

1973

The regional differential impact of monetary policy

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TABLE OF CONTENTS

	Page
LIST OF SYMBOLS USED	iii
CHAPTER I: MONETARY POLICY AND REGIONAL ECONOMIC ACTIVITY	1
CHAPTER II: THE THEORETICAL MODEL	10
CHAPTER III: THE EXPERIMENTAL DESIGN	32
CHAPTER IV: THE EMPIRICAL RESULTS	43
BIBLIOGRAPHY	55
ACKNOWLEDGEMENTS	57
APPENDIX	58

LIST OF SYMBOLS USED

- B: borrowings
- b: the interest rate paid on borrowings
- CD: certificates of deposit
- C: the rate of interest paid on certificates of deposit
- γ : the fraction by which the banker is able to adjust to equilibrium in a single period
- DD: demand deposits
- Δ : the first difference operator
- δ_1 : the service charge rate on demand deposits
- δ_2 : the cost of servicing demand deposits
- e: the expected value operator
- F: federal funds
- FC: fixed costs
- G: government securities
- g: the interest rate on government securities
- L: loans
- Λ : the liquidity measure
- λ_i : weights in the liquidity definition
- p: the average rate of interest on loans
- π : short-run profits
- π_L : long-run profits
- R: reserves
- r: the reserve requirement on demand deposits
- S: the measure of soundness
- s: the reserve requirement on time and savings deposits

TC: total costs

TR: total revenue

v: the rate of interest paid on time and savings deposits

CHAPTER I:

MONETARY POLICY AND REGIONAL ECONOMIC ACTIVITY

Introduction

It has been accepted by regional-urban economists that fiscal policy has a differential impact with respect to economic regions. Federal expenditures are used to improve a specific region's economic position relative to other regions, or to slow down the rate of decline in the most depressed regions. Federal expenditures for the purchase of goods and services from the private sector and for capital improvements such as road and dam construction have their most immediate impact on regional income and employment.

Monetary policy, on the other hand, is ignored by regional economists. It is tacitly assumed to have a homogenous effect on regional and urban economic activity. A survey of six of the most prominent textbooks used in teaching Regional-Urban Economics shows that only one, Wilbur Thompson's Preface to Urban Economics, lists monetary policy in the index.¹ However, an inspection of the relevant pages reveals that Thompson's discussion is limited to fiscal policy and structural unemployment. No mention at all is made of monetary policy. It is possible that regional-urban economists are not justified in ignoring the regional effects of monetary policy.

¹The textbooks surveyed are: Werner Z. Hirsch, Urban Economic Analysis (New York: McGraw-Hill, 1973); Hugh O. Nourse, Regional Economics (New York: McGraw-Hill, 1968); J. R. Boudeville, Problems of Regional Economic Planning (Edinburgh, Scotland: Edinburgh University Press, 1966); Wilbur R. Thompson, A Preface to Urban Economics (Baltimore: The Johns Hopkins Press, 1965); Harry W. Richardson, Elements of Regional Economics (Baltimore: Penguin, 1969); Edgar M. Hoover, The Location of Economic Activity (New York: McGraw-Hill, 1948).

Studies conducted by economists on the differential impact of monetary policy on individual sectors of the economy have raised serious doubts as to the appropriateness of the assumption that the effects of monetary policy work their way evenly throughout the economy. The contention by these economists is that changes in the stock of money have a differential impact on different sectors of the business community. It is felt by some economists that monetary policy serves to redistribute resources to some industries and firms at the expense of others. This is held to be especially true during periods of tight money. Bach and Huizenga sum up this position as follows:²

Restrictive monetary policy is widely opposed because of its alleged undesirably discriminatory effects. Tight money it is claimed, lets big borrowers go free while shutting off little ones. It restricts construction activity while letting investment in plant and equipment boom....

It runs up interest costs to those less able to pay. It penalizes new borrowers at the expense of old established customers.

The arguments in favor of the proposition that monetary policy has a differential impact on different sectors of the economy are based on the fact that different firms have different market structures and hence different market power in the economy. Some firms are more prosperous than others and are in a better economic position to command resources. During periods of tight money the more prosperous firms, the oligopolists according to Galbraith, are relatively better off in terms of obtaining loans

²G. L. Bach and C. J. Huizenga, "The Differential Effects of Tight Money," American Economic Review, LI, No. 1 (March, 1962), 52.

than the relatively weaker firms.³ The advantaged firms are both better able to pay the higher interest rates resulting from tight money and are less "risky" and therefore more creditworthy from the banker's point of view.

When money becomes scarce, a relatively greater amount of loans go to the most profitable firms and, as a result, the marginal borrowers are relatively worse off. Bach and Huizenga found that the differential impact, or discrimination in their terminology, could be explained mainly in terms of differences in the credit-worthiness of borrowers.⁴

Tight money in 1955-57 apparently led those commercial banks which felt its impact to alter their asset portfolio significantly; they shifted to obtain funds to increase loans to profitable borrowers, especially business firms, even at the cost of liquidating government securities on a declining market. Discrimination amongst borrowers was apparently largely on traditional banking standards of credit-worthiness and goodness of borrowers....

It has long been observed by regional economists that the more economically sound industries and firms, the faster growing industries, are found in the larger metropolitan areas and the weaker, slow growing or declining firms are found in the smaller towns. Regional economists explain this phenomenon in part by the filter-down theory of industrial location. Thompson explains the filter-down theory in the following manner.⁵

³John K. Galbraith, "Market Structures and Stabilization Policy," Review of Economics and Statistics, XXXIX (May, 1957), 124-133.

⁴Bach and Huizenga, "The Differential Effects of Tight Money," p. 79.

⁵Wilbur R. Thompson, "The Economic Base of Urban Problems," in Contemporary Economic Issues, ed. by Neil W. Chamberlain (Homewood, Illinois: Richard D. Irwin, Inc., 1969), 8.

In national perspective, industries filter down through the systems of cities, from places of greater to lesser industrial sophistication. Most often, the highest skills are needed in the difficult, early stage of mastering a new process, and skill requirements decline steadily as the production process is rationalized and routinized with experience. As the industry slides down the learning curve, the high wage rates become superfluous. The aging industry seeks out the industrial backwaters where the cheaper labor is now up to the lesser demands of the simplified process....

A filter-down theory of industrial location would go far toward explaining the isolated small towns lament that it always gets the slow growing industries. They find that they must run to stand still, as their industrial catches seem only to come to these out of the way places to die.

Although Thompson's concluding remarks may be a bit too strong, the point that the most economically viable and profitable firms are located in large urban regions is well taken. If monetary policy does have a differential impact on different sectors of the economy as some evidence suggests, it is reasonable to expect that the large urban regions in which the more dynamic industries are located will be affected in a different manner by changes in the stock of money than the regions composed of smaller towns and their less profitable enterprises.

There are no a priori grounds to dismiss the possibility that monetary policy may have a differential impact on regions. Whether or not all regions are affected in the same way by changes in the stock of money is an empirical question which should be subjected to investigation and statistical analysis.

If a regional differential impact exists, it is quite possible that changes in the stock of money to "fine tune" the economy can change regional income unequally. Decreases in the rate of growth of the

money stock would have a greater dampening effect on the smaller, slower growing regions. Monetary policy, coupled with the natural advantages of the industrial centers, would make it very difficult for the depressed areas to break their cycle of poverty. Monetary policy, in this case, could frustrate the fiscal efforts of State and Federal governments to upgrade the economies of the slow growing and declining regions. If the differential impact hypothesis is correct, there could very well exist a trade-off between inflation and regional income inequality. As the monetary authorities decrease the stock of money to curb inflation, they worsen the relative economic position of the disadvantaged regions. The extent of the trade-off would depend upon the effect that changes in the stock of money have on inflation at any point in time, and the extent to which those changes contribute to regional income inequality.

The Role of Commercial Banks

The monetary authorities formulate specific economic goals for the economy as a whole and set forces in motion that bring about changes in the stock of money in order to move the national economy in the desired direction. The authorities have three instruments they can use to bring about desired changes in the stock of money. They can: change the interest rate on member bank borrowing, change the legal reserve requirements of member banks, and engage in open market operations.

By changing the interest rate that the Federal Reserve charges to member bank borrowers, they can either encourage or discourage borrowing by commercial banks for the purposes of increasing their reserves. Theoretically, a low interest rate on Federal Reserve borrowing relative

to the interest rates received from commercial bank loans should encourage lending by commercial banks. Conversely, a high interest rate on Federal Reserve borrowing relative to the interest rates received on loans should discourage lending by commercial banks. In practice it is found, however, that commercial banks are reluctant to use the discount window as a means of acquiring reserves in order to increase their customer loans.⁶

If the authorities choose, they may change the legal reserve requirement that commercial banks have to meet and thereby increase or decrease the amount of reserves available for lending or other profit-making activities that the banks engage in. An increase (decrease) in the legal reserve requirement decreases (increases) the reserves available for loans, hence its contractionary (expansionary) impact on the stock of money.

The instrument used most frequently to bring about changes in the stock of money is open market operations. When the Fed buys securities, the textbooks tell us that securities dealers increase their deposits in commercial banks. Concomitantly, excess reserves in commercial banks are increased. These excess reserves are in turn loaned to the community, which sets in motion the familiar chain of events related to the multiple expansion of deposits, and thus in economic activity. Contrariwise, there is a decrease in the money stock and in economic activity when the Fed sells securities to the public.

Regardless of which instrument or combination of instruments the monetary authorities choose to use, the individual commercial banks play

⁶Murray E. Polakoff, "Reluctance Elasticity, Least Cost, and Member-Bank Borrowing: A Suggested Integration," Journal of Finance, XV (March, 1960), 1-18; Stephen M. Goldfeld and Edward J. Kane, "The Determinants of Member-Bank Borrowing: An Econometric Study," Journal of Finance, XXI (September, 1966), 499-514.

a central role in the transmission of monetary policy. How commercial banks respond to changes in their reserves has a direct effect on the amount of loans and the conditions under which loans are made available to the public and hence on economic activity. Banks not only serve as conduits through which the effects of monetary policy are channeled to the real sector, but their behavior helps determine the magnitude of those effects.

The Focus of Previous Studies of the Differential Impact of Monetary Policy

The empirical studies on the differential impact of monetary policy have largely limited their attention to discovering why the larger firms receive a greater share of the available loans during periods of tight money than the smaller firms. As was previously noted, Bach and Huizenga attribute the differential impact to differences in "credit-worthiness" between the bank's bigger and smaller customers.⁷ Their conclusions were challenged by Silber and Polakoff, in part because they failed to define the concept of credit-worthiness in either a theoretical framework, or in an operationally meaningful way.⁸

Silber and Polakoff estimate bank loan offer curves for small and large borrowers which are used to measure the bank's desire to discriminate. They then determine the actual discrimination, or differential effect of tight money, under different plausible assumptions about the borrower's demand curves. Unlike Bach and Huizenga, Silber and Polakoff

⁷Bach and Huizenga, "Differential Impact," p. 79.

⁸William L. Silber and Murray E. Polakoff, "The Differential Effects of Tight Money: An Econometric Study," Journal of Finance, XXV (March, 1970), 83-99.

do not make an explicit allowance for differences in the financial conditions of individual firms. As a consequence, they reject the notion that a differential impact can be attributed to anything other than bankers' unexplained desire to discriminate.

Neither the Bach and Huizenga nor the Silber and Polakoff studies explicitly identify which variables bankers consider when making loans. Gupta recognizes this inherent weakness in the previous studies and develops a "loan-safety model", as he calls it, which makes explicit the variables that bankers consider when lending to an individual firm.⁹ The implications of his model are that loans to the smaller firms are characterized by lower safety factors than loans to larger firms. Gupta contends that the bigger firms are more profitable and better able to withstand economic adversities. These economic advantages, coupled with the fact that credit costs vary inversely with the size of the loan, serves to squeeze out the small marginal borrowers when money becomes tighter.

The differential impact studies of monetary policy, such as the works cited above, have thus far been devoid of any spatial implications. To the extent that the location of the banks was not explicitly considered, they cannot test the proposition that changes in the stock of money have a differential impact with respect to regional economic activity.

If banks in different regions are all similarly affected by changes in monetary policy, and if they respond in a similar fashion to these changes, then a strong case can be made for the proposition that monetary

⁹Manak C. Gupta, "Differential Effects of Tight Money: An Economic Rationale," Journal of Finance, XXVIII (September, 1970), 828-838.

policy has no differential impact on regions. More specifically, it is necessary to find the effect of monetary policy on the supply of loans of banks in different regions.

Scope of the Study

It is the objective of this study to develop a theoretical model that identifies the variables that banks consider important in making loan decisions. Statistical tests will then be performed on regional bank portfolio data in order to test the regional differential impact hypothesis.

CHAPTER II:
THE THEORETICAL MODEL

The theoretical model used in this study to specify the determinants of bank lending is derived from the model of bank behavior developed by Dudley Lockett¹ and the work of Carl Vander Wilt² and Steve Steib.³ These studies use a microeconomic portfolio maximizing approach to analyze bank behavior. I have disaggregated the loan category in their model and have made long-run profits an explicit argument in the utility function.

Given the bank's position at any point in time, say $t-1$, it is assumed that in order to maximize utility the banker formulates a desired level of lending, L_t^* , which he would like to achieve in the following period t . If he is able to achieve equilibrium in one time period, L_t , the actual level of loans at t is equal to L_t^* , the desired level. The banker may be unable to reach equilibrium, however, so that L_t will be less than L_t^* . In that case, the actual change in lending between periods $t-1$ and t , $L_t - L_{t-1}$, is a fraction of $L_t^* - L_{t-1}$. This relation is expressed as follows:

$$(1) \quad L_t - L_{t-1} = (L_t^* - L_{t-1})$$

alternatively:

$$(2) \quad \Delta L_t = (L_t^* - L_{t-1})$$

¹Dudley G. Lockett, "Credit Standards and Tight Money," Journal of Money, Credit and Banking, II (November, 1970), 420-434.

²Carl Vander Wilt, "Member Bank Borrowing: A Microeconomic Approach" (unpublished Ph.D. dissertation, Iowa State University, 1968).

³Steve B. Steib, "The Euro-Dollar Market as a Source of United States Bank Liquidity" (unpublished Ph.D. dissertation, Iowa State University, 1972).

where:

ΔL_t = the actual change in loans between t-1 and t

γ = the fraction by which the banker is able to adjust to equilibrium in a single period.

L_t^* = the desired level of loans at t

L_{t-1} = the actual level of loans at t-1

t = time subscript

L_t is the aggregate level of loans outstanding at time t, and as such it is the sum of the individual loans. This relation is expressed as:

$$(3) \quad L_t = \sum_{i=1}^n L_{it}$$

where:

L_{it} = the amount of the loan outstanding of the i th customer at t.

In reality the banker is faced with requests for loans from borrowers with different characteristics, so that requests for loans are judged by the impact that either granting or denying the loan will have on the bank's position. Apart from the normal considerations of short-run profit and risk associated with each individual loan, loans may be evaluated by the effect that they will have on the bank's soundness and liquidity positions and by the effect of the loan on long-run profits.⁴

In this study it is assumed that bankers differentiate between loan requests on the basis of the effect that the loan will have on the bank's soundness, liquidity, short-run profits, and long-run profits.

⁴The concepts of "soundness", "liquidity" and "long-run profits" are defined and developed in the following section in the course of developing the theoretical model.

Regardless of the criteria that a banker may employ to differentiate among borrowers, the banker will find it cumbersome and expensive to gather all the information necessary to differentiate between each and every customer in minute detail. Jaffee and Modigliani suggest that bankers assign customers to different classes or categories where borrowers with similar but not identical characteristics will be treated in like fashion.⁵

In the limit the number of classes, m , can be as large as the number of individual customers, n , but, "to make the whole arrangement manageable the number of different rate classes would have to be reasonably small."⁶ We can assume that in the interest of saving time and money, the banker will choose a number of classes, m , such that m will be much smaller than the number of customers n .

If the banker chooses to classify his customers into m categories equation (3) can be written as:

$$(4) \quad L_t = \sum_{j=1}^m L_{jt}$$

where:

L_{jt} = the amount of loans outstanding for the j th category at time t .

In making a decision about the desired level of loans L_t^* , the banker is assumed to decide about the desired level of loans for each of the m classes, L_{jt}^* . The desired level of loans can be written as:

$$(5) \quad L_t^* = \sum_{j=1}^m L_{jt}^*$$

⁵Dwight M. Jaffee and Franco Modigliani, "A Theory and Test of Credit Rationing," American Economic Review, LIX (December, 1969), 850-872.

⁶Ibid., p. 860.

Substituting equations (4) and (5) into equation (2) yields:

$$(6) \quad \sum_{j=1}^m L_{jt} - \sum_{j=1}^m L_{jt-1} = \gamma \left(\sum_{j=1}^m L_{jt}^* - \sum_{j=1}^m L_{jt-1} \right) \quad 0 < \gamma < 1$$

Since the banker makes a decision about the desired level of loans for each class, equation (7) holds.

$$(7) \quad L_{jt} - L_{jt-1} = \gamma_j (L_{jt}^* - L_{jt-1})$$

for $j = 1, \dots, m$

where:

γ_j = the fraction by which the banker is able to adjust to equilibrium in a single period.

Changes in the level of loans are a function of the desired level of loans. In order to specify the variables that determine the desired level of loans, it is necessary to develop a model of individual bank behavior.

A Model of Bank Behavior

A simplified balance sheet identity can be written in the following manner:

$$(8) \quad R + L + G = DD + TD + CD + F + FR + UB$$

where:

$$R, G, L, DD, TD, CD, B \geq 0; \quad UB, F \leq 0$$

and

R = reserves

G = government securities

L = loans

DD = demand deposits

TD = time and savings deposits

CD = certificates of deposit

FR = borrowings from the Federal Reserve

UB = Euro-dollar borrowings

F = federal funds

Banks can increase their reserves, and hence their ability to make loans, by incurring liabilities. In addition to accepting demand deposits, time deposits and certificate of deposits, banks can borrow money from the Federal Reserve, the federal funds market, and in the case of the largest banks, the Euro-dollar market. In the interest of keeping the following analysis of bank behavior within reasonable limits, the specific "borrowings" variables, UB, FR, and F, will be treated as one variable, B. The main issue here is bank loans and not the banks' specific liabilities. Treating the borrowings variables separately adds nothing essential to this study and serves only to unnecessarily complicate the theoretical model. The balance sheet identity then can be written as:

$$(9) \quad R + L + G = DD + TD + CD + B$$

where:

$$(10) \quad B = F + FR + UB$$

Assuming that banks hold no excess reserves, reserves can be expressed as:

$$(11) \quad R = rDD + s(TD + CD)$$

where:

r = the reserve requirement ratio on demand deposits

s = the reserve requirement on time and savings deposits

Substituting equation (11) into (9) and simplifying yields:

$$(12) \quad G + L = (1-r)DD + (1-s)(TD + CD) + B$$

The banker is assumed to manage his portfolio in such a manner as to maximize his utility. His utility function is of the form:

$$(13) \quad U = U(\pi, S, \Lambda, \pi_L)$$

where:

π = short-run profits

S = soundness

Λ = liquidity

π_L = long-run profits

Short-run Profits

Short-run profits are defined as the difference between total revenue and total costs:

$$(14) \quad \pi = TR - TC$$

where:

TR = total revenue

TC = total costs

Total revenue is given by the following expression:

$$(15) \quad TR = gG + pL + \delta_1 DD$$

where:

g = the interest rate on government securities

p = an average interest rate on loans

δ_1 = the service charge rate on demand deposits

Total cost is given by:

$$(16) \quad TC = \sqrt{TD} + bB + cCD + \delta_2 DD + FC$$

where:

v = the rate of interest paid on time and savings deposit

b = the rate of interest paid on borrowings

c = the rate of interest paid on certificates of deposit

δ_2 = the cost of servicing demand deposits

FC = fixed costs including the cost of servicing loans

Substituting (15) and (16) into (14) yields:

$$(17) \quad \pi = gG + pL + \delta_1 DD - vTD - cCD - bB - \delta_2 DD - FC$$

Assuming that the service charge on demand deposits is equal to the cost of servicing demand deposits, equation (17) can be written as:

$$(18) \quad \pi = gG + pL - vTD - cCD - bB - FC$$

Under the assumption that bankers differentiate between loans to different customers, the banker is not constrained to charge a uniform rate of interest. The total revenue received from loans, pL , is the sum of the revenue received from each individual loan. This relation is expressed as:

$$(19) \quad pL = \sum_{i=1}^n p_i L_i$$

where:

p_i = the rate of interest charged to the i th customer

Substituting (19) into (18) yields:

$$(20) \quad \pi = gG + \sum_{i=1}^n p_i L_i - vTD - cCD - bB - FC$$

The aggregate revenue received from loans, pL , also can be expressed as the sum of the revenues received from each loan class:

$$(21) \quad pL = \sum_{j=1}^m p_j L_j$$

where:

p_j = the rate of interest charged to customers in the j th class

L_j = the level of loans of the j th class

Substituting (21) into (18) yields the following short-run profit

function:

$$(22) \quad \pi = gG + \sum_{j=1}^m p_j L_j - vTD - cCD - bB - FC$$

Soundness

The concept of soundness refers to the bank's ability to survive severe unforeseen contractions of a local or national character. Soundness is a measure of the bank's ability to meet its obligations to its customers in the event of forced liquidation due to an unexpected economic contraction.

The measure of soundness used in this study derives from the Federal Reserve's Form for Analyzing Bank Capital. Soundness is defined as a weighted difference between the realizable value of the bank's assets during periods of contraction and an assumed maximum decline in liabilities during that period. The banker, who quite naturally is concerned with the survival of the firm during periods of distress, is assumed to assign weights to each class of assets and liabilities. In this fashion he determines the bank's soundness position at any point in time. Soundness is given by:

$$(23) \quad S_t = R_t + W_2 G_t + W_3 L_t - W_4 CD_t - W_5 TD_t - W_6 DD_t - B_t$$

where:

S_t = the measure of soundness at time t

W_2 = the percentage of the current value of the bank's present holdings of government securities which would be available under assumed conditions of distress

W_3 = the percentage of the current value of the bank's present holdings of loans which would be available under assumed conditions of distress

W_4 = the percentage by which the bank's current certificate of deposit liabilities might decline under assumed conditions of distress

W_5 = the percentage by which the bank's current time and savings deposits might decline under assumed conditions of distress

W_6 = the percentage by which the bank's current demand deposits might decline under assumed conditions of distress

Since R is a linear function of DD and $TD + CD$, a weight can be defined such that:

$$(24) \quad W_1 R = W_6 r DD + W_5 s TD + W_4 s CD$$

Substituting (24) into (23) yields:

$$(25) \quad S_t = W_2 G + W_3 L - W_4 (1-s) CD - W_5 (1-s) TD - W_6 (1-r) DD - B$$

W_3 can be expressed as a weighted average of the percentage of the current value of the bank's loans which would be available under conditions of distress from each of the m loan categories.

$$(26) \quad W_3 = \sum_{j=1}^m \frac{W_{jL}^L}{L}$$

where:

W_j^L = the percentage of the current value of the bank's present holdings of j class loans which would be available under assumed conditions of distress

Substituting (24) into (23) yields the following measure of soundness:

$$(27) \quad S_t = W_2 G + \sum_{j=1}^m W_j^L L_j - W_4 (1-s) CD - W_5 (1-s) TD - W_6 (1-r) DD - B$$

which is the specification of soundness which will be adhered to in this study.

Liquidity

The banker is concerned with liquidity because he must meet obligations as a routine aspect of his business. He evaluates the bank's liquidity position in terms of the bank's ability to meet obligations which will come due between the current period t , and his planning horizon, $t + h$. The obligations are: repayment of matured borrowings, redemption of matured certificates of deposit, deposit withdrawals, and loan requests. Strictly speaking the bank is not under a legal obligation to meet any requests for loans, but there may be favored borrowers whom the bank is most anxious to accommodate. These are the class of customers who maintain large deposits and whose continued patronage will enhance the bank's long-run profitability.⁷

At time t the banker is certain about the portion of borrowings and certificates of deposit which will be due between t and $t + h$. The banker is assumed to form subjective expectations at t , based on his past experience with the bank's cyclical and seasonal variations, about the level of

⁷The discussion of long-run profits in the following section deals with the importance of bank customer relations in the banker's decision to grant or deny loan requests.

loan requests and deposit withdrawals between t and $t + h$. Maturing obligations, loans and deposit withdrawals are the uses of funds with which the banker must concern himself. He must make certain that the bank has enough funds to meet these obligations.

Sources of funds which are available to the banker include: liquidation of government securities, collection of matured loans, borrowings, increases in deposits, and the reserves freed by deposit withdrawals. If loan default is ignored, the banker is certain about the portion of the loan portfolio which will be repaid during t and $t + h$. However, he must form subjective expectations about the levels of certificates of deposit, deposits and borrowings which will exist at $t + h$.

In this study, the banker is assumed to base his measure of liquidity on the difference between sources and uses of funds. Liquidity is defined as:

$$(28) \quad G_t + \lambda_1 L_t - E[\Delta L] - \lambda_2 CD_t + E[\Delta CD] - \lambda_3 B_t + E[\Delta B] \\ - \lambda_4 E[(1-r)DD] + E[(1-r)\Delta DD] - \lambda_5 E[(1-s)TD] \\ + E[(1-s)\Delta TD] - \Lambda\sigma = 0$$

which may be written as

$$(29) \quad G_t + \lambda_1 L_t + E[\Delta CD + \Delta B + (1-r)\Delta DD + (1-s)\Delta TD - \Delta L] \\ - \lambda_4 (1-r)DD - \lambda_5 (1-s)TD - \lambda_2 CD_t - \lambda_3 B_t - \Lambda\sigma = 0$$

where:

E = the expected value operator

Δ = the change in the level indicated between t and $t + h$

λ_1 = the proportion of the total level of loans which will be collected between t and $t + h$

λ_2 = the proportion of certificate of deposit holdings at t which will be redeemed between t and $t + h$

λ_3 = the proportion of borrowings at t which will be repaid between t and $t + h$

λ_4 = the proportion of demand deposits at t which will be withdrawn between t and $t + h$

λ_5 = the proportion of time and savings deposits at t which will be withdrawn between t and $t + h$

σ = the standard deviation of the distribution of $[\Delta CD + \Delta B - \Delta L + (1-r)\Delta DD + (1-s)\Delta TD - \lambda_4(1-r)DD - \lambda_5(1-s)TD]$

Λ = the measure of liquidity

λ_1 , the proportion of the total level of loans which will be collected between t and $t + h$, can be expressed as a weighted average of the proportion of loans collected from each loan class between t and $t + h$.

$$(30) \quad \lambda_1 = \sum_{j=1}^m \frac{\lambda_j^L L_j}{L}$$

where:

λ_j^L = the proportion of the level of j class loans which will be collected between t and $t + h$.

Substituting (30) into (29) yields:

$$(31) \quad G_t + \sum_{j=1}^m \lambda_j^L L_j + E[\Delta CD + \Delta B + (1-r)\Delta DD + (1-s)\Delta TD - \Delta \sum_{j=1}^m L_j - \lambda_4(1-r)DD - \lambda_5(1-s)TD] - \lambda_2 CD_t - \lambda_3 B_t - \Lambda \sigma = 0$$

Solving equation (30) for Λ , the measure of liquidity, yields:

$$(32) \quad \Lambda = \frac{1}{\sigma} \left[G_t + \sum_{j=1}^m \lambda_j^L L_j + E[\Delta CD + \Delta B + (1-r)\Delta DD + (1-s)\Delta TD] - \Delta \sum_{j=1}^m L_j - \lambda_4(1-r)DD - \lambda_5(1-s)TD \right] - \lambda_2^{CD}_t - \lambda_3^{B}_t$$

If we assume that the expectations are distributed with a known mean and variance, Λ is the only unknown in the equation and can be calculated.

Long-run Profits

Kane and Malkiel argue that the overall customer relationships is an important element that bankers must consider when making decisions about loan requests. They maintain that there exists a class of loan applications, L^* , such that:⁸

... a bank's L^* applicants are those depositor-borrowers whose custom is afforded an important and favorable role in calculations of its expected profit and aggregate risk exposure. They are customers whose past behavior is characterized by their tendency to maintain stable or improving relationships. To turn down their requests for loans is to introduce explicit and calculable risks of customer alienation.

The banker will be reluctant to alienate some customers by refusing to grant their loan requests because of the adverse effect that the denial will have on long-run profits. Kane and Malkiel make this point explicit:⁹

... refusal of L^* requests will also reduce the expected value of both short-run and long-run profits.

⁸Edward J. Kane and Burton G. Malkiel, "Bank Portfolio Allocation, Deposit Variability and the Availability Doctrine," Quarterly Journal of Economics, LXXIX (February, 1965), 120.

⁹Ibid., p. 120.

The bank's long-run profits are also affected by the growth and development of the community. The banker is free to differentiate amongst loan requests with respect to the impact that the use of the borrowed funds will have on regional economic development and hence, on the long-run profit position of the bank.

At any point in time the banker must concern himself with the viability of the bank as an on-going enterprise. The banker realizes that lending will not only affect the bank's short-run profit position but, in some cases, will enhance the bank's long-run profitability via improved customer relations and community development. Each individual loan, or class of loans, is thought to affect the bank's short-run profit, liquidity and soundness positions, and in addition it is postulated that there exists specific loans that will affect the bank's long-run profits. Long-run profits can be written as:

$$(33) \quad \pi_L = \pi_L(L)$$

By equation (4) $L = \sum_{j=1}^m L_j$; π_L can be written as:

$$(34) \quad \pi_L = \pi_L\left(\sum_{j=1}^m L_j\right)$$

and

$$(35) \quad d\pi_L = \sum_{j=1}^m \frac{\partial \pi_L}{\partial L_j} dL_j \quad j = 1, 2, \dots, m$$

where:

$$\frac{\partial \pi_L}{\partial L_j} \geq 0 \quad \text{for } j = 1, 2, \dots, m$$

The total change in long-run profits resulting from changes in the level of loans, is the sum of the changes in long-run profits attributable to changes in the level of loans in each individual loan class. Some classes of loans have no effect on long-run profits. For those cases $\frac{\partial \pi_L}{\partial L_j} = 0$.

The total differential of the utility function describes the changes in utility when any or all of the variables in the utility function change.

The total differential of the utility function may be expressed as:

$$(36) \quad dU = \frac{\partial U}{\partial \pi} d\pi + \frac{\partial U}{\partial S} dS + \frac{\partial U}{\partial \Lambda} d\Lambda + \frac{\partial U}{\partial \pi_L} d\pi_L$$

Given that FC is a constant, $d\pi$ is given by:

$$(37) \quad d\pi = gdG + \sum_{j=1}^m p_j dL_j - vdTD - bdB - cdCD$$

The total derivative of soundness is:

$$(38) \quad dS = W_2 dG + \sum_{j=1}^m W_j^L dL_j - W_4(1-s)dCD - W_5(1-s)dTD \\ - W_6(1-r)dDD - dB$$

If we assume σ constant, $E[\Delta CD + \Delta B + (1-r)\Delta DD + (1-s)\Delta TD - \Delta \sum_{j=1}^m L_j$

$- \lambda_4(1-r)DD - \lambda_5(1-s)TD]$ constant, and the maturity structure of the bank's portfolio constant ($\lambda_1, \lambda_2, \lambda_3$ constant), the total derivative of liquidity reduces to:

$$(39) \quad d\Lambda = \frac{1}{\sigma} [dG + \sum_{j=1}^m \lambda_j^L dL_j - \lambda_2 dCD - \lambda_3 dB]$$

The total derivative of $d\pi_L$ is given by equation (35).

Substituting equations (35), (37), (38) and (39) into (36) yields:

$$(40) \quad dU = \frac{\partial U}{\partial \pi} \left[gdG + \sum_{j=1}^m p_j dL_j - vdTD - bdB - cdCD \right] + \\ + \frac{\partial U}{\partial S} \left[W_2 dG + \sum_{j=1}^m W_j^L dL_j - W_4(1-s)dCD - W_5(1-s)dTD \right. \\ \left. - W_6(1-r)dDD - dB \right] + \frac{\partial U}{\partial \Lambda} \frac{1}{\sigma} \left[dG + \sum_{j=1}^m \lambda_j^L dL_j - \lambda_2 dCD - \lambda_3 dB \right]$$

$$+ \frac{\partial U}{\partial \pi_L} \left[\sum_{j=1}^m \frac{\partial \pi_L}{\partial L_j} dL_j \right]$$

Factoring equation (40) yields the following total derivative of the utility function:

$$(41) \quad \begin{aligned} dU + dG \left[\frac{\partial U}{\partial \pi} g + \frac{\partial U}{\partial S} w_2 + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} \right] - dTD \left[\frac{\partial U}{\partial \pi} v + \frac{\partial U}{\partial S} w_5(1-s) \right] \\ - dCD \left[\frac{\partial U}{\partial \pi} c + \frac{\partial U}{\partial S} w_4(1-s) + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} \lambda_2 \right] - dDD \left[\frac{\partial U}{\partial S} w_6(1-r) \right] \\ - dB \left[\frac{\partial U}{\partial \pi} b + \frac{\partial U}{\partial S} + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} \lambda_3 \right] \\ + dL_1 \left[\frac{\partial U}{\partial \pi} p_1 + \frac{\partial U}{\partial S} w_1^L + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} \lambda_1^L + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_1} \right] \\ + dL_2 \left[\frac{\partial U}{\partial \pi} p_2 + \frac{\partial U}{\partial S} w_2^L + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} \lambda_2^L + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_2} \right] \\ \vdots \\ \vdots \\ + dL_m \left[\frac{\partial U}{\partial \pi} p_m + \frac{\partial U}{\partial S} w_m^L + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} \lambda_m^L + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_m} \right] \end{aligned}$$

Equation (41) can be written as:

$$(42) \quad \begin{aligned} dU = dG \left[\frac{\partial U}{\partial \pi} g + \frac{\partial U}{\partial S} w_2 + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} \right] - dTD \left[\frac{\partial U}{\partial \pi} v + \frac{\partial U}{\partial S} w_5(1-s) \right] \\ - dCD \left[\frac{\partial U}{\partial \pi} c + \frac{\partial U}{\partial S} w_4(1-s) + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} \lambda_2 \right] - dDD \left[\frac{\partial U}{\partial S} w_6(1-r) \right] \\ - dB \left[\frac{\partial U}{\partial \pi} b + \frac{\partial U}{\partial S} + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} \lambda_3 \right] \\ + dL_j \left[\frac{\partial U}{\partial \pi} p_j + \frac{\partial U}{\partial S} w_j^L + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} \lambda_j^L + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_j} \right] \end{aligned}$$

for $j = 1, 2, \dots, k, \dots, m$

The desired level of loans is that level which yields the banker maximum utility under the constraints imposed by the bank's balance sheet identity. The necessary (first order) condition for utility maximization is that $dU = 0$ for all variations which satisfy the balance sheet identity.

$$(43) \quad dG + dL = (1-r) dDD + (1-s) dTD + (1-s)dCD + dB$$

which can be written as:

$$(44) \quad dG + \sum_{j=1}^m dL_j = (1-r)dDD + (1-s)dTD + (1-s)dCD + dB$$

Solving equation (44) for $\sum_{j=1}^m dL_j$ yields:

$$(45) \quad \sum_{j=1}^m dL_j = (1-r)dDD + (1-s)dTD + (1-s)dCD + dB - dG$$

Under the assumption that the bank is faced with an increase in loan demand from only one customer, a class k borrower, $\sum_{j=1}^m dL_j = dL_k$

and (45) can be written as:

$$(46) \quad dL_k = (1-r) dDD + (1-s)dTD + (1-s)dCD + dB - dG$$

Substituting (46) into (42) imposes the condition of the balance sheet identity on the model and yields:

$$(47) \quad \begin{aligned} dU = & dG \left[\frac{\partial U}{\partial \pi} g + \frac{\partial U}{\partial S} w_2 + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} \right] - dTD \left[\frac{\partial U}{\partial \pi} v + \frac{\partial U}{\partial S} w_5 (1-s) \right] \\ & - dCD \left[\frac{\partial U}{\partial \pi} c + \frac{\partial U}{\partial S} w_4 (1-s) + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} \lambda_2 \right] - dDD \left[\frac{\partial U}{\partial S} w_6 (1-r) \right] \\ & - dB \left[\frac{\partial U}{\partial \pi} b + \frac{\partial U}{\partial S} + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} \lambda_3 \right] \\ & + \left[(1-r)dDD + (1-s)dTD + (1-s)dCD + dB - dG \right] \\ & \left[\frac{\partial U}{\partial \pi} p_k + \frac{\partial U}{\partial S} w_k^L + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} \lambda_k^L + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} \right] \end{aligned}$$

Factoring and simplifying equation (47) results in:

$$(48) \quad \begin{aligned} dU = & dG \left[\frac{\partial U}{\partial \pi} (g - p_k) + \frac{\partial U}{\partial S} (w_2 - w_k^L) + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} (1 - \lambda_k^L) - \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} \right] \\ & + dTD \left[\frac{\partial U}{\partial \pi} (p_k - v - p_k s) \frac{\partial U}{\partial S} (w_k^L - w_5) (1-s) + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} \lambda_k^L + \right. \\ & \left. \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} (1-s) \right] \end{aligned}$$

$$\begin{aligned}
& + dCD \left[\frac{\partial U}{\partial \pi} (p_k - c - p_k s) + \frac{\partial U}{\partial S} (w_k^L - w_4^L) (1-s) + \frac{\partial U}{\partial \Lambda} \frac{1}{\sigma} (\lambda_k^L - \lambda_2^L - \lambda_k^L s) \right. \\
& \left. + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} (1-s) \right] \\
& + dDD \left[\frac{\partial U}{\partial \pi} p_k + \frac{\partial U}{\partial S} (w_k^L - w_6^L) + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} \right] (1-r) \\
& + dB \left[\frac{\partial U}{\partial \pi} (p_k - b) + \frac{\partial U}{\partial S} (w_k^L - 1) + \frac{\partial U}{\partial \Lambda} \frac{1}{\sigma} (\lambda_k^L - \lambda_3^L) + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} \right]
\end{aligned}$$

The first order conditions for utility maximization require that $dU = 0$ for all variations in the independent variables. Thus each quantity in brackets in (48) must equal zero.

$$(49) \quad \left[\frac{\partial U}{\partial \pi} (g - p_k) + \frac{\partial U}{\partial S} (w_2^L - w_k^L) + \frac{\partial U}{\partial \Lambda} \frac{1}{\sigma} (1 - \lambda_k^L) - \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} \right] = 0$$

$$(50) \quad \left[\frac{\partial U}{\partial \pi} (p_k - v - s p_k) + \frac{\partial U}{\partial S} (w_k^L - w_5^L) (1-s) + \frac{\partial U}{\partial \Lambda} \frac{1}{\sigma} \lambda_k^L \right. \\ \left. + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} (1-s) \right] = 0$$

$$(51) \quad \left[\frac{\partial U}{\partial \pi} (p_k - c - s p_k) + \frac{\partial U}{\partial S} (w_k^L - w_4^L) (1-s) + \frac{\partial U}{\partial \Lambda} \frac{1}{\sigma} (\lambda_k^L - \lambda_2^L - s \lambda_k^L) \right. \\ \left. + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} (1-s) \right] = 0$$

$$(52) \quad \left[\frac{\partial U}{\partial \pi} p_k + \frac{\partial U}{\partial S} (w_k^L - w_6^L) + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} \right] (1-r) = 0$$

$$(53) \quad \left[\frac{\partial U}{\partial \pi} (p_k - b) + \frac{\partial U}{\partial S} (w_k^L - 1) + \frac{\partial U}{\partial \Lambda} (\lambda_k^L - \lambda_3^L) + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} \right] = 0$$

The first-order conditions of equations (49) through (53) give the bankers general equilibrium response to an increase in loan requests. They give the relations which must hold in the general case when the banker is faced with an increase in demand for loans. In order to discover the relations considered by the banker when deciding amongst the various means of adjusting to the desired level of lending, alternative restrictions will

be imposed on the model.

If we assume that the banker is faced with an increase in loan demand and he considers making up the increase in demand by selling government securities, the balance sheet identity requires that:

$$(54) \quad dL_k = -dG$$

The change in utility is given by:

$$(55) \quad dU = dL_k \left[\frac{\partial U}{\partial \pi} p_k + \frac{\partial U}{\partial S} w_k^L + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} \lambda_k^L + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} \right] \\ + dG \left[\frac{\partial U}{\partial \pi} g + \frac{\partial U}{\partial S} + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} \right]$$

and since $dL_k = -dG$ by (54), (55) can be written as:

$$(56) \quad dU = -dG \left[\frac{\partial U}{\partial \pi} p_k + \frac{\partial U}{\partial S} w_k^L + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} \lambda_k^L + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} \right] \\ + dG \left[\frac{\partial U}{\partial \pi} g + \frac{\partial U}{\partial S} w_2 + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} \right]$$

which reduces to:

$$(57) \quad dU = dG \left[\frac{\partial U}{\partial \pi} (p_k - g) + \frac{\partial U}{\partial S} (w_k^L - w_2) + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} (\lambda_k^L - 1) \right. \\ \left. + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} \right]$$

the first order conditions require that:

$$(58) \quad \frac{\partial U}{\partial \pi} (p_k - g) + \frac{\partial U}{\partial S} (w_k^L - w_2) + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} (\lambda_k^L - 1) + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} = 0$$

If we make a realistic assumption that the interest rate on loans is greater than the government securities rate of interest, p_k is greater than g and $\frac{\partial U}{\partial \pi}$ is positive. w_2 is considered greater than w_k^L , therefore $\frac{\partial U}{\partial S}$ is negative. Not all classes of loans contribute to long-run profits, so that $\frac{\partial \pi_L}{\partial L_k} \geq 0$. $\frac{\partial \pi_L}{\partial L_k} \geq 0$ implies that $\frac{\partial U}{\partial \pi_L} \geq 0$ according as the

inequality is read from the top down.

Equation (58) implies that loans will be made if the positive utility received from short-run profits, and possibly long-run profits, offsets the disutility incurred from soundness and liquidity considerations. From the relations implied by (59), one could reasonably infer that bankers with "sounder" borrowers and with borrowers who are in a position to contribute to the long-run profitability of the bank will grant more loan requests, than bankers with less advantaged customers.

Expressions similar to (58) can be written for situations in which the banker adjusts his position using each of the other possible sources available to him. The possibilities are: $dL_k = (1-r)dDD$, $dL_k = (1-s)TD$, $dL_k = (1-s)dCD$ and $dL_k = dB$. The expressions are respectively:

$$(59) \quad \frac{\partial U}{\partial \pi} p_k + \frac{\partial U}{\partial S} (w_k^L - w_6) + \frac{\partial U}{\partial \Lambda} \frac{1}{\sigma} \lambda_k^L + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} = 0$$

$$(60) \quad \frac{\partial U}{\partial \pi} \frac{p_k - v - sp_k}{1-s} + \frac{\partial U}{\partial S} (w_k^L - w_5) + \frac{\partial U}{\partial \Lambda} \frac{1}{\sigma} \lambda_k^L + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} = 0$$

$$(61) \quad \frac{\partial U}{\partial \pi} \frac{p_k - c - sp_k}{(1-s)} + \frac{\partial U}{\partial S} (w_k^L - w_4) + \frac{\partial U}{\partial \Lambda} \frac{1}{\sigma} \lambda_k^L + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} = 0$$

$$(62) \quad \frac{\partial U}{\partial \pi} (p_k - b) + \frac{\partial U}{\partial S} (w_k^L - 1) + \frac{\partial U}{\partial \Lambda} \frac{1}{\sigma} (\lambda_k^L - \lambda_3) + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} = 0$$

When a banker is faced with an increase in demand for loans, he is not constrained to increase his reserves from only one source of funds as was done in deriving expressions (58) through (62). He can adjust his position with any combination of sources available to him.

If the banker wishes to increase his lending by selling government securities and selling certificates of deposit, the balance sheet requires that:

$$(63) \quad dL_k = (1-s)dCD - dG$$

The change in utility is given by:

$$(64) \quad dU = dL_k \left[\frac{\partial U}{\partial \pi} p_k + \frac{\partial U}{\partial S} w_k^L + \frac{\partial U}{\partial \Lambda} \frac{1}{\sigma} \lambda_k^L + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} \right] \\ + dG \left[\frac{\partial U}{\partial \pi} g + \frac{\partial U}{\partial S} w_2 + \frac{\partial U}{\partial \Lambda} \frac{1}{\sigma} \right] \\ - dCD \left[\frac{\partial U}{\partial \pi} c + \frac{\partial U}{\partial S} (1-s)w_4 + \frac{\partial U}{\partial \Lambda} \frac{1}{\sigma} \lambda_2 \right]$$

Substituting $(1-s)dCD - dG$ for dL_k in (64) and simplifying yields:

$$(65) \quad dU = dCD \left[\frac{\partial U}{\partial \pi} p_k (1-s) - c + \frac{\partial U}{\partial S} w_k^L (1-s) - w_4 (1-s) \right. \\ \left. + \frac{\partial U}{\partial \Lambda} \frac{1}{\sigma} \lambda_k^L (1-s) - \lambda_2 + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} (1-s) \right] \\ + dG \left[\frac{\partial U}{\partial \pi} (g - p_k) + \frac{\partial U}{\partial S} (w_2 - w_k^L) + \frac{\partial U}{\partial \Lambda} \frac{1}{\sigma} (1 - \lambda_k^L) + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} \right]$$

The first order conditions are:

$$(66) \quad \frac{\partial U}{\partial \pi} p_k (1-s) - c + \frac{\partial U}{\partial S} w_k^L (1-s) - w_4 (1-s) + \frac{\partial U}{\partial \Lambda} \frac{1}{\sigma} \lambda_k^L (1-s) - \lambda_2 \\ + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} (1-s) = 0$$

$$(67) \quad \frac{\partial U}{\partial \pi} (g - p_k) + \frac{\partial U}{\partial S} (w_2 - w_k^L) + \frac{\partial U}{\partial \Lambda} \frac{1}{\sigma} (1 - \lambda_k^L) + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} = 0$$

The first order conditions can be written as:

$$(68) \quad \frac{\partial U}{\partial \pi} p_k (1-s) - c + (p_k - g) + \frac{\partial U}{\partial S} w_k^L (1-s) - w_4 (1-s) + (w_k^L - w_2) \\ + \frac{\partial U}{\partial \Lambda} \frac{1}{\sigma} \lambda_k^L (1-s) - \lambda_2 + (\lambda_k^L - 1) + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} (2 - e) = 0$$

Expressions similar to (68) can be written for situations in which the banker adjusts his position with other combinations of sources available to him. The possibilities considered here are: $dL_k = -dG + dB$ and $dL_k = (1-s)dCD + B$. The expressions are respectively:

$$(69) \quad \frac{\partial U}{\partial \pi} \left[(p_k - b) + (p_k - g) \right] + \frac{\partial U}{\partial S} \left[(w_k^L - 1) + (w_k^L - w_2) \right] \\ + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} \left[(\lambda_k - \lambda_4) + (\lambda_4 - 1) \right] + 2 \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} = 0$$

$$(70) \quad \frac{\partial U}{\partial \pi} \left[p_k(1-s) - c + (p_k - b) \right] + \frac{\partial U}{\partial S} \left[w_k^L(1-s) - w_4(1-s) + (w_k^L - 1) \right] \\ + \frac{\partial U}{\partial \lambda} \frac{1}{\sigma} \left[\lambda_k^L(1-s) - \lambda_2 + (\lambda_k^L - \lambda_3) \right] + \frac{\partial U}{\partial \pi_L} \frac{\partial \pi_L}{\partial L_k} (2-s) = 0$$

Equations (68), (69) and (70) identify the variables which a banker must evaluate when he considers increasing his desired level of lending by the combinations: selling certificates of deposits and government securities, borrowing and selling government securities, and borrowing and selling certificates of deposit. The variables are: $[p_k(1-s) - c + (p_k - g)]$, $[w_k^L(1-s) - w_4(1-s) + (w_k^L - w_2)]$, $[\lambda_k^L(1-s) - \lambda_2 + (\lambda_k^L - 1)]$, e , $\frac{1}{\sigma}$, $\frac{\partial U}{\partial \pi}$, $\frac{\partial U}{\partial S}$ and $\frac{\partial U}{\partial \lambda}$.

Regardless of what combination of sources of funds a utility maximizing banker chooses in determining his desired level of lending, he must weigh the total effects of the proposed transactions on his utility. That is, he must consider the impact the lending will have on the bank's short-run profits, soundness position, liquidity position and long-run profits.

CHAPTER III:
THE EXPERIMENTAL DESIGN

The theoretical model developed in the previous section implies that if a regional differential impact of monetary policy exists, it will manifest itself in lending behavior of bankers. When money becomes scarce, bankers with the economically advantaged customers will grant more requests for loans than bankers with weaker customers. The bankers with the strong customers will forego the purchase of securities and also will borrow money in order to satisfy customer requests for loans. Bankers with marginal customers will not sell securities or borrow money in order to satisfy the demand for loans.

The hypothesis that, during periods of tight money, there is relatively less lending in small rural areas than in large metropolitan areas ultimately turns on the willingness of banks to satisfy individuals requests for loans. Ideally a test of the hypothesis should be based on data describing: changes in individual bank portfolios, the characteristics of individual borrowers, and the terms of each individual loan. Such detailed data was not available for this study.¹ Although data of the individual decision makers (lenders and borrowers) could not be found, the Federal Deposit Insurance Corporation's Bank Operating Statistics does provide bank portfolio data disaggregated on a regional basis. It was this data that was used to test the regional differential impact hypothesis.

¹An unsuccessful attempt was made to obtain the Federal Reserve System data that was used for the major studies it conducted on commercial and industrial loans in 1955 and 1957. Bank disclosure laws made it impossible to use the data for this study.

In States that do not have statewide branch banking, bank portfolio statistics are given for each of the local areas in the state. The FDIC defines local areas as:²

The area definition most frequently used in this report is the State Economic Area (SEA), described by the Bureau of Census as a county or group of counties, within a state, which are homogeneous in general livelihood and socio-economic characteristics. Where there is sufficient overlapping of branch banking systems among SEAs, these areas have been combined to make one larger area.

The FDIC has compiled bank portfolio statistics for the years 1967, 1968, 1969 and 1970. Many of the definitions of specific loan categories and securities-held categories were revised at various times, particularly in 1968. The revisions make yearly comparisons prior to 1969 difficult. While the statistics that were used in this study will be described in the subsequent section, the following is a sample of the data published in

Bank Operating Statistics:

- (1) the value of government securities held by banks in each local area
- (2) the value of state and municipal obligations held by banks in each local area
- (3) the value of loans made by banks in each local area by type of loan such as commercial and industrial loans, agriculture loans, real estate loans and loans to individuals.

Annual percentage increases in these variables are also given. Although the problem of aggregation is not completely solved, the Federal Deposit Insurance Corporation statistics do allow stratification by region, which is the central focus of this investigation.

²Federal Deposit Insurance Corporation, Bank Operating Statistics, explanatory notes.

In order to discover the effects of monetary ease and stringency on bank lending in regions of different population size, it is necessary to categorize and define the local areas by two distinctly different criteria. First, the local areas must be identified by their population size to allow stratification of the sample by population size. Secondly, they must be identified according to the degree of monetary tightness or ease which they are experiencing to allow stratification according to monetary ease and tightness.

Although this study is primarily concerned with comparing and contrasting the effects of monetary policy on large metropolitan centers and on the small hinterlands, the data also lends itself to the investigation of the impact of monetary policy on areas which fall in the middle range, those urban areas which lie in the middle of the spectrum between the huge metropolitan centers and the small rural places. Any criterion chosen to designate an area as either metropolitan, urban, or rural will of necessity be somewhat arbitrary. There are no clear-cut definitions which are suitable for all studies.

The areas defined in the FDIC's Bank Operating Statistics are composed of socioeconomic homogeneous counties. In this study, an FDIC local area was defined to be "metropolitan" if the population of its largest county exceeded 500,000 in the 1970 census. A local area was designated as "urban" if the population of its largest county was less than 500,000 but greater than 150,000. All other local areas were classified as "rural".

The definitions were in part dictated by the needs of the study. It would have been preferable to be able to include only the very largest

areas in the population of metropolitan areas. Admittedly, the disparity in size between an area whose largest county contains a population of 500,000 and the industrial centers of New York and Chicago is great. However, if only the large megalopolises were included in the population of metropolitan areas, there would have been too few observations to do any meaningful statistical analysis. As it is, this definition yielded a population of only forty metropolitan areas from which to sample.

With the areas defined according to a size criteria, the next step is to delineate the areas according to their degree of monetary ease or stringency. Once each area can be defined by these two classifications, a sample can be stratified to yield observations on: metropolitan areas experiencing tight monetary conditions (TM areas), metropolitan areas experiencing relatively easier monetary conditions (EM areas), urban areas under tight money conditions (TU areas), urban areas experiencing easier monetary conditions (EU areas), rural areas experiencing tight monetary conditions (TR areas), and finally rural areas under easier monetary conditions (ER areas). Such a stratification allows for the development of statistical models designed to test the relative effectiveness of tight money on bank lending in metropolitan, rural and urban regions.

Measures of Bank Tightness

While the classification of regions as either metropolitan, urban or rural was difficult, classifying them as "tight money" or "easy money" regions is a much more formidable task. Objective measures for such a classification are difficult to define. Whether or not a bank is tight or loose for lending purposes is a subjective decision that is made by

the banker. Because of the subjective nature of the lending decision, Bach and Huizenga reject the normally used measures, excess reserves and free reserves, as indicators of bank tightness or looseness.³

For explaining banker (lender) behavior, how tight a bank is depends on how tight the banker (decision-maker) feels it is. One bank may be extremely tight for lending purposes, even though it has a large volume of excess reserves and liquid securities, if the banker believes that these reserves and securities are essential to the sound operation of the bank. Another bank may be loose for lending purposes even though it has very small excess reserves and only a modest supply of liquid securities, if the banker feels that he nevertheless has more reserves and securities than he needs for normal operating purposes (assuming that he is within standard examination regulations). Thus, standard measures like excess reserves and free reserves are not reliable measures of a banks tightness for lending purposes.

Bach and Huizenga suggest that percentage changes in deposits is an adequate measure of change in bank tightness.⁴

For the individual bank as distinguished from the banking system, it is primarily gain or loss of deposits which makes the banks looser or tighter for new lending and investment. Therefore, the simplest measure of whether an individual bank is growing looser or tighter is the extent to which it is gaining or losing reserves.

The percentage change in deposits is the criteria which will be used here to designate whether a region is becoming looser or tighter.

Ideally, it would be best for the purposes of this study to choose areas for the sample from different geographical locations for each of the six categories. In other words, each of the individual units in the TM, TU, TR, EM, EU, and ER categories would be from different geographical locations, with no one location contributing more than one observation to

³Bach and Huizenga, "Differential Impact", p. 54.

⁴Ibid., p. 56.

any category. The problem of one geographical area dominating any particular category would be prevented. Thus it could be said with more assurance that the results of this study hold for metropolitan, urban and rural regions in general, rather than, say, only for metropolitan areas on the east coast. Unfortunately, the small population of metropolitan and urban areas prevented the selection of metropolitan and urban areas for the sample on anything other than the percentage change in deposits criteria.

Percentage changes in deposits from 1969 to 1970 were calculated for each of the local areas. The areas in the metropolitan and urban categories were ranked from high to low according to the percentage increase in deposits. The ten metropolitan areas and ten urban areas with the smallest increase in deposits were chosen for the sample to represent metropolitan and urban regions under tight monetary conditions - categories TM and TR respectively. Likewise, the ten metropolitan and ten urban areas with the greatest increase in deposits were chosen for the sample to represent metropolitan and urban areas under easier monetary conditions - categories EM and EU respectively. Rural areas of comparable percentage changes in deposits as the TM areas were chosen to represent rural areas under tight monetary conditions - category TR. Rural areas of comparable percentage increase in deposits as EM areas were chosen for the sample to represent rural areas under easier monetary conditions - category ER.

The national average increase in deposits from 1969 to 1970 was 10.3%. The average increase in deposits for regions designated as tight was 4.10% and the average for regions designated as loose was 17.4%.

Whether a difference of 13.3% increase in deposits is enough to differentiate between "tight" and "loose" regions cannot be answered a priori. But hopefully it will be enough to enable statistical tests to pick up any meaningful differences that may exist in regional bank lending behavior during periods of tight and easy money. This study assumes that consumer demand patterns within region size categories are essentially the same. It is assumed, for example, that the demand for credit in tight rural areas is the same for easy rural areas. Furthermore, it is also assumed that differences in changes in deposits among areas is attributable to changes in the rate of growth of the money supply resulting from the actions of the monetary authorities. Strictly speaking changes in deposits could result from changing economic conditions within a region which also would effect demand. The specific areas chosen for the sample are given in the Appendix.

The Statistical Model

In order to determine if a differential exists, an analysis of variance experiment was performed to compare regional bank portfolios under conditions of tight money with those under easier monetary conditions.

The model is of the following form:

$$(71) \quad Y_{ijk} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \epsilon_{ijk}$$

where α_i is the added effect of the i th A treatment ($i = 1, 2, \dots, a$); β_j is the added effect of the j th B treatment ($j = 1, 2, \dots, b$). $(\alpha\beta)_{ij}$ is the added effect of the interaction of the i th A treatment and j th B treatment. ϵ_{ijk} is the experimental error and the only random component on the right hand side of equation (71). The factors α_i , β_j and $(\alpha\beta)_{ij}$

are assumed to be fixed and ϵ_{ijk} has an expected value of zero and variance σ_e^2 . Y_{ijk} is the k th observation of variable Y under treatment combination $A_i B_j$ ($k = 1, 2, \dots, n$). In this experiment, $i = (1, 2)$; $j = (1, 2, \dots, 10)$; A = monetary factor; B = region size factor; and:

a = the total number of levels of factor A

b = the total number of levels of factor B

where:

a_1 = easier monetary conditions

a_2 = tight monetary conditions

b_1 = metropolitan areas

b_2 = urban areas

b_3 = rural areas

The expected values of mean squares and tests of hypothesis for the experiment are given in Table 3.1.

Table 3.1 Expected Values of Mean Squares

Source of Variation	E(MS)	Hypothesis being tested	F ratios
Main effect of factor A	$\sigma^2 + \frac{kb\sum\alpha^2}{a-1}$	$H_0: \sum_i \alpha_i = 0$	MS_a / MS_{error}
Main effect of factor B	$\sigma^2 + \frac{ka\sum\beta^2}{b-1}$	$H_0: \sum_j \beta_j = 0$	MS_b / MS_{error}
AXB interaction	$\sigma^2 + \frac{k\sum(\alpha\beta)^2}{(a-1)(b-1)}$	$H_0: \sum_{ij} (\alpha\beta)_{ij} = 0$	$MS_{ab} / MS_{\text{error}}$
error	σ^2		

Of special interest is the AB interaction which measures the failure of the response to A, monetary ease and tightness, to be the same for each level of B, the size of region. Ten different bank portfolio variables were tested to determine if differences in A on metropolitan areas (b_1), urban areas (b_2), and rural areas (b_3) are statistically significant. The test of the simple effect of A on b_1 determines if there are any significant differences between tight metropolitan areas and easy metropolitan areas. Likewise, the test of the simple effect of A on b_2 (b_3) determines if there are any significant differences between tight urban (rural) areas.

Tests on four security asset variables and on six loan variables were performed to determine if bank lending and bank purchases of securities in tight money regions is significantly different than in easier money regions. Heterogeneity of the variances within regions necessitated that the variables be measured in percentage changes. As with percentage changes in deposits, the following variables are measured as percentage changes from 1969 to 1970:

- (1) U.S. Treasury Securities
- (2) Other U.S. Government Agency Securities
- (3) Obligations of States and Municipalities
- (4) Other Securities
- (5) Residential Real Estate Loans
- (6) Other Real Estate Loans
- (7) Commercial and Industrial Loans
- (8) Agriculture Loans

(9) Loans to Individuals to Purchase Automobiles

(10) Other Loans to Individuals

If it is true that the larger regions have the sounder borrowers, the theory suggests that increases in the purchases of securities in general, and specifically U.S. government securities, should be significantly less in tight metropolitan areas than in easy metropolitan areas. Increases in commercial and industrial loans should not be significantly different in tight and easy metropolitan areas.

It is expected that banks in rural areas with their weaker business customers will not be as anxious to satisfy requests for commercial and industrial loans. Tests should reveal no statistical difference in the purchase of securities between tight and easy rural areas and significantly less commercial and industrial lending in tight rural areas than in easy rural areas is expected. In view of the importance of customer relations to the bank's long-run survival, agricultural loans, which are most important to rural bankers, are expected to be less affected by tight money conditions.

Urban banks undoubtedly have stronger customers than rural banks, although they probably do not have sounder customers than metropolitan banks. If the urban areas are more like metropolitan areas than they are like rural areas, increases in the purchases of securities should be significantly less in tight urban areas than in easy urban areas. Likewise tight money should not significantly effect commercial and industrial loans. Agriculture loans are probably not the most important loan category for urban bankers. It is expected that increases in agriculture

loans will be significantly less in tight urban areas than in easy urban areas. Loans to individuals in all regions should be very responsive to tight monetary conditions. The difference in increases in loans to individuals in tight money regions is expected to be significantly less than that in easy money regions. When money becomes scarce bankers in metropolitan, urban and rural areas will reduce their loans to individuals in order to satisfy their regular business customers.

CHAPTER IV:
THE EMPIRICAL RESULTS

Brief Overview of the Findings

For the most part, the empirical test results conformed to expected results suggested by the theoretical model of Chapter II. It was expected that tight money conditions would press more heavily on bank lending in smaller regions than in larger regions. The percentage increase in commercial and industrial loans in both tight rural areas and tight urban areas was significantly less than in easy rural areas and easy urban areas respectively. Although the average percentage change in commercial and industrial loans was negative for tight metropolitan areas and positive for easy metropolitan areas, the difference was not statistically significant. It seems that tight money conditions has a little or no impact on commercial and industrial loans in metropolitan areas.

Agriculture loans in either metropolitan, rural or urban regions did not seem to be affected by tight money conditions. When money becomes scarce, rural bankers can be expected to favor their agricultural customers and take special measures to keep this category of borrowers satisfied. However, one would not expect this to be the case for metropolitan and urban bankers. If monetary conditions had been tighter during this period, perhaps the banks in the large industrial centers would have shut out the agricultural borrowers in favor of commercial and industrial customers as expected.

In all three regions, metropolitan, urban, and rural, consumer automobile loans were very responsive to tight money conditions. In each

case the average percentage change in consumer automobile loans was negative for tight money regions and positive for easy money regions. In view of the importance of the bank's continuing customer relations with its important business borrowers and soundness considerations, it is not surprising to find that requests for consumer automobile loans are the most likely to be denied when money becomes scarce.

Bank lending for the two categories of real estate loans, residential real estate loans, which includes multi-family properties and "other" real estate loans, which includes industrial and business real estate loans, was not much different in tight regions than in easy regions. Tight metropolitan and tight rural areas were not statistically different than easy metropolitan areas and easy rural areas in either of the two real estate loan categories. The percent change in "other real estate loans" was significantly less in tight urban areas than in easy urban areas. The same occurred for residential real estate loans in urban areas. The percent change in tight urban areas was significantly less than in easy urban areas. Apparently tight money more readily curtails urban residential construction than either metropolitan or rural residential construction.

The average percentage increase in securities held by banks was significantly less in tight metropolitan areas than in easy metropolitan areas for three of the four security asset categories. The average percentage increase in securities held by urban banks was significantly less in tight urban areas than in easy urban areas for two of the four security asset categories. The average percentage increase in securities held by tight rural banks was not significantly different than easy rural banks

for any of the four security asset categories tested. It seems that the larger the region the more willing the banks are to hold fewer securities during tight money in order to grant loan requests. Rural banks are the least willing to forego purchase of securities when money gets tight. If it can be inferred that rural bankers have weaker customers than urban or metropolitan bankers, the rural bankers are behaving rationally by not taking special measures to grant loans to weak business customers.

The Empirical Test Results

Results of the statistical tests are to be found in Tables 2 through 4 in the Appendix. Test results of the analysis of variance of the interaction model $Y_{ijk} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \epsilon_{ijk}$ are given in Table 2. The results of the analysis of variance of the simple main effects are given in Table 3. Interaction means are found in Table 4.

In contrast to the behavior of banks in metropolitan and urban areas, an examination of the test results reveals that the percentage increase in the holdings of securities in tight rural banks was not significantly less than in easy rural banks. Fig. 4.1 below, a geometric representation of the interactions of monetary conditions and region size, shows that the effects of tight and easy money for the variable Percentage Increase in Holdings of U.S. Treasury Securities is more pronounced in metropolitan and urban areas than in rural areas.

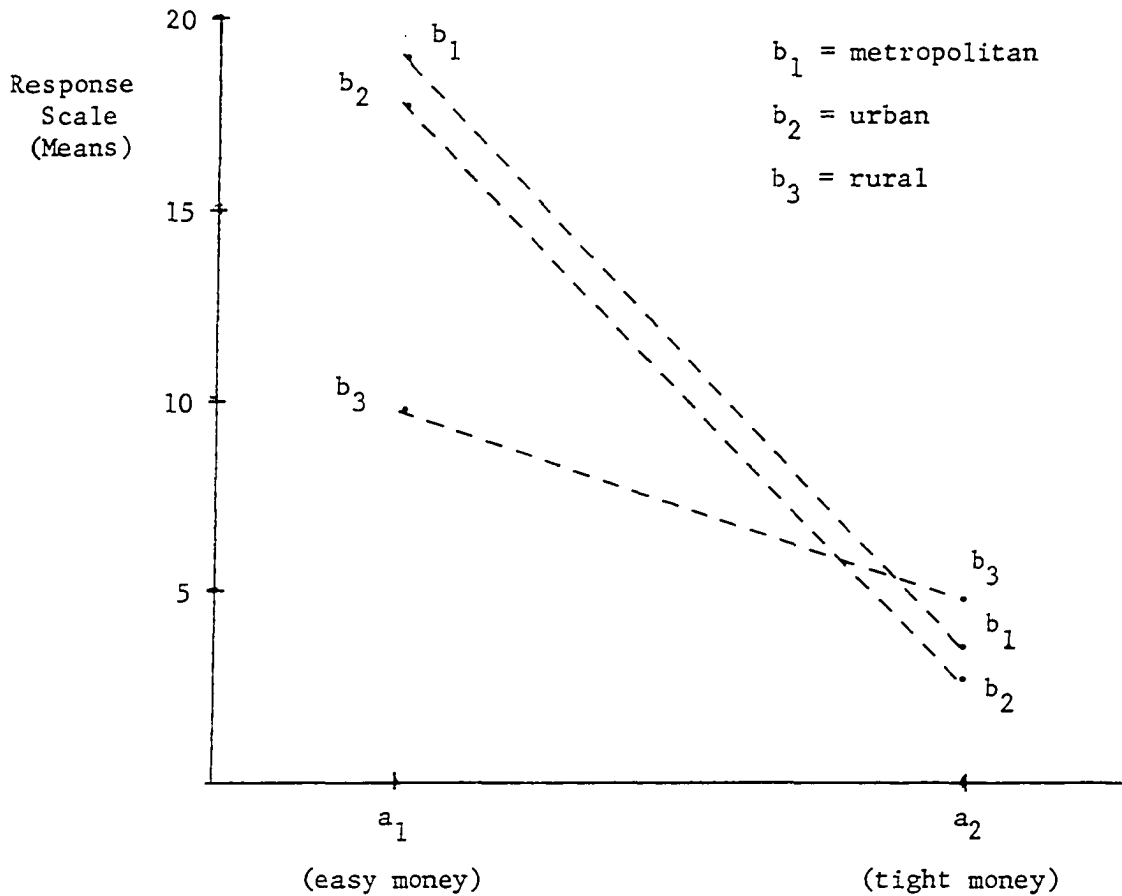


Fig. 4.1. Interaction for Percentage Change in Holdings of U.S. Treasury Securities

As Fig. 4.1 illustrates, there is a difference in the magnitude of regional response to tight money. Tests of the simple main effects of monetary conditions, Factor A, on metropolitan regions (b₁), urban regions (b₂) and rural regions (b₃) showed that: the simple effects of A on b₁ and b₂ was significant at 0.01 level. However, the effect of A on b₃ was insignificant.

Similar results were obtained for the variable, Percentage Increase in the Holdings of Obligations of States and Municipalities. Again, as Fig. 4.2 illustrates, there is a difference in the magnitude of the

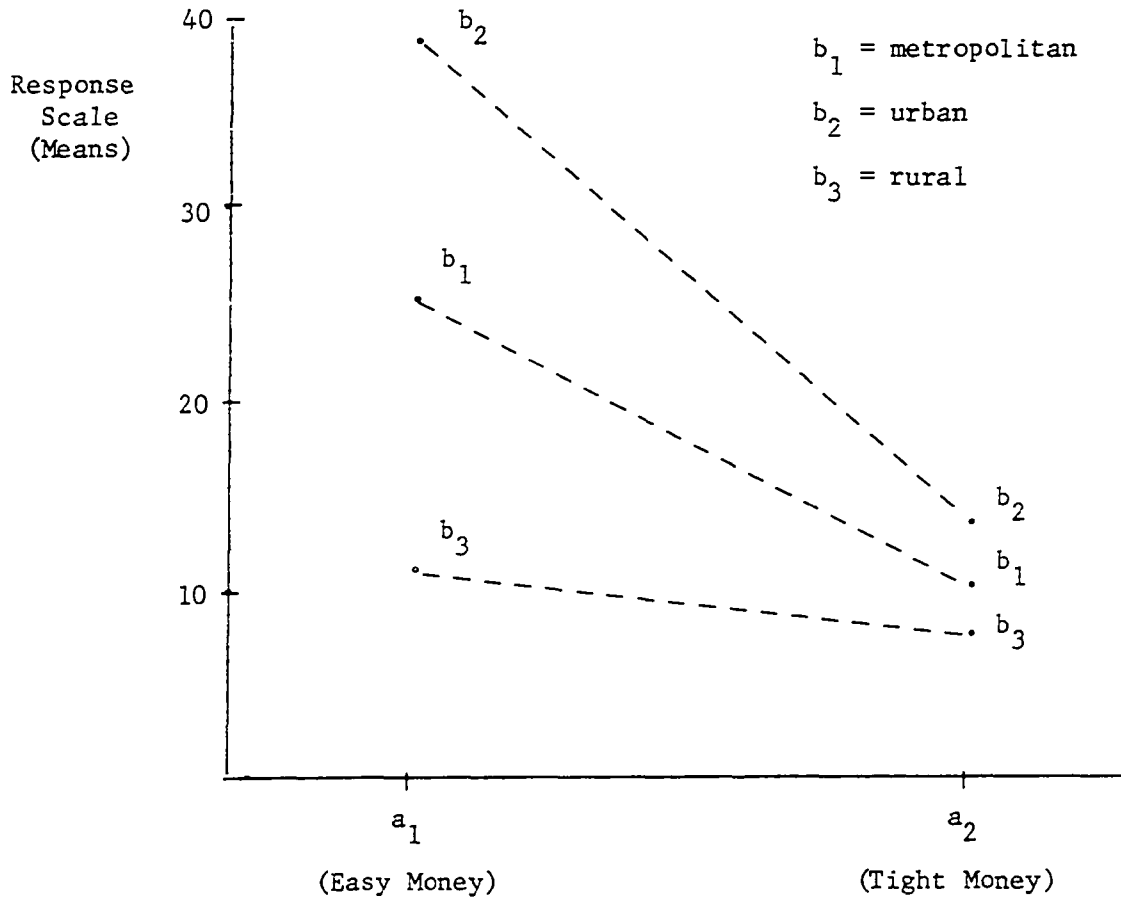


Fig. 4.2. Interaction for Percentage Change in Holdings of Obligations of States and Municipalities

regional response to tight money conditions. The increase in bank holdings of state and municipal obligations was significantly less in tight metropolitan and tight urban areas than in easy metropolitan and easy urban areas respectively. Although the percentage increase was less for tight rural areas than for easy rural areas, the difference was not statistically significant.

The simple main effects of monetary conditions (A) on metropolitan and urban areas was significant at the 0.01 level. The test of simple main effects of A on b_3 did not reveal any significant differences.

The variable, Percentage Increase in Holdings of Other U.S. Agency Securities, exhibited a different differential response than the first two security asset variables tested. The simple main effect of monetary conditions on metropolitan areas proved to be significant at the 0.10 level, but the simple main effects of monetary conditions on urban and rural areas was statistically insignificant. The simple main effect on urban and rural areas was statistically insignificant. In this case, as Fig. 4.3 indicates, there is a change in direction as well as a change in the magnitude of response. The average percent increase in Holdings of Other U.S. Agency Securities was greater for tight metropolitan areas than for easy metropolitan areas. This response is the opposite of urban and rural response.

It appears that tight metropolitan banks are willing to hold fewer U.S. treasury securities and fewer state and municipal bonds, but they will hold more securities of other U.S. government agencies than easy metropolitan banks. As a percentage of securities held, securities of other U.S. government agencies is quite small, and the overall response of tight metropolitan banks is to hold fewer securities than easy metropolitan banks.

The variable, Percentage Change in Other Securities, which as far as can be ascertained from the explanatory notes in Bank Operating Statistics is simply the percentage change in corporate bonds held by banks, was immune to changes in monetary conditions. There was no statistical difference between any of the tight money and easy money regions. The simple effects of monetary conditions on metropolitan, urban, and rural regions was statistically insignificant.

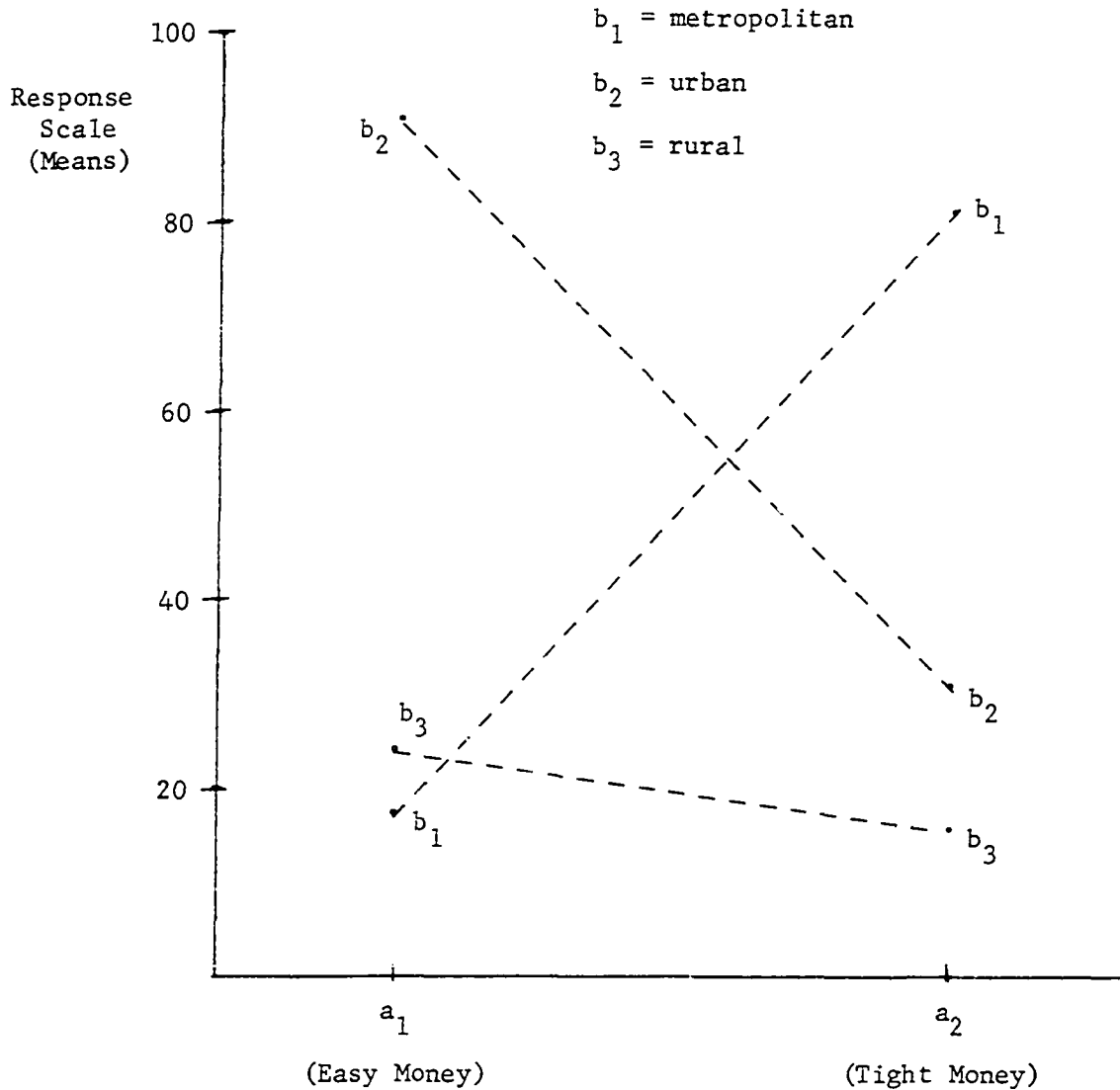


Fig. 4.3. Interaction for Percentage Change in Holdings of Other U.S. Government Agency Securities

Agricultural loans were also shown to be somewhat unresponsive to monetary conditions. The simple main effects of monetary conditions on region size were statistically insignificant. There was no indication of a differential impact in this loan category.

Neither was there a differential impact with respect to consumer automobile loans. Metropolitan, urban, and rural regions all responded in

much the same way. The average percentage change in consumer automobile loans was negative in each of the tight money regions. The simple main effects of money on metropolitan, urban, and rural regions was significant at the 0.01 level. It appears that bankers in all regions reduce the number of consumer automobile loans significantly when money gets tight.

The percentage change in commercial and industrial loans in tight metropolitan areas was essentially the same as easy metropolitan areas. The simple main effects of monetary conditions on metropolitan areas was statistically insignificant. The percentage change in commercial and industrial loans was significantly less for tight urban areas and tight rural areas than for easy urban areas and easy rural areas. Fig. 4.4 illustrates these relations. The simple main effects of money on urban areas was significant at the 0.05 level. The test of the simple main effect of money on rural areas revealed significant differences between tight rural areas and easy rural areas at the 0.01 level.

The F scores of the simple main effects of monetary conditions on metropolitan areas and on rural areas were statistically insignificant. The same results held for the variable other real estate loans. The simple effects of A on metropolitan areas and rural areas was not significant. The simple main effects of monetary conditions on urban areas was significant at the 0.01 level for residential real estate loans and at the 0.05 level for other real estate loans. The percentage increase in both categories of real estate loans was significantly less in urban areas experiencing tight monetary conditions than urban areas experiencing easier monetary conditions.

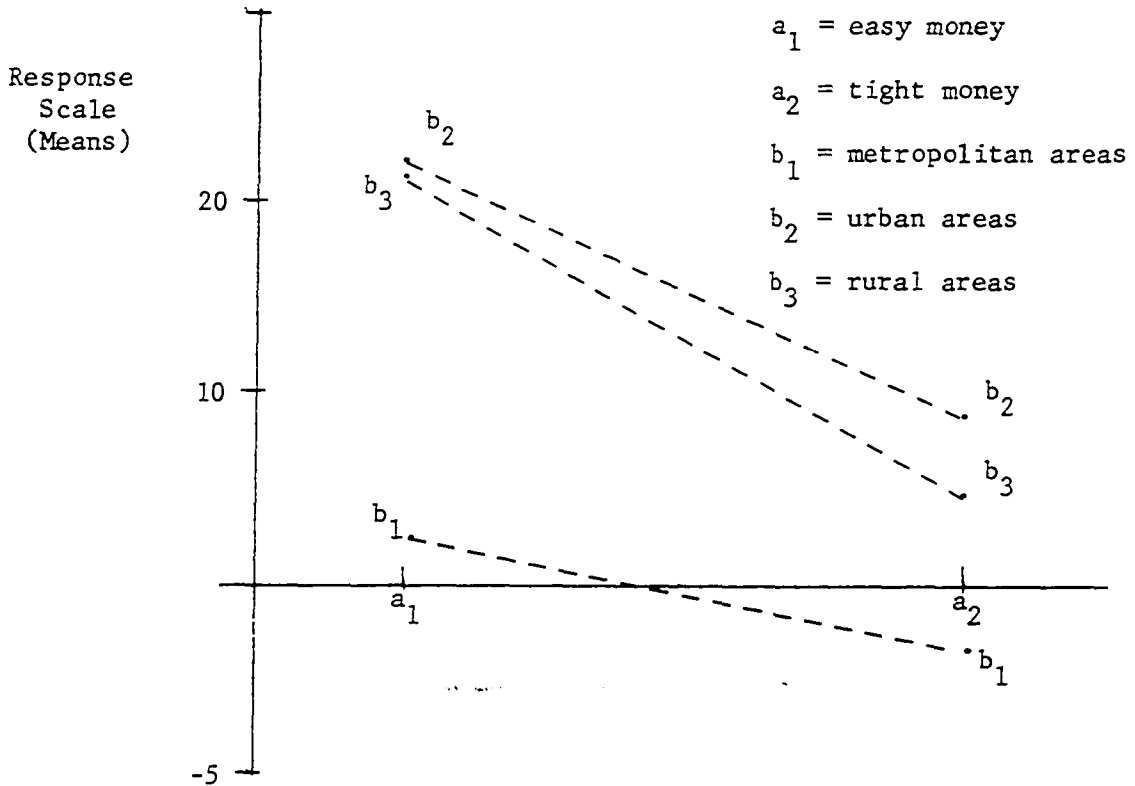


Fig. 4.4. Interaction for Commercial and Industrial Loans

Summary and Conclusions.

Twenty local areas were chosen for the sample to represent metropolitan areas, twenty were designated as urban areas, and twenty local areas represented rural areas. Of the twenty areas in each region, i.e., metropolitan, rural and urban, ten were designated tight money areas and ten were designated easier money areas according to the percentage change in deposits criteria. It was assumed that, other than differences in local bank changes in deposits, the tight areas were the same in all major respects as the easy areas. Differences in percentage increases in securities and loans then are mainly attributable to the local bankers'

evaluation of the soundness of their customers and importance they attach to each loan request in terms of their own utility maximization.

The major finding was that tight money did not effect business loans in metropolitan areas to any great degree. Urban and rural bankers in tight money areas were reluctant to maintain the same level of commercial and industrial loans as urban and rural bankers in easy money areas. Regional economic growth is based on industrial and commercial expansion. As the industrial base of a region expands and employment increases, commercial businesses find it profitable to operate. Tertiary activities, such as real estate development, and supportive service industries are attracted to growing regions; they cannot exist when the industrial or commercial foundation of a region declines. If tight money curtails regional economic growth by reducing the growth of commercial and industrial loans, as it apparently does in smaller regions, the basic economic structure of the smaller regions is weakened. Regional economic activity supported by the structure also suffers. If the interpretation of the results is correct, the smaller regions are relatively worse off than the metropolitan regions. It would be of interest to conduct a similar future study based on FDIC data to determine if these results hold only for the 1969-1970 period, or if they are indicative of a definite cyclical pattern. However, studies such as this one are, in themselves, incomplete. In order to discover the precise regional impact of monetary policy, data which will enable investigators to estimate regional loan demand curves must be gathered and made available.

This study suffers from not being able to determine the extent to which differences in changes in bank deposits among regions can be attributable to relative differences in regional economic activity rather than changes in monetary policy and from failing to isolate regional demand for loans. It could be the case, for example, that relatively greater loans to individuals for automobile purchases in easy money areas than in tight money areas reflects relative differences in economic prosperity between tight money areas and easy money areas, and is not solely attributable to portfolio adjustments by bankers in tight money areas. The consistency of the results with the theory, however, suggests further studies incorporating regional demand for loan functions might be used to determine the magnitude of the regional differential impact. For policy purposes, the question of a regional differential impact does deserve further study. If the results in this study are any indication, monetary policy does not press down evenly on all sectors and regions of the economy. The extent to which some regions will have to bear a greater burden to curtail inflation should be determined.

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APPENDIX

TABLE 1

FDIC LOCAL AREAS CHOSEN FOR THE SAMPLE

Tight Metropolitan Areas	Tight Urban Areas	Tight Rural Areas	Easy Metropolitan Areas	Easy Urban Areas	Easy Rural Areas
D.C.	Ga. (05)	Ind. (08)	Ala. (02)	Col. (01)	Ark. (02)
Ind. (06)	Fla. (05)	Kan. (01)	Fla. (09)	Fla. (06)	Ark. (03)
Mo. (10)	Ia. (12)	Minn. (01)	Ill. (13)	Ill. (15)	Col. (07)
N.Y. (01)	Kan. (09)	Mo. (09)	La. (06)	Ind. (05)	Ga. (02)
N.Y. (08)	N.J. (03)	N.D. (01)	Mass. (01)	N.Y. (02)	Ga. (03)
Ohio (12)	Ohio (05)	N.D. (02)	Ohio (10)	N.M. (04)	Ken. (04)
Ohio (13)	Ohio (08)	Ohio (03)	Okla. (12)	N.Y. (03)	Mich. (01)
Ohio (17)	Ohio (11)	Ohio (15)	Penn. (01)	Tex. (17)	Okla. (02)
Tex. (01)	Ohio (14)	Okla. (09)	Tex. (14)	Tex. (21)	Okla. (07)
Tex. (08)	Tex. (19)	Tex. (01)	Tex. (18)	Tex. (23)	W.V. (02)

TABLE 2

F RATIOS^a FOR THE INTERACTION MODEL

$$Y_{ijk} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \epsilon_{ijk}$$

Variables	Source of Variation		
	A	B	AB
U.S. Treasury Securities	21.107 (0.0001)	0.996 (0.622)	1.914 (0.155)
Other U.S. Government Agency Securities	0.008 (0.926)	1.376 (0.261)	2.789 (0.069)
Obligations of States, etc.	18.675 (0.002)	3.654 (0.032)	1.625 (0.205)
Other Securities	1.226 (0.272)	3.730 (0.029)	0.457 (0.642)
Residential Real Estate Loans	4.577 (0.035)	3.351 (0.041)	3.263 (0.045)
Other Real Estate Loans	0.326 (0.577)	0.461 (0.638)	2.217 (0.117)
Commercial and Industrial Loans	13.996 (0.0007)	6.249 (0.004)	1.069 (0.3515)
Agriculture Loans	0.050 (0.828)	1.591 (0.212)	0.202 (0.820)
Loans to Individuals to Purchase Automobiles	33.856 (0.0001)	8.559 (0.009)	0.095 (0.098)
Other Loans to Individuals	4.330 (0.040)	7.270 (0.002)	0.550 (0.583)

^aThe probability of a greater F score for each source of variations is given in parentheses below each calculated F score.

TABLE 3
 F RATIOS^a FOR THE SIMPLE EFFECTS OF
 A^b ON b₁, b₂ AND b₃

Variables	Source of Variation		
	(b ₁) Metropolitan	(b ₂) Urban	(b ₃) Rural
U.S. Treasury Securities	12.740** (92.51)	11.952**	1.251
Other U.S. Government Agency Securities	3.02 [†] (6545.22)	2.465	0.104
Obligations of States, etc.	4.75* (254.67)	15.2**	1.980
Other Securities	0.007 (13706.97)	1.723	0.415
Residential Real Estate Loans	0.284 (246.52)	9.47**	1.347
Other Real Estate Loans	1.126 (849.30)	3.610 [†]	0.022
Commercial and Industrial Loans	1.044 (188.251)	5.849*	9.255**
Agriculture Loans	0.411 (2129.73)	2.314	0.171
Loans to Individuals to Purchase Automobiles	12.201** (67.45)	9.090*	12.828**
Other Loans to Individuals	0.121 (103.41)	2.935 [†]	2.406

^a A [†] denotes significance at the 0.1 level, an * denotes significance at the 0.05 level and a ** denotes significance at the 0.01 level. Mean square error is given in parenthesis under the b₁ F ratio. Tests of significance areas calculated with 1 and 54 degrees of freedom for the F ratios.

^b A is the monetary tightness factor, b₁ denotes metropolitan areas, b₂ urban areas and b₃ rural areas.

TABLE 4
MEANS^a

Variables	Easy Metro. Areas	Tight Metro. Areas	Easy Urban Areas	Tight Urban Areas	Easy Rural Areas	Tight Rural Areas
U.S. Treasury Securities	18.7	3.4	17.3	2.5	9.3	4.5
Other U.S. Government Agency Securities	17.2	80.0	89.1	32.3	25.3	13.6
Obligations of States, etc.	25.9	10.3	39.3	11.5	16.8	6.7
Other Securities	20.8	18.8	76.6	14.5	10.6	44.4
Residential Real Estate Loans	-1.0	2.7	24.4	2.8	11.3	3.16
Other Real Estate Loans	9.0	22.8	24.1	-0.6	8.0	6.07
Commercial and Industrial Loans	4.92	-1.35	23.8	9.0	22.4	3.8
Agricultural Loans	53.8	95.7	2.8	-6.5	14.7	6.1
Loans to Individuals to Purchase Automobiles	1.4	-11.4	8.4	-2.6	11.8	-1.2
Other Loans to Individuals	2.0	0.4	13.4	-623.8	16.6	9.6

^aThe means are given as the average percentage change from 1969 to 1970.