td>
<td>642,000</td>
<td>476,000</td>
<td>N on</td>
</tr>
<tr>
<td>Little Rock, Ark.</td>
<td>9-72</td>
<td>126,000</td>
<td>27,000</td>
<td>N on</td>
</tr>
<tr>
<td>Louisville, Ky.</td>
<td>11-72</td>
<td>273,000</td>
<td>134,000</td>
<td>L on</td>
</tr>
<tr>
<td>Memphis, Tenn.</td>
<td>9-72</td>
<td>297,000</td>
<td>99,000</td>
<td>L on</td>
</tr>
<tr>
<td>Minneapolis, Minn.</td>
<td>10-72</td>
<td>671,000</td>
<td>305,000</td>
<td>N on</td>
</tr>
<tr>
<td>Denver, Colo.</td>
<td>5-71</td>
<td>47,000</td>
<td>15,000</td>
<td>N on</td>
</tr>
<tr>
<td>Oklahoma City, Okla.</td>
<td>4-72</td>
<td>46,000</td>
<td>6,000</td>
<td>N on</td>
</tr>
<tr>
<td>Omaha, Neb.</td>
<td>5-72</td>
<td>240,000</td>
<td>95,000</td>
<td>N on</td>
</tr>
<tr>
<td>Dallas, Tex.</td>
<td>8-72</td>
<td>700,000</td>
<td>500,000</td>
<td>N on</td>
</tr>
<tr>
<td>Houston, Tex.</td>
<td>9-72</td>
<td>400,000</td>
<td>200,000</td>
<td>N on</td>
</tr>
</tbody>
</table>

a"S" indicates statewide branching, "L" indicates limited branching and "N" indicates no branching in the state where the RCPC is located.
The computation of marginal cost of transit processing (\( MC^B_t \)) was based on 1970 Functional Cost Analysis data for banks with demand deposits greater than $50 million. In order to compute marginal cost, it was first necessary to describe a cost function for check processing, and solve for the partial derivative with respect to transit volume.

Demand deposit processing in a commercial bank involves three separate functions that share resources. These are, the processing of deposits (i.e., the actual credit as opposed to the checks or cash contained in the deposit), the processing of home debits (checks charged against accounts of the processing bank's customers) and the processing of transit checks. Thus, the direct variable cost of check processing was expected to be a function of transit volume, home debit volume and the volume of deposits.

The cost function was tested in the form

\[
C_d = b_0 \cdot V_t^{b_1} \cdot V_h^{b_2} \cdot V_d^{b_3} \cdot E \tag{III-1}
\]

where

\( C_d \) = direct variable cost of demand deposit processing
\( V_t \) = volume of transit checks
\( V_h \) = volume of home debits
\( V_d \) = volume of deposits
E = Stochastic error term

\( b_1 (i = 0, 1, 2, 3) = \) cost parameters.

The parameters \( (b_1) \) were estimated with least squares linear regression in the following form:

\[
\log C_d = \log b_0 + b_1 \log V_t + b_2 \log V_h + b_3 \log V_d + \log E \tag{III-2}
\]

Because of the interrelated nature of the three check processing functions and the large capital expenditure requirements for computerized operation it should be expected that the unit cost of each function would decline with volume, at the margin. Thus, the following hypotheses were tested.

1. \( H_0 \) : \( 0 < b_1 < 1 \)
2. \( H_0 \) : \( 0 < b_2 < 1 \)
3. \( H_0 \) : \( 0 < b_3 < 1 \)

The question of the existence of economies of scale in check processing has been raised by Cox\(^3\) and by others. This formulation of the cost function raises the additional question of definition of scale economies.

For a production function of the Cobb-Douglas form economies of scale are defined to exist if the function has less than unitary homogeneity, that is, if the sum of the exponents is less than unity.

Such a definition of scale economies in this cost function implies that average cost per unit processed must decline as volume increases, given a constant proportionate mix of deposits, home debits and transit checks. Given this definition, the question of scale economies may be tested as a hypothesis in the following form:

\[ 4C_{H_0} = b_1 + b_2 + b_3 < 1 \]

Three questions arise as to utilization of least squares linear regression to estimate the parameters in equation (III-1). The first two questions relate to the technique itself, and the third relates to the acceptability of the results.

The first question concerns the direction of causation. Utilization of linear regression implies that the dependent variable is caused by the explanatory variable and that the explanatory variables are independent of "feedback" effects from the dependent variable.

In limiting the analysis to direct variable costs, this condition appears to be met in this analysis. If fully burdened costs were used, it might reasonably be argued that advertising expenses or other marketing costs generate additional volume. With direct variable costs as a measure, however, it is reasonable to assume a single direction of causation.
The second question concerns the validity of least squares for estimating the parameters. The Markoff Theorem states that least-squares estimators of the b's in equation (III-2) are the best linear unbiased estimators if the following four conditions are met.

1. The expected value of the residual is zero, for each bank. (Zero expected value of residuals)

2. The expected value of the square of the residual for each bank is equal to the variance of the estimate. (Constant variance of residuals)

3. The expected value of the product of residuals for any two banks is zero. (Independence of the observations)

4. The expected value of the product of the residual times each variable is zero for each variable for each bank. (Independence of explanatory variables from residuals)

Condition 1 was assumed to be met. In bank cross-sectional studies analysts frequently deflate variables by dividing by total assets to minimize the likelihood of heteroskedasticity, in fulfilling condition 2. This technique is clearly not appropriate for the purpose at hand, however. Condition 2 was assumed to be met and analysis of plots of residuals bore out the assumption.

In order for condition 3 to be violated it would be necessary for the residuals of certain classes of banks to have a higher likelihood of having a particular sign. For
the group of banks included in the analysis it may be safely assumed that processing equipment and methodology are sufficiently homogenous that condition 3 is not violated.

If conditions 1, 2, and 3 were met and condition 4 were violated, it would imply that some banks could make up excessive costs in one function with more efficient operations in another. This possibility seems very remote because of the sharing of resources among functions.

A possibility exists for correlation between the residuals and the independent variables due to errors in reporting the data. The Federal Reserve as assimilating agent for the data exerts no control over the collection method, and bias could enter from this source. In the absence of a means of evaluating or measuring reporting error, it is assumed to be normally distributed and to not violate condition 4.

From the above considerations, it was assumed that the conditions of the Markoff Theorem were met by equation (III-2) and that the least-squares estimates of the b's are the best linear unbiased estimators. The third question involving the technique is, given that the least squares estimators are the best estimators, does collinearity among the independent variables sufficiently obstruct the ability to measure the coefficients so as to invalidate the results.
The correlation semi-matrix of the variables is as follows.

\[
\begin{matrix}
C_d & V_t & V_h & V_d \\
C_d & 1.0000 & & \\
V_t & 0.6034 & 1.0000 & \\
V_h & 0.8259 & 0.5599 & 1.0000 \\
V_d & 0.8333 & 0.5331 & 0.9506 & 1.0000 \\
\end{matrix}
\]

The question of what is an acceptable level of correlation among explanatory variables is difficult to answer, a priori. Because the analysis is concerned solely with the coefficient for \( V_t \), however, and because the results were reasonably close to cost values calculated by other methods, it was assumed that collinearity among explanatory variables did not invalidate the results.

Banks participating in the Federal Reserve Functional Cost Analysis program allocate direct costs according to function. Of the costs allocated to the demand deposit function, the sum of the following elements is defined as variable direct cost \( (C_d) \).

- Employees' salaries, wages, and fringe benefits,
- Furniture and equipment,
- Computer service fees,
- Printing, stationery and office supplies,
- Postage, freight, and delivery,
- Telephone and telegraph, and
- Data processing expense.

This definition coincides with expense elements defined by the Federal Reserve System accounting system as the direct variable cost elements of check processing, thus
insuring the comparability of commercial bank and Federal Reserve Bank cost results. The definition was also discussed with commercial bank officers who concurred in the definition.

The relationship described above was tested on 1970 Functional Cost data for all participating banks with total demand deposits equal to or greater than fifty million dollars. Of 159 such banks in the data file, preliminary analysis resulted in the elimination of nine banks because of incomplete responses, errors in keypunching of the data or obvious anomalies.

The BMD, PiR multiple linear regression program (October, 1971, version) was utilized for the analysis. The results for the log function are as follows: (Values in parentheses are standard errors.)

\[
\begin{align*}
    b_0 &= \text{Antilog } -0.4998035 = 0.316 \\
    b_1 &= 0.1274526 \ (0.02766942) \quad 21.218 \\
    b_2 &= 0.4404892 \ (0.1115159) \quad 15.603 \\
    b_3 &= 0.4229242 \ (0.1035890) \quad 16.669 \\
    \text{Standard error of the estimate} &= 0.1313 \\
    \text{Multiple } R &= 0.9264 \\
    \text{All coefficients were significantly different from zero at the 99\% level of confidence.}
\end{align*}
\]
The analysis of variance table is as follows:

<table>
<thead>
<tr>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>15.25248</td>
<td>3</td>
<td>5.084161</td>
</tr>
<tr>
<td>Residual</td>
<td>2.518622</td>
<td>146</td>
<td>0.017251</td>
</tr>
</tbody>
</table>

**Tests of Hypotheses**

Confidence intervals based on the "t" statistic were computed for the parameters estimated by the equation. The 99% confidence intervals are as follows:

- \( b_0 \): (0.2878, 0.3442)
- \( b_1 \): (0.1216, 0.1334)
- \( b_2 \): (0.4141, 0.4668)
- \( b_3 \): (0.4007, 0.4451)

Based on these results, hypotheses 1\( H_0 \), 2\( H_0 \), and 3\( H_0 \) were not rejected. That is, the unit cost of each function—deposit processing, home debit processing, and transit check processing—was found to decline at the margin for fixed volume in the other two functions.

Hypothesis 4\( H_0 \) was also tested utilizing the "t" statistic, with the variance of the statistic, \( b_1 + b_2 + b_3 \), computed from the following formula:

\[
\text{VAR} (\Sigma b_1) = \Sigma \text{VAR} (b)_i + 2 \sum_{i<j} \rho_{ij} s_i s_j
\]

where:
- \( \rho_{ij} \) = the correlation coefficient for \( b_i \) and \( b_j \)
- \( s_i \) = the standard error of \( b_i \)
Computation of the variance for the statistic $b_1 + b_2 + b_3$ permitted identification of the following confidence intervals.

99% confidence interval = (.9421, 1.0397)
95% confidence interval = (.9539, 1.0279)

Thus, the sum of the exponents of the cost function was found to be not significantly different from 1.0 at the 99 per cent or at the 95 per cent level, and hypothesis $H_0$ was rejected. That is, it was found that for constant proportionate distribution of transit volume, home debit volume and deposit volume unit costs do not decline with increased workload.

**Marginal Cost Calculations**

From above, total direct variable cost has been defined as related to processing volume, in the functional form,

$$C_d = b_0 \cdot v_t^{b_1} \cdot v_h^{b_2} \cdot v_d^{b_3}.$$

The test of hypothesis $H_0$ indicated that total cost changes at a constant rate if all three types of volume change proportionately. It is expected, however, that with the implementation of RCPC's, only transit volume will decline so that $V_h$ and $V_d$ are expected to remain constant.

To determine the amount of change expected in total cost it was necessary to estimate the unit cost and multiply by the volume. The approach taken in estimating unit cost
was to compute marginal cost for large correspondent banks and compute an average for the group.

The marginal cost of transit processing is defined as the partial derivative of the total cost function with respect to transit volume.

\[ MC_t^B = \frac{d C}{d V_t} = b_1 \cdot b_o \cdot V_t^{b_1-1} \cdot V_h^{b_2} \cdot V_d^{b_3} \]

From above, the marginal cost of transit check processing may be calculated from the following equation:

\[ MC_t^B = 0.040326 \cdot V_t^{-0.8725474} \cdot V_h^{0.4404892} \cdot V_d^{0.4229242} \]

This equation was applied to the reported volumes for the 150 Functional Cost banks with demand deposits greater than $50 million. The results are described in Table 2.

Computed mean values are as follows:

- all 150 banks: 0.0171
- 73 banks with Demand Deposits greater than $100 million: 0.0123
- 33 banks with Demand Deposits greater than $200 million: 0.0127
- 13 banks with Demand Deposits greater than $400 million: 0.0128
- 32 banks identified as regional correspondents: 0.0125

Based on these results, a value of 0.0125 was used throughout the analysis as the estimate of \( MC_t^B \).
TABLE 2

DISTRIBUTION OF COMPUTED COMMERCIAL BANK MARGINAL COST OF TRANSIT PROCESSING (FUNCTIONAL COST BANKS, 1970)

<table>
<thead>
<tr>
<th>Computed Marginal Cost</th>
<th>50-100</th>
<th>100-200</th>
<th>200-400</th>
<th>400+</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-0.0025</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>0.0025-0.0050</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>0.0050-0.0075</td>
<td>8</td>
<td>4</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>0.0075-0.0100</td>
<td>5</td>
<td>4</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>0.0100-0.0125</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>0.0125-0.0150</td>
<td>12</td>
<td>11</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>0.0150-0.0175</td>
<td>7</td>
<td>4</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>0.0175-0.0200</td>
<td>8</td>
<td>4</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>0.0200-0.0225</td>
<td>9</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>0.0225-0.0250</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.0250-0.0275</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0.0275-0.0300</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.0300-0.0325</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.0325+</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Totals: 76 40 21 13 150 (32)

aValues in parenthesis indicate distribution of calculated marginal costs among thirty-two banks identified by Federal Reserve Bank officers as regional correspondents.

bThe reported values for the two banks in this cell appear to be due to reporting or keypunching errors.

Net Transit Volume at Respondent Banks

Estimation of local transit volume deposited at respondent banks was based upon an assumption as to the flow of checks after the establishment of a Federal Reserve Regional Check Processing Center. This assumption was
substantiated in interviews with commercial bankers, both respondent and correspondent, participating in the Baltimore RCPC, and with operations officers at various Federal Reserve banks.

From above, the value \((V_{1}^{\text{f}})\) is the net of the volume of checks payable locally and first deposited in a respondent bank \((V_{1}^{\text{r}})\) minus the volume of such items that are payable at the correspondent of the bank of first deposit \((V_{1}^{\text{c}})\).

It was assumed that, with the establishment of an RCPC, respondent banks begin depositing all locally payable checks with the Federal Reserve facility. Under this assumption the volume of items received by the RCPC from such banks corresponds identically to \(V_{1}^{\text{f}}\).

The bases for the assumption were, first, under the RCPC program Federal Reserve offices have lifted an historic prohibition to permit non-member participating banks to deposit locally payable items with the Federal Reserve. Second, because the Federal Reserve does not levy a charge for its services, respondent banks are motivated to deposit directly with the RCPC in order to reduce correspondent balances or purchase additional services with existing balances. Further, to the extent that member bank respondents traditionally cleared checks through correspondents because of later deposit deadlines and earlier credit availability, the overnight credit and midnight deadlines at RCPC's should reroute the flow of checks.
Finally, in establishing regional centers, Federal Reserve Banks have begun underwriting the cost of transporting checks from the bank of deposit to the RGPC. Correspondent banks are prohibited from offering similar service because of the prohibition against payment of interest on demand deposit accounts.

Although the interviews discussed above indicate that this assumption is generally valid, it is certain that there are exceptions. Analysis of the schema developed in Chapter I, however, leads to the conclusion that the exceptions to the assumption—local checks continuing to flow to correspondents—do not invalidate the computational results because the computational form accounts for such checks in an appropriate manner.

Estimates for $V_1^C$ for the four centers under analysis were derived by annualizing the average daily volume of checks received from respondent banks at the four centers during the five-day business week beginning March 26, 1973. The letter from Board Member, George W. Mitchell, dated March 1, 1973, requesting the data from Federal Reserve banks left identification of noncorrespondent banks to the discretion of the Reserve banks.

Conversion of the reported volumes to an annual basis was accomplished in the following manner. The Federal Reserve Banks of Boston and Cleveland, and the Baltimore Branch of the Federal Reserve Bank of Richmond provided the
percentage that each month represented of total annual volume during 1971, and the percentage distribution of monthly volume by quarter of the month.

The use of these distributions, therefore, assumes (1) that the 1971 distributions remain valid; (2) that the flow within each month does not vary significantly over time; and (3) that the time pattern for the Federal Reserve Bank of Boston is not significantly different than the time pattern for the two, newly created, off-premise facilities in the Boston District.

The values provided by the Federal Reserve banks permitted computation of a value representing the percentage of annual volume contained in an average day's workload during the last week in March. Average daily volumes were determined by summing the reported individual daily volumes and dividing by five.

Values for estimation of \( V_{\text{ho}} \) were derived from surveys of commercial banks conducted by the Federal Reserve Banks of Boston and Cleveland and the Baltimore Branch of the Federal Reserve Bank of Richmond. The survey form requested, among other items; the volume of items received, by source, and the fraction from each source that was home debit, on a daily average basis for a representative five-day business week. The survey form is attached as Appendix A.
Survey results from banks identified by officers of the respective Federal Reserve banks as being major correspondent banks were utilized for computation of $V_{no}^F$. The lists of banks in each area is contained in Appendix B. In utilizing the survey results, it was assumed that the fraction of items deposited by respondents that is payable at the correspondent remains constant over time.

**Federal Reserve Costs**

The second product on the right hand side of equation (I-7), $MC_t^F \cdot V_n$, was estimated in two ways with both results presented. The first method was to compute the budgeted 1973 per item cost and apply the results to projected "new" volumes to derive a product. These values are then compared with actual unit costs of operation during the fourth quarter of 1972, for validation.

**The Baltimore RCPC**

The daily average volume deposited with the Baltimore RCPC by participating banks other than major correspondent banks for the five-day week beginning Monday, March 26, 1973, was 553,100.\(^4\) From 1971 results described above, this daily average volume is expected to represent 0.00387

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\(^4\)Letter to Mr. Donald G. Barnes, Assistant Director, Board of Governors of the Federal Reserve System, from The Federal Reserve Bank of Richmond, dated April 11, 1973.
of total annual volume from this source. Therefore, 1973 volume for $V_1^T$ was estimated as 142,919,000 items.

Two major correspondent banks in the Baltimore RCPC area responded to the survey of disposition of checks by source. From these responses the average percentage of checks received from same zone respondents that are payable at the correspondent was calculated to be 5.65 per cent. The estimate for $V_{nc}^T$ for the year, 1973, therefore, was 8,075,000 and the estimate for $(V_1^T)_*$ is 134,844,000.

Utilizing computed average marginal cost for correspondent check processing ($MC_t^B$) of $0.0125$ the estimated value for $MC_t^B (V_1^T)_*$ for 1973 was $1,685,550. This value represents the estimated 1973 operating cost reductions in commercial banks due to the existence of the Baltimore RCPC.

For the Baltimore RCPC an estimate for the 1973 "new" volume was not as readily available as it was for the other three centers analyzed, because the Baltimore center has been operational since 1970 and the other three began operations during 1972 or 1973. An estimate for $V_n$ was derived as follows.

The annual growth rate in check volume processed by the Baltimore Branch was calculated for the period 1967 through 1969 and for the period 1970 through 1972. Total volumes before 1970 are not comparable with volumes after 1970 because of the opening of the RCPC on January 1, 1970.
From the five observations an average annual growth rate was computed to be 13.84 per cent. This growth rate was applied to the 1969 total check volume at the Baltimore Branch to derive an estimate for the 1972 equivalent of "old" check volume.

The 1972 equivalent was subtracted from 1972 actual volume at the Baltimore Branch, including RCFC volume, to derive an estimate for 1972 new volume, $V_n$. The ratio of 1972 $V_n$ to total 1972 RCFC volume was computed.

The projected 1973 daily average volume for the Baltimore center from Table 1 of 1,469,000 includes a projected increase in daily average volume of 340,000 due to an expansion of the clearing area which was scheduled to take place at mid year. Thus, the appropriate value for applying the 1972 ratio of $V_n$ to total RCFC volume was 1,129,000 and the estimated 1973 value for daily average $V_n$ was 0.62 times 1,129,000. The annual estimate for 1973 $V_n$ was 200,400,000.

It was possible to project the analysis to beyond the 1973 expansion by adding the projected volume increase both to $V_1^o$ and $V_n$ for the second half of the year. These results are included below. A summary of computations for 1973 Baltimore $V_n$ is contained in Table 3.

During the fourth quarter of 1972 the direct variable unit cost of transit check processing at the Baltimore
**TABLE 3**

**COMPUTATIONS FOR 1973 Vₙ AT BALTIMORE CLEARING CENTER**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Check Volume (in Thousands)</th>
<th>Growth Rate From Previous Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966</td>
<td>89,927</td>
<td>NA</td>
</tr>
<tr>
<td>1967</td>
<td>100,595</td>
<td>11.9 %</td>
</tr>
<tr>
<td>1968</td>
<td>107,443</td>
<td>6.8</td>
</tr>
<tr>
<td>1969</td>
<td>126,422</td>
<td>17.7</td>
</tr>
<tr>
<td>1970</td>
<td>259,489</td>
<td>8.6</td>
</tr>
<tr>
<td>1971</td>
<td>317,658</td>
<td>22.4 %</td>
</tr>
<tr>
<td>1972</td>
<td>344,833</td>
<td>8.6</td>
</tr>
</tbody>
</table>

**Average Growth Rate**

**1972 Actual Volume**
- RCPC 259,136
- Other 85,697
- Total 344,833
- Less: 1972 Equivalent of 1969 Volume 184,358
- 1972 New Volume (Vₙ) 160,475

**Ratio of 1972 Vₙ to Total 1972 RCPC Volume** 0.62

**Estimated 1973 Daily Average Vₙ** 699,980 times 252 Business days 252

**Estimated 1973 Vₙ, Without Expansion**
- plus 340,000 Items for 126 days
- Estimated total 1973 Vₙ 243,240,000
Regional Center was 0.00828. The 1973 budgeted unit cost for the Baltimore center, based on a daily average volume of 1,129,000 for the first half year and 1,460,000 for the second is 0.00995. Table 4 contains the computational results for the Baltimore center. The values in parentheses in Table 4 and subsequent tables in this chapter represent negative values.

<table>
<thead>
<tr>
<th>Case</th>
<th>B C</th>
<th>(V)</th>
<th>C F</th>
<th>V n</th>
<th>S d</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.0125</td>
<td>134,844,000</td>
<td>0.00828</td>
<td>200,400,000</td>
<td>26,238</td>
</tr>
<tr>
<td>2</td>
<td>0.0125</td>
<td>134,844,000</td>
<td>0.00995</td>
<td>200,400,000</td>
<td>(308,430)</td>
</tr>
<tr>
<td>3</td>
<td>0.0125</td>
<td>177,684,000</td>
<td>0.00828</td>
<td>243,240,000</td>
<td>207,023</td>
</tr>
<tr>
<td>4</td>
<td>0.0125</td>
<td>177,684,000</td>
<td>0.00995</td>
<td>243,240,000</td>
<td>(199,188)</td>
</tr>
</tbody>
</table>

Breakeven value for MC F at Low Volume $0.00841$
Breakeven value for MC F at High Volume $0.00913$

---


Lewiston RCPC

The Lewiston, Maine, clearing center analysis also contained unique properties. Although there are regional correspondents in the state of Maine, most checks being processed by the Lewiston center were previously collected through Boston correspondents.

The major difference for the purpose of this analysis is that the average ratio value of \( V_{ho}^r \) was 6.75 per cent for Boston banks and 5 per cent for Maine banks. The analysis considered both extremes.

The daily average volume deposited with the Lewiston RCPC by participating respondent banks during the survey week was 117,200. Based on the 1971 Boston Federal Reserve volume distribution, this volume represented 0.00375 of total annual volume from this source. Therefore, 1973 volume for \( V_1^r \) was estimated as 31,253,000. The two estimates for \( (V_1^r) \) were 29,690,000 based on the assumption that \( V_{ho}^r = 5 \) per cent, and 29,143,000 if \( V_{ho}^r = 6.75 \) per cent.

Although the Lewiston Center is a new facility, not all of the volume processed at the center is considered as "new" to the Federal Reserve. An estimated 100,000 items, on a daily average basis, were previously being processed by

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the Federal Reserve Bank of Boston. Of the 100,000 processed in Boston, 37,000 originated in Maine and were transferred to the center. The remaining 63,000 continue to be processed in Boston and are sent to Lewiston for presentation, (see Table 1) so that the estimated value for $V_n$ at Lewiston is 25,200,000.

The Federal Reserve Bank of Boston, in proposing to establish the Lewiston RCPC projected unit operating costs of 0.01128. During the fourth quarter of 1972, the initial quarter of operation for the center, direct variable operating costs were 0.01249 per item. 9

Table 5 summarizes the results of the analysis of the Lewiston RCPC.

**TABLE 5**

**ESTIMATED AGGREGATE SAVINGS**
FOR CHECK PROCESSING
LEWISTON CENTER
AREA, 1973

<table>
<thead>
<tr>
<th>Case</th>
<th>$MC^B_{st}$</th>
<th>$(V^F)^*$</th>
<th>$MC^F_{st}$</th>
<th>$V_n$</th>
<th>$S_d$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.0125</td>
<td>29,690,000</td>
<td>0.01128</td>
<td>25,200,000</td>
<td>86,869</td>
</tr>
<tr>
<td>2</td>
<td>0.0125</td>
<td>29,690,000</td>
<td>0.01249</td>
<td>25,200,000</td>
<td>56,377</td>
</tr>
<tr>
<td>3</td>
<td>0.0125</td>
<td>29,143,000</td>
<td>0.01128</td>
<td>25,200,000</td>
<td>80,031</td>
</tr>
<tr>
<td>4</td>
<td>0.0125</td>
<td>29,143,000</td>
<td>0.01249</td>
<td>25,200,000</td>
<td>49,539</td>
</tr>
</tbody>
</table>


In the case of an off-premise center, such as Lewiston, if there is a shift in volume from another Federal Reserve office, and if unit costs are different for the two facilities, the net impact on Federal Reserve costs is not totally reflected in the value $MC_t^F \cdot V_n$. It is necessary to adjust the values of $S_d$ computed in Table 5 by the difference in unit cost for the daily average of 37,000 items shifted from Boston.

During the fourth quarter of 1972 the unit direct variable cost of check processing at the Federal Reserve Bank of Boston was 0.00925.\(^\text{10}\) Thus, the adjustment factors for $S_d$ in cases 1 and 3 are $(0.01128 - 0.00925)$ times 9,324,000 or $\$18,927$ and the adjustment factors for cases 2 and 4 are $(0.01249 - 0.00925)$ times 9,324,000 or $\$30,209$. The adjustment results are presented in Table 6.

<table>
<thead>
<tr>
<th>Case</th>
<th>adjusted $S_d$</th>
<th>Adjustment</th>
<th>Adjusted $S_d$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>86,869</td>
<td>18,927</td>
<td>67,942</td>
</tr>
<tr>
<td>2</td>
<td>56,377</td>
<td>30,209</td>
<td>26,168</td>
</tr>
<tr>
<td>3</td>
<td>80,031</td>
<td>18,927</td>
<td>61,104</td>
</tr>
<tr>
<td>4</td>
<td>49,539</td>
<td>30,209</td>
<td>19,330</td>
</tr>
</tbody>
</table>

\(^\text{10}\)Ibid.
The area served by the Windsor Looks Regional Center is characterized by being geographically relatively small, having statewide branching in most of the area and containing a few dominant correspondents. Prior to the establishment of the Federal Reserve center in January, 1973, two Hartford correspondent banks offered regional clearing services for local and remote respondents. As an indication of the relative market position of these banks, the average rate of $V_{ho}^T$ experienced was 33.2 per cent.

The daily average volume deposited with the Windsor Looks RCPC by participating respondent banks during the survey week was 412,000. Based on the 1971 Boston distribution, this volume is expected to account for 0.00375 of total 1973 $V_T^T$. The estimate of 1973 $V_T^T$ at Windsor Looks, therefore, was 109,869,000. Based upon the above 33.2 per cent rate for $V_{ho}^T$, the estimated value for $(V_{ho}^T)^*$ is 74,492,000.

The Federal Reserve Bank of Boston proposal to establish a Regional Check Processing Center at Windsor Looks, Connecticut, anticipated direct variable unit costs of 0.01153. Because the center began operation in

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January, 1973, no record of performance has been established. Considering the volume of operations at the Windsor Locks facility, however, it is not unreasonable to expect that Windsor Locks could achieve operating cost levels equivalent to those of the parent facility at Boston of 0.00925. This possibility was considered in the analysis.

Table 1 indicates that a daily average "new" volume of 621,000 items was expected at the Windsor Locks facility. Thus, the estimated value for $V_n$ was 156,492,000. As was the case with Lewiston, it was necessary to adjust the computed value of $S_d$ due to a shifting of 400,000 items per day from Boston to Windsor Locks. A summary of the computations is contained in Table 7.

**TABLE 7**

ESTIMATED AGGREGATE SAVINGS FOR CHECK PROCESSING, WINDSOR LOCKS CENTER AREA, 1973

<table>
<thead>
<tr>
<th>Case</th>
<th>$MC^B_f$</th>
<th>$(V^F_f)^*$</th>
<th>$MC^F_f$</th>
<th>$V_n$</th>
<th>$S_d$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.0125</td>
<td>74,492,000</td>
<td>0.01153</td>
<td>156,492,000</td>
<td>(873,202)</td>
</tr>
<tr>
<td>2</td>
<td>0.0125</td>
<td>74,492,000</td>
<td>0.00925</td>
<td>156,492,000</td>
<td>(517,436)</td>
</tr>
</tbody>
</table>

Adjustment for Case 1 = $100,800,000 \times 0.00228 = ($229,824)

Adjusted $S_d$ (Case 1) = ($1,103,026)
Cleveland RCPC

As indicated in Table 1, the Federal Reserve Bank of Cleveland anticipated a substantial growth in volume with the opening of its on-premise center in January, 1973, due to the dissolution of bank clearing arrangements that existed prior to that time. A substantial portion of the volume growth, however, came from the large correspondent banks rather than from the respondents.

The Federal Reserve Bank of Cleveland reported daily average volumes from participating respondent banks of 208,440 for the survey week. Based on 1971 volume distributions, the estimated value of $V_1^T$ for 1973 was 50,715,000. Four Cleveland correspondent banks reported values for the rate of $V_{ho}^T$ and the average value was 5.75 per cent, yielding an estimated value for 1973 ($V_1^T$)* at Cleveland of 47,800,000.

The Federal Reserve Bank of Cleveland proposal for the implementation of the Cleveland clearing center anticipated unit variable costs of 0.00611. This compares with actual unit direct variable cost for the Federal Reserve


Bank of Cleveland during the fourth quarter of 1972, of 0.00710. The summary of Cleveland RCPC computations is contained in Table 8.

### TABLE 8

**ESTIMATED AGGREGATE SAVINGS FOR CHECK PROCESSING CLEVELAND CENTER AREA, 1973**

<table>
<thead>
<tr>
<th>Case</th>
<th>$\frac{MB}{t}$</th>
<th>$(V_l^F)_t$</th>
<th>$\frac{MF}{t}$</th>
<th>$V_N$</th>
<th>$S_d$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.0125</td>
<td>47,800,000</td>
<td>0.00611</td>
<td>179,440,000</td>
<td>(498,878)</td>
</tr>
<tr>
<td>2</td>
<td>0.0125</td>
<td>47,800,000</td>
<td>0.00710</td>
<td>179,440,000</td>
<td>(676,524)</td>
</tr>
</tbody>
</table>

**Interpretation**

In this chapter an estimate was derived for the average of the marginal cost of transit check processing among large correspondent banks. The result was applied to volume and cost data from analysis of four Federal Reserve Regional Check Processing Centers to estimate the net effect that those RCPC's have on the total direct cost of processing checks.

The functional form of the relationship between direct variable costs and check processing volumes was estimated to be:

$$C_d = b_o \cdot V_t^{b_1} \cdot V_h^{b_2} \cdot V_d^{b_3}$$

with the solution values for the parameters as follows:

\[ b_0 = 0.316 \]
\[ b_1 = 0.1274526 \]
\[ b_2 = 0.4404892 \]
\[ b_3 = 0.4229242 \]

Utilizing the partial derivative of the cost function with respect to transit volume, a marginal cost value was computed for all banks in the data base. The average value of the computed marginal cost for 32 data base banks identified as regional correspondents was $0.0125 or 1.25 cents per transit item. This value was used as the marginal cost of transit check processing in commercial banks.

Although the cost calculations were made only as input to the RCPC evaluation schema, certain of the results are of more general interest. These results have to do with the existence and observation of economies of scale in bank demand deposit processing.

Based on the analysis of this chapter it was concluded that the sum, \( b_1 + b_2 + b_3 \), is not significantly different from unity. This finding indicates that economies of scale do not exist for check processing if the proportionate mix of transit items, home debits and deposits processed remains constant.

If, on the other hand, the ratio of transit volume to total work load \( \frac{V_t}{V_t + V_h + V_d} \) increased with bank size, the average cost per unit processed would decline because transit items cost less to process than do home debits and
deposits. If correspondent banks have a higher proportion of transit items to total work load than do banks of similar size that do not specialize in correspondent services, then measured cost per unit processed would be lower for correspondents even if unit costs per functional item were the same.

Cox observed the cost per item processed to decline with increased work load and concluded that economies of scale exist in check processing. What appears more likely is that for a given bank, as workload increases the proportion of transit checks in the total work load increases. Thus, it is not necessarily the case that larger volumes of transit checks cost less per item than smaller volumes of transit items.

Tables 4 through 8 contain the computational results of the cost analysis for the four BCPCs studied. Table 4, containing the Baltimore Center results, indicates that the center could expect to meet its cost reduction objectives if it were able to match its 1972 unit processing cost during 1973. If, on the other hand, costs increase as anticipated, the expectation would be that the total cost of check collection will be higher because of the RCPC than they would have been if it did not exist.

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16 Cox, *The Outlook for the Nation's Check Payments System.*
Tables 5 and 6 contain the cost calculations for the Lewiston, Maine RCPC. The Maine center is comparatively small in terms of check volumes processed, but the calculations indicate that it should be expected to reduce the total cost of check collection in the area served.

Unlike the areas served by the other centers in the sample group, the state of Maine does not contain a major financial center or a group of large banks, by national standards. As is discussed below, this area characteristic appears to be critical in determining the success of a regional center in meeting its objective of reducing check collection costs.

The computational results for the Windsor Locks, Connecticut, and Cleveland, Ohio, regional centers are contained in Tables 7 and 8, respectively. Within the limits of the measurement technique and data utilized in this study, it should be expected that the implementation of RCPCs in these two areas will result in an increase in the total direct variable cost of local check collection. This result is contrary to the Federal Reserve's stated objective of reducing total cost.

Further analysis was performed on the values in Tables 7 and 8 to test the sensitivity of the direction of the results to the cost values used in estimating total savings. For Windsor Locks Case 1, the breakeven value for $MC^P_t$, given $MC^F_t = 0.01153$, is 0.0242, or almost twice the
estimated value, and the breakeven value for $MC^F_t$, given $MC^B_t = 0.0125$ is 0.059, or less than half the budget estimate. Comparable breakeven values for Cleveland Case 2 are $MC^B_t = 0.0229$ and $MC^F_t = 0.0032$.

The conclusion from this further analysis is that the findings with respect to Windsor Locks and Cleveland are valid within the range of error for the cost estimates used. An explanation of the substantially differing results between these two centers on one hand and Baltimore and Lewiston on the other must, therefore, lie in the volume relationships.

In comparing the values contained in Tables 4 through 8, the relationship between $V_n$ and $(V^F_1)^*$ stands out as being critical for success. The ratios $(V^F_1)^*/V_n$ from the above tables are presented in Table 9.

### TABLE 9
RATIO OF NET LOCAL VOLUME FROM RESPONDENTS TO NEW RCPC VOLUME RCPC CASES

<table>
<thead>
<tr>
<th>Case</th>
<th>$(V^F_1)^*/V_n$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baltimore: 1, 2</td>
<td>0.67</td>
</tr>
<tr>
<td>Baltimore: 3, 4</td>
<td>0.73</td>
</tr>
<tr>
<td>Lewiston: 1, 2</td>
<td>1.18</td>
</tr>
<tr>
<td>Lewiston: 3, 4</td>
<td>1.16</td>
</tr>
<tr>
<td>Windsor Locks: 1, 2</td>
<td>0.48</td>
</tr>
<tr>
<td>Cleveland: 1, 2</td>
<td>0.27</td>
</tr>
</tbody>
</table>
The ratio \( \frac{V_{1}^{2}}{V_{n}} \) indicates the maximum of new volume that could be contributed by respondent banks. Because the concept of the Regional Center approach is the reduction of check handlings, it would be expected that the higher the value of the ratio, that is, the higher the likelihood that new volume to the Federal Reserve is bypassing a correspondent bank handling, the more likely the center is to meet its total cost reduction objective.

If Baltimore were considered marginally successful, Lewiston considered successful and Windsor Locks and Cleveland considered unsuccessful in meeting cost reduction objectives, Table 9 would indicate that value of the ratio \( \frac{V_{1}^{2}}{V_{n}} \) in the order of seventy per cent is a break even point for success or failure. That is, among the four centers analyzed, for areas in which large collecting banks contribute in excess of thirty per cent of new volume to the RCPC, the resultant cost increases from redundant handlings dominate cost savings.

This result was seemingly anticipated by the Board of Governors which stated in its press release of February 2, 1972, "The new system will make maximum use, consistent with improved service to the public, of check processing centers operated by commercial banks." It should be surprising,

therefore, to find RCPCs located in cities such as Cleveland, which contain large banks with large processing centers of their own.

The Baltimore results are of considerable interest for two reasons. First, it might be expected that an area containing large nonmember banks, such as is the case in the Baltimore area, would show more positive results than areas in which members predominate. This is the case because, in the absence of an RCPC, nonmember banks are not permitted to deposit directly with the Federal Reserve, but must pass their checks through a member bank in order to avail themselves of Federal Reserve collection services.

Second, the Baltimore center may be considered a mature operation relative to the other three analyzed. A likely result of maturization is that check flows shift over time and not overnight, so that smaller respondent banks in the Baltimore RCPC area generally deposit directly with the center. In the other centers, it is likely that many smaller banks continue to deposit with their correspondents out of custom or habit; but will, with time, shift their check flow.

From the analysis of this chapter it must be concluded that, as of March, 1973, the Windsor Locks and Cleveland RCPCs were not meeting Federal Reserve cost reduction objectives. This result does not appear to be related to a failure to perform operationally, but rather it is related to this distribution of check flows.
It cannot be determined from available data or from the analysis whether the computed cost increases result from continued correspondent deposits by local respondents that result in redundant handlings, or whether the large new volume to the center coming from correspondents originates locally with the correspondent banks. If the former is the case, it could be expected that over time check flows will be rerouted with a commensurate reduction in redundant processing and costs. If, however, the latter is the case, the two centers cannot expect to meet cost reduction objectives.

While it is dangerous to generalize from a small group to the entire population, especially from a non-random sample, it appears that the results of the analysis of the four centers described in this chapter do have applicability to the Federal Reserve RGFC Program as a whole. Based on these results, with the Baltimore center being pivotal, it appears that the Federal Reserve System cannot expect to achieve its cost reduction objective in those areas in which large correspondent banks are the local bank of first deposit for checks constituting over thirty per cent of new Federal Reserve volume.

The data and analysis of this study do not permit testing of the sensitivity of the thirty per cent figure, and that value would be expected to vary locally depending
on operating costs at banks and the Federal Reserve. It should not, however, be expected to fluctuate widely because of widespread sharing of check processing methodology.
CHAPTER IV

IMPLICATIONS OF REGIONAL CHECK PROCESSING
CENTERS FOR CORRESPONDENT
BANKING RELATIONSHIPS

The purpose of this chapter is to identify the expected adjustment in correspondent banking relationships resulting from the establishment of Federal Reserve Regional Check Processing Centers, and to estimate the impact of such adjustments on the profitability of correspondent and respondent banks. The approach taken is to apply national cost and pricing data to regional volumes in order to estimate the magnitude of the scale of the effect. The results, therefore, are not intended to be precise estimates for the areas analyzed, but rather they are intended to be representative, generally, of all RCPC situations.

The analysis in this chapter may reasonably be construed as an extension of Robert Knight’s analysis of correspondent relationships. The analysis focuses on the

four regional clearing areas analyzed in Chapter III, Lewiston, Maine; Windsor Locks, Connecticut; Cleveland, Ohio; and Baltimore, Maryland.

Check Flow Adjustments

As discussed in Chapters I and III, Federal Reserve regional centers are expected to affect the flow of checks between the bank of first deposit and the paying bank, when both banks are located within the same clearing area, especially when the bank of first deposit is a smaller, respondent bank. The assumed routing of checks deposited in respondent banks, in the absence of an RCPC is through a correspondent located in the respondent's trade area. With the establishment of a regional center, however, the pattern is assumed to change, with all area banks depositing local items directly with the Federal Reserve.

Correspondent banks charge for check collection services by requiring a deposit balance sufficiently large to enable investment return to cover the price of services. Because Federal Reserve banks do not charge for check collection services, respondent banks that reroute their transit items may either reduce their compensating balances or purchase additional services with existing balances.

State chartered nonmember banks may be restricted from reducing correspondent balances by the existence of state reserve requirements. Competition for balances among
correspondents, however, should insure that these banks receive services of equivalent value to check collecting services no longer required.

**Balance Requirement**

From the discussion in Chapter I, the compensating balance requirement for displaced check collection services was identified as:

\[
B = \frac{P}{K_1 (1 - r_1)} V_1^T
\]

where:

- \( B \) = collected balance requirement
- \( P \) = unit price of collection services
- \( K_1 \) = earnings rate applied to \( B \) by correspondent
- \( r_1 \) = reserve requirement applied to account analysis by correspondent
- \( V_1^T \) = volume of locally payable transit items deposited in respondent banks

The unit balance requirement, \( \frac{P}{K_1 (1 - r_1)} \), corresponds identically to Knight's construction. Knight points out the flexibility of correspondent banks in adjusting \( P, K_1 \), and \( r_1 \), indicating that a particular bank may offset a relatively high earnings allowance, \( K_1 \), with a high unit price, \( P \), or a high value for \( r_1 \). Thus, Knight has properly

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2Knight, "Correspondent Banking: Account Analysis," Footnote 8, p. 11.
viewed the variable $k_1 (\frac{P}{1 - r_1})$ as a single element for
each bank and has not separated the components for analysis
of compensating balance requirements.

**Profitability Impact**

Chapter I also discussed the profitability effects on
the two bank groups of the establishment of RCPCs.
Correspondent banks lose either the investment income from
correspondent balances held as compensation for local check
clearing services, or the equivalent in the production of
other services. Correspondents are benefitted, however, by
a reduction in operating costs from a reduction in check
volume. Respondents, on the other hand, should experience a
net gain from acquiring, without charge, a service that they
have traditionally paid for.

These indirect effects were evaluated by estimating
values for the right hand side of the following two
equations.

\[ S^c_1 = MC^B_1 \cdot (V^P_1)^* - k_2 \cdot B(1 - r_2) \quad (I-9) \]
\[ S^r_1 = k_3 \cdot B(1 - r_3) \quad (I-10) \]

where:

- $S^c_1$ = indirect savings to correspondent banks
- $S^r_1$ = indirect savings to respondent banks
- $k_2$ = average before tax return on earning assets
  by correspondent banks
- $k_3$ = average before tax return on earning assets
  by respondent banks
Estimates for the unit balance requirement, 
\[ k_1 \left( 1 - r_1 \right) \], were based on a survey conducted by the Federal Reserve Bank of Kansas City in July, 1972. The eighty-five responding banks represent the major financial centers of the United States, exclusive of those in the Tenth and Sixth Federal Reserve Districts, and all survey respondents were among the 125 largest banks by order of deposits due to domestic banks as of the December 31, 1971, call report.\(^3\)

The published results of the survey provided the range, average and median annual balance requirements for items deposited. The analysis in this chapter considered the high, low, and average values for each area in order to identify the maximum, minimum, and most likely impact.

Survey results indicated that correspondent banks assess a lower balance requirement for items deposited that are amount encoded by the respondent than for items

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\(^3\)The responding banks agreed to supply analysis information on the understanding that the responses would be treated as strictly confidential. The description of the responding group was supplied by Robert Knight of the Federal Reserve Bank of Kansas City.
that are not encoded. The values utilized in this analysis were based on pre-encoded items because Federal Reserve regional centers require amount encoding, and those respondents that previously purchased encoding services would lose part of the overall benefit through the requirement that they now encode.

The annual balance requirements per transaction, for encoded items deposited, reported by Knight are as follows:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>$0.42</td>
</tr>
<tr>
<td>Low</td>
<td>0.13</td>
</tr>
<tr>
<td>High</td>
<td>1.14</td>
</tr>
<tr>
<td>Median</td>
<td>0.32</td>
</tr>
</tbody>
</table>

Reserve Requirements

The correspondent banks that were expected to lose check collection business because of the establishment of Federal Reserve regional centers were assumed to be large member banks. With the exception of the Lewiston, Maine

Federal Reserve banks require amount encoding of depositing banks with a daily average volume in excess of 300 checks. Even for such banks, however, early deposit deadlines for unencoded checks generally induce them to deposit encoded checks.

Knight, "Innovations and Trends in Bank Account Analysis."

Subsequent to the analysis described in this chapter but prior to completion of this dissertation, the Board of Governors of the Federal Reserve System raised reserve requirements for all banks with more than $2 million of net demand deposits. Although that change would affect the specific results obtained in the analysis, it is not believed that the conclusions would be affected.
center, therefore, the marginal reserve requirement rate, \( r_2 \), was assumed to be 17.5 per cent. The Maine correspondents are somewhat smaller so the value of \( r_2 \) applied to Maine data was 12 per cent, the marginal rate for banks with net demand deposits between $10 and $100 million.

Estimation of the marginal reserve requirement rate for respondent banks is somewhat more complex. It is necessary to distinguish between member banks and nonmembers, as well as to take into account the rate differentials between size categories and among states.

The value computed for \( B \) represents the average balance requirement for all respondent banks for local check collection services in each respective area. On the assumption that \( V_1^p \) is distributed among respondents according to demand deposit size, \( B \) was allocated to member and nonmember banks according to demand deposit size.\(^7\)

Table 10 contains the distribution of demand deposits as of year end, 1971, between member and nonmember respondent banks in the areas served by the four RCPCs under analysis.

A weighted average value of \( r_3 \) was computed for the member bank group by weighting each of the Federal Reserve System reserve requirement rates by the proportional distribution in each area of banks with total demand deposits in

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\(^7\)This assumption, while intuitively appealing, is supported by unpublished research in Russell D. Morris, "Techniques for Estimating Transit Volume," working paper, Board of Governors of the Federal Reserve System, November 16, 1972.
the respective categories. Because reserve requirements are assessed against net demand deposits, this technique may tend to overstate the true value of \( r_3 \), but the difference was not considered to be material. The results are presented in Table 11.

The value used for \( r_3 \) for nonmember respondent banks was the state reserve requirement for banks in each of the states containing participating banks. The values and weighted averages are contained in Table 12.

**Earnings Rates**

The earnings rates utilized in determining a value for \( S^0 \) in the four areas under consideration were weighted averages of earnings rates for all banks in the respective membership and size groupings. National data were selected in order to maintain the generality of the results— the results were intended to be exemplary rather than definitive—and to maintain the confidentiality of earnings data for those areas with a small number of banks in the correspondent class.

The ratio of interest, dividends and service charges on securities and loans to total loans and securities was computed for all insured commercial banks, based on 1971 earnings and year end, 1971, statements of condition. The banks were grouped according to size, Federal Reserve membership status, and clearing status, i.e., membership in a clearinghouse association or regional clearing area, and
the arithmetic mean was calculated for each group. This process is described in detail in Chapter V, and the results are contained in Tables 36 and 37.

The value for $K_2$ was taken directly from the computed average return ratio for large clearinghouse banks, except in Lewiston, for which the average return for the smaller clearing bank group was applied. As was the case with reserve requirement computations, the estimation of the value of $K_3$ is somewhat more complex. Participating banks in each of the four RCPCs under analysis were grouped according to demand deposit size and Federal Reserve membership, corresponding to the groups for which the earnings ratio had been calculated. A weighted average $K_3$ was computed, based on the distribution of demand deposits among the groupings in each RCPC area.

The earnings rates applied were those of nonclearing banks. While it is the case that not all respondents are nonclearing banks and that during 1971, all Baltimore RCPC banks were clearing banks, the use of nonclearing bank earnings is more consistent with the purpose of this study. Because the objective of this section is to draw conclusions as to the likely impact on the general class of country banks, it was decided that the earnings rates for nonclearing banks would be more appropriate to this end. In the particular case of Baltimore, the results may be viewed as an estimate of what happened in 1970 or what would
be expected to happen if the center were opened in 1972 or 1973. The results of the calculations of $K_3$ are presented in Table 13 and Table 14.

**TABLE 10**

DISTRIBUTION OF DEMAND DEPOSITS BETWEEN MEMBER AND NONMEMBER PARTICIPATING BANKS
SELECTION AREAS AS OF 12-31-71
(dollar values in thousands)

<table>
<thead>
<tr>
<th>RCPC</th>
<th>Member $</th>
<th>Nonmember $</th>
<th>Total $</th>
<th>% Member</th>
<th>% Nonmember</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lewiston</td>
<td>233,321</td>
<td>127,631</td>
<td>360,952</td>
<td>64</td>
<td>36</td>
</tr>
<tr>
<td>Windsor Locks</td>
<td>673,751</td>
<td>455,927</td>
<td>1,129,678</td>
<td>66</td>
<td>34</td>
</tr>
<tr>
<td>Cleveland</td>
<td>2,134,706</td>
<td>422,731</td>
<td>1,567,437</td>
<td>83</td>
<td>17</td>
</tr>
<tr>
<td>Baltimore</td>
<td>1,100,825</td>
<td>1,544,625</td>
<td>2,645,450</td>
<td>41</td>
<td>59</td>
</tr>
</tbody>
</table>

Source: Call Report, Year End, 1971, FDIC.

**TABLE 11**

DISTRIBUTION OF DEMAND DEPOSITS OF MEMBER BANK RESPONDENTS, SELECTED AREAS, AS OF 12-31-71
(dollar values in thousands)

<table>
<thead>
<tr>
<th>RCPC</th>
<th>0-2 Million</th>
<th>2-10 Million</th>
<th>10-100 Million</th>
<th>100-400 Million</th>
<th>Total Million</th>
<th>Weighted Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lewiston</td>
<td>$5,120</td>
<td>$68,978</td>
<td>$169,232</td>
<td>-0-</td>
<td>$233,521</td>
<td>11.22</td>
</tr>
<tr>
<td>%</td>
<td>2.2</td>
<td>29.6</td>
<td>68.2</td>
<td>-0-</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Windsor Locks</td>
<td>$5,727</td>
<td>$117,211</td>
<td>$397,616</td>
<td>$352,997</td>
<td>$873,751</td>
<td>12.11</td>
</tr>
<tr>
<td>%</td>
<td>0.7</td>
<td>18.4</td>
<td>45.4</td>
<td>40.4</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Cleveland</td>
<td>$45,189</td>
<td>$455,367</td>
<td>$1,294,194</td>
<td>$340,958</td>
<td>$2,134,708</td>
<td>11.65</td>
</tr>
<tr>
<td>%</td>
<td>2.0</td>
<td>21.4</td>
<td>60.6</td>
<td>16.0</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Baltimore</td>
<td>$14,187</td>
<td>$145,041</td>
<td>$619,577</td>
<td>$524,020</td>
<td>$1,100,825</td>
<td>12.08</td>
</tr>
<tr>
<td>%</td>
<td>1.5</td>
<td>13.0</td>
<td>56.3</td>
<td>29.4</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Source: Call Report, Year End, 1971, FDIC.
<table>
<thead>
<tr>
<th>Location</th>
<th>Demand Deposits $</th>
<th>Reserve Requirements</th>
<th>Weighted Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lewiston, Maine</td>
<td>127,631</td>
<td>12.0%</td>
<td></td>
</tr>
<tr>
<td>Windsor Locks, Connect.</td>
<td>445,927</td>
<td>11.4</td>
<td></td>
</tr>
<tr>
<td>Massachusetts, Cleveland</td>
<td>396,603</td>
<td>12.0</td>
<td></td>
</tr>
<tr>
<td>Massachusetts, Cleveland</td>
<td>47,324</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>Cleveland, Ohio</td>
<td>422,731</td>
<td>12.0</td>
<td></td>
</tr>
<tr>
<td>Baltimore, District of C.</td>
<td>1,544,625</td>
<td>14.0</td>
<td></td>
</tr>
<tr>
<td>Maryland</td>
<td>1,109,385</td>
<td>15.0</td>
<td></td>
</tr>
<tr>
<td>Virginia</td>
<td>316,510</td>
<td>10.0</td>
<td></td>
</tr>
</tbody>
</table>

*aSources: Call Report, Year End, 1971, FDIC.*

*bSource: A Profile of State Chartered Banking, National Association of Supervisors of State Banks, (Washington, D.C., 1971).*
## TABLE 13

**Computed Earnings Rates for Member Respondent Banks**

**Selected Areas, by Demand Deposit Size**

(dollar values in thousands)

<table>
<thead>
<tr>
<th>RCPC</th>
<th>Demand Deposits</th>
<th>Percentage Distribution</th>
<th>National Average Earnings</th>
<th>Weighted Average Earnings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lewiston</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-2</td>
<td>5,120</td>
<td>2.2</td>
<td>7.9%</td>
<td></td>
</tr>
<tr>
<td>2-10</td>
<td>68,978</td>
<td>29.6</td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td>10-100</td>
<td>159,223</td>
<td>68.2</td>
<td>9.3</td>
<td></td>
</tr>
<tr>
<td>100-400</td>
<td>-0-</td>
<td>-0-</td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>235,321</td>
<td>100.0</td>
<td></td>
<td>8.9%</td>
</tr>
<tr>
<td>Windsor Lake</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-2</td>
<td>5,727</td>
<td>0.7</td>
<td>7.9</td>
<td></td>
</tr>
<tr>
<td>2-10</td>
<td>117,211</td>
<td>15.4</td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td>10-100</td>
<td>597,816</td>
<td>45.5</td>
<td>9.3</td>
<td></td>
</tr>
<tr>
<td>100-400</td>
<td>552,997</td>
<td>40.4</td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>875,761</td>
<td>100.0</td>
<td></td>
<td>8.7</td>
</tr>
<tr>
<td>Cleveland</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-2</td>
<td>43,189</td>
<td>2.0</td>
<td>7.9</td>
<td></td>
</tr>
<tr>
<td>2-10</td>
<td>456,357</td>
<td>21.4</td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td>10-100</td>
<td>1,294,194</td>
<td>60.6</td>
<td>9.3</td>
<td></td>
</tr>
<tr>
<td>100-400</td>
<td>340,866</td>
<td>16.0</td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2,154,706</td>
<td>100.0</td>
<td></td>
<td>8.7</td>
</tr>
<tr>
<td>Baltimore</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-2</td>
<td>14,187</td>
<td>1.5</td>
<td>7.9</td>
<td></td>
</tr>
<tr>
<td>2-10</td>
<td>143,041</td>
<td>15.0</td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td>10-100</td>
<td>619,577</td>
<td>55.3</td>
<td>9.3</td>
<td></td>
</tr>
<tr>
<td>100-400</td>
<td>324,020</td>
<td>29.4</td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1,100,826</td>
<td>100.0</td>
<td></td>
<td>8.8</td>
</tr>
</tbody>
</table>

---

*aSource: Call Report, Year End, 1971, FDIC.*

*bSource: Ratio of interest, dividends and service charges on securities and loans, from 1971 Statement of Income, FDIC; to total loans and securities from Call Report, Year End, 1971, FDIC.*
<table>
<thead>
<tr>
<th>RGPC</th>
<th>Demand Deposita</th>
<th>Percentage Distribution</th>
<th>National Average Earningsb</th>
<th>Weighted Average Earnings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lewiston</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-2</td>
<td>3,613</td>
<td>2.8</td>
<td>8.8%</td>
<td>10.4%</td>
</tr>
<tr>
<td>2-10</td>
<td>27,309</td>
<td>21.4</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>10-100</td>
<td>96,809</td>
<td>75.8</td>
<td>10.9</td>
<td></td>
</tr>
<tr>
<td>100-400</td>
<td>-0-</td>
<td>-0-</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>127,631</td>
<td>100.0</td>
<td>10.4%</td>
<td></td>
</tr>
<tr>
<td>Windsor Locks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-2</td>
<td>3,472</td>
<td>0.8</td>
<td>8.8</td>
<td></td>
</tr>
<tr>
<td>2-10</td>
<td>24,750</td>
<td>21.4</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>10-100</td>
<td>100,657</td>
<td>22.6</td>
<td>10.9</td>
<td></td>
</tr>
<tr>
<td>100-400</td>
<td>247,068</td>
<td>55.4</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>445,927</td>
<td>100.0</td>
<td>9.4</td>
<td></td>
</tr>
<tr>
<td>Cleveland</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-2</td>
<td>45,232</td>
<td>10.7</td>
<td>8.8</td>
<td></td>
</tr>
<tr>
<td>2-10</td>
<td>175,626</td>
<td>42.3</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>10-100</td>
<td>198,673</td>
<td>47.0</td>
<td>10.9</td>
<td></td>
</tr>
<tr>
<td>100-400</td>
<td>-0-</td>
<td>-0-</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>432,731</td>
<td>100.0</td>
<td>9.9</td>
<td></td>
</tr>
<tr>
<td>Baltimore</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-2</td>
<td>25,221</td>
<td>1.6</td>
<td>8.8</td>
<td></td>
</tr>
<tr>
<td>2-10</td>
<td>214,061</td>
<td>13.9</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>10-100</td>
<td>259,469</td>
<td>16.8</td>
<td>10.9</td>
<td></td>
</tr>
<tr>
<td>100-400</td>
<td>1,045,894</td>
<td>67.6</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1,564,625</td>
<td>100.0</td>
<td>9.3</td>
<td></td>
</tr>
</tbody>
</table>

aSource: Call Report, Year End, 1971, FDIC.

bSource: Ratio of interest, dividends and service charges on securities and loans, from 1971 Statement of Income, FDIC; to total loans and securities from Call Report, Year End, 1971, FDIC.
Utilizing the 1973 annual volume for $V_i^F$ as computed in Chapter III and the unit balance requirements reported by Knight as above, the following values may be computed for reduced compensating balance requirements due to the existence of the Baltimore clearing center.

TABLE 15

AGGREGATE BALANCE REQUIREMENT FOR DISPLACED CHECK COLLECTION SERVICES, BALTIMORE AREA BANKS 1973 VOLUMES

<table>
<thead>
<tr>
<th>Case</th>
<th>Unit Balance</th>
<th>Annual Volume</th>
<th>Aggregate B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Low Value</td>
<td>0.15</td>
<td>142,919,000</td>
<td>18,589,470</td>
</tr>
<tr>
<td>2. High Value</td>
<td>1.14</td>
<td>142,919,000</td>
<td>162,227,660</td>
</tr>
<tr>
<td>3. Average Value</td>
<td>0.42</td>
<td>142,919,000</td>
<td>60,025,980</td>
</tr>
</tbody>
</table>

Tables 16 and 17 combine the results of Tables 10 through 15 with volume estimates derived in Chapter III for estimation of $S_i^0$ and $S_i^F$, respectively. Values in parentheses are negative. The three cases in each of the tables relate to the low value, high value, and average value estimates of the collected balance requirement, respectively. Cases 1 and 2 indicate the range of possible results, but were not considered representative.

The results, based on average values, indicate an expectation that Baltimore-Washington correspondents as a class would experience reductions in collected balances in
the order of 60 million dollars and reduced before-tax profits of approximately 1.6 million. Respondents as a class should have found the RCPC's check collection services worth 4.7 million dollars in terms of before-tax profits in 1973.

**TABLE 16**

**COMPUTATIONS FOR 32. BALTIMORE AREA BANKS 1978 VOLUMES**

<table>
<thead>
<tr>
<th>Case</th>
<th>$M_E^C $</th>
<th>$(V_2^F)$</th>
<th>$K_2$</th>
<th>$P$</th>
<th>$(1-r_2)$</th>
<th>$S^F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0.0125</td>
<td>134,844,000</td>
<td>.066</td>
<td>16,589,470</td>
<td>0.825</td>
<td>673,354</td>
</tr>
<tr>
<td>2.</td>
<td>0.0125</td>
<td>134,844,000</td>
<td>.066</td>
<td>162,927,660</td>
<td>0.825</td>
<td>(7,455,111)</td>
</tr>
<tr>
<td>3.</td>
<td>0.0125</td>
<td>134,844,000</td>
<td>.066</td>
<td>60,025,960</td>
<td>0.825</td>
<td>(1,582,864)</td>
</tr>
</tbody>
</table>

**TABLE 17**

**COMPUTATIONS FOR 32. BALTIMORE AREA BANKS 1978 VOLUMES**

<table>
<thead>
<tr>
<th>Case</th>
<th>Distribution</th>
<th>B $</th>
<th>$(1-r_2)$</th>
<th>$K_2$</th>
<th>$S^F$ $</th>
<th>$\sum s^F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Member</td>
<td>.61</td>
<td>18,589,470</td>
<td>.8792</td>
<td>.083</td>
<td>859,658</td>
<td>1,466,895</td>
</tr>
<tr>
<td>Nonmember</td>
<td>.59</td>
<td>18,589,470</td>
<td>.8600</td>
<td>.093</td>
<td>877,257</td>
<td>1,466,895</td>
</tr>
<tr>
<td>2-Member</td>
<td>.41</td>
<td>162,927,660</td>
<td>.8792</td>
<td>.083</td>
<td>5,188,065</td>
<td>12,856,621</td>
</tr>
<tr>
<td>Nonmember</td>
<td>.59</td>
<td>162,927,660</td>
<td>.8600</td>
<td>.093</td>
<td>7,688,556</td>
<td>12,856,621</td>
</tr>
<tr>
<td>3-Member</td>
<td>.41</td>
<td>60,025,980</td>
<td>.8792</td>
<td>.083</td>
<td>1,904,024</td>
<td>4,756,649</td>
</tr>
<tr>
<td>Nonmember</td>
<td>.59</td>
<td>60,025,980</td>
<td>.8600</td>
<td>.093</td>
<td>2,832,625</td>
<td>4,756,649</td>
</tr>
</tbody>
</table>
In spite of the fact that the Baltimore Center was established in 1970, these results cannot be substantiated empirically by analysis of balance sheets and income statements. The following is a partial list of impediments to such analysis, derived from conversations with local bankers.

For many of the nonmember banks, compliance with state reserve requirements resulted in holding balances sufficient to pay for check collection services so that a reduction in due-from-bank accounts was not observed. For others, including member banks, transaction balances and purchases of additional services have held due-from-banks accounts near previous levels.

Although the correspondents did experience balance reductions from local respondents, as a class they were able to replace the lost balances by selling local collection services to out-of-area banks. The deposit deadlines at the Baltimore center permitted participating banks to deposit until midnight, or later for preprocessed checks, but restricted out-of-area banks with an afternoon deadline. Baltimore and Washington correspondent banks were, thus, able to replace balances lost from local banks with deposits of banks in other cities who were eager to speed collection of RGPC area checks.

With respect to increased profitability among respondent banks, the advantage was at least partially offset by the requirement that participating banks pay for
items presented by the center on the day of presentment.
The Baltimore center was established prior to the November, 1972, amendment to Regulation J, discussed in Chapter V; and, thus, the respondent banks as a class experienced an offsetting reduction in investable funds and likely, a reduction in earnings.

Thus, while in every likelihood the relationships between respondent banks and their regional correspondent are significantly affected by the establishment of Federal Reserve centers, the effect is reflected in check flows and not necessarily in balance sheets and income statements. One area correspondent banker confided that his bank had lost eighteen million dollars in collected balances from local respondents, yet that loss was not reflected in year end balance sheet comparisons.

Tables 18 through 26 contain the computations for the Lewiston, Windsor Locks and Cleveland clearing areas respectively.
### TABLE 18

**AGGREGATE BALANCE REQUIREMENT FOR DISPLACED CHECK COLLECTION SERVICES, LEWISTON AREA BANKS 1973 VOLUMES**

<table>
<thead>
<tr>
<th>Case</th>
<th>Unit Balance Requirement</th>
<th>Annual Volume</th>
<th>Aggregate E $</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Low Value</td>
<td>0.13</td>
<td>31,255,000</td>
<td>4,062,890</td>
</tr>
<tr>
<td>2. High Value</td>
<td>1.14</td>
<td>31,255,000</td>
<td>35,628,420</td>
</tr>
<tr>
<td>3. Average Value</td>
<td>0.42</td>
<td>31,255,000</td>
<td>15,126,260</td>
</tr>
</tbody>
</table>

### TABLE 19

**COMPUTATIONS FOR $s^g$, LEWISTON AREA BANKS 1973 VOLUMES**

<table>
<thead>
<tr>
<th>Case</th>
<th>$\frac{M^g}{c}$</th>
<th>$(V^f)^c_1$</th>
<th>$K_2$</th>
<th>$B$</th>
<th>$(1-r_2)$</th>
<th>$s^g_1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0.0125</td>
<td>29,690,000</td>
<td>0.062</td>
<td>4,062,890</td>
<td>0.86</td>
<td>77,947</td>
</tr>
<tr>
<td>2.</td>
<td>0.0126</td>
<td>29,690,000</td>
<td>0.062</td>
<td>35,628,420</td>
<td>0.86</td>
<td>92,199,621</td>
</tr>
<tr>
<td>3.</td>
<td>0.0125</td>
<td>29,690,000</td>
<td>0.062</td>
<td>15,126,260</td>
<td>0.88</td>
<td>187,085</td>
</tr>
</tbody>
</table>

### TABLE 20

**COMPUTATIONS FOR $s^f$, LEWISTON AREA BANKS 1973 VOLUMES**

<table>
<thead>
<tr>
<th>Case</th>
<th>Distribution</th>
<th>$\frac{s^f}{r}$</th>
<th>$K_3$</th>
<th>$s^f_1$</th>
<th>$\sum s^f_1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Member</td>
<td>.64</td>
<td>4,062,890</td>
<td>.089</td>
<td>205,225</td>
<td></td>
</tr>
<tr>
<td>Nomember</td>
<td>.36</td>
<td>4,062,890</td>
<td>.089</td>
<td>135,960</td>
<td>339,085</td>
</tr>
<tr>
<td>2-Member</td>
<td>.64</td>
<td>35,628,420</td>
<td>.089</td>
<td>1,173,556</td>
<td>2,973,523</td>
</tr>
<tr>
<td>Nomember</td>
<td>.36</td>
<td>35,628,420</td>
<td>.089</td>
<td>665,035</td>
<td>1,095,508</td>
</tr>
<tr>
<td>3-Member</td>
<td>.64</td>
<td>15,126,260</td>
<td>.089</td>
<td>432,475</td>
<td>1,095,508</td>
</tr>
<tr>
<td>Nomember</td>
<td>.36</td>
<td>15,126,260</td>
<td>.089</td>
<td>432,475</td>
<td>1,095,508</td>
</tr>
</tbody>
</table>
### TABLE 21
AGGREGATE BALANCE REQUIREMENT FOR DISPLACED CHECK
COLLECTION SERVICE, WINDSOR LOCKS AREA BANKS
1973 VOLUMES

<table>
<thead>
<tr>
<th>Case</th>
<th>Unit Balance Requirement</th>
<th>Annual Volume</th>
<th>Aggregate B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Low Value</td>
<td>0.13</td>
<td>109,869,000</td>
<td>14,282,970</td>
</tr>
<tr>
<td>2. High Value</td>
<td>1.14</td>
<td>109,869,000</td>
<td>125,250,660</td>
</tr>
<tr>
<td>3. Average Value</td>
<td>0.42</td>
<td>109,869,000</td>
<td>46,144,980</td>
</tr>
</tbody>
</table>

### TABLE 22
COMPUTATIONS FOR ST, WINDSOR LOCKS AREA BANKS
1973 VOLUMES

<table>
<thead>
<tr>
<th>Case</th>
<th>MCt</th>
<th>(V1)²</th>
<th>K2</th>
<th>B</th>
<th>(1-r2)</th>
<th>S1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0.0125</td>
<td>74,492,000</td>
<td>0.066</td>
<td>14,282,970</td>
<td>0.88</td>
<td>101,595</td>
</tr>
<tr>
<td>2.</td>
<td>0.0125</td>
<td>74,492,000</td>
<td>0.066</td>
<td>125,250,660</td>
<td>0.88</td>
<td>(6,343,408)</td>
</tr>
<tr>
<td>3.</td>
<td>0.0125</td>
<td>74,492,000</td>
<td>0.066</td>
<td>46,144,980</td>
<td>0.88</td>
<td>(1,748,950)</td>
</tr>
</tbody>
</table>

### TABLE 23
COMPUTATIONS FOR ST, WINDSOR LOCKS AREA BANKS
1973 VOLUMES

<table>
<thead>
<tr>
<th>Case</th>
<th>Distribution</th>
<th>B</th>
<th>(1-r2)</th>
<th>K3</th>
<th>S1</th>
<th>ΣS1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Member</td>
<td>.65</td>
<td>14,282,970</td>
<td>.087</td>
<td></td>
<td>720,310</td>
<td></td>
</tr>
<tr>
<td>Membe r</td>
<td>.34</td>
<td>14,282,970</td>
<td>.087</td>
<td></td>
<td>5,343,408</td>
<td>1,125,254</td>
</tr>
<tr>
<td>2-Member</td>
<td>.66</td>
<td>125,250,660</td>
<td>.087</td>
<td></td>
<td>6,343,408</td>
<td></td>
</tr>
<tr>
<td>Membe r</td>
<td>.34</td>
<td>125,250,660</td>
<td>.087</td>
<td></td>
<td>9,867,622</td>
<td></td>
</tr>
<tr>
<td>3-Member</td>
<td>.66</td>
<td>46,144,980</td>
<td>.087</td>
<td></td>
<td>2,306,667</td>
<td>3,685,439</td>
</tr>
<tr>
<td>Membe r</td>
<td>.34</td>
<td>46,144,980</td>
<td>.087</td>
<td></td>
<td>1,306,667</td>
<td></td>
</tr>
</tbody>
</table>
### Table 24

**Aggregate Balance Requirement for Displaced Check Collection Services, Cleveland Area Banks 1973 Volumes**

<table>
<thead>
<tr>
<th>Case</th>
<th>Unit Balance Requirement</th>
<th>Annual Volume</th>
<th>Aggregate Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Low Value</td>
<td>0.15</td>
<td>60,715,000</td>
<td>6,592,950</td>
</tr>
<tr>
<td>2. High Value</td>
<td>1.14</td>
<td>60,715,000</td>
<td>57,815,100</td>
</tr>
<tr>
<td>3. Average Value</td>
<td>0.42</td>
<td>60,715,000</td>
<td>21,300,300</td>
</tr>
</tbody>
</table>

### Table 25

**Computations for $s^r$, Cleveland Area Banks 1973 Volumes**

<table>
<thead>
<tr>
<th>Case</th>
<th>$\mu$</th>
<th>$(V_i^r)$</th>
<th>$\lambda$</th>
<th>$\rho$</th>
<th>$s^g$</th>
<th>$s^g$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0.0125</td>
<td>47,800,000</td>
<td>0.066</td>
<td>6,592,950</td>
<td>0.68</td>
<td>214,581</td>
</tr>
<tr>
<td>2.</td>
<td>0.0125</td>
<td>47,800,000</td>
<td>0.066</td>
<td>57,815,100</td>
<td>0.68</td>
<td>(2,760,401)</td>
</tr>
<tr>
<td>3.</td>
<td>0.0125</td>
<td>47,800,000</td>
<td>0.066</td>
<td>21,300,300</td>
<td>0.68</td>
<td>(659,621)</td>
</tr>
</tbody>
</table>

### Table 26

**Computations for $s^r_1$, Cleveland Area Banks 1973 Volumes**

<table>
<thead>
<tr>
<th>Case</th>
<th>Distribution</th>
<th>$B$</th>
<th>$(1-r_3)$</th>
<th>$s^r_1$</th>
<th>$\sum s^r_1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Member</td>
<td>.83</td>
<td>6,592,950</td>
<td>.3355</td>
<td>.087</td>
<td>420,615</td>
</tr>
<tr>
<td>2-Member</td>
<td>.83</td>
<td>57,815,100</td>
<td>.8555</td>
<td>.087</td>
<td>3,688,480</td>
</tr>
<tr>
<td>3-Member</td>
<td>.83</td>
<td>21,300,300</td>
<td>.3355</td>
<td>.087</td>
<td>1,356,906</td>
</tr>
<tr>
<td></td>
<td>.17</td>
<td>6,592,950</td>
<td>.8555</td>
<td>.099</td>
<td>315,465</td>
</tr>
<tr>
<td></td>
<td>.17</td>
<td>57,815,100</td>
<td>.8555</td>
<td>.099</td>
<td>1,674,571</td>
</tr>
<tr>
<td></td>
<td>.17</td>
<td>21,300,300</td>
<td>.8555</td>
<td>.099</td>
<td>1,674,571</td>
</tr>
</tbody>
</table>
Interpretations

Analysis of the results contained in Tables 15 through 26 leads overwhelmingly to the conclusion that in the areas served by Federal Reserve Check Processing Centers correspondent banks may be expected to experience a significant loss of income and respondents may be expected to experience a significant increase. The Federal Reserve is absorbing a larger share of the cost of check collection and is passing the private sector cost reductions back to the bank of first deposit. In doing so the Federal Reserve is also effectively passing the correspondents’ profit margin on sales of check collection services back to the respondents.

It is expected that the aggregate level of interbank balances will be reduced substantially because of RCPCs. The reduction will be mitigated somewhat by the existence of reserve requirements imposed by the states.

Additionally, it would appear that correspondents that price their check collection services at or near the lowest point of the range found by Knight either provide such services at a loss, or have unique situations with regard to operating costs. Because the average cost values utilized in this analysis are direct variable costs and do not include any overhead allocation, it is reasonable to assume that lowest price banks are offering check collection
services as a loss leader, either knowingly or unknowingly. For such banks the establishment of an RCFC may tend to increase profitability.

Finally, the data from Tables 15 through 26, along with volume data from Chapter III, permit a consideration of a peculiarity of the market for correspondent services that is a result of both the regulatory system and the nature of compensation. This peculiarity lies in the fact that the value to the seller of what is received as payment is lower than the value to the buyer of what is paid, in an absolute sense as opposed to a utility sense.

Under the assumptions of this and the previous chapters the gross value of compensation to correspondent banks for local check collection services is equal to:

\[ V^F_1 \cdot MC^B_t + S^C_1, \]

and the cost to respondents of providing the correspondent with this compensation is equal to \( S^F_1 \). Table 27 lists these values, based on average values for \( S^0_1 \) and \( S^F_1 \).

Even if earnings rates were equal, due to the graduated schedule of reserve requirements, correspondents would receive less than respondents pay. Because smaller banks hold lower reserves against demand deposits, respondents as a class can earn more on each dollar deposited than can large correspondents as a class. This implies that under the existing structure of reserve requirements,
respondents would be better off to pay for correspondent services on a fee basis than on a compensating balance basis.

**TABLE 27**

**COMPARISON OF VALUE OF COMPENSATION AND COST FOR CHECK CLEARING SERVICES, ANNUAL BASIS 1973 ESTIMATED VALUES**

<table>
<thead>
<tr>
<th>Area</th>
<th>Compensation to Correspondent $</th>
<th>Cost to Respondent $</th>
<th>Difference $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baltimore</td>
<td>4,665,612</td>
<td>4,736,649</td>
<td>71,037</td>
</tr>
<tr>
<td>Lewiston</td>
<td>966,727</td>
<td>1,096,608</td>
<td>128,781</td>
</tr>
<tr>
<td>Windsor Locks</td>
<td>3,122,312</td>
<td>3,630,429</td>
<td>513,127</td>
</tr>
<tr>
<td>Cleveland</td>
<td>1,273,558</td>
<td>1,674,371</td>
<td>400,815</td>
</tr>
</tbody>
</table>

The reasons for paying for correspondent check collection services through compensating balances are not entirely clear. Part of the reason is the fact that the deposit of checks for collection automatically generates deposits, and detailed monitoring of collected balances may be a task of considerable difficulty for smaller banks.

From the seller's standpoint, banks are notoriously size conscious, and, other things equal, larger banks would prefer to be paid in deposits to become larger banks. In Knight's survey none of the reporting correspondent banks indicated that it offered check collection services on a fee basis.  

---

8Knight, "Innovations and Trends in Bank Account Analysis," Table 4.
Robert Knight suggested that the basis for payment via compensating balances is the balances generated through check collection services.\(^9\) If this were the case a shift of check collection services to the Federal Reserve would open the way for payment on a fee basis, and may tend to increase competition for the sale of other correspondent services by reducing the respondent's dependence on correspondent banks located in geographic proximity.

Overall, the results presented in this chapter do not appear to be unique to the areas analyzed. It should be expected, therefore, that the proliferation of Federal Reserve Regional Check Processing Centers will have a substantive impact on the relationship of respondent and correspondent banks that will be detrimental to the profitability of correspondents as a class and beneficial to respondents as a class.

\(^9\)Ibid.
CHAPTER V

EXPECTATIONS FROM REGULATION J

This chapter is concerned with anticipating the effects of the November 9, 1972, amendment to Federal Reserve Regulation J on the relative profitability of various classes of commercial banks. The analysis is concerned with comparing asset and profitability measures between classes of banks and does not, therefore, consider secondary effects that may occur due to shifts in the pattern of check collection because of the amendment.

As discussed in Chapter I, it should be expected, a priori, that banks that are permitted to defer payment for their customers' checks for one day should be more profitable than banks that are not permitted to do so, other things equal. It should also be expected that if such an advantage existed prior to the amendment, the advantage would disappear.

The advantage to deferred payment banks should come about due to the operation of two factors. First, by deferring payment for its customers' checks for one business day, a country bank, historically, would have had a permanent pool of investment funds larger by an average day's presentments than a city bank of equal size. That is,
it should be expected that investable funds per dollar of demand deposit would be higher for deferred payment banks.

Second, banks that are able to defer payment have one business day to react that is not available to immediate payment banks. Increased reaction time reduces the risk of illiquidity due to unusually large deposit withdrawals, and it should be expected, therefore, that deferred payment banks would hold a smaller proportion of highly liquid, near-cash assets in their portfolios relative to city banks. Because, on average, yield is inversely related to liquidity, deferred payment banks would be expected to gain a higher return per dollar invested than would immediate payment banks.

Commercial banks are not totally dependent on the Federal Reserve for check collection. Clearinghouses, correspondent deposits and check exchange agreements are utilized when they are justified on the basis of faster collection time. A lack of significant differences in earnings and asset measures between city and country banks would indicate that the extra-Federal Reserve collection system has negated the potential advantage of the deferred payment system.

To analyze these postulations the population of commercial banks in the United States was divided into twenty groups, and a series of hypotheses was tested. The
groupings were by size, by payment status prior to November 9, 1972, and by Federal Reserve membership. The distribution of banks among the twenty groups is contained in Table 28.

### Table 28

**Distribution of Number of Banks by Size, Federal Reserve Membership and Payment Status as of December 31, 1971**

<table>
<thead>
<tr>
<th>Demand Deposits (in millions)</th>
<th>Member Banks</th>
<th>Non-Member Banks</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Immediate</td>
<td>Deferred</td>
<td>Immediate</td>
</tr>
<tr>
<td>0 - 2</td>
<td>30</td>
<td>751</td>
<td>141</td>
</tr>
<tr>
<td>2 - 10</td>
<td>258</td>
<td>2,668</td>
<td>560</td>
</tr>
<tr>
<td>10 - 100</td>
<td>309</td>
<td>1,258</td>
<td>265</td>
</tr>
<tr>
<td>100 - 400</td>
<td>80</td>
<td>109</td>
<td>15</td>
</tr>
<tr>
<td>400 +</td>
<td>62</td>
<td>22</td>
<td>0</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>719</strong></td>
<td><strong>6,012</strong></td>
<td><strong>779</strong></td>
</tr>
</tbody>
</table>

Source: Call Report, Year End, 1971, FDIC.

The size groupings were selected to correspond with Federal Reserve groupings for assignment of reserve requirements to member banks. A slight difference in groupings occurred because this study based its size classifications on total demand deposits whereas the Federal Reserve classifications are based on net demand deposits, a measure which nets uncollected checks and balances due from other banks against total demand deposits. It was assumed that
the Federal Reserve selected the five size categories as approximately representing banks with different characters of business. It was further assumed that distinctions observed by the Federal Reserve are not precisely defined by the net demand deposit groupings and that the total demand deposit groupings utilized in this study contain banks of similar character.

Although the characteristic of interest in this study was the immediate or deferred payment status of the banks in each size group, it was decided that the size groups should also be segregated by Federal Reserve membership. This segregation was made because differences in reserve requirement burdens and other regulatory requirements render the two groups not wholly comparable with respect to earnings expectations.

A further classification, based on holding company affiliation, was rejected. Although it may be suggested that holding company affiliation improves the earnings of smaller affiliates, a recent study by Talley found no significant increase in profitability of a group of acquired banks relative to similar sized independent banks in the same market area.¹

Analysis

Analysis of the first effect described above was based on the ratio of earning assets attributable to demand deposits to demand deposits. Because of wide differences in reserve requirements applied to nonmember banks among the states this measure was applied only to member banks.

Earning assets attributable to demand deposits were defined as follows:

\[ E_d = E - \left[ CD (1 - r_{CD}) + T (1 - r_T) + F F_p + B \right] \]

where:

- \( E_d \) = earning assets attributable to demand deposits
- \( E \) = total earning assets
- \( CD \) = certificate of deposit liabilities
- \( r_{CD} \) = reserve requirement on certificate of deposit liabilities
- \( T \) = other time deposits
- \( r_T \) = reserve requirement on other time deposits
- \( F F_p \) = Federal Funds purchased
- \( B \) = other funds borrowed

This construction makes the simplifying assumption that banks do not hold nonearning assets as reserves against time deposit withdrawals in excess of legal requirements.

The following hypotheses related to the ratio, \( E_d/d \) were tested in the study, where \( E_d \) is as defined above, and \( d \) is total demand deposits.
For member banks in size class A the ratio $E_d/d$ for immediate payment banks is equal to the ratio $E_d/d$ for deferred payment banks.

For member banks in size class B the ratio $E_d/d$ for immediate payment banks is equal to the ratio $E_d/d$ for deferred payment banks.

For member banks in size class C the ratio $E_d/d$ for immediate payment banks is equal to the ratio $E_d/d$ for deferred payment banks.

For member banks in size class D the ratio $E_d/d$ for immediate payment banks is equal to the ratio $E_d/d$ for deferred payment banks.

For member banks in size class E the ratio $E_d/d$ for immediate payment banks is equal to the ratio $E_d/d$ for deferred payment banks.

Where size groups were defined as follows:

- Size group A = $0 < \text{total demand deposits} \leq 2,000,000$
- Size group B = $2,000,000 < \text{total demand deposits} \leq 10,000,000$
- Size group C = $10,000,000 < \text{total demand deposits} \leq 100,000,000$
- Size group D = $100,000,000 < \text{total demand deposits} \leq 400,000,000$
- Size group E = $400,000,000 < \text{total demand deposits}$
The alternative hypotheses $1JH_A$ through $5JH_A$ were that ratio $E_d/d$ is larger for deferred payment banks than for immediate payment banks in each of the respective groups.

In the absence of prior knowledge concerning the distribution of the ratio it was decided to employ a nonparametric test to evaluate the hypotheses. Three nonparametric tests are particularly applicable to testing for attribute difference between two groups, Chi Square, Kolmogorov-Smirnov one tailed test, and the Mann Whitney U test.

The Chi Square test is not satisfactory for the purpose of this study because, while it permits statements as to the similarity of distributions of two sets of statistics, it does not identify which parameters of the two distributions differ. Because the interest of this study is with the location and not with the variance or other parameters, the Chi Square test is not satisfactory.

The Kolmogorov-Smirnov (K-S) test and the Mann-Whitney (M-W) test both test for location and both rely on ranking of observations rather than on the absolute values. The K-S test relies on cumulative distributions of observations, and the M-W relies on individual observations. Because M-W is more powerful than K-S for a given sample
size greater than 20, it was decided to utilize the Mann-Whitney U test to test hypotheses $H_0$ through $5H_0$.²

The ratio $E_d/d$ was computed for each of the ten member bank sub-groups. Summary results are shown in Table 29.

The values of the ratio $E_d/d$ for each of the pairs of sub-groups by size were ranked in order of size and the U statistic was computed. The U statistic was normalized by computing the $Z$ statistic which is normally distributed with zero mean and unit variance. These results are also contained in Table 29. The "$\bar{X}$" column contains the arithmetic mean value for each bank class, and the "$S$" column contains the standard error.

**TABLE 29**

**COMPUTATIONS FOR RATIO $E_d/d$ FOR MEMBER BANKS BY SIZE AND PAYMENT STATUS AS OF DECEMBER 31, 1971**

<table>
<thead>
<tr>
<th>Demand Deposits (in billions)</th>
<th>Immediate Banks</th>
<th>Deferred Banks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\bar{X}$</td>
<td>$S$</td>
</tr>
<tr>
<td>0 - 2</td>
<td>1.187</td>
<td>0.419</td>
</tr>
<tr>
<td>2 - 10</td>
<td>1.125</td>
<td>0.392</td>
</tr>
<tr>
<td>10 - 100</td>
<td>1.087</td>
<td>0.195</td>
</tr>
<tr>
<td>100 - 400</td>
<td>0.628</td>
<td>0.234</td>
</tr>
<tr>
<td>400 +</td>
<td>0.805</td>
<td>0.110</td>
</tr>
</tbody>
</table>

Five ratios were employed to measure the second
effect, as follows:

1. Liquidity: Cash and due from banks + U.S.
   Government securities/Total assets.
2. Liquid Investments: U.S. Government securities/
   Total assets.
3. Average Return: Total current operating revenue-
   Trust income/Total earning assets.
4. Average Yield: Interest, dividends and service
   charges on securities and loans/Total loans and
   securities.
5. Profitability: Net income/Total assets.

A total of forty-five hypotheses were tested in
comparison of asset and profit ratios between city and
country banks. Numerically, the hypotheses were identified
as 6JH₀ through 50JH₀.

The form of the hypothesis statements was identical
throughout and may be characterized by the following
statement of hypothesis 6JH₀.

6JH₀: The liquidity ratio for immediate payment
member banks of size group A is equal to the
liquidity ratio for deferred payment member
banks of size group A.

Hypothesis 7JH₀ concerned nonmember banks in size group A,
and so on through the size groups with nine hypotheses for
each ratio. As is indicated in Table 28, there were no nonmember banks in size group E, so that nine hypotheses cover the entire population.

Statement of the hypotheses may, thus, be simplified as follows:

6$H_0$-14$H_0$: The liquidity ratio for immediate payment banks is equal to the liquidity ratio for deferred payment banks (by respective size groups and membership status).

15$H_0$-23$H_0$: The liquid investments ratio for immediate payment banks is equal to the liquid investments ratio for deferred payment banks.

24$H_0$-32$H_0$: The average return ratio for immediate payment banks is equal to the average return ratio for deferred payment banks.

33$H_0$-41$H_0$: The average yield ratio for immediate payment banks is equal to the average yield ratio for deferred payment banks.

42$H_0$-50$H_0$: The profitability ratio for immediate payment banks is equal to the profitability ratio for deferred payment banks.
The alternative hypotheses $6JH_A$ through $50JH_A$ are as follows:

$6JH_A-14JH_A$: The liquidity ratio for immediate payment banks is higher than the liquidity ratio for deferred payment banks (by respective membership and size groups).

$15JH_A-23JH_A$: The liquid investments ratio for immediate payment banks is higher than the liquid investments ratio for deferred payment banks.

$24JH_A-32JH_A$: The average return ratio for deferred payment banks is higher than the average return ratio for immediate payment banks.

$33JH_A-41JH_A$: The average yield ratio for deferred payment banks is higher than the average yield ratio for immediate payment banks.

$42JH_A-50JH_A$: The profitability ratio for deferred payment banks is higher than the profitability ratio for immediate payment banks.

The methodology employed to test hypotheses $6JH_0$ through $50JH_0$ was identical to that employed to test hypotheses $1JH_0$ through $5JH_0$. Relevant data are contained in Tables 30 through 39. A rejection level of $\alpha = .01$ was employed for all tests. Table 40 contains a summary of hypotheses tests.
### TABLE 30

**COMPUTATIONS FOR LIQUIDITY RATIO FOR MEMBER BANKS AS OF DECEMBER 31, 1971**

<table>
<thead>
<tr>
<th>Demand Deposits (in millions)</th>
<th>Immediate Banks</th>
<th>Deferred Banks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\bar{X}$</td>
<td>$s$</td>
</tr>
<tr>
<td>0 - 2</td>
<td>0.371</td>
<td>0.177</td>
</tr>
<tr>
<td>2 - 10</td>
<td>0.316</td>
<td>0.115</td>
</tr>
<tr>
<td>10 - 100</td>
<td>0.301</td>
<td>0.100</td>
</tr>
<tr>
<td>100 - 400</td>
<td>0.295</td>
<td>0.115</td>
</tr>
<tr>
<td>400 +</td>
<td>0.294</td>
<td>0.078</td>
</tr>
</tbody>
</table>

### TABLE 31

**COMPUTATIONS FOR LIQUIDITY RATIO FOR NONMEMBER BANKS AS OF DECEMBER 31, 1971**

<table>
<thead>
<tr>
<th>Demand Deposits (in millions)</th>
<th>Immediate Banks</th>
<th>Deferred Banks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\bar{X}$</td>
<td>$s$</td>
</tr>
<tr>
<td>0 - 2</td>
<td>0.349</td>
<td>0.140</td>
</tr>
<tr>
<td>2 - 10</td>
<td>0.302</td>
<td>0.113</td>
</tr>
<tr>
<td>10 - 100</td>
<td>0.286</td>
<td>0.087</td>
</tr>
<tr>
<td>100 - 400</td>
<td>0.239</td>
<td>0.077</td>
</tr>
<tr>
<td>400 +</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

---

$^a$The $Z$ statistic approximates the normal distribution if the number of observations in the larger group, $N_2$, exceeds 20. In this case $N_2$ equals 20. The value in the $Z$ column for the comparison is the critical value of $U$ for a one-tailed test at the 0.01 level.
### Table 32

**Computation for Liquid Investments Ratio for Member Banks as of December 31, 1971**

<table>
<thead>
<tr>
<th>Demand Deposits (in millions)</th>
<th>Immediate Banks</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Deferred Banks</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$X$</td>
<td>$S$</td>
<td>$Y$</td>
<td>$S$</td>
<td>$U$</td>
<td>$Z$</td>
<td></td>
<td>$X$</td>
<td>$S$</td>
<td>$Y$</td>
<td>$S$</td>
<td>$U$</td>
</tr>
<tr>
<td>0 - 2</td>
<td>0.253</td>
<td>0.179</td>
<td>0.251</td>
<td>0.134</td>
<td>10,513.0</td>
<td>-0.621</td>
<td></td>
<td>0.288</td>
<td>0.130</td>
<td>0.260</td>
<td>0.156</td>
<td>162,757.0</td>
</tr>
<tr>
<td>2 - 10</td>
<td>0.185</td>
<td>0.112</td>
<td>0.206</td>
<td>0.106</td>
<td>292,907.0</td>
<td>-3.640</td>
<td></td>
<td>0.200</td>
<td>0.109</td>
<td>0.209</td>
<td>0.111</td>
<td>592,448.0</td>
</tr>
<tr>
<td>10 - 100</td>
<td>0.162</td>
<td>0.093</td>
<td>0.153</td>
<td>0.076</td>
<td>190,689.5</td>
<td>-0.430</td>
<td></td>
<td>0.164</td>
<td>0.088</td>
<td>0.156</td>
<td>0.093</td>
<td>79,555.0</td>
</tr>
<tr>
<td>100 - 400</td>
<td>0.120</td>
<td>0.069</td>
<td>0.119</td>
<td>0.055</td>
<td>4,156.0</td>
<td>-0.011</td>
<td></td>
<td>0.140</td>
<td>0.071</td>
<td>0.134</td>
<td>0.057</td>
<td>107.0</td>
</tr>
<tr>
<td>400 +</td>
<td>0.109</td>
<td>0.054</td>
<td>0.107</td>
<td>0.055</td>
<td>874.0</td>
<td>-0.213</td>
<td></td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

### Table 33

**Computation for Liquid Investments Ratio for Non-Member Banks as of December 31, 1971**

<table>
<thead>
<tr>
<th>Demand Deposits (in millions)</th>
<th>Immediate Banks</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Deferred Banks</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$X$</td>
<td>$S$</td>
<td>$Y$</td>
<td>$S$</td>
<td>$U$</td>
<td>$Z$</td>
<td></td>
<td>$X$</td>
<td>$S$</td>
<td>$Y$</td>
<td>$S$</td>
<td>$U$</td>
</tr>
<tr>
<td>0 - 2</td>
<td>0.233</td>
<td>0.130</td>
<td>0.260</td>
<td>0.156</td>
<td>162,757.0</td>
<td>-2.647</td>
<td></td>
<td>0.233</td>
<td>0.130</td>
<td>0.260</td>
<td>0.156</td>
<td>162,757.0</td>
</tr>
<tr>
<td>2 - 10</td>
<td>0.200</td>
<td>0.109</td>
<td>0.209</td>
<td>0.111</td>
<td>592,448.0</td>
<td>-2.041</td>
<td></td>
<td>0.200</td>
<td>0.109</td>
<td>0.209</td>
<td>0.111</td>
<td>592,448.0</td>
</tr>
<tr>
<td>10 - 100</td>
<td>0.164</td>
<td>0.088</td>
<td>0.156</td>
<td>0.093</td>
<td>79,555.0</td>
<td>-1.578</td>
<td></td>
<td>0.164</td>
<td>0.088</td>
<td>0.156</td>
<td>0.093</td>
<td>79,555.0</td>
</tr>
<tr>
<td>100 - 400</td>
<td>0.140</td>
<td>0.071</td>
<td>0.134</td>
<td>0.057</td>
<td>107.0</td>
<td>80</td>
<td></td>
<td>0.140</td>
<td>0.071</td>
<td>0.134</td>
<td>0.057</td>
<td>107.0</td>
</tr>
<tr>
<td>400 +</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td></td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

*See footnote, Table 31.*
### TABLE 34

**COMPUTATIONS FOR AVERAGE RETURN RATIO FOR MEMBER BANKS AS OF DECEMBER 31, 1971**

<table>
<thead>
<tr>
<th>Demand Deposits (in millions)</th>
<th>Immediate Banks</th>
<th>Deferred Banks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\bar{X}$</td>
<td>$S$</td>
</tr>
<tr>
<td>0 - 2</td>
<td>0.0776</td>
<td>0.0882</td>
</tr>
<tr>
<td>2 - 10</td>
<td>0.0766</td>
<td>0.0863</td>
</tr>
<tr>
<td>10 - 100</td>
<td>0.0822</td>
<td>0.0978</td>
</tr>
<tr>
<td>100 - 400</td>
<td>0.0791</td>
<td>0.0776</td>
</tr>
<tr>
<td>400 +</td>
<td>0.0670</td>
<td>0.0734</td>
</tr>
</tbody>
</table>

### TABLE 35

**COMPUTATIONS FOR AVERAGE RETURN RATIO FOR NONMEMBER BANKS AS OF DECEMBER 31, 1971**

<table>
<thead>
<tr>
<th>Demand Deposits (in millions)</th>
<th>Immediate Banks</th>
<th>Deferred Banks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\bar{X}$</td>
<td>$S$</td>
</tr>
<tr>
<td>0 - 2</td>
<td>0.0940</td>
<td>0.0870</td>
</tr>
<tr>
<td>2 - 10</td>
<td>0.0700</td>
<td>0.0533</td>
</tr>
<tr>
<td>10 - 100</td>
<td>0.0723</td>
<td>0.0909</td>
</tr>
<tr>
<td>100 - 400</td>
<td>0.0579</td>
<td>0.0663</td>
</tr>
<tr>
<td>400 +</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

*aSee footnote, Table 31.*
### Table 36

**Computations for Average Yield Ratio for Member Banks As of December 31, 1971**

<table>
<thead>
<tr>
<th>Demand Deposits (in millions)</th>
<th>Immediate Banks</th>
<th>Deferred Banks</th>
<th>( u )</th>
<th>( z )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( X )</td>
<td>( S )</td>
<td>( X )</td>
<td>( S )</td>
</tr>
<tr>
<td>0 - 2</td>
<td>0.0714</td>
<td>0.0816</td>
<td>0.0742</td>
<td>0.0629</td>
</tr>
<tr>
<td>2 - 10</td>
<td>0.0698</td>
<td>0.0590</td>
<td>0.0766</td>
<td>0.0622</td>
</tr>
<tr>
<td>10 - 100</td>
<td>0.0752</td>
<td>0.0881</td>
<td>0.0860</td>
<td>0.0814</td>
</tr>
<tr>
<td>100 - 400</td>
<td>0.0708</td>
<td>0.0683</td>
<td>0.0752</td>
<td>0.0622</td>
</tr>
<tr>
<td>400 +</td>
<td>0.0596</td>
<td>0.0697</td>
<td>0.0592</td>
<td>0.0532</td>
</tr>
</tbody>
</table>

### Table 37

**Computations for Average Yield Ratio for Nonmember Banks As of December 31, 1971**

<table>
<thead>
<tr>
<th>Demand Deposits (in millions)</th>
<th>Immediate Banks</th>
<th>Deferred Banks</th>
<th>( u )</th>
<th>( z )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( X )</td>
<td>( S )</td>
<td>( X )</td>
<td>( S )</td>
</tr>
<tr>
<td>0 - 2</td>
<td>0.088</td>
<td>0.061</td>
<td>0.083</td>
<td>0.077</td>
</tr>
<tr>
<td>2 - 10</td>
<td>0.0640</td>
<td>0.0482</td>
<td>0.0632</td>
<td>0.0697</td>
</tr>
<tr>
<td>10 - 100</td>
<td>0.0876</td>
<td>0.0907</td>
<td>0.0966</td>
<td>0.1035</td>
</tr>
<tr>
<td>100 - 400</td>
<td>0.0748</td>
<td>0.0462</td>
<td>0.0803</td>
<td>0.0599</td>
</tr>
<tr>
<td>400 +</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

*aSee footnote, Table 31.*
### TABLE 38
COMPUTATIONS FOR PROFITABILITY RATIO FOR MEMBER BANKS AS OF DECEMBER 31, 1971

<table>
<thead>
<tr>
<th>Demand Deposits (in millions)</th>
<th>Immediate Banks</th>
<th>Deferred Banks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>U</td>
</tr>
<tr>
<td>0 - 2</td>
<td>0.0080</td>
<td>0.0149</td>
</tr>
<tr>
<td>2 - 10</td>
<td>0.0089</td>
<td>0.0096</td>
</tr>
<tr>
<td>10 - 100</td>
<td>0.0094</td>
<td>0.0109</td>
</tr>
<tr>
<td>100 - 400</td>
<td>0.0074</td>
<td>0.0088</td>
</tr>
<tr>
<td>400 +</td>
<td>0.0082</td>
<td>0.0017</td>
</tr>
</tbody>
</table>

### TABLE 39
COMPUTATIONS FOR PROFITABILITY RATIO FOR NONMEMBER BANKS AS OF DECEMBER 31, 1971

<table>
<thead>
<tr>
<th>Demand Deposits (in millions)</th>
<th>Immediate Banks</th>
<th>Deferred Banks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>U</td>
</tr>
<tr>
<td>0 - 2</td>
<td>0.0094</td>
<td>0.0161</td>
</tr>
<tr>
<td>2 - 10</td>
<td>0.0077</td>
<td>0.0036</td>
</tr>
<tr>
<td>10 - 100</td>
<td>0.0116</td>
<td>0.0125</td>
</tr>
<tr>
<td>100 - 400</td>
<td>0.0094</td>
<td>0.0032</td>
</tr>
<tr>
<td>400 +</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

^See footnote, Table 31."
Table 40 summarizes the results of hypothesis testing.

**Table 40**

**RESULTS OF HYPOTHESIS TESTING**

<table>
<thead>
<tr>
<th>Ratio</th>
<th>Liquid Investments</th>
<th>Average Return</th>
<th>Average Yield</th>
<th>Profitability</th>
</tr>
</thead>
<tbody>
<tr>
<td>A - Member</td>
<td>N</td>
<td>M</td>
<td>M</td>
<td>N</td>
</tr>
<tr>
<td>A - Nonmember</td>
<td>R</td>
<td>N</td>
<td>M</td>
<td>N</td>
</tr>
<tr>
<td>B - Member</td>
<td>R</td>
<td>M</td>
<td>M</td>
<td>R</td>
</tr>
<tr>
<td>B - Nonmember</td>
<td>N</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>C - Member</td>
<td>R</td>
<td>M</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>C - Nonmember</td>
<td>N</td>
<td>N</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>D - Member</td>
<td>R</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>D - Nonmember</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>E - Member</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

*R indicates the null hypothesis was rejected in favor of the alternative hypothesis.
N indicates the null hypothesis was not rejected.

**Interpretation**

In general, the results in Table 40 indicate that the relative performance between immediate and deferred banks was not significantly different in the smallest and largest bank groups, but was significantly different within medium sized bank groups. Relative performance comparisons of nonmember banks generally parallels that of member banks with the exception of the 10 - 100 million size group.
A feasible explanation of the general pattern is as follows: Very small country banks are typically located some distance from financial centers so that most of their customers' checks are received over the counter or through informal exchange arrangements with other local banks. Thus, relatively few checks are received by these banks for payment on a deferred basis, and they do not differ substantially with regard to payment from their city counterparts.

The very large deferred payment banks typically are located in regional financial centers that do not contain Federal Reserve offices, but do contain clearinghouses providing for "immediate" payment for checks cleared. Examples of such cities would be Hartford, Columbus, Indianapolis, Milwaukee, and Phoenix.

Checks drawn on these large "country" banks and deposited in banks that are not members of the paying bank's clearinghouse were typically collected through correspondents that are clearinghouse members. Thus, while large country banks had deferred status relative to the Federal Reserve system, the proportion of the value of checks paid that were presented by the Federal Reserve was not substantial. Thus, as with the very small banks, they did not differ significantly from their Federal Reserve city counterparts with regard to overall check payment.
For member banks in the size range from two to one hundred million in demand deposits, and for nonmembers in the two to ten million range, liquidity ratios do not differ significantly, but country banks exhibit higher average yields and higher profitability. Country banks also exhibit higher values for the ratio \( R_d/d \).

An acceptable interpretation of the results for medium sized banks may be found in a standard banking test, such as Robinson. Banks are expected to hold a primary liquidity reserve in U.S. Government securities and, to a lesser extent, balances with other banks, in relation to the daily variability of demand deposits. In addition to the primary reserve, however, banks are also expected to hold a secondary liquidity reserve of somewhat less liquid, higher yielding assets, for contingencies.

Assuming that the size and makeup of the secondary liquidity portfolio is related to reaction time, and assuming that the primary reserve is not, the Table 40 results for medium sized banks is not inconsistent with the hypothesis that deferred payment banks are more profitable because they are deferred payment banks.

The results of the tests for nonmember banks in size class C are not consistent with the above interpretations.

for medium sized banks. Analysis of Tables 35, 37, and 39 reveals two facts that help resolve the differing results within the size class.

First, while the grouping differences are not statistically significant at the level specified, the difference in the means are all in the direction of higher earnings rates for deferred payment banks. Hypotheses 29$H_0$, 38$H_0$, and 47$H_0$ would be rejected at alpha levels of 0.13, 0.075, and 0.187, respectively.

The second fact apparent from analysis of the tables is that in all three earnings performance measures the means for the two nonmember bank groups in size class C are substantially higher than the means for every other bank group. It is reasonable to conclude, therefore, that characteristics of nonmember banks in that size group, other than payment status, sufficiently dominate earnings performance to create a high level of within class homogeneity.

Conclusions

In view of the analytical results and the interpretations applied to those results the following conclusions have been drawn with respect to the expected impact of Regulation J on the relative performance of immediate and deferred payment banks. First, for very small banks and very large banks the amendment to Regulation J will not have a significant impact on the relative profitability of immediate and deferred payment banks.
For member banks with demand deposits between two and one hundred million dollars and for nonmember banks with demand deposits between two and ten million dollars, country banks are expected to become less profitable relative to city banks. This adjustment is expected to come about as a result of shifts in asset holdings as well as relative declines in earning assets as a per cent of total assets.

For nonmember banks with demand deposits between ten and one hundred million dollars the Regulation J amendment is not expected to have a significant impact on the relative profitability of immediate and deferred payment banks. This conclusion is based on an assumption that the factors unique to this bank class dominating 1971 earnings are permanent and not transitory.
CHAPTER VI

SUMMARY AND CONCLUSIONS AND RECOMMENDATIONS

The preceding three chapters presented the analysis of three distinct but related phenomena. This chapter summarizes the findings of each, and considers the combined effect of the Federal Reserve System Payments Mechanism Program.

The summary section treats each topic in the order of the chapters containing the analyses: direct cost effects of RCPCs, indirect correspondent banking effects of RCPCs and profitability effects of the Regulation J amendment. The section immediately following the summary contains recommendations for further related study. The final section of this chapter contains a discussion of the overall effect of the Federal Reserve program and states conclusions with regard to the impact on industry structure as well as the attainment of Federal Reserve objectives.

Direct Cost Effects

Chapter III of this study described a technique for estimating the variable direct cost of transit check processing at commercial banks and applied the technique to a representative group of Regional Check Processing Center
banks to estimate gross direct cost savings due to the establishment of RCPCs. The results permit statements as to the likelihood of the Federal Reserve System meeting its cost reduction objectives. Further, the analysis permits identification of the conditions under which the Federal Reserve system should expect favorable results.

Chapter III specified that the direct cost function for demand deposit processing in commercial banks takes the following form:

$$ C = b_o \cdot v_t^{b_1} \cdot v_h^{b_2} \cdot v_d^{b_3} $$

and computed the marginal cost of transit processing in the form:

$$ MC_t^B = b_1 \cdot b_0 \cdot v_t^{b_1-1} \cdot v_h^{b_2} \cdot v_d^{b_3}.$$ Utilizing 1970 Functional Cost Analysis data from 150 banks having demand deposits greater than $50 million, with ordinary least squares regression in the Log form of the above function, the following values were derived as estimates for the parameters of the cost function.

$$ b_0 = 0.316 $$
$$ b_1 = 0.1274526 $$
$$ b_2 = 0.4404892 $$
$$ b_3 = 0.4229242 $$

The marginal cost computations resulted in an estimate of the average for large correspondent banks of $0.0125 for transit item processing.
Analysis of the parameters indicated that all were significantly less than 1, but that the sum of $b_1$, $b_2$, and $b_3$ was not significantly different from 1. This finding led to the conclusion that economies of scale do not exist for direct variable cost of check processing in large banks, for a given proportionate mix of volumes.

The computed value for marginal cost is of the order of magnitude found in the studies by Fenner and by Cox\(^1\) that were discussed in Chapter II. The absence of economies of scale in the function, however, is contrary to Cox's conclusion. Cox's result is likely attributable to a change in the mix of items over bank size.

Application of the cost results to volumes reported and estimated by Federal Reserve banks in combination with actual and projected Federal Reserve processing costs resulted in a series of estimates for the effect of regional processing centers on 1973 direct cost of collecting checks. The estimates varied according to the assumptions on volumes and Federal Reserve processing costs. The range for each center analyzed was as follows:

<table>
<thead>
<tr>
<th>Center</th>
<th>Low Estimate*</th>
<th>High Estimate*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baltimore, Maryland</td>
<td>$ (308,430)</td>
<td>$ 207,023</td>
</tr>
<tr>
<td>Lewiston, Maine</td>
<td>19,330</td>
<td>67,942</td>
</tr>
<tr>
<td>Windsor Looks, Connecticut</td>
<td>(1,103,026)</td>
<td>(517,436)</td>
</tr>
<tr>
<td>Cleveland, Ohio</td>
<td>(676,524)</td>
<td>(498,878)</td>
</tr>
</tbody>
</table>

*Values in parentheses indicate negative savings.

These results led to the conclusion that the Federal Reserve System is thus far failing to meet its direct cost reduction objective at Windsor Looks and Cleveland. Comparative analysis of the results for the four centers indicated that the critical variable in determining the success of the cost reduction program is the relationship between the volume of regional items coming from respondent banks and the new volume received by the BCPC.

In cases where the Federal Reserve Center merely replaces a clearing network operated by the banks, aggregate costs tend to rise. On the other hand, in cases where the BCPC eliminates the correspondent as a redundant processor, costs tend to decline. As a first order approximation it would appear that in those cases in which the large correspondent bank group contributes more than approximately thirty per cent of new volume to an BCPC, the Federal Reserve will not achieve its cost objective. The thirty per cent value was not tested parametrically.
Indirect Correspondent Banking Effects

The fourth chapter of this paper discussed the anticipated effect that regional centers will have on the relationship between respondent and correspondent banks. The chapter also estimated the cost of the centers to correspondents and the gain to respondents. One interesting side benefit of the analysis was an opportunity to view the disparity between the cost of correspondent services to the respondent and the value received by the correspondent. This disparity exists because of differing reserve requirements.

The analysis in Chapter IV applied the results of Robert Knight's survey of unit balance requirements\(^2\) to volume estimates derived in Chapter III in order to estimate the interbank balance requirement reductions available due to the opening of specific RCPCs. Actual reserve requirement rates and national average earnings rates were applied to the estimated balance requirements in order to estimate losses to correspondents and gains to respondents. Gross reductions in income to correspondents were partially offset by reductions in the cost of processing checks from respondents.

The results, based on the average unit balance requirement found by Knight, were as follows:

<table>
<thead>
<tr>
<th>Center</th>
<th>Balance Requirement</th>
<th>Cost to Correspondents</th>
<th>Gain to Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baltimore</td>
<td>$60,025,980</td>
<td>$1,582,864</td>
<td>$4,736,449</td>
</tr>
<tr>
<td>Lewiston</td>
<td>13,126,260</td>
<td>576,065</td>
<td>1,095,508</td>
</tr>
<tr>
<td>Windsor Locks</td>
<td>46,144,980</td>
<td>1,748,950</td>
<td>3,635,439</td>
</tr>
<tr>
<td>Cleveland</td>
<td>21,300,300</td>
<td>639,621</td>
<td>1,674,371</td>
</tr>
</tbody>
</table>

The Federal Reserve is effectively creating a monopoly in the collection of local checks, in those areas where it is establishing RCPCs, by pricing the correspondents out of the market. In so doing, it is not only transferring the cost of check collection from the private to the public sector, but also it is effectively transferring a substantial portion of the private sector benefit to respondent banks as a class.

Correspondent banks that traditionally derived substantial income from the sale of check collection services face a challenge in developing substitute services to maintain their historic profitability positions or accepting reduced earnings from the loss of a market. Respondent banks that have traditionally purchased check collection services should be expected to reap windfall profits at the public’s expense.
Chapter V of this paper described a comparative analysis of bank groups designed to anticipate the effect that the November 9, 1972 amendment to Federal Reserve Regulation J will have on the relative profitability of city and country banks. The amendment requires all banks to pay for checks presented on the day of presentment. This eliminates a practice under which banks located outside Federal Reserve office cities previously paid for their checks on the day after presentment.

Banks were grouped into five size classes, by Federal Reserve membership, and as to payment practice. Data from the December, 1971 Report of Condition and Statement of Income were used to compare various asset and earnings relationships between immediate and deferred payment banks within the same size and Federal Reserve membership categories. Member banks were not compared with nonmembers and size group lines were not crossed.

In general, the conclusions were that deferred payment banks were neither more profitable nor less liquid than their immediate payment counterparts in the smallest and largest bank groups. Further, in the smallest and largest groups, deferred payment banks did not appear to have more money to invest per dollar of demand deposit.
For banks in the size range between two million and one hundred million in demand deposits, however, deferred payment banks appeared to have been more profitable than their city counterparts. These banks also appeared to have had more money to invest per dollar of demand deposit liability.

It was concluded from the analysis that medium-sized country banks should expect to experience a decline in earnings relative to their city counterparts. The absence of significant differences within the large and small bank groups can be explained by the fact that for those two groups the Federal Reserve Bank presentments typically do not constitute the bulk of checks received for payment.

**Considerations for Further Research**

Programs to effect major change in the payments mechanism, both ongoing and potential, raise a number of important questions for the banking industry in general, and the Federal Reserve System in particular, as well as for the nonbank users of payments services. This section identifies certain major questions that should be researched as payments mechanism change becomes increasingly widespread.

Although the Federal Reserve System has stated repeatedly that its objective in the BCPC program is the reduction of check collection costs, it may be that the program would be defensible on other grounds even if cost
reduction objectives were not met. The following are three areas in which research may demonstrate the social desirability of RCPC's.

1. RCPC's may reduce the risk of loss to banks from faster return of unpayable checks. Although data are not made available on the losses of commercial banks from acceptance of checks that are not collectible, they are believed to be substantial. Under the assumption that the likelihood of loss increases with the time required to determine that a check is unpayable, it would be expected that RCPC's would reduce the risk of loss by reducing collection and return time.

2. It has been shown by Miller and Orr that the balances held by business firms increase with increased uncertainty in the net flow of funds. It is likely, therefore, that both RCPC's and the Regulation J amendment result in aggregate savings through reductions in unproductive asset holding by reducing the uncertainty in corporate cash flow.

3. It is conceivable that Federal Reserve RCPC's, because of their profusion as well as their access to the Federal Reserve telecommunications network, will become nodes of a national network for widespread use of electronic

---

funds transfers. Further research and analysis is required to identify the requirements and potential economies of such a system.

The Federal Reserve program, both RCPCs and the Regulation J amendment, have had the effect of reducing check float in the banking system; and, as time passes, it should be expected that other programs will be instituted that will further reduce check float. The possibility of substantial reduction or elimination of check float raises important issues in bank-to-bank relationships, bank-customer relationships, and corporate cash management practices as well as in the management of the money supply by the Federal Reserve. Although check float is usually regarded as an inefficiency in the banking system, it has clearly been institutionalized and capitalized such that its elimination may cause disruptions that may or may not be socially desirable.

One final question that has been raised elsewhere is worthy of note in this paper. Regardless of whether the Federal Reserve program is meeting its cost reduction objective, it is clear that the Federal Reserve is increasing its subsidy to check collection. At some point, Federal Reserve subsidies may prove to be a roadblock to the development of a more efficient payments system because banks may lose their incentive to reduce aggregate costs.  

4This problem was suggested to the author by Donald Hester in a conversation during the summer of 1971.
Conclusions and Recommendations

The conclusions that can be drawn from this study are as follows. First, the Federal Reserve System is generally not currently meeting its cost reduction objectives in implementing Regional Check Processing Centers at Windsor Locks and Cleveland and the conditions that cause this failure may reasonably be expected to exist in many large metropolitan areas. In the two centers named, the opposite condition pertains, and the total cost of check processing is increasing because of the RCPC program.

Second, in pursuing its RCPC program, the Federal Reserve is in all likelihood dismantling its predecessor system, the correspondent banking collection network. Earlier studies of the correspondent network have concluded that its users were pleased with the level of service, indicating that there was not a demand for the RCPC program from the banking community, in terms of service levels.

The RCPC program, by offering check collection services without charge, creates a windfall for respondent banks that traditionally have purchased such services from correspondents. This windfall will be partially offset in many cases by a reduction in profitability due to the Regulation J amendment.
The analysis did indicate that there are certain conditions under which Federal Reserve RCPCs can accomplish the System's cost reduction objectives. In those areas in which large banks do not exist and, therefore, are not providing local check collection services, RCPCs can reduce check collection costs. A review of Table 1 in Chapter III, however, indicates that RCPCs are being placed predominately in large metropolitan areas where the likelihood of success in terms of the cost reduction objective must be considered as relatively low.

These results bring forward two questions of public policy relative to the Federal Reserve System and its independent nature. The first question is, as a matter of public priorities, is it desirable to increase the Federal subsidy of the check collection industry. While there is clearly considerable value to maintaining an effective payments mechanism, there is a legitimate policy question of whether such a mechanism should be operated as a public or a private enterprise, especially in the absence of demonstrable scale economies.

The second issue is related to the first, but is more general in nature. The question of interest is, does the Federal Reserve System's independence with respect to monetary policy imply that independence from Congress is also required in performing its other legislatively assigned functions.
The litigation that delayed the implementation of the Regulation J amendment resulted in a finding that the Federal Reserve System has the authority under law to specify the conditions under which it collects checks, without a requirement for legislative review or public hearing. In view of the possibility that the Federal Reserve may have erred in the RCPC segment of its payments mechanism program, the system's independence to disburse its revenues should perhaps be reconsidered in the Congress. Federal Reserve check collection expenditure, for direct costs, will have increased from about $65.5 million in 1971\(^5\) to nearly $100 million in 1973.\(^6\)


\(^6\)Estimate provided by the Division of Federal Reserve Bank Operations, Board of Governors of the Federal Reserve System.
APPENDIX A

SURVEY FORM DISTRIBUTED BY SELECTED FEDERAL RESERVE BANKS AND UTILIZED FOR COMPUTATION OF $V_{n0}$

INCOMING CHECKS BY SOURCE

<table>
<thead>
<tr>
<th>Source</th>
<th># of Items</th>
<th>$ of Items</th>
<th>% of # on US*</th>
<th>% of $ on US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teller Function (include night deposit)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correspondents (same city)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correspondents (other FRB Zones)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clearinghouse</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FRB</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noncorrespondent Banks (Direct Presentment)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Do not include items in this category which are received as DDA items for other banks.*
APPENDIX B

LIST OF SURVEY BANKS UTILIZED
FOR COMPUTING $V_{F,0}$

First Federal Reserve District

Maine Banks

Maine National Bank
Northeast Bank N. A.

Connecticut Banks

Hartford National Bank
Connecticut Bank and Trust

Boston Banks

First National Bank of Boston
National Shawmut National Bank

Fourth Federal Reserve District

Cleveland Trust Company
Central National Bank of Cleveland
National City Bank of Cleveland
Society National Bank

Fifth Federal Reserve District

Maryland National Bank, Baltimore
Riggs National Bank, Washington, D.C.
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