CHAIN BANKING IN OKLAHOMA: STRUCTURE AND PERFORMANCE

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CHAPTER I

INTRODUCTION

Problem Statement

Financial institutions develop in response to economic needs. As is true of most businesses, their growth patterns are determined in large measure by the competitive environment within which they exist. However, these growth patterns are also shaped by the legal framework which governs and regulates them. From this latter cause-and-effect relationship, very difficult problems of public policy arise. The form and thrust of financial regulation in this country have been a source of enormous controversy almost since the day the Declaration of Independence was signed [1].

Alternative forms of banking structure exist within the United States. The particular form in effect at a particular location is a matter of state law. Generally, there are two forms of structure: single-office banking and multiple-office banking. Each type has several variations.

Single-office, or "unit", banking is a system in which a banking firm operates a single banking business from a single place of business. This is the banking structure authorized by Oklahoma law. Unit banks in Oklahoma are permitted by the law to operate "auxiliary teller's windows" at a detached but nearby location only for the purposes of receiving deposits, paying withdrawals, making change, and otherwise

servicing depositor accounts. Functionally, these activities take the form of "drive-in" facilities. Present Oklahoma law also permits unit banks to operate detached automated teller machines.

With respect to bank ownership, two variations within unit banking are present in Oklahoma. One is the one-bank holding company (OBHC hereafter). In this form of ownership, one corporation may hold ownership control of several businesses, one of which is a bank. Within such a corporate structure, the bank is a subsidiary of the holding company, operated separately from the holding company's other subsidiaries.

The second variation in unit banking is the chain bank. A chain bank exists when some degree of control over two or more independent unit banks is held by one individual or group of individuals. Such control is exercised through common directorships and/or stock ownership. Many chain banks are also subsidiaries of OHBC's.

Multiple-office banking is the general alternative to unit banking. It has two forms: branch banking, and the multiple-bank holding company (MBHC hereafter). In both forms, one business organization operates two or more bank "offices", the difference between the two forms being that in branch banking the offices are directly owned and operated as parts of a single organization, while in a MBHC the offices are separate businesses, all owned and operated by a single parent corporation. All forms of multiple-office banking are prohibited in Oklahoma.

Regardless of the banking structure which exists in the state, the chosen structure should support and enhance the economic well-being of the population. Economic prosperity and development should not be impeded by the banking structure employed. Therefore, it is worthwhile to investigate the performance of the present structure of banking in Oklahoma.

Some evidence exists concerning the level of user-satisfaction produced by the present unit system. Stanton [43] reported survey results which indicate that small manufacturers often experience extreme difficulty in obtaining needed funds within the state. Barth [2] found that while farmers and ranchers seem satisfied with the quality of service at their banks, there were desired services which the local bank often did not offer. Although this evidence is limited, both studies indicate that some degree of dissatisfaction with the performance of the present unit system probably exists.

Empirical evidence supports reasonably well the proposition that multiple-office banking systems produce operating performance characteristics which are generally superior to results produced by unit systems. However, no research on the performance of the Oklahoma banking structure has been reported nor have any investigations of performance been located which were directed toward chain banking anywhere. In 1962, Darnell [11] produced the major descriptive work, to date, on chain banking. He reported 82 chain banks in Oklahoma, which constituted 36.3 percent of all member banks in the state and held 32.7 percent of the assets of all member banks. Although uncorroborated by other research, Darnell's data do indicate that chain banking constituted a substantial part of the banking structure in Oklahoma nearly two decades ago.

A summary of the existing knowledge about the Oklahoma banking structure suggests that (1) Oklahoma permits unit banking only, (2) nearly 20 years ago, chain banks accounted for a substantial part of banking activity in Oklahoma, and (3) some degree of user-dissatisfaction with the present structure appears to exist. Nothing is known about the performance of the Oklahoma banking structure relative to

banking systems elsewhere. Nor is anything known about the operating characteristics or competitive conditions produced by chain bank systems wherever located.

Hopefully, policy-makers in Oklahoma are concerned about the capability of the present banking industry to provide the funds necessary to support anticipated economic expansion. Ben-Avi [3] estimated that during the period of 1985-2000, an additional 355 million dollars annually will be needed to finance projected economic growth in Oklahoma. That amount is more than three times the average increase in commercial and industrial lending by Oklahoma banks during the decade of 1966-1975 [3]. If such a dramatic increase in financial requirements for industrial development is to be met by the banking system, one of the goals of public policy in Oklahoma must be to provide a banking structure that encourages maximum economic efficiency. Economic growth should not be restrained by the structure of the banking industry. Such a huge, anticipated need for new financing makes it imperative to expand understanding of the performance of the present structure.

Purpose of the Research

The major problem in the analysis of chain banking has been the lack of information identifying banks involved in chain relationships. The purpose of this investigation is to identify all chain banks in the State of Oklahoma and empirically analyze the performance characteristics produced by a chain bank structure. Chain banking is widely hypothesized to provide a method by which bankers attempt to secure the benefits of multiple-office banking in states which prohibit those forms of bank ownership. The proposed research addresses that argument by investigating the nature and extent of chain banking in Oklahoma. The

performance of the chain banks will be measured and compared to that of the unit banks to evaluate the relative performance differences. In addition, the empirical results will be compared to those of previous investigations to determine if the performance of the Oklahoma chain structure resembles that of multiple-office systems in other states.

CHAPTER II

THEORETICAL FRAMEWORK AND HYPOTHESES

Definition of Chain Banking

The term "chain banking" is used to denote a phenomenon of bank ownership which has no legal or regulatory recognition. Loosely defined, a chain bank exists when two or more independent, unit banks are controlled by the same individual or group of individuals. Because chain banks appear in some respect to resemble other formal types of multiple-office banks, chain banking is often suggested to be a means of circumventing state laws prohibiting multiple-office banking.

Chain bank relationships are not reported to any regulatory agency, and because bank stock changes hands rather infrequently, chain banks usually exist with little or no public recognition. The lack of published information identifying banks involved in chain relationships presents a major obstacle to proper analysis of the effects of chain association.

A Valuation Model of the Banking Firm

The general capitalization of income model of asset valuation provides the foundation for analyzing the effects of chain bank association. The model states that:

$$V_0 = \sum_{t=1}^{\infty} \frac{C_t}{(1 + k)^t} \qquad (1)$$

where V_0 is the present value of the asset, C_t is the net cash flow produced by the asset in period t (whether in the form of dividends or capital gain), and k is the discount rate appropriate to the time preference and risk aversion of the owner(s). It is assumed that bank managers endeavor to maximize the value of their firms.

A form of Equation (1), more convenient to this analysis is:

$$V_0 = \sum_{t=1}^{\infty} \frac{R_t - (C_t + O_t + T_t)}{[1 + (i + p)^t} \qquad (2)$$

in which R signifies the gross receipts from the bank's assets and services, C denotes the costs of its liabilities and capital, O represents the overhead costs associated with R and C, and T is the tax paid by the bank [20]. The risk-free interest rate is estimated by i, and p is the risk premium appropriate to the bank's assets and liabilities.

Given that bank managers are wealth maximizers, it follows that they form chain relationships because of expected increments to firm value. The market for the shares of most banks is negotiated and inefficient, which makes any change in V_0 resulting from participation in a chain difficult if not impossible to observe directly. Thus, in order to determine if chain bank membership affects firm value, it is necessary to examine the behavior of the variables of chain bank performance.

Equation (2) makes readily apparent the interdependent nature of the variables. The bank gathers funds from its liability and capital sources and pays C for their use. It places those funds into assets which generate R. O will depend, in part, on the particular assets and liabilities selected, and it will reflect fixed costs as well.

$T = f[R - (C + O)$, and p will be influenced by the riskiness of the particular assets and liabilities the bank chooses, although it is an exogenous variable.

If chain bankers perceive chain membership to provide them with opportunities unavailable to unit bank competitors, they will adjust their behavior to exploit those opportunities. Suppose, for example, a unit banker purchases control of another unit bank, forming a chain. He may conclude his overall risk position has been thereby reduced. Therefore, he is able to lower the joint level of cash reserves in the two banks, and increase the joint level of auto loans held. Reflecting those decisions, the cash reserves to total asset ratios would decline and the total loans to total assets ratios would rise. These results would be observable from public information.

If the hypothetical banker were able to rearrange his assets successfully, as suggested, R_t at both banks would rise reflecting the higher interest rates on auto loans, C_t will remain unchanged except as bad debt losses increase, and T_t will rise, but less than R_t. The risk premium, p, will remain stationary or decline, and the overall result is that V_0 will rise. Thus, the banker improved the value of both banks through the formation of a chain.

From the preceding rationale, the overall hypothesis of this research emerges: the performance of chain banks in Oklahoma, on the average, is different from that of unit banks in Oklahoma, on the average.

Hypothesized Relationships

Portfolio Composition

A unit bank ordinarily is heavily dependent upon the local economy

because a bank's market area is small geographically, at least until the bank becomes quite large. In Oklahoma, probably fewer than 20 banks have significant market penetration beyond the county line. As a result of such market compactness, loan portfolios and deposit sources of neighboring banks tend to be rather homogeneous, which suggests the covariances of returns of local unit banks probably are quite high, particularly in rural areas.

Modern portfolio theory suggests that the variance of returns for two unit banks A and B may be reduced by combining the assets of both banks into a single portfolio [20]. A diversification effect will occur and reduce the unsystematic risk present in both banks, provided the coefficient of correlation of the banks' returns is less than one ($\rho_{AB} < 1$). Reduction of any diversifiable risk present in the unit banks through a portfolio effect will decrease the variance of the aggregate cash flows for the chain below the variance of each unit bank considered separately, and increase aggregate firm values, ceteris paribus. The ability, created by chain bank association, of the individual chain members to be considered as parts of a single, large portfolio, thereby altering the risk-return relationships of all chain members simultaneously, is possibly the chief benefit to be derived from chain banking.

Analysis of the effects of diversification upon chain bank value requires that the effects on return be considered separately from effects upon risk. The expected return from a portfolio of assets is the weighted average of the expected returns from the individual assets which may be expressed as follows:

$$E(r_p) = \sum_{i=1}^{n} X_i \left(\sum_{t=1}^{T} p_{it} r_{it} \right) \qquad (3)$$

where $E(r_p)$ = the expected portfolio return,

X_i = the fraction of the total equity invested in the i^{th} asset, such that $\sum_{i=1}^{n} X_i = 1$,

P_{it} = the probability of t^{th} rate of return from asset i, and

r_{it} = the t^{th} rate of return on asset i.

Diversification, in the sense used here, will not affect $E(r_p)$. That is to say, combining a group of individual financial assets into one bundle will not change the return from any of them individually or in the aggregate. Only the actions of bank managers in response to perceived changes in portfolio risk will alter the expected return from an asset portfolio existing in equilibrium conditions.

However, considering the asset portfolios of several unit banks to be parts of a larger, single portfolio may reduce the risk premium, p, in Equation (2).

Total portfolio risk is often expressed as [20]:

$$Var(r_p) = \sum_{i=1}^{n} X_i^2 \sigma_i^2 + \sum_{i=1}^{n} \sum_{j=1}^{n} X_i X_j \sigma_{ij} \qquad (4)$$

where σ_i^2 = the variance of return on the i^{th} asset,

j = the j^{th} asset, and

σ_{ij} = the covariance of returns of the i^{th} and the j^{th} assets when $i \neq j$ and n is any positive integer ≥ 2.

It is apparent that total risk will be reduced if the returns of assets i and j are less than perfectly correlated; i.e., if $\rho_{ij} < 1$. Viewed through Equation (2), the ability of the chain bank to obtain positive diversification effects suggests that:

$$\frac{R_A - (C + \quad + T)_A}{[1 + (i + p_A)]} + \frac{R_B - (C + O + T)_B}{[1 + (i + p_B)]} < \frac{R_{A+B} - (C + O + T)_{A+B}}{[1 + (i + p_{AB})]} \qquad (5)$$

in which p_{AB} is the risk premium for the chain bank after portfolio effects.[1] Thus the availability of positive benefits accruing from the diversification effect makes it attractive for unit banks to become associated in a chain structure with unit banks in other locations having different economic environments.

Chain bank managers may react to reduced risk levels in several ways. They may choose not to alter the behavior of chain members at all and simply enjoy the increased value of their less risky unit banks. In this case, the behavior of chain banks will be no different from that of independent, unit banks in Oklahoma.

On the other hand, chain bank management may view any reduction of risk obtained through chain bank association as a competitive advantage to be exploited by accepting higher risk assets and liabilities than before. A wider investment in varied economic markets will reduce default risk, and that will make possible more aggressive portfolios.

On the asset side, central management could decide to reduce cash reserves and accept more high-risk, high-yield loans. If so, cash reserves to total assets ratios would fall and total loans to total assets ratios would rise. A reallocation of credit toward the local communities is implied by such a decision. A significant rise in the ratios of municipal securities to total assets, consumer loans to total assets, residential mortgage loans to total assets, and commercial loans to total assets would be expected. Possible diversification effects on the liability side are discussed below.

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[1]While it is true that $[R_A - (C + O + T)_A] + [R_B - (C + O + T)_B] = [R_{A+B} - (C + O + T)_{A+B}]$, in no sense is it true that $p_A + p_B = p_{AB}$. The risk premiums, p_A, p_B, and p_{AB}, reflect the investor-perceived riskiness of the cash flows produced by unit banks A and B and the joint chain bank AB. p_{AB} is not a weighted average of the two individual returns.

Previous research generally supports the riskier-behavior posture of chain banks relative to unit banks as just described, and that is the hypothesis of this research as well.

Capital Position and Liability Structure

Chain bank members may experience a diversification effect upon their liabilities if their sources of deposits are independent of each other and subject to different economic influences. The general formulas for determining return and risk of an n-asset portfolio expressed in Equations (3) and (4) respectively, apply to the n-liability portfolio as well. Therefore, the essence of the diversification effect upon liabilities of the chain bank lies in the correlation of cash inflows from the deposit sources of the chain members. If Bank A were urban and its local economy predominately industrial, while associated Bank B were rural and subject to agricultural influences, their combined liabilities may show a greater stability of deposit inflows and outflows as a result of diversification effects. Bank managers may then perceive the greater stability of their overall liabilities as requiring a smaller base of permanent capital and decide to adopt a more aggresive liability management strategy. If so, a higher degree of leverage is implied, along with a willingness to pay higher prices for deposits and to extend maturities.

Additional effects from chain membership may occur in the capital account. Because of the absence of a public market for their shares, small, unit banks may experience difficulty raising additional capital through the sale of new stock. Growth capital in that case, would be limited to additions to undivided profits or the sale of capital notes (also likely to be difficult or impossible). Even retention of profits

may be quite restricted. The owners of small banks often are also the officers and directors and they may inflate wages and salaries in order to shield bank income from income tax. Chain banks may find capital markets more accessible, and they may be more willing to allow undistributed profits to grow at a faster rate in order to enhance capital appreciation. Moreover, the improved availability of capital may be viewed by the central chain management as augmenting any diversification effect on their liabilities and that may lead them to even more aggressive liability management policies.

An improved capital position would be reflected by a rise in a bank's ratio of total capital to total assets. The implied reduced risk level of the firm will permit the risk premium, p, in Equation (2) to decline, and firm value would rise. However, it seems more likely that chain bank managers, perceiving less variation in their liability flows, would choose to lever up instead of down in response to favorable diversification effects, thereby causing p to rise rather than fall. Therefore, the total capital to total assets ratio is hypothesized to be lower for chain banks than for unit banks.

In the valuation model, C will rise as the bank adds to its liabilities, R should rise more than C, and T will also rise. Whether or not V rises will depend on the rise in R relative to those of C, T, and p. However, the entire idea is to get R to increase more rapidly than C, T, or p. A move toward increased leverage would also imply support for the previously stated hypothesis of higher total loans to total asset ratios for chain banks. As chain members increase their deposits, it follows that those funds will be used to increase loans of various types, rather than safer cash balances.

Operational Efficiency

Pure economies of scale are not likely to result from chain banking simply because of the physical separation, and often wide geographic distance, between chain members. Any opportunities for chain banks to achieve cost advantages over comparably sized unit banks arises from the potential ability of chain bank management to centralize certain service functions, thereby eliminating duplication of effort. Such activities might include purchasing, computer facilities and operation, investment portfolio supervision, and certain trust and correspondent functions.

However, if the lead bank in a chain does perform some functions for other chain members, such as those just mentioned, the lead bank is also likely to charge transfer fees for those services. While the ability to eliminate duplicate activities implies that chain banks may be able to operate with relatively fewer employees than unit banks, and that total salaries, wages, and benefits may be relatively lower for chains, tactical transfer pricing decisions adverse to chain members may be made by central management for a variety of reasons unrelated to cost. For example, management may prefer, for tax reasons, to transfer income from a chain member to the lead bank in the form of transfer fees rather than as dividends. Or it may be desirable for the lead bank to show high profits in order to enhance public offerings of securities. Transfer fees paid show up as Other Operating Expenses, which suggests that chain bank results here will be worse than those produced by unit banks.

Diversification effects arising from chain association may also indirectly affect some chain bank costs unfavorably. If diversification effects do induce management to make riskier loans, the loan loss

ratio is likely to rise. Such a result will be reflected in this study by the total operating expense to total assets ratio.

In this section, influences upon several variables of the valuation model, Equation (2), have been described. Some of those influences are likely to be favorable to chain banks, while others are unfavorable. While the overall effect of chain banking upon costs is unclear, it is hypothesized that: (1) chain bank net income per employee is higher than for unit banks; (2) the ratio of labor costs to total assets is lower for chain banks than for unit banks; (3) the ratio of other operating expenses to total assets is higher for chain banks; and (4) the ratio of total operating expenses to total assets is lower for chain banks relative to unit banks.

Rates on Deposits and Loans

If diversification effects from chain association induce bank managers to shift funds out of relatively safe, low-yield treasury instruments into riskier assets such as commercial loans, auto loans, etc., it follows that the average return on its asset portfolio should increase. Management may also choose to lower its credit standards in order to achieve higher rates of interest on the loan portfolio.

On the liability side, a more aggressive deposit acquisition strategy will require payment of higher interest rates. Thus, chain banks, on the average could be expected to charge higher interest rates on assets and to pay higher interest rates on liabilities than unit banks do. It is hypothesized that chain banks have higher ratios of interest and fees on loans to total loans and of interest on deposits to total deposits than unit banks do.

The practices of banks levying service charges on customer accounts presents something of an enigma. Previous researchers are virtually unanimous in finding that multiple-office banks levy higher service charges than unit banks. Yet, no theoretical explanation for this phenomenom has emerged. Perhaps the most plausible explanation stems from the observation that multiple-office banks on the average, are larger than unit banks. This size difference allows multiple-office banks to engage more in wholesale banking in which the customer is a business carrying on both checking and borrowing activities, whereas the smaller unit banks tend to emphasize individual accounts which involve checking and time deposits. The wholesale banker prices out his services more carefully and explicitly while the retail banker relies more on low cost checking accounts to attract time deposits.

In any event, the observed association between multiple-office banks and higher service charges is very strong. Therefore, it is hypothesized here that chain banks levy higher service charges than unit banks.

Profitability

To the extent that chain bank membership produces significant economies of scale of operations, and/or encourages the use of increased financial leverage, bank profitability could be expected to increase. Most of the performance characteristics discussed above are expected to be improved by chain membership. Therefore, it follows that overall measures of profitability should show improvement as well. However, it is possible that various chain influences will prove to be offsetting and no improvement in overall profitability will occur. In that case, any impact on firm value will depend upon what happens to the risk premium.

It is possible, of course, that management's underlying motive for chain association could be to gain monopoly power, in which case it would form a chain within its own local market. Efforts to improve profitability would then be likely to cause other measures of performance to move opposite to a priori expectations consistent with portfolio theory. Asset portfolios probably would become safer and more liquid, the pricing spread would probably widen, and leverage and the risk premium would decline. This is not a likely scenario, however, because local-market banks generally tend to behave as discriminating monopolists [42], thus limiting the benefits to be gained from other monopoly-seeking activity. Moreover, formation of a chain in the same market would severely limit, if not eliminate the possibility of obtaining diversification effects from chain association.

All measures of profitability to be tested in this research, total revenues to total assets, net income to total assets, and net income to total capital, are hypothesized to be higher for chain banks than for unit banks.

CHAPTER III

THE EVIDENCE ON CHAIN BANKING AND BANK PERFORMANCE

Chain Banking

Through the years, data on chain banking have been considered unreliable because of the difficulty of determining chain ownership. Consequently, few studies have appeared. Those which did were descriptive in nature.

The Federal Reserve collected and published data on chain banks for the first time in 1931. Subsequent studies appeared in 1939, 1941, and 1945. After 1945, the Federal Reserve ceased publishing information on chains, probably because the data continued to be unreliable.

In 1962, the Federal Reserve collected data on the 20 largest stockholders in all member banks and those figures were published in 1964 [48]. Using that information, Darnell [8] [9] [10] [11] produced the only comprehensive work on chain banking since Cartinhour's chronicle [6] in 1931.

The chain bank segment of the U. S. commercial banking appears to be substantial. Darnell [8] reported that 19 percent of all member banks in the nation were chain affiliated and these chain banks held 19.3 percent of all member bank assets. The typical chain bank was only slightly larger than the average member bank and the typical chain consisted of only two or three banks [8]. However, about three

out of four chains were located in areas where the probability of facing competition from more than one other local bank was less than one-half [8].

Darnell [8] located 82 chain banks in Oklahoma, which placed Oklahoma third among all states in 1962. Those 82 chain banks were 36.3 percent of all member banks in the state and 21.2 percent of all insured banks. They held 32.7 percent of member bank assets and 27.4 percent of insured bank assets.

Table I depicts the change in chain banking as reported by the FRS studies and Darnell [8].

The sharp declines in Oklahoma for 1945 reported in Table I were not explained. However, in view of the large gains registered by 1962, the 1945 data must be viewed suspiciously.

Darnell [9] found that the large chains were located in states which permit only unit banking. Furthermore, Darnell [9] tested and rejected the hypothesis that chain banks behave like unit banks in the same state, and he concluded that where branching is prohibited, chain banking develops as a substitute.

In a recent study of chain banking activity in the Seventh FRS District, Keating [26] found that 12.2 percent of the banks in the District were chain affiliated. Those banks held about 11 percent of all commercial bank deposits in the Seventh District. The average chain bank held deposits of about $42 million versus about $47 million for the average of all banks. The average chain had 3.9 banks in it.

Illinois is presently the only unit banking state in the Seventh District. Fifty-nine percent of all chain banks in the District were in Illinois, where they numbered about 20 percent of all banks, and held 14.6 percent of total commercial bank deposits. The average chain

TABLE I

NUMBER AND DEPOSITS OF CHAIN BANKS AS A PERCENTAGE OF ALL BANKS, 1939-1962

	Number of Banks in Chains					Deposits of Banks in Chains				
	1939	1941	1943*	1945*	1962	1939	1941	1943*	1945*	1962
United States	2.9	3.2	3.4	3.9	19.0	1.6	2.1	2.7	3.1	19.3
Oklahoma	9.4	13.6	13.7	8.1	36.3	8.7	27.2	27.8	0.8	32.7

Source: Darnell, Jerome C., "Chain Banking Development in the United States," Bankers Magazine, Vol. 153 (Winter, 1970), p. 43. Compiled from various FR Bulletins, FDIC Reports, Banking and Monetary Statistics.

*Darnell's computations.

in Illinois contained 4.9 banks. Keating concluded that chain banking in Illinois appeared to be a direct attempt by bankers to circumvent the prohibition of multiple-office banking by Illinois law. He further stated that, "In states that currently prohibit or limit multibank holding companies or branch banking, chain banking organizations provide a viable method of multi-office bank expansion" [26, p. 15].

The Comparative Performance of Multiple-Office Banking and Unit Banking

A large body of evidence exists on the relative performance characteristics of branch banks, multi-bank holding company (MBHC) banks, and unit banks. While discrepancies in the evidence exist, a general consensus has emerged concerning many of the relationships addressed in the present research.

Risk Effects and Portfolio Composition

Empirical research has produced substantial support for the hypothesis that multi-office banks have riskier asset portfolios. Horvitz and Shull [22] and Fraser [17] found that branch banks tend to have higher loan-to-asset ratios than unit banks and higher proportions of retail-type loans with longer maturities at lower interest rates. Moreover, loans-to-assets ratios are higher at unit banks in branching states than at unit banks in unit states. Many investigators found MHBC affiliates to have significantly higher loan-to-asset ratios than independent banks [21] [24] [29] [30] [45], to hold significantly lower cash balances [24] [32], to hold significantly more municipal bonds [29] (32] [33] [34] [41], and to hold significantly lower amounts of U. S. Government securities [24] [31] [32] [33].

Numerous analyses have shown that MBHC affiliation has an important impact on the loan-portfolio composition of those banks. Curry [7] found that MBHC affiliated banks tend to make more of all types of loans except farm loans, while Fraser [17] reported that branch banks devote a much larger fraction of their resources to real estate lending. Overall, the evidence is inconclusive with respect to the impact of affiliation upon the choice among types of loans made. However, it is reasonable to conclude that multiple-office system banks are more risk-oriented than comparable unit banks. The finding that multiple-office system banks hold proportionately more loans than unit banks indicates that the affiliated banks probably also extend more credit to their local communities.

Capital Structure

Empirical results on capital structure have been quite consistent. Several studies found that MBHC subsidiaries operate with lower ratios of total capital to total assets [23] [32] [33] and of equity capital to total assets than comparable unit banks [16] [19] [23]. Fraser [17] found no significant difference between branch banks and independent banks on this point, however. The writers who found negative differences in capital structure attributed the difference to the lower risk of the diversified firms and the readier access to funds provided by the holding company structure.

Operational Efficiency

Early studies by Benston [4], Lawrence [29], and Ware [49] all located evidence of higher expense ratios for affiliated banks, with slight economies of scale. Two recent studies by Mayne [32] and

Drum [13] refute these findings. Drum found slightly higher costs at branch banks than unit banks, but found no empirical justification for the proposition that MBHC affiliation produces economies of scale unavailable to independent banks. Horvitz and Shull [22] found branch bank costs to be slightly higher than unit bank costs.

Rates and Prices

The evidence on service fees is quite uniform. Horvitz and Shull [22], Lawrence [29], Johnson and Meinster [24], Mayne [32], and Fraser [17] all report evidence which indicates multiple-office banks charge higher service fees relative to deposits. To the contrary, the evidence on interest rates paid on liabilities and received on assets is decidedly mixed. Horvitz and Shull [22] identified higher rates being paid and received by branch banks, while Fraser [17] found no differences. Johnson and Meinster [24] found interest rates paid by MBHC banks were lower than those paid by unit banks. Lawrence [29] found no differences in rates paid or received between the two groups.

Probability

The impact of multiple-office association upon overall profitability is vague. Conceptual problems exist with the accurate measurement of subsidiary bank profitability. The roles of parent and subsidiary bank capital and debt may be ambiguous due to "double leverage". Furthermore, the expense-generating methods employed to transfer income within a multiple-office organization may obscure profitability. This makes it necessary to consider the differences (between the two systems) in Other Operating Expenses which is the account in which fees paid to the parent would be recorded for services

rendered to the affiliate. Lawrence [29] and Mayne [32] both found significantly higher ratios for MBHC banks, but Mayne also found lower Total Operating Expenses which implies positive economies of scale for MBHC banks.

The evidence on overall profitability is also mixed. Horvitz and Shull [22] found the ratio of Net Income to Total Assets to be lower for branch banks, yet they found Net Income to Total Capital to be higher. Fraser [17] found no differences in Net Income to Total Assets, but reported negative results on Net Income to Total Capital. Lawrence [29] found no differences in either measure, while Mayne [32] found positive differences on both measures. Mingo's [34] results corroborate Mayne's findings while Light's [31] refute them.

Summary

Prior research has provided substantial evidence of several significant differences between multiple-office banks and unit banks (refer to Table II for a summary of some of this evidence). Multiple-office banks have been shown to operate with fewer cash assets relative to total assets than unit banks and to make more loans proportionately. However, multiple-office bankers have not shown clear preferences for any particular types of loans relative to unit bankers. Multiple-office banks do hold higher proportion of municipal bonds and lower proportions of U. S. Government securities.

The evidence suggests that multiple-office banks operate with lower capital and equity bases, but that they tend to incur higher expense ratios. While multiple-office banks most frequently employ higher service charges, they exhibit no clear patterns with respect to interest rates charged or paid. Likewise, no clear evidence has been

TABLE II

PERFORMANCE MEASURES FOR MULTIPLE-OFFICE VERSUS UNIT BANKS: RESULTS OF FIVE MAJOR STUDIES

Performance Measure	Horvitz & Shull (1964)	Lawrence (1967)	Johnson & Meinster (1975)	Mayne (1977)	Fraser (1978)	Present Research Expected Difference
Cash Assets/Total Assets		-	-	-	-	-
Municipals/Total Assets		+	+	+	-	+
Total Loans/Total Assets	+	+	+		-	+
Consumer Loans/Total Assets		+			+	+
Mortgages/Total Assets		ND		+	+	+
Business Loans/Total Assets		ND		-		+
Total Capital/Total Assets		ND	-			-
Net Income per Employee						+
Labor Costs/Total Assets		ND				-
Other Operating Expenses/TA		+		+		+
Total Operating Expenses/TA		+		-		-
Service Charges/Deposits	+	+	+	+	+	+
Interest, Fees/Loans	+	ND	-		ND	+
Interest Paid/Deposits	+	-				+
Total Revenue/Total Assets						+
Net Income/Total Assets	-	ND		+	ND	+
Net Income/Total Capital	+	ND		+	-	+
Statistical Methods Used:	1	2	3	4	5	

Notes: Statistical methods used are (1) Bivariate Correlation, Multiple Regression; (2) "t" tests; (3) Multiple Discriminate Analysis; (4) Multiple Regression; and (5) Cluster Analysis. ND indicates no statistical difference was found; a blank space indicates the variable was not tested; a positive sign indicates that multiple-office banks exhibited higher values than unit banks for this measure; and a negative sign indicates that multiple-office banks exhibited lower values than unit banks for this measure.

found to indicate that multiple-office banks enjoy economy of scale advantages or higher levels of profitability over unit banks.

CHAPTER IV

RESEARCH METHODOLOGY

An Operational Definition of a Chain Bank

The term "chain bank" lacks a generally accepted definition which is sufficiently precise for a rigorous analysis. Darnell [8] defined chain banking as follows:

> A chain system was deemed to exist when two or more banks have one or more stockholders in common (excluding banks controlled by registered bank holding companies) provided that: (1) the stockholder(s) in common is among the 20 largest stockholders in each bank, (2) the stockholder(s) in common is a director or an officer in each bank, and (3) if the stockholder(s) in common is not a director or an officer, he owns 5 percent or more of the stock in the bank in which he is not a director or officer. This definition does not specify that two or more banks must be 'controlled' by an individual or group of individuals . . . Instead, the basic assumption underlying the definition is that banks with common owners satisfying the three stated conditions have the potential capability of coordinating operating policies and are therefore considered chain banks (p. 308).

Bank ownership is not a matter of public record. Therefore, Darnell's definition cannot be utilized in tact. More recently, Keating [25, p. 15] defined chain banking as, ". . . the control of two or more commercial banks by the same individual or group of individuals." Unfortunately, Keating did not address the problem of determining when "control" exists. In the present study, a chain bank is deemed to exist when control over two or more independently operated unit banks is exercised by one individual or group of individuals.

Control is defined as the case where two or more banks have common directors or officers.

Restricting the definition to instances in which common directors or officers are observed results in the loss of the case of the silent stockholder who owns a significant investment interest in two or more banks but does not participate in management by holding office. Thus the restriction shifts the emphasis from that of potential control as specified by Darnell [8], to that of actual influence exercised upon operating policies.

Most banks are closely held, frequently within families. A silent stockholder who holds a significant amount of stock probably is related to some other stockholder who is exercising managerial influence, and the chain would be reflected in the data through that person's presence. Thus, there is reason to believe that the analysis will not be seriously affected because the potential number of missed chains is very small. Furthermore, the identification procedure involved a cross-checking procedure which should mitigate problems associated with a more strict definition of a chain.

Identification of the Chain

Banks in Oklahoma

Given the above definition of chain banking, identification of a complete list of all banks in the state which share common directors and/or officers became a simple, two-part problem. First, using a computer, an alphabetical list of all names of bank officers and directors was constructed from the Oklahoma Bank Directory [36], distributed by the Oklahoma Bankers Association. Since the Directory lists all officers/directors by bank, a person's name appeared once for

each position held. Thus, on the computerized list, the name of an individual who sat on the boards of three banks, for example, appeared three times.

The second part of the identification task was to establish a list of chain banks by utilizing information from sources within the banking industry. Certain bank officers are in a position to know about chain bank relationships among banks they are doing business with. Contact with some of those bankers resulted in a state-wide list of chains based upon industry sources. That list was then reconciled with the computer-constructed list to obtain a relatively error-free picture of chain associations within Oklahoma.

For this research, chain-bank lists were developed for the years of 1979, 1977, and 1975. The computer-generated lists contained an upward bias of 10-15 percent. For example, in 1979, the computer identified 234 chain banks. Twenty banks were falsely identified as chain banks, while nine chain banks were identified as units. The reconciled list for 1979 is considered to have minimal errors. However, the error widens somewhat in the earlier years because no records are kept of chain affiliation and disaffilication, and the memories of knowledgeable individuals quickly become unreliable, forcing more reliance on the computer-constructed lists. Even so, the lists for 1977 and 1975 are believed to be reliable, with the total error rate remaining low.

The Population

All commercial banks in the state were a part of this study. Bank size ranged from less than two million dollars of total assets to over 1.4 billion dollars. Table III shows all banks classified by the amount of total assets held.

TABLE III

ALL BANKS IN OKLAHOMA BY TOTAL ASSETS

Total Assets (000's $)	Number of Banks 1975	1977	1979
0- 10,000	218	194	155
10,001- 25,000	150	148	148
25,001- 50,000	57	82	108
50,001- 100,000	27	38	53
100,001- 500,000	6	10	20
500,001-1,000,000	4	2	1
>1,000,000	0	2	4
Totals	462	476	489

Table IV presents the number of banks in the state in each year studied, divided between national banks and state banks.

TABLE IV

ALL BANKS IN OKLAHOMA BY CHARTER (%)

Year	State Banks	National Banks	Total Banks
1979	297 (60.7)	192 (39.3)	489
1977	285 (59.9)	191 (42.1)	476
1975	268 (58.0)	194 (42.0)	462

The number of banks is greatest in counties of moderate population levels, as seen in Table V. That clustering, however, is merely a

reflection of the large number of counties having moderate population.

TABLE V

ALL BANKS IN OKLAHOMA BY COUNTY POPULATION

County Population (000's)	Number of Banks		
	1975	1977	1979
0- 5.0	6	9	8
5.1- 10.0	51	52	52
10.1- 25.0	122	117	120
25.1- 50.0	154	149	135
50.1-100.0	39	44	63
100.1-400.0	11	20	22
400.1-500.0	34	39	40
>500	45	46	49
Total	462	476	489

In Table V, the population groupings are arranged so that all banks in the 400.1-500.0 bracket are in Tulsa County and all banks in the >500 bracket are in Oklahoma County.

The Data

The data for the study were obtained from the Board of Governors of the Federal Reserve System. They consist of Statement of Condition and Income Statement information from all commercial banks in Oklahoma.

A trade-off arose between the desirability of having the study encompass a wide time span and the tendency of the chain identification error rate to increase in earlier years. Therefore, the years of 1979, 1977, and 1975 were chosen for study. The FRS data were complete except

for the omission of Total Loans, and Salaries + Benefits data for all banks in year 1975. The impact of those omissions was that the variables Y_3, Y_9, and Y_{13} could not be used for 1975.

Performance Measures

The performance of the two banking systems under scrutiny, unit versus chain, can be measured by using financial ratios. The appropriate ratios have been prescribed by the theory developed in Chapter II. They are listed in Table VI below, along with a sign indicating the direction in which chain bank performance is expected to differ from unit bank performance.

There are several limitations to the use and interpretation of the financial ratios as performance measures. As always is true when ratios are used, they are meaningless without a norm for comparison. In this research, the adequacy of performance of either system was not in question. The ratios were being used only to compare one system against the other.

Nor was the total explanatory power of the models at issue, since the determinants of bank performance were not being sought. The models attempted to hold constant the major forces which influence bank behavior so that the impact of chain association could be observed. They were not designed to separate those forces which do influence bank behavior from those which do not.

There were no lead or lag effects taken into account, and perhaps most important of all, there was no feasible way to include consideration of the length of time from chain entry or exit by a bank. No records are available to indicate when a bank affiliates or disaffiliates with a chain and therefore it is not possible to examine the effects of

TABLE VI

THE PERFORMANCE MEASURES

Performance Category	y_j	Performance Measure	Sign*
Portfolio Composition	1	(Cash assets, U. S. Government Securities, Federal Funds Sold)/Total Assets	-
	2	Municipal Securities/Total Assets	+
	3	Total Loans/Total Assets	+
	4	Consumer Loans/Total Assets	+
	5	Residential Mortgages/Total Assets	+
	6	Commercial and Industrial Loans/Total Assets	+
Capital and Liability Structure	7	(Σ Common stock, preferred stock, surpluses, undivided profits, contingency reserves, loan and valuation reserves, capital notes and debentures)/Total Assets	-
Operational Efficiency	8	Net Income/Number of Employees	+
	9	Total Salaries and Benefits/Total Assets	-
	10	Other Operating Expenses/Total Assets	+
	11	Total Operating Expenses/Total Assets	-
Rates and Prices	12	Interest on Time Deposits/Total Deposits	+
	13	Total Interest and Fees/Total Loans	+
	14	Service Charges/Deposits	+
Profitability	15	Total Revenue/Total Assets	+
	16	Net Income/Total Assets	+
	17	Net Income/Σ common stock, preferred stock surpluses, undivided profits, contingency reserves, loan and valuation reserves, capital notes and debentures	+

*Indicates the hypothesized sign for the chain bank performance.

chain membership on a bank across time. Clearly, it takes time for new strategies arising from a change in status to become effective and show up in a bank's performance ratios. At the present, those effects cannot be isolated and tested.

Statistical Analysis

Two approaches were employed to test the hypotheses of this study. First, since all population parameters were known, direct comparison of the parameters of the two subpopulations, chain banks and unit banks, was possible. A qualitative guideline of performance difference was logically determined and the parameters were compared to it to detect if substantial operating differences existed between the two groups.[1]

Second, three statistical tests were applied to the data to observe what results would have been obtained had the data occurred as random samples of larger populations. T-tests were used to determine the equality of sample group means. Multiple regression was used with each performance ratio serving as a dependent variable to be regressed on seven independent variables which influence bank performance. By including chain bank affiliation in the regression equation as an independent variable, its effects upon bank performance can be examined, when the other influences are held constant. If the coefficient of the chain bank variable is statistically significant, the sign will indicate the direction in which chain bank performance differs from unit bank performance. The regression results should corroborate those from the t-tests.

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[1]The establishment of the guideline is discussed in Chapter VI.

Moreover, most prior studies of multiple-office bank performance have utilized these two procedures, and using them here will facilitate comparison of the results from this research with those from earlier work.

Finally, the question of whether chain bank performance differs from unit bank performance is fundamentally a classification problem. Multiple discriminate analysis (MDA) seems well suited, conceptually, to the problem. Furthermore, MDA has the advantage of being a multivariate test, while the other two are univariate techniques. Thus, any interactive effects among the variables will be captured by MDA and brought to bear on the question. Therefore, the data were analyzed with MDA also.

The t-tests

The null hypothesis tested for each variable was H_0: $\mu_1 = \mu_2$. The test statistic was:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\hat{\sigma}\bar{x}_1 - \bar{x}_2} \tag{6}$$

where $\bar{x}_n$ was a mean and $\hat{\sigma}\bar{x}_1 - \bar{x}_2$ is an estimate of the standard error of the difference between the means. A significance level of .05 was considered significant.

Multiple Regression

The hypotheses were tested with OLS linear multiple regression. The dependent variables were ratios formed from accounting statement data of the sample banks. A separate regression was estimated for each dependent variable. The dependent variables were defined in Table VI.

The general regression equation was specified as follows:

$$Y_{jk} = \beta_0 + \beta_1 CB_j + \beta_2 I_i + \beta_3 CH_j + \beta_4 P_i + \beta_5 CN_i + \beta_6 S_j + \beta_7 D_j + \mu_j \quad (7)$$

where Y_{jk} was the k^{th} performance variable of the j^{th} bank in the i^{th} market.

CB_j was a binary variable which denoted if a bank belonged to a chain. The sign and statistical significance of the coefficient of this variable were the central items of concern in this study. Evidence that chain bank membership substantially affected bank performance appeared when the coefficient of this variable was significant and the sign was in the expected direction. CB = 1 if the observed bank was part of a chain; otherwise, CB = 0.

I_i represented economic influences of the local area which impact banking activity. Per capita income of the county was taken as a proxy of the overall effects of a wide range of factors.

CH_j was a binary variable which denoted the type of charter a bank held. If the bank was a national bank, CH = 1; otherwise, CH = 0.

P_j was the population of the county (in thousands) in which the bank was located.

CN_i was a measure of competition facing a bank. It was expressed as a Herfindahl Index, H, such that $H = \Sigma S_i^2$, where S_i = market share of bank i, based on total deposits in the local market area. The range of H is $0 < H \leq 1$. As H rises, the degree of concentration within a market increased.[2]

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[2]Theory suggests that the lower the degree of concentration within a market, the greater the level of competition is likely to be. However,

S_j was the logrithm of the bank's assets.

D_j was the straight-line distance in miles to the nearest large metropolitan area having two or more banks large enough to have an influence beyond just their own county. More specifically, D was the distance to the nearest of five cities: Oklahoma City or Tulsa, Oklahoma; Wichita, Kansas; Amarillo or Dallas/Ft. Worth, Texas. The closer a bank was located to the big banks in those cities, the more likely it was to face direct competition from them in addition to competition from other local banks.

μ_j represented the error factor in the regression equation.

The independent variables are summarized and named in Table VII.

The assumptions of OLS multiple regression models are described in standard statistics texts.[3] Briefly stated, they are:

1. The sample is randomly drawn.
2. Each array of Y for a given combination of X's follows the normal distribution.
3. The regression of Y on X's is linear.
4. All the Y distributions have the same variance.

Since this research utilizes data from the entire population under study, the assumption of the sample being randomly drawn does not apply. No inference about chain banking outside Oklahoma can be drawn.

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theory is not specific on the most appropriate measure to discern the level of concentration existing in a market, e.g., the number of firms, size dispersion, or dominance of the largest few. In recent banking studies, the Herfindahl Index has been the most commonly used proxy for the degree of competition present in a market. However, the important point is that regardless of the measure employed, the concentration proxy has been significantly related to performance about 80 percent of the time [40].

[3]For example, see Social Statistics, Chapter 17, by Hubert N. Blaylock, Jr., or Applied Regression Analysis, Chapter 1, by Norman Draper and Harry Smith.

The assumption of normality of the dependent variables is critical only when N is small, due to the Central Limit Theorem [5]. In this research, N > 460 for all variables in all three years, and therefore, the normality assumption can be relaxed.

TABLE VII

NAMES AND DEFINITIONS OF INDEPENDENT VARIABLES

Variable Name	Symbol	Definition
HERF	CN_i	Herfindahl Index number
CHAINBK	CB_i	Binary variable = 0 if unit bank; 1 if chain bank
INCOME	I_i	Per capita income of county in which Bank j is located, in thousands
CHARTER	CH_j	Binary variable = 0 if state bank; 1 if national bank
POPUL	P_j	Population of county in which Bank j is located, in thousands
DIST	D_j	Straight-line mileage from Bank j to nearest metropolitan area
LOGTA	S_j	Natural logarithm of the total assets of Bank j

Multiple Discriminant Analysis

MDA is a statistical technique which assigns observations to one or two (or more) predetermined groups, given a set of characteristics for each group. The discriminating variables are used to derive a set of coefficients, or weights, for each variable. The resulting function produces a score for each observation which can be compared to some

critical value and the observation then assigned to a group. In the discriminant function:

$$Z_i = b_0 + b_1X_{1i} + \ldots + b_jX_{ji} + \ldots + b_n X_{ni} \quad (8)$$

Z_i is the discriminant score for observation i, b_j is the classification function coefficient, or weight, for variable X_{ji}, and X_{ji} is the j^{th} discriminating variable in the i^{th} observation.

If the theory presented in this paper is correct, and chain banks do perform differently from unit banks, then Multiple Discriminant Analysis should be able to classify each bank correctly and assign it to its respective group on the basis of the same variables[4] used in the regression analysis. Those variables have already been theoretically justified as the ones which will affect, or be affected by chain bank membership.

The Assumption of Multivariate Normality. MDA assumes the discriminating variables have multivariate normal distributions. Violation of that assumption may have several undesirable consequences. According to Pinches [39]:

> . . . the presence of multivariate non-normality indicates that (1) error rates are generally affected for both the linear and quadratic discriminant functions; (2) the quadratic is affected even more than the linear; and (3) correlation among the predictor variables may substantially influence classification results. The magnitude and direction of the impact is, in general, unknown (p. 433).

Presently, there are no procedures available which test the distributions of variables in discriminant problems for multivariable

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[4] In MDA, the Y_k's shed the dependency status which they possess in regression analysis, and become predictor variables along with independent regression variables. Thus, the Y_k designation in MDA is merely a variable name.

normality [14] [39]. Various strategies have been employed by researchers when confronted with uncertainty about the distributions of their variables. The most common approach has been to assume normality of the data [14] [39]. In this study, there is no basis for such an assumption. Indeed, the opposite assumption seems more likely to be true.

Attempts have been made in the past to compensate for the lack of a test for multivariate normality by testing all variables for univariate normality. However, that procedure will not ensure multivariate normality since all the variables can have univariate normal distributions withou the data being multivariate normal [39].

Another strategy often employed has been to assume that the MDA classification procedures are robust to non-normality [14] [39]. Controversy exists in the literature about that approach. Lachenbruch, Sneeringer, and Revo [28] examined the robustness of both linear and quadratic procedures against three nonmultivariate normal distributions having known classification errors. They concluded that the standard procedures may be quite sensitive to nonmultivariate normality. On the other hand, Klecka [27] states,

> The statistical theory of discriminant analysis assumes that the discriminating variables have a multivariate normal distribution and that they have equal variance-covariance matrices within each group. In practice, the technique is very robust and these assumptions need not be strongly adhered to (p. 435).

To escape from that difficulty, a commonly used strategy has been to perform various transformations upon the data prior to estimating the discriminant function. The natural log transformation has been used frequently because it does make the distribution more symmetric and probably more normal [14]. However, the transformation may also

alter both the relationships among the variables and the relative positions of the observations [14].

The procedure utilized in this research followed the recommendations of Pinches [39], and Lachenbruch, Sneeringer, and Revo [28]. They suggested that the original data be used to test for equality of group dispersion matrices, then the discriminant functions estimated, and the error rates observed, followed by retesting after transforming the data, to determine if discriminatory power was increased.

A Priori Probabilities. Standard discriminant analysis classification rules incorporate a priori probabilities to account for the probability of an observation actually arising from each of the groups in the population. Eisenbeis [14] has shown that mis-statement of the prior probabilities can cause the classification error to increase quite substantially.

Because a universe is under consideration in the present research, a priori probabilities are known, provided the initial classifications are correct. As previously described, all banks have been classified by two methods, and the results then reconciled. The 1979 classifications are believed to be error free, and those of prior years to be nearly so.

Classification Procedures and Error Rates. Initially, all variables, both dependent and independent (except for the chain bank dummy) were used. However, correlation among the variables reduces the discriminatory power of the MDA model [14], and it was apparent that several of the bank performance measures must be correlated. For example, an increase in the total loans to total assets ratio must be accompanied by increases in one or more of the ratios of loan

sub-categories. Five different step-wise procedures were used, attempting to locate the optimal set of variables, with identical results. The step-wise procedures all performed less well than the direct method of using all variables at once.

Each time a classification analysis was run, Box's M was calculated to test for equality of the covariance matrices. In all cases, the null hypothesis of equal covariance matrices was rejected at an extremely high level of confidence (>.9999), indicating that quadratic classification rules should be employed.

The term, "error rate," is used to denote the classification accuracy of the model. There are methods for estimating the expected population error rate which do not depend upon normality of the data. They are: (1) the resubstitution method, (2) the holdout or split sample method, and (3) the Lachenbruch U method. It has been well documented [39] that the resubstitution and the holdout methods produce biased estimated of the actual error rate, while the U method produces results which are relatively free of bias.

The Lachenbruch U method was chosen for use in this study, although the choice involved a trade-off. The only computer package presently available which includes the U method provides for linear classification rules only. Thus, in order to utilize the most accurate test, it was necessary to accept theoretically less desirable classification rules in the test procedure. To compensate for the trade-off, linear rules were used to analyze the data, and the results were compared to those from the quadratic procedure to locate any large differences between the two methods. Close similarity of the classification results from all three procedures could serve to validate the U method results. That

procedure seemed preferable to the alternative of using a test which is known to produce estimates having an unpredictable amount of bias.

Also useful in assessing the classification efficiency of the model is a test employed by Joy and Tollefson [25]. The test statistic used was:

$$Z = \frac{\bar{y} - \pi}{\left[\frac{(1 - \pi)}{N}\right]^{\frac{1}{2}}} \tag{9}$$

where $\bar{y}$ is the proportion of observations correctly classified by the discriminant model and π is the probability of classification by chance.[5] The Z-score measures the likelihood of the correct classification occurring by chance, and it can be evaluated against a normal distribution.

Interpretation of the Significance of the Individual Variables. The interpretation of the output of MDA is somewhat more difficult than that of multiple regression because of the nature of the discriminant function coefficients. The coefficients are not unique, only their ratios are [14]. That property makes it impossible to establish levels of significance for the coefficients. Eisenbeis [14] points out that:

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[5] If the classification matrix is constructed as follows

Actual Group Membership	Classified Group Membership		
	Group 1	Group 2	Total
Group 1	A	B	C
Group 2	D	E	F
Total	G	H	N

then, $\bar{y} = (A + E) \div N$; and $\pi = F \div N$.

> . . . it is not possible, nor does it make any sense to test, as in the case with regression analysis, whether a particular discriminant function coefficient is equal to zero or any other value. That is, there is no test for the absolute value of a particular variable (p. 883).

Moreover, the relative magnitudes of the weights cannot be compared because of different units of measure (e.g., dollars versus miles) [35]. Therefore, variables in MDA are standardized by their standard deviations. Once standardized, the magnitudes of the absolute values of the standardized canonical correlation coefficients can be compared to determine which variables contribute the most to definitions of the composite function [27] [35] [38] [46].

The unstandardized classification function coefficients do provide information about the association between the observations being scored and the discriminating variables. The size and sign of the b_j's in Equation (8) determine the effects of the discriminating performance measures, the X_j's [35]. If b_j increases (positively or negatively), Z_i increases and moves toward reassignment from the unit bank group to the chain bank group [35]. Thus, it was possible to determine the influence of chain bank association upon the performance variables of a bank by examining the differences in the classification coefficients of the two groups. For example, the coefficients for the variable Y_1 (Total Cash Assets ÷ Total Assets) in the year 1979 were 517.4 and 515.4 for unit banks and chain banks respectively. The conclusion drawn was that chain banks held lower proportions of cash assets than unit banks during that period.

Because there is no test for significance of the individual variables, significance can only be inferred from the differences of group means, which is tested by the use of Wilk's lambda statistic [27]. Lambda is an inverse measure of the discriminating power of the original

variables which has not yet been removed by the discriminating function [27]. The larger the value of lambda, the less information remaining [27]. Lambda is evaluated by a chi-square statistic.

To summarize the interpretive procedure of the MDA output used in the research, the steps were these:

1. The significance levels of the differences between the group means were established by the chi-squared statistic from Wilk's λ [27].
2. The absolute values of the standardized canonical discriminant function coefficients were examined to determine which were the most important variables in discriminating between groups. A coefficient value lying above the median was considered to be important.
3. When a performance variable was located whose value was above the median in at least two years having significant X^2 values, its classification function coefficients were examined to determine the direction of the difference between unit banks and chain banks. From those differences, a profile of chain banks versus unit banks was drawn.

CHAPTER V

THE NATURE OF CHAIN BANKING IN OKLAHOMA

Chain banking has experienced substantial growth in Oklahoma, both absolutely and relative to unit banking, since Darnell's study in 1962 [8]. Table VIII presents the number and percentages of Oklahoma banks, classified by unit and chain status.

TABLE VIII

NUMBER (%) OF UNIT AND CHAIN BANKS IN OKLAHOMA

Year	1962*	1975	1977	1979
Unit Banks	144 (64)	253 (55)	259 (54)	256 (52)
Chain Banks	82 (36)	209 (45)	217 (46)	233 (48)
Total Banks	226	462	476	489

*Darnell [8], insured banks only.

The use of figures from Darnell's work for comparative purposes in this research required consideration of three points. First, the definition of chain banking used by Darnell was somewhat different from the one upon which this research was based. To the extent that chain

bank associations exist through common directors who are not also owners, Darnell's definition is more restrictive than the one employed herein.

Second, attention was previously called to the suspicious nature of Year 1945 data reported by Darnell [8], which is contained in Table I (page 20). That might cast some doubt (although probably only slightly) on his 1962 data as well.

Third, Darnell dealt only with banks insured by FDIC, whereas all banks in the State were considered in the present study.

Relying upon Darnell's data as the best available, the compound rate of growth (calculated from the data in Table VIII) of the number of chain banks during the period 1962-1979 was 6.34 percent, compared to 3.44 percent per year for unit banks. During the more recent years of 1975-1979, both growth rates have dropped off considerably, to 2.2 percent per year for chain banks and 0.25 percent for unit banks, with the number of unit banks actually declining slightly from its peak in 1977.

Table IX shows the proportions of assets held by chain banks relative to assets held by all Oklahoma banks.

TABLE IX

TOTAL ASSETS HELD BY CHAIN BANKS AS PERCENTAGE OF TOTAL ASSETS OF ALL BANKS IN OKLAHOMA

	1962*	1975	1977	1979
% Chain Banks Assets	27.4	51.1	51.6	53.5

*Darnell [8], insured banks only.

The rate of growth shown by chain banks assets in Table IX was 4.01 percent per year, somewhat lower than the growth rate of the number of chain banks seen in Table VIII. The lower rate is at least partially explained by the fact that new chain banks often are de nova banks.

On a wider scope, only one other study besides Darnell's [8] is available for comparison. In 1977, Keating [26] examined chain banking practices in the Seventh FRS District. He found that in Illinois, the heaviest chain banking state in the District, only about 20 percent of all banks, holding about 14.6 percent of all banks assets, were chain affiliated. Those proportions were markedly different from those Darnell [8] reported for Illinois in 1962, when 11.3 percent of all insured banks held 30 percent of all insured bank assets. Thus it appears that in Illinois between 1962 and 1977, the number of chain banks nearly doubled while the assets they controlled dropped by one-half. The reasons for the sharply devergent experience between the two states (Oklahoma and Illinois) cannot be ascertained in this research. However, the fact that while chain bank penetration was declining sharply in one state, it was growing steadily to become the dominant structure in another, makes it quite hazardous to draw generalized, global conclusions about the nature of chain banking.

Another interesting sidelight (on which no recent evidence has been published) is that in 1962, in only one state (Rhode Island) did chain banks hold more than one-half of all insured bank assets. In Rhode Isalnd, three chain banks held 90 percent of all insured bank assets in 1962 [8]. However, chain bank assets were in the 45-49.5 percent range in the states of Colorado, Florida, and Texas [8].

Chain banks showed a definite preference for being state chartered. A classification of chain banks by type of charter is shown in Table X.

TABLE X

OKLAHOMA CHAIN BANKS BY CHARTER (%)

Charter	1975	1977	1979
State	135 (65)	145 (67)	161 (69)
National	74 (35)	72 (33)	72 (31)
Total	209	217	233

Not only did chain banks prefer to be state chartered, they were widely dispersed throughout the state. Except for Oklahoma and Tulsa counties, the number of chain banks in a county was small. Table XI presents an enumeration of chain banks per county.

TABLE XI

NUMBER OF CHAIN BANKS PER COUNTY IN OKLAHOMA

		Number of Chain Banks in Each County												
	Year	0	1	2	3	4	5	6	7	19	22	24	28	30
'Number	1979	14	15	14	11	9	6	5	1			1		1
of	1977	15	14	11	13	9	6	5	2		1		1	
Counties	1975	16	14	16	12	10	3	3	1	1			1	

About one-fifth of Oklahoma's 77 counties had no chain banks, while about 52 percent had between 1-3 chain banks. Thus, about three-fourths of the counties had fewer than four chain banks in them. On the other hand, the state's two metropolitan counties contained about one-fourth of all the chain banks (but only about 18 percent of all banks) in Oklahoma.

In Table XII, chain banks are classified by population of the counties in which they are located.

TABLE XII

CHAIN BANKS CLASSIFIED BY POPULATION (1979) OF COUNTY IN WHICH THEY ARE LOCATED

Population	Number of Chain Banks
0- 5,000	1
5,001- 10,000	21
10,001- 25,000	54
25,001- 50,000	68
50,001- 75,000	26
75,001-100,000	0
100,001-400,000	9
400,001-500,000	24
over 500,000	30
Total	233

The heavy concentration of banks in counties having 10,000-50,000 people reflects the average county population of about 30,000 in 1979. The 24 chain banks in the 400,001-500,000 category were all in Tulsa county, and all banks in the over 500,000 category were in Oklahoma

county. Thus, it appears that while chain banks were positioned to compete over most of the state, chain bank penetration intensified somewhat in the more populous counties.

Even so, the number of banks in a chain tended to be very low. Table XIII shows the classification of chain banks by the number of banks within each chain.

TABLE XIII

NUMBER OF BANKS PER CHAIN

Number of Banks in the Chain	Number of Chains	Cumulative Percentage
2	52	47
3	11	61
4	6	72
5	3	79
6	1	82
7	1	85
8	2	92
18	1	100

About two-thirds of the chain organizations contained only two members although they accounted for only 47 percent of all chain banks. No other structural patterns within chains were discernable. There were chains in which all banks were large or all banks were small; chains in which the lead bank was large and the other(s) was(were) small and vice versa; chains in which all members were within a few miles of each other and chains with all members widely separated. The

strategies observed were so diverse as to give the appearance of being more of less randomly drawn. The only generalization that could be inferred is that the chains tended to have only two or three members.

Taken altogether, the above data suggest that the profile of the typical chain bank is that of a small-to-medium sized, state-chartered bank in a town of less than 75,000 population, and the bank is associated with one other bank which could be located anywhere in the State. The small number of banks in the average chain was unanticipated since both Darnell [8] and Keating [26] reported the average chain to have 5-to-6 banks in it. Oklahoma bankers appear to prefer the chain structure, but only in a very limited fashion.

CHAPTER VI

COMPARISONS OF POPULATIONS

In this study, data from the entire population of all banks in Oklahoma were available for examination. Those data were divided into two sub-populations, unit banks and chain banks. Since all parameters of the two sub-populations were known, it was possible to make direct comparisons of the performance measures and other parameters of the two sets of banks.

In any study in which population data are present, the conclusions drawn by the observer are the products of the interpretation which the observer places upon the information provided by the data. Obviously, observers having different perspectives of the data will arrive at different conclusions. Using the means of the two groups on the variable Total Assets as an example, one observer might conclude that the mean of the chain bank group of $45,239,000 was significantly and meaningfully greater than that of the unit bank group of $35,823,000. Not only is the difference of about $9,400,000 a large amount of money, but it is a difference of over 26 percent. Another observer, wishing to give more weight to the standard deviations, might note that in data which range up to $1.4 billion, a difference of $9.4 million is quite small, and conclude that the means really are not significantly different from each other. Thus, population data present knotty problems of interpretation for the researcher who is trying to arrive at objective conclusions about the topic under investigation.

In this study, generally, a meaningful difference was first deemed to exist when the group mean of the chain bank variable differed from the group mean of the unit bank variable by at least 10 percent in two of the three time periods, and/or the means were diverging as time passed. Then, the guideline was relaxed to 5 percent and any additional differences were noted. Whenever the standard deviations were large relative to the means, they were also considered. It must be recognized that these guidelines may not be the appropriate ones in each case. However, they have the advantage of providing a uniform standard and of reducing the number of necessary decisions to a minimum.

Table XIV presents the group means and standard deviations of all variables, along with the percentage by which the chain bank means differed from those of the unit banks. The variables which exhibited meaningful differences are discussed below.

Total Assets

Bank size, as measured by Total Assets appeared to be substantially larger for the average chain bank by about 26 percent in all three years. However, the total asset values of the four largest banks in the State caused the distributions to be severely skewed to the right. The variable's range extended from $1 million to over $1.4 billion, which produced standard deviations roughly three times the size of their respective means. Because the first and third largest banks (having combined assets of $2.36 billion in 1979) are chain banks and the second and fourth ranked banks are units (having combined assets of $2.09 billion in 1979), the impact of those outliers on the statistical measures is largely offsetting. Therefore, it appears likely that the

TABLE XIV

GROUP MEANS AND STANDARD DEVIATIONS OF ALL PERFORMANCE AND DEMOGRAPHIC VARIABLES

Variable	Year	Means		$\frac{\bar{X}_c - \bar{X}_u}{\bar{X}_u}$	Standard Deviations	
		Unit	Chain		Unit	Chain
Totalas (000's)	1979	$35,823	$45,239	.2628	$115,304	$137,626
	1977	28,223	35,906	.2722	91,199	109,520
	1975	22,816	28,845	.2642	73,936	87,913
Herf	1979	.2633	.2387	-.0934	.140	.110
	1977	.2641	.2443	-.0750	.141	.114
	1975	.2681	.2510	-.0638	.139	.115
Y_1	1979	.3298	.2837	-.1398	.145	.128
	1977	.3262	.2945	-.0972	.139	.134
	1975	.3331	.3132	-.0597	.145	.128
Y_2	1979	.1185	.1354	.1426	.081	.086
	1977	.1218	.1352	.1100	.090	.089
	1975	.1435	.1469	.0237	.093	.093
Y_3	1979	.5032	.5288	.0509	.118	.107
	1977	.5068	.5266	.0312	.122	.117
Y_4	1979	.1603	.1658	.0299	.085	.087
	1977	.1529	.1589	.0392	.084	.091
	1975	.1345	.1402	.0424	.076	.082
Y_5	1979	.1290	.1434	.1116	.081	.080
	1977	.1167	.1251	.0720	.075	.224
	1975	.0886	.0906	.0226	.059	.728
Y_6	1979	.1033	.1296	.2546	.609	.083
	1977	.1051	.1261	.1998	.080	.090
	1975	.0957	.1160	.2121	.075	.091
Y_7	1979	.0945	.0903	-.0444	.051	.042
	1977	.0898	.0906	.0089	.050	.041
	1975	.0845	.0882	.0438	.029	.039
Y_8	1979	13.58	13.77	.0144	7.20	7.16
	1977	9.07	9.60	.0580	5.13	5.46
	1975	7.57	7.86	.0384	4.40	4.74
Y_9	1979	.0168	.0154	-.0833	.006	.005
	1977	.0159	.0150	-.0566	.005	.005

TABLE XIV (Continued)

Variable	Year	Means		$\frac{\bar{X}_c - \bar{X}_u}{\bar{X}_u}$	Standard Deviation	
		Unit	Chain		Unit	Chain
Y_{10}	1979	.0099	.0105	.0606	.004	.005
	1977	.0089	.0099	.1124	.004	.005
	1975	.0084	.0091	.0833	.004	.004
Y_{11}	1979	.0685	.0716	.0453	.014	.015
	1977	.0599	.0615	.0267	.012	.013
	1975	.0569	.0586	.0299	.012	.013
Y_{12}	1979	.0634	.0657	.0363	.013	.012
	1977	.0522	.0527	.096	.009	.008
	1975	.0516	.0531	.0291	.009	.009
Y_{13}	1979	.1054	.1106	.0493	.020	.018
	1977	.0906	.0915	.0099	.014	.016
Y_{14}	1979	.0036	.0041	.1389	.004	.004
	1977	.0029	.0033	.1379	.003	.003
	1975	.0030	.0033	.1000	.003	.003
Y_{15}	1979	.0857	.0879	.0257	.013	.014
	1977	.0721	.0734	.0180	.011	.011
	1975	.0694	.0704	.0144	.010	.011
Y_{16}	1979	.0142	.0140	.0141	.007	.006
	1977	.0113	.0122	.0796	.005	.006
	1975	.0110	.0111	.0091	.005	.005
Y_{17}	1979	.1671	.1715	.0263	.094	.113
	1977	.1346	.1420	.0550	.063	.069
	1975	.1334	.1333	.0007	.056	.058
INC (000's)	1979	6.75	6.75	.0002	1.61	1.52
	1977	6.04	6.09	.0089	1.26	1.35
	1975	4.93	4.94	.0023	1.10	1.10
Popul (000's)	1979	96.9	142.4	.4685	164.9	202.0
	1977	95.6	136.2	.4251	162.7	197.4
	1975	87.7	133.6	.5237	153.9	195.9
Dist (miles)	1979	62.0	49.2	-.2050	38.4	37.2
	1977	61.2	50.6	-.1740	38.4	36.8
	1975	62.4	50.6	-.1890	37.9	36.6

typical chain bank is larger than the typical unit bank, although they may not be quite as large as the means indicated.

Y_1: Cash Assets to Total Assets Ratio

The proportion of Total Assets devoted to cash reserves by the average unit bank was relatively constant during 1975-1979, and was well above the corresponding figure for the average chain banks. Furthermore, the chain bank ratio declined steadily, as Figure 1 shows.

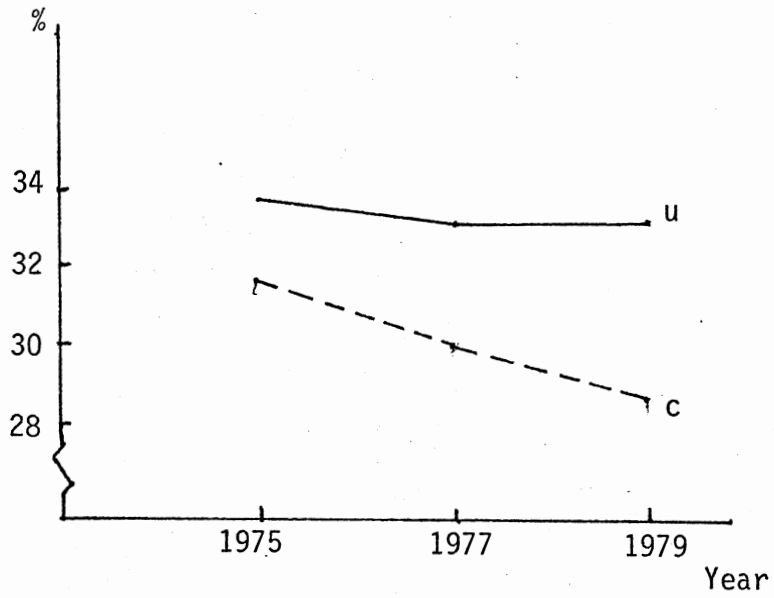

Figure 1. Ratio of Cash Assets to Total Assets

Although the percentage of difference met the 10 percent standard in 1979 only, the gap widened by about 4 percentage points each year, and in the hypothesized direction. Therefore, it seems reasonable to conclude that chain banks devoted less of their assets to cash reserves than did unit banks.

Y_2: Municipal Securities to Total Assets Ratio

Although both groups decreased their commitments to municipal securities during the period, chain bank asset proportions were consistently above those of unit banks, and the standard was exceeded in two of three years. The gap also widened each year (Figure 2).

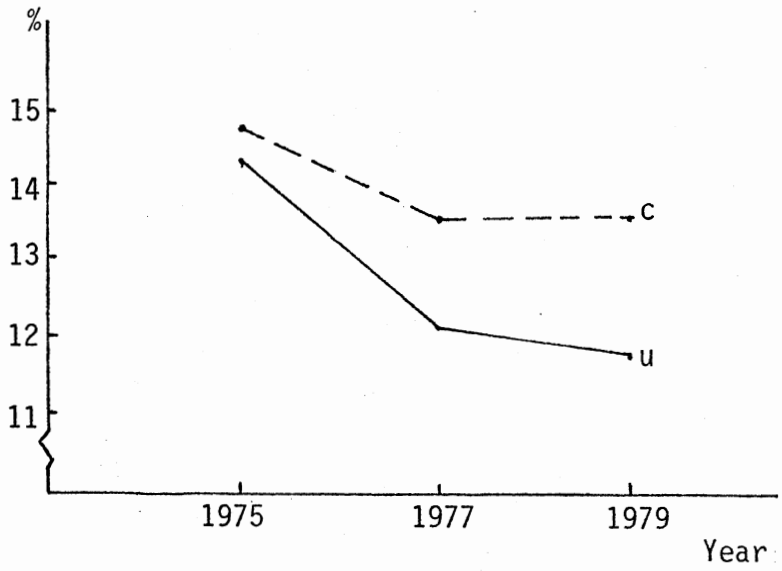

Figure 2. Ratio of Municipal Securities to Total Assets

The reduction in portfolio commitments was inconsistent with expected behavior, but both groups acting in the same direction suggests that they were responding in the same way to changes in the general economic environment, or to some other external disturbances. However, the difference between the groups widened in the expected

direction, thereby supporting the hypothesis that chain banks devote more resources to municipal securities.

Y_5: Residential Mortgage Loans to Total Assets Ratio

Both groups of banks increased their commitment to residential mortgages by over 50 percent during 1975 to 1978. Chain banks moved up more sharply, widening the difference percentage from 2.26 percent to 11.16 percent. As was the case with Y_1, only one year's results (1979) exceeded the established standard of 10 percent, but because the trend was consistent and in the hypothesized direction, a conclusion that operating differences exist between chain banks and unit banks on this performance measure seemed warranted.

Y_6: Commercial and Industrial Loans to Total Assets Ratio

While the fraction of Total Assets which both groups devoted to commercial loans was only in the 11-13 percent range, the percentage difference between the two groups was large. Figure 3 presents the data.

Y_{14}: Service Charges to Total Deposits Ratio

This measure produced clear evidence of an operating difference between the two groups. The percentage difference rose from 10 percent in 1975 to 13.9 percent in 1979. Those results were in line with expectations, and with previous evidence found by other investigators.

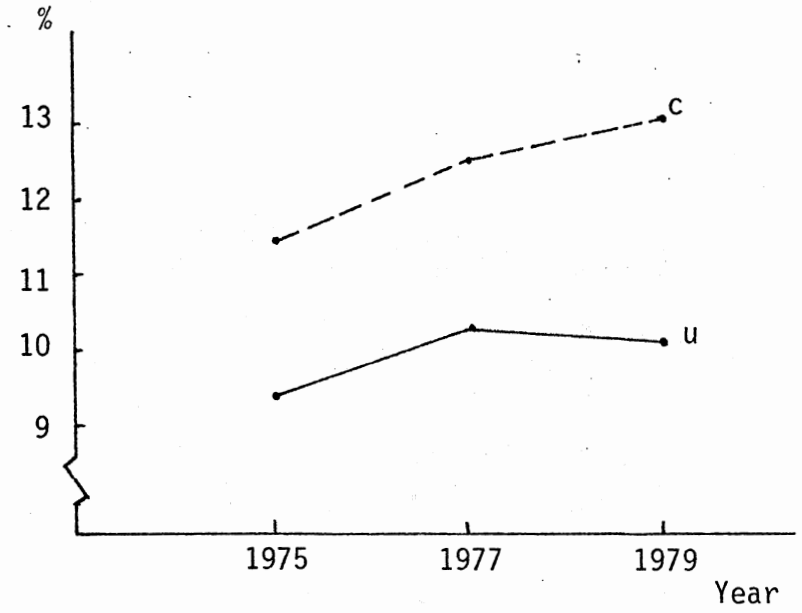

Figure 3. Ratio of Commercial and Industrial Loans to Total Assets

Population

The data indicated definitely that the average chain bank operated in a more heavily populated county than did the average unit bank, on the basis of the percentage difference between the group means. However, the means and standard deviations were badly affected by a right hand bi-modal distribution (see Table V, page 31) arising from a large number of banks, both units and chains, being located in the Oklahoma City and Tulsa areas. Nevertheless, the wide differences of around 45 percent between the group means appears to be rather compelling evidence that chain banks tend to be located in more populous areas than unit banks do.

Distance

Substantial differences of group means were also found in the Distance variable. Mean differences ragned from -18.94 percent in 1975, to -17.42 percent in 1977, to -20.53 percent in 1979, while standard deviations were stable, around 38. The average chain bank clearly appears to be closer to a metropolitan area than the average unit bank.

Summarizing the conclusions drawn from examining the parameters of the two sub-populations of chain and unit banks, strong evidence appeared which indicated that chain banks tend to be larger than unit banks, and that they also tend to be located in more populous counties, closer to a large metropolitan area. It also appears quite clear that chain banks place more of their funds into municipal securities and commercial loans than unit banks do, and that chain banks make higher service charges. Weaker evidence also appeared to indicate that chain banks place lower amounts of funds into liquid assets than unit banks do and also make more residential mortgage loans. Each of the conclusions about performance is in line with the stated hypotheses of this paper.

Relaxation of the significant difference guideline from 10 percent to 5 percent causes the variables Y_9 and Y_{10} to become significant. Those variables indicate that chain banks tend to pay lower salaries and benefits relative to total assets than unit banks do, and that chain banks also tend to incur higher Other Operating Expenses. Both conclusions are also in line with expectations.

CHAPTER VII

THE STATISTICAL COMPARISON OF PERFORMANCE OF CHAIN BANKS AND UNIT BANKS IN OKLAHOMA

Univariate t-tests

Group means and standard deviations were calculated for all variables, and then t-tests were performed to determine if significant differences existed between the means. Table XV presents the results for those variables in which significant differences between group means were indicated at the .05 significance level or lower in at least one year.

To be considered as evidence that the performance of chain banks was different from that of unit banks, t-tests which were statistically significant at the .05 level in at least two of the three years examined were required. On that basis, the t-tests indicated that chain banks tend to hold fewer liquid assets than unit banks do. The significance levels were .012 and .000 for 1977 and 1979 respectively. Furthermore, in 1975, the significance level of .112, while outside the specified range, was still reasonably good.

The t-tests suggest that chain bankers place the funds, obtained by reducing liquid assets, into commercial loans. The significance levels for that variable were .010, .008, and .000 for 1975, 1977, and 1979. It also appears that chain banks incur higher Other Operating

TABLE XV

GROUP MEANS WHICH PRODUCED T-VALUES SIGNIFICANT AT THE .05 LEVEL IN AT LEAST ONE YEAR

Means	1975 Units	1975 Chains	1975 Significance Level	1977 Units	1977 Chains	1977 Significance Level	1979 Units	1979 Chains	1979 Significance Level
Herf Index	.268	.251	.149	.264	.244	.091	.263	.239	.031
Cash Assets / Total Assets	.333	.313	.112	.326	.295	.012	.330	.284	.000
Municipals / Total Assets	.144	.147	.699	.122	.135	.107	.119	.135	.026
Total Loans / Total Assets	NA*	NA	NA	.507	.526	.152	.503	.529	.012
Mortgages / Total Assets	.089	.091	.728	.117	.125	.224	.129	.143	.049
Coml Loans / Total Loans	.096	.116	.010	.105	.126	.008	.103	.130	.000
Tot Sal + Bens / Total Assets	NA	NA	NA	.016	.015	.057	.017	.015	.003
Other Op Exp / Total Assets	.008	.009	.043	.009	.010	.025	.010	.011	.162
Tot Op Exp / Total Assets	.057	.059	.141	.060	.062	.171	.069	.072	.022
Int on TD / Time Deps	.052	.052	.072	.052	.053	.539	.063	.066	.039
Tot Int + Fees / Total Loans	NA	NA	NA	.091	.092	.548	.105	.111	.002
Population	87.7	133.6	.206	95.6	136.2	.016	96.9	142.4	.007
Distance	62.4	50.6	.001	61.2	50.6	.002	62.0	49.2	.000

*NA indicates data missing from the FRS tapes.

Expenses to Total Assets ratios than unit banks experience, as indicated by significance levels of .043 in 1975 and .025 in 1977.

County population was a significant factor in 1977 and 1979, at the level of .016 and .007, respectively, while distance from a large city was a highly significant influence in all three years with levels of .001 (1975), .002 (1977), .000 (1979).

The significance levels of several of the variables exhibited quite wide variation across time. For example, the significance level of the Municipals to Total Assets variable improved from .69 in 1975 to .107 in 1977 to .026 in 1979. Mortgages to Total Assets shows the same pattern, going from .728 to .224 to .049 across the three periods 1975-1979. The probable cause(s) of those wide variations might be changing economic or regulatory conditions, but a more plausable explanation seems likely to be the rising difficulty of correctly identifying the chain banks in earlier years. In 1979, 12 out of the 13 variables listed in Table XV were significant at the .05 level or better. In 1977, only five variables fell into that range, and in 1975, the number of significant variables dropped to three. It seems doubtful that the differences between the two groups widened that dramatically in the span of five years.

Summarizing the results from the t-tests, chain banks, relative to unit banks, tended to:

1. Hold fewer liquid assets,
2. Make proportionately more commercial loans,
3. Incur higher Other Operating Expenses,
4. Be located in more populous counties, and
5. Be closer to major metropolitan areas.

Regression Analysis

Multicollinearity and Auto-Correlation

Careful searches were made for evidence of the presence of both auto-correlation and multicollinearity. The correlation matrices showed low-to-moderate correlation between most variables. The highest r found was $r = .679$ between Distance and Population, and Population showed $r = .592$ with Income. Each of three variables involved was dropped out of the equations in turn. The only consequential changes which occurred in the retests were declines in the R^2 values and the F-ratios. The regression coefficient values showed no marked instability across the retests, and standard errors remained low and stable. Multicollinearity did not appear to be a problem.

The usual test for auto-correlation is the Durbin-Watson d statistic. Tables of critical values of d in statistics texts only go as far as $N = 100$, $k = 6$. Therefore, it was necessary to estimate critical values by using a formula developed by Theil and Nager [47] which yields only the upper boundary. Values of d were calculated for the residuals from all equations in all three years. The results, along with the estimated critical values are given in Table XVI.

Of all calculated values which fall below their appropriate critical upper values, only that of Y_{17} in 1979 is likely to be below the lower limit, indicating a clear rejection of the null hypothesis that $\rho = 0$ at the .01 level of significance. The rest of the unfavorable calculated values probably fall within the indeterminant range. Therefore, auto-correlation did not appear to pose a problem to this research.

TABLE XVI

DURBIN WATSON d VALUES WITH ESTIMATED UPPER LIMIT CRITICAL VALUES AT THE .01 LEVEL OF SIGNIFICANCE

Y_k	1975	1977	1979
1	1.750	1.898	1.883
2	1.840	1.764	1.876
3	---	1.853	1.818
4	1.946	1.989	1.907
5	1.793	1.755	1.694
6	1.091	1.917	1.837
7	1.989	1.967	2.015
8	1.817	1.783	1.891
9	---	1.999	1.993
10	2.119	2.133	1.955
11	1.843	2.128	1.997
12	1.977	2.198	1.960
13	---	1.982	1.936
14	1.848	1.949	2.066
15	1.982	2.028	2.015
16	1.852	1.740	1.933
17	1.894	1.793	1.116
Critical Value	1.810	1.813	1.815

Normality of Variables

All variables were tested for normality using the Kolmogorov-Smirnov goodness of fit test [5]. The test results are displayed in Table XVII. The null hypothesis of normality was rejected at a very high level of confidence for all variables except one: Y_{11} in 1979. After transforming all variables to log form, the tests were rerun. While the Z-scores for the most variables fell as a result of the transformations, normality was not achieved for most of them (see Table XVIII).

TABLE XVII

RESULTS OF KOLMOGOROV-SMIRNOV TESTS FOR NORMALITY OF ALL VARIABLES, BEFORE TRANSFORMATIONS, 1975-1979

	1975		1977		1979	
Variable	K-S Z	Significance Level	K-S Z	Significance Level	K-S Z	Significance Level
TOTALAS	8.187	.000	8.300	.000	8.394	.000
HERF	3.233	.000	3.603	.000	3.694	.000
INCOME	3.333	.000	2.330	.000	3.056	.000
POPUL	8.399	.000	8.415	.000	8.460	.000
DIST	1.401	.039	1.516	.020	1.652	.009
Y1	1.728	.005	2.071	.000	2.072	.000
Y2	1.268	.080	1.694	.006	1.446	.031
Y3	---	---	1.981	.001	2.182	.000
Y4	2.037	.000	1.861	.002	2.290	.000
Y5	1.793	.003	1.413	.037	1.593	.012
Y6	2.234	.000	2.255	.000	2.117	.000
Y7	4.817	.000	5.673	.000	6.026	.000
Y8	2.014	.001	1.480	.025	1.654	.000
Y9	---	---	3.011	.000	2.797	.000
Y10	3.025	.000	2.755	.000	2.644	.000
Y11	1.561	.015	1.541	.017	1.019	.250
Y12	3.784	.000	3.808	.000	2.115	.000
Y13	---	---	2.388	.000	2.462	.000
Y14	4.256	.000	4.780	.000	4.268	.000
Y15	1.812	.003	2.018	.001	1.405	.039
Y16	1.446	.031	2.464	.000	2.624	.000
Y17	1.404	.039	2.703	.000	4.955	.000

TABLE XVIII

RESULTS OF KOLMOGOROV-SMIRKOV TESTS FOR NORMALITY OF ALL VARIABLES, AFTER TRANSFORMATIONS, 1975-1979

	1975		1977		1979	
Variable	K-S Z	Significance Level	K-S Z	Significance Level	K-S Z	Significance Level
TOTALAS	1.096	.181	1.132	.154	0.978	.294
HERF	2.226	.000	2.335	.000	2.620	.000
INCOME	2.449	.000	2.261	.000	2.137	.000
POPUL	3.227	.000	3.098	.000	3.166	.000
DIST	4.818	.000	4.818	.000	4.836	.000
Y1	0.923	.362	0.630	.822	0.483	.974
Y2	2.487	.000	2.815	.000	2.958	.000
Y3	---	---	3.272	.000	3.445	.000
Y4	1.352	.052	1.314	.063	1.141	.148
Y5	2.060	.000	1.757	.004	2.437	.000
Y6	1.291	.071	1.609	.011	1.546	.017
Y7	2.812	.000	2.982	.000	3.146	.000
Y8	1.763	.004	2.233	.000	2.317	.000
Y9	---	---	1.651	.009	1.511	.021
Y10	1.586	.013	2.516	.000	1.654	.008
Y11	1.777	.008	2.514	.000	1.114	.167
Y12	5.751	.000	6.586	.000	4.317	.000
Y13	---	---	4.616	.000	4.810	.000
Y14	4.976	.000	5.809	.000	4.228	.000
Y15	3.479	.000	4.152	.000	2.468	.000
Y16	2.923	.000	2.845	.000	2.792	.000
Y17	3.244	.000	3.662	.000	3.674	.000

The Regression Results

All regression equations were estimated using the natural log transformations of all variables, except the binary ones and the Herfindahl Index number. The regression results are presented in Table XIX including the standardized regression coefficients (i.e., the regression coefficients divided by their standard errors) for all independent variables, the F-ratio for each coefficient and its significance level (at the .10 level or lower), and the R^2 for each regression.

The focus of the regression analysis was upon the sign and statistical significance of the coefficient of the CHAINBK variable. At the .05 level of significance in at least two of the three years tested, only Y_9 (percentage of total assets paid in salaries and benefits) produced positive evidence of differences between unit banks and chain banks. The sign was also in the hypothesized direction.

Relaxation of the significance level requirement to .10 brought the evidence on Y_1 (the cash funds to total assets ratio) and Y_8 (net income per employee) into the acceptable range. In both cases, the signs were consistently in the hypothesized direction.

A step-wise procedure was used; however, it contributed no information beyond what the direct method produced, other than the step at which the CHAINBK variable entered. All seven independent variables entered the regression on each trial.

While the regression equations produced little positive evidence about chain bank performance, they did seem to perform well overall. The R^2 values mostly were in the .15-.36 range and the signs of the coefficients were consistent and plausable. Although the design of the research did not include an attempt to explain bank performance,

TABLE XIX

REGRESSION COEFFICIENTS, F-RATIOS, AND SIGNIFICANCE LEVELS FOR ALL INDEPENDENT VARIABLES

Performance Variable Y_k	Independent Variable								
	Year	Charter	Herf Index	Total Assets	Population	Distance	Income	Chainbk	R^2
Cash Funds/Total Assets Y_1	1979	.1314*	.1270	-.4458	.0085	-.0138	-.0555	-.1188	.1959
		8.63	6.30	84.73	1.05	0.03	0.01	7.91	
		.005	.025	.001				.005	
	1977	.1459	.0365	-.4279	.0582	-.0220	-.0459	-.0770	.1664
		9.96	0.52	71.86	0.56	0.08	0.76	3.18	
		.005		.001				.10	
	1975	.1462	.0152	-.4354	.0282	-.0686	-.0053	-.0419	.1521
		9.69	0.09	71.53	0.10	0.66	0.01	0.89	
		.005		.001					
Municipals/ Total Assets Y_2	1979	-.0225	-.0175	.4748	-.1835	-.0024	-.0181	+.0910	.1943
		0.25	0.12	95.93	4.87	0.00	0.14	4.63	
				.001	.05			.05	
	1977	-.0297	-.0089	.4412	-.1220	.0293	.0335	+.0617	.1618
		0.41	0.03	75.96	2.43	0.15	0.40	2.03	
				.001					
	1975	-.0243	-.0492	.4644	-.0945	.1487	-.0055	+.0183	.1718
		0.27	0.92	83.32	1.18	3.16	0.01	0.17	
				.001		.10			
Total Loans/ Total Assets Y_3	1979	-.1689	-.1097	.2341	.0061	.0167	-.0238	+.0621	.0783
		12.44	4.10	20.38	0.01	0.04	0.20	1.88	
		.001	.05	.001					
	1977	-.1512	-.0155	.1681	.0292	.0619	.0458	+.0389	.0399
		9.28	0.08	9.63	0.12	0.57	0.65	0.71	
		.005		.005					

TABLE XIX (Continued)

Performance Variable Y_k	Independent Variable								
	Year	Charter	Herf Index	Total Assets	Population	Distance	Income	Chainbk	R^2
Consumer Loans/ Total Assets Y_4	1979	.0989 4.65 .05	.0093 0.03	-.1521 9.38 .005	.4062 22.76 .001	-.0568 0.51	-.1682 11.09 .001	-.0354 0.67	.1549
	1977	-.0492 1.14	.0380 0.57	-.1347 7.20 .01	.4600 35.08 .001	-.0659 0.74	-.1354 6.64 .01	-.0186 0.19	.1745
	1975	-.0406 0.76	.0674 1.71	-.1358 7.12 .01	.5520 40.15 .001	.0428 0.26	-.1362 6.75 .01	-.0215 0.24	.1704
Mortgages/ Total Assets Y_5	1979	-.0279 0.38	.0556 1.19	.1857 14.48 .001	.4400 27.63 .001	.0555 0.50	-.3291 43.90 .001	+.0307 0.52	.1832
	1977	-.0559 1.42	.0120 0.05	.2156 17.69 .001	.3098 15.28 .001	.0154 0.04	-.3247 36.68 .001	+.0102 0.05	.1402
	1975	-.0367 0.62	.0279 0.29	.1772 12.01 .001	.3530 16.27 .001	.0638 0.58	-.4092 60.41 .001	-.0317 0.52	.1633
Commercial Loans/ Total Assets Y_6	1979	-.0624 2.25	-.0171 0.13	.3575 63.02 .001	.2412 9.75 .005	-.0214 0.09	-.0344 0.56	+.1020 6.75 .01	.3047
	1977	-.1060 5.91 .025	.0246 0.27	.2953 38.51 .001	.2349 10.19 .005	-.1042 2.07	-.0058 0.01	+.0555 1.86	.2590
	1975	-.1421 11.51 .001	.0337 0.53	.3112 45.93 .001	.2862 13.27 .001	-.1237 2.69	-.0292 .038	+.0310 0.61	.3254

TABLE XIX (Continued)

Performance Variable Y_k	Independent Variable: Year	Charter	Herf Index	Total Assets	Population	Distance	Income	Chainbk	R^2
Total Capital/ Total Assets Y_7	1979	.1417 10.08 .005	.1858 13.56 .001	-.5075 110.4 .001	.2470 8.89 .005	-.1163 2.24	.0402 0.67	-.0227 0.29	.2004
	1977	.0384 0.67	.0798 2.41	.4163 66.30 .001	.1177 2.22	-.1805 5.38 .025	.0521 0.95	+.0062 0.02	.1498
	1975	.0885 3.71 .10	.1133 4.96 .05	-.4681 86.55 .001	.0721 0.70	-.3041 13.52 .001	.0451 0.76	+.0447 1.06	.1900
Net Income/ No. Employees Y_8	1979	-.0533 1.36	-.0170 0.11	.2772 31.39 .001	-.4671 30.30 .001	-.0123 0.02	.0611 1.47	+.0461 1.14	.1608
	1977	-.0255 0.30	.0150 0.09	.3834 57.79 .001	.2058 6.97 .01	.2122 7.65 .01	.1387 6.92 .01	+.0728 2.86 .10	.1681
	1975	.0562 1.46	.0562 1.19	.3146 38.03 .001	-.3602 17.04 .001	.0186 0.05	.1391 7.01 .025	+.0724 2.72 .10	.1674
Total Salaries & Benefits/Total Y_9	1979	-.0706 3.08 .10	.0484 1.13	-.5608 166.0 .001	.3886 27.10 .001	-.0686 0.96	-.0364 0.68	-.1676 19.47 .001	.3506
	1977	-.0483 1.35	.0617 1.83	-.5122 159.1 .001	.3386 23.31 .001	-.0837 1.47	-.0355 0.56	-.1032 7.09 .01	.3268

TABLE XIX (Continued)

Performance Variable Y_k	Independent Variable								
	Year	Charter	Herf Index	Total Assets	Population	Distance	Income	Chainbk	R^2
Other Operation Exps/Total Assets Y_{10}	1979	-.0333 0.61	.1503 9.75 .005	-.4564 98.19 .001	.5163 42.73 .001	.0442 0.36	-.0620 1.75	+.0255 0.40	.2729
	1977	-.0209 0.22	.0969 3.92	-.3581 54.06 .001	.4647 38.09 .001	-.0688 0.86	-.0618 1.47	+.0701 2.84 .10	.2239
	1975	-.0927 4.46 .05	.1287 7.01 .01	-.3184 43.86 .001	.5147 39.14 .001	-.0791 1.00	-.0630 1.62	+.0316 0.58	.2602
Total Operating Exps/ Total Assets Y_{11}	1979	-.0642 1.99	.0115 0.05	-.0371 0.57	.3866 20.87 .001	-.0621 0.61	-.0687 1.87	+.0368 0.73	.1652
	1977	-.1070 5.00 .05	-.0349 0.44	-.1200 5.28 .025	-.3460 18.37 .001	.0307 0.15	-.0758 1.92	+.0206 0.21	.1079
	1975	-.0426 0.84	.0016 0.00	-.0718 1.98	-.4576 27.47 .001	-.0386 0.21	-.2340 19.84 .001	+.0038 0.01	.1668
Int. on Time Deps/ Time Deps Y_{12}	1979	-.0941 5.48 .025	-.0825 3.30 .10	.5773 176.0 .001	-.1794 5.78 .025	-.0463 0.44	.1685 14.48 .001	+.0512 1.82	.3507
	1977	-.0744 2.57	-.1439 8.01 .005	.4306 72.29 .001	-.0842 1.16	.3055 15.72 .001	.0346 0.43	+.0300 0.48	.1609
	1975	-.0168 0.14	-.1111 4.92 .05	.4937 99.46 .001	.0634 0.56	.2108 6.71 .01	-.0638 1.57	+.0678 2.53	.2160

TABLE XIX (Continued)

Performance Variable Y_k	Independent Variable								
	Year	Charter	Herf Index	Total Assets	Population	Distance	Income	Chainbk	R^2
Total Int + Fees/Total Loans Y_{13}	1979	-.1046 5.15 .025	-.0376 0.52	.2354 22.27 .001	.2353 7.57 .01	-.0138 0.03	-.1452 8.19 .005	+.0698 2.57	.1469
	1977	-.0889 3.20 .10	.0087 0.03	.0033 0.00	.2380 8.07 .005	.1156 1.96	-.1615 8.12 .005	+.0078 0.03	.0392
Service Charges/ Deposits Y_{14}	1979	-.0467 1.23	.0403 0.72	-.2034 19.93 .001	.5969 58.39 .001	.0069 0.01	.0092 0.04	-.0067 0.03	.2887
	1977	-.0026 0.00	.0162 0.12	-.2062 19.12 .001	.4494 37.98 .001	-.1633 5.18 .025	-.0312 0.40	+.0021 0.00	.2722
	1975	.0627 2.19	.0865 3.45 .10	-.2864 38.64 .001	.6141 60.71 .001	-.0775 1.05	-.0257 0.29	-.0229 0.33	.3211
Total Revenue/ Total Assets Y_{15}	1979	-.1681 13.30 .001	.0071 0.02	-.0081 0.03	.3639 18.08 .001	-.0234 0.09	-.0985 3.76 .10	+.0080 0.03	.1463
	1977	-.1714 12.38 .001	-.0281 0.28	-.0111 0.04	.2767 11.33 .001	.0642 0.63	-.1184 4.54 .05	+.0010 0.07	.0749
	1975	-.1078 4.85 .05	.0299 0.30	-.0222 0.17	.3258 12.62 .001	.0110 0.02	-.1652 8.96 .005	+.0010 0.01	.0806

TABLE XIX (Continued)

Performance Variable Y_k	Independent Variable								
	Year	Charter	Herf Index	Total Assets	Population	Distance	Income	Chainbk	R^2
Net Income/ Total Assets Y_{16}	1979	-.1173 6.10 .025	.0746 1.93	-.2008 15.26 .001	.0185 0.04	.0270 0.11	-.0129 0.06	-.0097 0.05	.0943
	1977	-.0658 1.76	.0433 0.63	-.0305 0.32	.1331 2.53	.2595 9.92 .005	.0844 2.22	+.0983 4.51 .05	.0408
	1975	.0595 1.42	.1315 5.64 .025	-.1522 7.73 .01	-.0631 0.45	-.0231 0.07	.0960 2.90 .10	+.0442 0.88	.0412
Net Income/ Total Capital Y_{17}	1979	-.0827 2.99 .10	.0046 0.01	.3083 35.43 .001	-.1494 2.83 .10	-.1165 1.95	-.0402 0.58	-.0079 0.03	.0804
	1977	-.0492 0.98	.0323 0.35	.1185 4.78 .05	.1371 2.68	.2969 12.96 .001	.0614 1.17	+.0675 2.12	.0386
	1975	.0315 0.40	.0658 1.40	.0713 1.68	-.1172 1.56	.0660 0.53	0.678 1.43	+.0284 0.36	.0336

*The top number in each cell is the standardized regression coefficient. The middle number is f-ratio for the above coefficient. The bottom number in each cell is the significance level indicated by the F-ratio. A blank space in the bottom position means the F-ratio was not significant.

evidence about the relative importance of the independent variables is a product of regression analysis. Bank size was clearly the dominant variable in the equations. Its coefficient was significant at a very high level over 80 percent of the time. Following size as an important variable were county population and per capita income, which appeared significant at the .05 level about 60 percent and 35 percent of the time, respectively.

Summarizing the regression results, acceptable support for the hypothesized differences between unit banks and chain banks was found in only one performance variable, Total Salaries and Benefits to Total Assets. Marginal evidence was found which indicated that chain banks tend to hold proportionately lower levels of cash resources than unit banks, and that chain banks produce more profit per employee than unit banks do.

Multiple Discriminant Analysis Results

The procedures recommended by Lachenbruch, Sneeringer, and Revo [18] and by Pinches [28] (described in Chapter IV) for dealing with the normality problem were followed. Preliminary tests were made using the original data and then were rerun using transformed data. In both cases, the hypothesis of equal group dispersion matrices was rejected at an extremely high significance level. The error rates were uniformly lower by small amounts when original data were used. Therefore, original data were used for the study.

Error Rate Estimation

The error rates were estimated and tested using the Lachenbruch U method. Table XX presents the matrix from a normal classification

TABLE XX

ESTIMATION OF ERROR RATES USING LACHENBRUCH U METHOD

	1975			1977			1979		
	Predicted Group		Percent Correct	Predicted Group		Percent Correct	Predicted Group		Percent Correct
Pre-Test Classification Matrix:									
Actual Group	U	C	55.8*	U	C	60.3*	U	C	65.4*
U	190	63	75.1	194	82	70.3	194	72	72.9
C	141	68	32.5	107	93	46.5	97	126	56.5
Test Classification Matrix:									
Actual Group	U	C	55.6*	U	C	59.7*	U	C	64.4*
U	189	64	74.7	191	85	69.2	191	75	71.8
C	141	68	32.5	107	93	46.5	99	124	55.6

*Over-all percent correctly classified.

procedure, using the same data and linear classification rules. The test rates were consistently very close to the observed rates, indicating the classification model performed very well.

The Classification Results

The results of the classification trials, using quadratic rules, are displayed in Table XXI. Although the overall percentage of cases correctly classified remains quite stable, the percentage of chain banks correctly classified declines rather markedly, from 1979 to 1975. The increasing error rate in prior years might be the result of chain bank practice becoming more clearly delineated from unit bank practices as time passes. Or, it could result from the difficulty of correctly identifying the chain banks in earlier years. In any event, the Z-scores and the X^2 scores both were significant at very high levels in all three years, and therefore the results were acceptable.

The standardized canonical discriminant function coefficients are listed in Table XXII. The variables considered to be significant were those having coefficients with absolute values above the median in at least two years. Variables which met those criteria were Y_6, Y_8, Y_9, Y_{10}, Y_{15}, Y_{16}, Y_{17}, INCOME, POPUL, DIST, AND CHARTER.

The next step in the analysis of the MDA output was to determine if the classification function coefficients differed in direction consistently in the years in which the standardized canonical coefficients were found to be significant. The classification function coefficients are shown in Table XXIII. Y_8, Y_{16}, and Y_{17}, did not meet the consistency test. In 1975 and 1977, the absolute values of the canonical coefficients for Y_8 were .495 and .401, well above the median values in those years of .305 and .189 (Table XXII). However, the sign

TABLE XXI

MULTIPLE DISCRIMINANT ANALYSIS CLASSIFICATION
RESULTS AND ASSOCIATED STATISTICS

Actual Group	1975 Number of Cases	1975 Predicted Group Membership u	1975 Predicted Group Membership c	1977 Number of Cases	1977 Predicted Group Membership u	1977 Predicted Group Membership c	1979 Number of Cases	1979 Predicted Group Membership u	1979 Predicted Group Membership c
u	253	181	72	259	178	81	256	165	91
		71.5%	28.5%		68.7%	31.3%		64.5%	35.5%
c	209	91	118	217	86	131	233	77	156
		43.5%	56.5%		39.6%	60.4%		33.0%	67.0%
% Correctly Classified	64.7% (z = 8.41)[1]			64.9% (z = 8.47)			65.7% (z = 7.97)		
Eigenvalue	.09320			.11304			.19798		
Wilks λ	.9147			.8984			.8347		
χ^2	40.0[2]			49.4[3]			85.7[4]		

[1]Z-scores test the hypothesis that classification results occur by chance. All z-scores reject the hypothesis at significance level exceeding .001.

[2]Significance level = .0108.

[3]Significance level = .0025.

[4]Significance level exceeds 0.000.

TABLE XXII

STANDARDIZED CANONICAL DISCRIMINANT FUNCTION COEFFICIENTS FOR ALL YEARS

Variable	1975	1977	1979
Y_1	-.300	-.182	-.264
Y_2	-.190	.102	.189
Y_3		.016	.167
Y_4	-.046	-.263	-.140
Y_5	-.245	-.126	-.093
Y_6	-.010	.189	.356
Y_7	.415	-.128	-.104
Y_8	.495	-.401	.012
Y_9		-.730	-.837
Y_{10}	.450	.407	.262
Y_{11}	-.140	.183	.217
Y_{12}	.615	.058	.099
Y_{13}		.117	.622
Y_{14}	-.068	.173	.104
Y_{15}	-.251	-.194	-.545
Y_{16}	-.429	.998	.056
Y_{17}	.305	-.442	-.181
LOGTA	.132	.014	-1.00
INCOME	-.640	-.373	-.349
POPUL	.427	.163	.442
DIST	-.456	-.409	-.292
CHARTER	-.513	-.476	
HERF	-.119	-.104	-.004
Median Absolute Value	.305	.189	.189

TABLE XXIII

CLASSIFICATION FUNCTION COEFFICIENTS FOR ALL VARIABLES, ALL YEARS

Variable	1975			1977			1979		
	Units	Chains	Sign	Units	Chains	Sign	Units	Chains	Sign
Y_1	130.9	129.9	-	657.4	656.7	-	519.1	517.8	-
Y_2	-1.75	-3.00	-	458.1	458.8	+	324.3	326.3	+
Y_3				579.6	579.7	+	475.7	476.6	+
Y_4	-17.1	-17.4	-	-98.5	-100.5	-	-36.7	-38.2	-
Y_5	-25.6	-28.1	-	-65.8	-66.9	-	-32.0	-32.8	-
Y_6	-182.6	-182.7	-	-131.3	-129.8	+	-241.6	-238.2	+
Y_7	1031	1039	+	434.4	432.6	-	723.1	722.5	-
Y_8	-3.43	-3.36	+	-3.42	-3.47	-	-.296	-.296	
Y_9				2289	2195	-	2104	1973	-
Y_{10}	1136	1207	+	2131	2194	+	1705	1753	+
Y_{11}	679.6	672.5	-	171.2	180.8	+	307.8	323.1	+
Y_{12}	-488.5	-446.6	+	86.7	91.3	+	-340.5	-333.9	+
Y_{13}				-401.6	-396.3	+	12.5	39.7	+
Y_{14}	-1408	-1422	-	-2181	-2144	+	-2289	-2263	+
Y_{15}	1767	1752	-	1562	1551	-	1166	1130	-
Y_{16}	-2103	-2157	-	3319	3443	+	-3398	-3391	+
Y_{17}	440.1	443.4	+	12.6	8.1	-	452.5	451.2	-
LOGTA	61.9	62.0	+	66.9	66.9		74.0	73.4	-
INCOME	7.06	6.70	-	5.93	5.73	-	5.70	5.52	-
POPUL	-.104	-.103	+	-.910	-.904	+	-.913	-.900	+
CHARTER	-18.4	-19.1	-	-11.6	-12.2	-	-12.9	-13.8	-
DIST	.238	.230	-	.360	.287	-	.218	.210	-
HERF	-22.3	-22.8	-	-13.7	-14.3	-	-62.7	-63.1	-

on the classification function coefficient of Y_8 was positive in 1975, but negative in 1977 (Table XXIII). Therefore, Y_8 fell out as a discriminating variable. The same pattern was true for Y_{16} and Y_{17}, except that for Y_{16}, the coefficient signs were negative in 1975 and positive in 1977.

The performance profile which emerged from the MDA indicates that, relative to unit banks, chain banks tend to:

1. Make more commercial and industrial loans;
2. Pay lower salaries and benefits;
3. Experience higher Other Operating Expenses;
4. Generate lower total revenue;
5. Be located in counties having lower per capita income;
6. Be located in more populous counties;
7. Be state-chartered; and
8. Be located closer to metropolitan areas.

Summary and Analysis

Various hypotheses of chain bank behavior were advanced in Chapter II. The profiles of chain banking produced by the three statistical methods are reviewed below and reconciled relative to those hypotheses.

Portfolio Composition

Substantial support was found for the hypothesis that chain banks maintain less liquid, higher-risk asset portfolios than unit banks. The choice of particular assets preferred by chain banks appears to be increased commercial loans. All three tests reflect evidence that chain banks hold less of their assets in cash items and make more commercial loans than unit banks, but in only isolated instances was

support found for the hypotheses of more municipals, more total loans, more consumer loans, and more residential loans by chain banks. Table XXIV presents the test results in detail.

TABLE XXIV

STATISTICALLY SIGNIFICANT TEST RESULTS OF HYPOTHESES OF PORTFOLIO COMPOSITION; BY DIRECTION OF CHAIN BANK DIFFERENCE

Variable	Year	t-test	Signif. Level	MR	Signif. Level	MDA	Hypoth. Sign
Cash Assets / Total Assets	1979	-	.000	-	.005	-	-
	1977	-	.012				
Municipals / Total Assets	1979	+	.026	+	.05	+	+
Total Loans / Total Assets	1979	+	.012				+
Consumer Loans / Total Assets	1977					-	+
Residential Mtgs / Total Assets	1975	+	.049			-	+
Commercial Loans / Total Assets	1979	+	.000	+	.05	+	+
	1977	+	.008			+	
	1975	+	.010				

Capital Position and Liability Structure

No evidence was located in support of the hypothesis that chain banks maintain lower capital-to-total assets ratios than unit banks. Only in the MDA results for 1975 did Y_7 appear as an influential variable, when it had a standardized canonical coefficient of 0.415.

The sign, however, was positive, rather than negative, as hypothesized. Thus, what little evidence did appear indicated higher capital ratios for chain banks, not lower.

Operational Efficiency

This group of variables, Y_8 through Y_{11}, provided good evidence of chain bank differences, as shown in Table XXV.

TABLE XXV

STATISTICALLY SIGNIFICANT TEST RESULTS OF HYPOTHESES OF OPERATIONAL EFFICIENCY; BY DIRECTION OF CHAIN BANK DIFFERENCES

Variable	Year	t-test	Signif. Level	MR	Signif. Level	MDA	Hypoth. Sign
Net Income Per Employee	1977					-	+
	1975					+	
Tot. Sal + Ben. Total Assets	1979	-	.003	-	.001	-	-
	1977			-	.01	-	
Other Op. Exp. Total Assets	1979					+	+
	1977	+	.025			+	+
	1975	+	.043			+	
Total Op. Exp. Total Assets	1979	+	.022			+	-

Evidence on Y_8, Net Income Per Employee, was produced only by MDA and it was internally contradictory. A conclusion of no difference between groups appears warranted.

The variables Y_9 and Y_{10}, Total Salaries and Benefits to Total Assets, and Other Operating Expenses to Total Assets, respectively,

produced strong evidence of chain bank differences. The significance levels were good across time as well as statistical methods, and the signs were uniformly in the expected direction.

Chain banks definitely appear to compensate their employees with lower salaries and fringe benefits than unit banks do, relative to the bank's total assets. And they also appear to incur significantly higher Other Operating Expenses than unit banks do.

The evidence with respect to the Total Operating Expenses to Total Assets ratio, however, is unconvincing. The failure of the tests of Y_{11} to corroborate the results on Y_{10} seems contradictory. Perhaps chain banks are able to offset higher Other Operating Expenses with greater employee efficiency, and thereby hold Total Operating Expenses steady.

Rates on Deposits and Loans

The hypotheses that chain banks pay higher interest rates on time deposits (Y_{12}) and charge higher interest rates and fees on loans (Y_{13}) received only negligible support from the tests, as Table XXVI shows.

TABLE XXVI

STATISTICALLY SIGNIFICANT TEST RESULTS OF HYPOTHESES OF RATES AND PRICES; BY DIRECTION OF CHAIN BANK DIFFERENCE

Variable	Year	t-test	Signif. Level	MR	Signif. Level	MDA	Hypoth. Sign
Int. on TD's	1979 1975	+	.039				+
Total Int. + Fees / Total Loans	1979	+	.002			+	+

There was no support whatsoever for the higher service charges argument. Chain banks and unit banks appear to perform similarly on Y_{14}.

Profitability

The test results are inconclusive with respect to the profitability measures, Y_{15} through Y_{17} (Table XXVII).

TABLE XXVII

STATISTICALLY SIGNIFICANT TEST RESULTS OF HYPOTHESES OF PROFITABILITY; BY DIRECTION OF CHAIN BANK DIFFERENCE

Variable	Year	t-test	Signif. Level	MR	Signif. Level	MDA	Hypoth. Sign
Total Revenue	1979					-	+
Total Assets	1977					-	
Net Income	1977			+	.05	+	+
Total Assets	1975					-	
Net Income	1977					-	+
Total Capital	1975					+	

The failure of the tests to confirm results across time periods coupled with conflicting signs produced by the three methods makes it impossible to draw any conclusions about the impact of chain affiliation upon profitability.

Demograhpics

The t-tests and MDA produced some strong evidence about the population of counties in which chains are located, and the distance the chain banks tend to be from large cities, relative to the unit banks. These results are in Table XXVIII.

TABLE XXVIII

STATISTICALLY SIGNIFICANT TEST RESULTS ABOUT POPUL AND DIST; BY DIRECTION OF CHAIN BANK DIFFERENCE

Variable	Year	t-test	Significance	MDA
POPUL	1979	+	.007	+
	1977	+	.016	
	1975	+	.006	+
DIST	1979	-	.000	-
	1977	-	.002	-
	1975	-	.001	-

The MDA results indicated that per capita income tended to be lower in counties having chain banks, and that chain banks tended to hold state charters, but the t-tests did not confirm that evidence.

Table XXIX summarizes the significant findings of this research, along with the hypothesized sign for each performance measure, and the results of prior studies of multiple office banking performance.

Most of the hypotheses about chain bank differences were not supported by the tests. Moreover, few of the performance earmarks of

TABLE XXIX

RESULTS OF TESTS OF MULTIPLE OFFICE BANK PERFORMANCE VARIABLES, THIS RESEARCH AND FIVE MAJOR PRIOR STUDIES; BY DIRECTION OF DIFFERENCE OF MULTIPLE OFFICE SYSTEM

Performance Measure	Horvitz & Shull (1964)	Lawrence (1967)	Meinster (1975)	Mayne (1977)	Fraser (1978)	Hill	Hypothesized Sign
Cash Assets / Total Assets		-	-	-	-	-	-
Municipals / Total Assets		+	+	+	-	ND	+
Total Loans / Total Assets	+	+	+		-	ND	+
Consumer Loans / Total Assets		+			+	ND	+
Mortgages / Total Assets		ND		+	+	ND	+
Commercial Loans / Total Assets		ND		-		+	+
Total Capital / Total Assets		ND	-			ND	+
Net Income Per Employee						ND	+
Total Sal + Ben / Total Assets		ND				-	-

TABLE XXIX (Continued)

Performance Measure	Horvitz & Shull (1964)	Lawrence (1967)	Meinster (1975)	Mayne (1977)	Fraser (1978)	Hill	Hypothesized Sign
Other Op Exp / Total Assets		+		+		+	+
Total Op Exp / Total Assets		+		+		ND	-
Int on TD / Time Deps	+	-				ND	-
Total Int + Fees / Total Loans	+	ND	-		ND	ND	+
Service Chgs / Total Assets	+	+	+	+	ND	ND	+
Total Revenue / Total Assets						*	+
Net Income / Total Assets	-	ND		+	ND	*	+
Net Income / Total Capital	+	ND		+	-	*	+

NOTE: ND indicates no statistical difference was found. A blank space indicates the variable was not tested. * indicates the results were inconclusive.

multiple-office banking, as reported by other writers, were found to be true of the chain banks in Oklahoma. Table XXIX indicates that the only characteristics which Oklahoma chain banks consistantly have in common with multiple-office systems studied by other researchers are lower Liquid Assets ratios and higher Other Operating Expenses ratios. The evidence presented in Table XXIX largely refutes the widely held belief that chain banking provides a multiple-office alternative to unit banking in a state in which multiple-office banking is prohibited.

CHAPTER VIII

CONCLUSIONS

The purposes of this research were to identify all the chain banks in Oklahoma and then to analyze their overall performance characteristics relative to the unit banks in the State. In addition, the results were compared to those of prior studies of multiple-office banking systems to see if the performance of the chain bank structure in Oklahoma resembles that of multiple-office structures elsewhere. The chain banks were successfully identified for the years 1975, 1977, and 1979, and they are listed in Appendix A.

Chain Banking in Oklahoma

The chain bank structure in Oklahoma has grown substantially since 1962. The number of chain banks has nearly tripled, so that nearly one-half of all Oklahoma banks are chain affiliated. Slightly over one-half of all bank assets in Oklahoma are held by chain banks, although the growth rate of chain bank assets has been somewhat slower than the rate of growth of the number of chain banks. The slower growth of assets perhaps is the result of new chain banks often being de nova banks, initially having low assets.

No particular structural patterns within the chains emerged, other than that most chains consist of only two or three banks. Proximity to a metropolitan area and higher county population both appear to be related to chain membership.

Performance Characteristics of Unit and Chain Banking in Oklahoma

The overall hypothesis of this research was that chain banks in Oklahoma perform differently from unit banks in the State. Substantial evidence was uncovered which indicates that chain banks do, in a limited way, operate differently from unit banks.

Chain bankers appear to take greater risks than unit bankers, as demonstrated by their willingness to reduce cash balances and increase credit to local businesses through increased levels of commercial loans. They also appear to combine some banking operations and thereby reduce labor costs, as implied by a lower ratio of salaries and benefits-to-total assets. Also implied is a higher level of efficiency by the chain banks.

Evidence of the expected increase in Other Operating Expenses appeared, suggesting the payment of transfer fees to the lead bank in the chain. Thus, it appears that chain banks differ from unit banks in four performance areas: lower cash reserves, higher commercial loan portfolios, lower salaries and benefits, and higher other operating expenses.

The results of this study perhaps are more significant for what evidence was <u>not</u> found, than for what was. Overall, Oklahoma bankers who associate themselves with chain organizations do not appear to pursue aggressively the potential benefits of chain bank participation. They only minimally exploit the potential diversification effects. While cash balances are reduced and commercial loans are increased, the Total Loans ratio was no different. Only the analysis of the sub-popultion parameters found evidence of differences in the ratios

of Municipals, or Residential Mortgage Loans. No evidence of increased Consumer Loans was found. Furthermore, the capital ratios of unit banks and chain banks tend to be similar, as do pricing practices.

Two possible explanations for the behavior of the chain banks are: (1) the chains perhaps are too small to exploit the advantages of their associations more fully, or (2) bankers join chains to increase their monopoly power. If the latter were true, chains would form within markets, and behavior would become less risky (see page 17). The signs on the coefficients would be in the opposite direction from what was hypothesized. Neither the structural patterns nor any of the results of the study support the monopoly idea. Thus, the motivation behind the rapid increase in the number of chain banks in the last 20 years is not clear.

Comparison of Chain Performance and Other Multiple Office Systems

It is clear, however, that the chain bank system in Oklahoma produces few of the performance characteristics of multiple-office systems in use in other states. Neither the Oklahoma banking public nor Oklahoma bankers secure many of the benefits of multiple-office banking. Contrary to the widely held belief, the chain bank system, as it exists in Oklahoma, does not provide a very effective de facto multiple-office system. The unit rule does seem to be substantially effective in blocking multiple-office activity in Oklahoma.

Generalizing the results of this research beyond the boundaries of Oklahoma requires that the sub-populations be considered as representative samples of chain and unit banks elsewhere. Chain bank activity tends to be strongest in unit bank states [8] [26], of which

Oklahoma is one. It is in those states, where banking regulation is basically similar to that of Oklahoma, that banking conditions and practices are likely to resemble closely those present in Oklahoma. Thus, the evidence about chain banking in Oklahoma can reasonably be inferred to shed light on chain banking practices in other unit banking states as well.

While chain banking is strongest in unit banking states, it does occur throughout the country in a significant way. Darnell [8] reported 20 percent of all banks in the U.S. were chain affiliated. Therefore, these results can be further generalized to unit-chain bank relationships in multiple-office banking states as well, although probably with somewhat less validity.

Present Limitations and Future Research

A significant objective of future research into chain banking must be to overcome the limited geographic scope of the study. Accurate identification of the chains will continue to be a major difficulty, if present reporting requirements remain in effect. Because the computer-constructed lists contained error of 10-15 percent, it would be hazardous to apply that method without the ability to verify the results, as was done in this study, through industry contacts. On a national scale, that would be extremely difficult.

Another problem for future solution is to provide for lags in the variables. Clearly, it takes time for new strategies arising from a change in status to become effective and show up in a bank's performance variables. Under present reporting requirements, it is impossible to determine when a bank changed its status.

Implications for Public Policy

Comparison of the results of this research with those of prior studies of multiple-office systems (Table XXIX) makes clear that Oklahoma banks do not follow the performance patterns produced by banks in other states which permit multiple-office banking. Of particular concern is the lower level of credit provided by Oklahoma banks to their local commjnities including the resulting effects upon prices and interest rates. Although chain banks do appear to provide more commercial loans and may buy more municipal bonds, they do not make more consumer loans or more total loans, and they may not make more residential mortgage loans. To the extent that local credit needs are not met by local lenders, local business either is constrained by the banking system, or must seek sources of credit outside the state. In either case, the present system does not appear optimal.

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APPENDICES

APPENDIX A

CHAIN BANK LISTS

TABLE XXX

BANKS WHICH ARE CHAIN MEMBERS--1979
TENTH FRS DISTRICT

Town	Bank
Ada	Citizens Bank and Trust Company
Alex	First National Bank of Alex
Allen	Farmers State Bank
Alva	Alva State Bank and Trust Company
Alva	Central National Bank of Alva
Anadarko	Anadarko Bank and Trust Company
Ardmore	Exchange National Bank and Trust Company
Barnsdall	Barnsdall State Bank
Bartlesville	First National Bank in Bartlesville
Bartlesville	Plaza National Bank of Bartlesville
Bartlesville	Union Bank and Trust
Beggs	Bank of Beggs
Binger	Binger Community Bank
Bixby	Citizens Security Bank and Trust Company
Bixby	Town and County Bank
Blair	Peoples State Bank
Blanchard	First State Bank
Bristow	American National Bank of Bristow
Broken Arrow	Arkansas Valley State Bank
Burns Flat	Washita State Bank
Calumet	First National Bank of Calumet
Canton	Bank of Canton
Canute	First State Bank
Cashion	Cashion Community Bank
Catoosa	1st Bank of Catoosa
Cement	First State Bank
Chandler	Union National Bank of Chandler
Chattanooga	First Bank of Chattanooga
Chelsea	First National Bank of Chelsea
Cherokee	Alfalfa County Bank
Chickasha	Chickasha Bank and Trust Company
Chickasha	First National Bank and Trust Company
Chickasha	Oklahoma National Bank and Trust Company of Chickasha
Choctaw	Choctaw State Bank
Chouteau	Bank of Commerce
Claremore	First Bank in Claremore
Cleo Springs	Cleo State Bank
Clinton	Oklahoma Bank and Trust Company
Comanche	Security State Bank
Cordell	Farmers National Bank of Cordell
Coweta	Security National Bank of Coweta
Coyle	Eighty Niner Bank of Coyle
Crescent	Bank of Crescent
Crescent	Farmers and Merchants Bank
Custer	First National Bank of Custer

TABLE XXX (Continued)

Town	Bank
Cyril	Cyril State Bank
Davenport	Security State Bank
Davis	First National Bank of Davis
Del City	Del State Bank and Trust Company
Drummond	Bank of Drummond
Drumright	Citizens Bank
Edmond	Central State Bank
Elgin	Bank of Elgin
Elk City	First National Bank of Elk City
Elmore City	First State Bank
El Reno	First National Bank and Trust Company of El Reno
Enid	Central National Bank and Trust
Enid	Community Bank and Trust Company
Enid	First National Bank and Trust Company of Enid
Enid	Northwest Bank of Enid
Enid	Security National Bank of Enid
Fairfax	First State Bank
Fairview	Fairview State Bank
Fletcher	First National Bank of Fletcher
Forgan	First State Bank
Fort Gibson	First National Bank in Fort Gibson
Fort Sill	Fort Sill National Bank
Frederick	First National Bank and Trust Company
Gracemont	First National Bank of Gracemont
Grandfield	First State Bank
Grove	State Bank of Grove
Guthrie	First National Bank of Guthrie
Guthrie	First State Bank and Trust Company
Haileyville	Bank of Haileyville
Harrah	First State Bank
Hartshorne	Bank of Hartshorne
Healdton	Bank of Healdton
Hennessey	First National Bank of Hennessey
Hinton	First State Bank
Hobart	Home State Bank
Holdenville	First National Bank and Trust Company of Holdenville
Holdenville	Peoples State Bank and Trust Company
Hollis	First State Bank and Trust Company
Hopeton	Hopeton State Bank
Hydro	Bank of Hydro
Inola	Bank of Inola
Jay	Delaware County Bank
Jenks	Bank of Commerce
Jones	First State Bank
Ketchum	First State Bank

TABLE XXX (Continued)

Town	Bank
Konawa	First National Bank of Konawa
Konawa	Oklahoma State Bank
Langley	Bank of the Lakes
Lawton	Citizens Bank
Lawton	City National Bank and Trust Company
Leedey	First National Bank of Leedey
Lexington	First State Bank
Lindsay	American Exchange Bank
Lone Wolf	First State Bank
Luther	First National Bank of Luther
McAlester	American Bank of Commerce
McAlester	First National Bank and Trust Company of McAlester
McLoud	Bank of Commerce
Mangum	First National Bank of Mangum
Mannford	Mannford State Bank
Marshall	Bank of Marshall
Maud	Citizens State Bank
Meeker	Bank of Meeker
Meno	Meno Guaranty Bank
Miami	First National Bank and Trust Company of Miami
Miami	Security Bank and Trust Company
Midwest City	Midwest National Bank
Midwest City	Security Bank and Trust Company
Morrison	Citizens State Bank
Muldrow	Sequoyah State Bank of Muldrow
Muskogee	American Bank of Muskogee
Muskogee	Commercial Bank and Trust Company
Muskogee	First National Bank and Trust Company of Muskogee
Mustang	First Mustang State Bank
Mustang	Mustang Community Bank
Newcastle	Bank of Newcastle
Noble	First State Bank
Norman	City National Bank and Trust
Okeene	First National Bank of Okeene
Okeene	State Guaranty Bank
Okemah	Citizens State Bank
Oklahoma City	Allied Oklahoma Bank
Oklahoma City	Capital Hill State Bank and Trust Company
Oklahoma City	Central National Bank
Oklahoma City	City National Bank
Oklahoma City	Crossroads State Bank
Oklahoma City	Fidelity Bank
Oklahoma City	First National Bank of Britton
Oklahoma City	Friendly National Bank

TABLE XXX (Continued)

Town	Bank
Oklahoma City	First Security Bank and Trust Company
Oklahoma City	Founders Bank and Trust Company
Oklahoma City	Grant Square Bank and Trust Company
Oklahoma City	Oklahoma National Bank and Trust Company
Oklahoma City	Quail Creek National Association
Oklahoma City	Penn Square Bank
Oklahoma City	Southwestern Bank and Trust Company
Oklahoma City	Republic Bank
Oklahoma City	United Oklahoma Bank
Oklahoma City	Union Bank and Trust Company
Oklahoma City	Will Rogers Bank and Trust Company
Oologah	Lakeside State Bank
Pauls Valley	First National Bank of Pauls Valley
Pawhuska	First National Bank in Pawhuska
Pawhuska	National Bank of Commerce in Pawhuska
Piedmont	Rolling Hills State Bank
Ponca City	Security Bank and Trust Company
Poteau	Poteau State Bank
Prague	Prague National Bank
Pryor	American Bank of Oklahoma
Purcell	First American Bank and Trust
Purcell	McClain City National Bank
Quapaw	Bank of Quapaw
Quinton	Farmers State Bank
Red Oak	Bank of Red Oak
Ringling	Ringling State Bank
Rocky	State Bank of Rocky
Roff	American Bank of
Sallisaw	First National Bank
Sand Springs	First Bank and Trust Company
Sand Springs	Sand Springs State Bank
Sapulpa	American National Bank and Trust
Sayre	City National Bank of Sayre
Seminole	First National Bank of Seminole
Sentinel	Southwest State Bank
Shawnee	Federal National Bank and Trust
Shidler	Shidler State Bank
Skiatook	Exchange Bank
Snyder	Bank of the Wichitas
Stillwater	First National Bank and Trust
Stonewall	First American Bank
Stratford	First American Bank
Stroud	First State Bank
Stroud	Stroud National Bank
Sulphur	Sulphur Community Bank
Tahlequah	First National Bank of Tahlequah
Taloga	Dewey County State Bank

TABLE XXX (Continued)

Town	Bank
Tecumseh	Tecumseh Bank
Temple	First National Bank of Temple
Temple	First State Bank in Temple
The Village	The Village Bank
Thomas	First National Bank of Thomas
Tipton	First National Bank of Tipton
Tonkawa	Service Bank of Tonkawa
Tulsa	Bank of Commerce and Trust Company
Tulsa	Admiral State Bank
Tulsa	Boulder Bank and Trust Company
Tulsa	American Bank of Tulsa
Tulsa	City Bank and Trust Company
Tulsa	Commercial Bank
Tulsa	Guaranty National Bank
Tulsa	Mercantile Bank and Trust Company
Tulsa	North Side State Bank
Tulsa	Southwest Tulsa Bank
Tulsa	Security Bank
Tulsa	Republic Bank and Trust Company
Tulsa	United Bank
Tulsa	Utica National Bank and Trust Company
Tulsa	Woodland Bank
Tulsa	Western National Bank of Tulsa
Tuttle	Bank of Tuttle
Verden	Bank of Verden
Wagoner	American Bank of Wagoner
Wagoner	First Wagoner Bank and Trust Company
Wakita	Citizens Bank
Walters	Walters Bank and Trust Company
Warr Acres	Community Bank
Watonga	First State Bank
Waurika	First Farmers National Bank of Waurika
Weatherford	Security State Bank
Welch	Welch State Bank
Westville	Peoples Bank
Wilburton	Latimer State Bank
Wilburton	Wilburton State Bank
Willow	First State Bank
Wyandotte	Bank of Wyandotte
Atoka	First Bank in Atoka
Broken Bow	American State Bank
Broken Bow	First Bank and Trust
Caddo	Bryand County National Bank
Coalgate	First National Bank in Coalgate
Durant	Durant Bank and Trust Company
Idabel	Fist State Bank of Idabel

TABLE XXX (Continued)

Town	Bank
Kingston	Texoma Bank
Madill	First National Bank in Madill
Valliant	First State Bank
Wright City	Wright City State Bank
Oklahoma City	First National Bank
Tulsa	First National Bank

TABLE XXXI

BANKS WHICH ARE CHAIN MEMBERS--1977
TENTH FRS DISTRICT

Town	Bank
Ada	Citizens Bank and Trust Company of Ada
Alex	First National Bank of Alex
Allen	Farmers State Bank
Alva	Alva State Bank and Trust Company
Alva	Central National Bank of Alva
Anadarko	Anadarko Bank and Trust Company
Ardmore	Exchange National Bank and Trust Company
Barnsdall	Barnsdall State Bank
Bartlesville	First National Bank in Bartlesville
Bartlesville	Plaza National Bank of Bartlesville
Bartlesville	Union Bank and Trust
Beggs	Bank of Beggs
Binger	Binger Community Bank
Bixby	Bank of Bixby
Bixby	Citizens Security Bank and Trust Company
Blair	Peoples State Bank
Blanchard	First State Bank
Bristow	American National Bank of Bristow
Broken Arrow	Arkansas Valley State Bank
Burns Flat	Washita State Bank
Calumet	First National Bank of Calumet
Canton	Bank of Canton
Canute	First State Bank
Catoosa	First Bank of Catoosa
Cement	First State Bank
Chandler	Union National Bank of Chandler
Chattanooga	First National Bank of Chattanooga
Chelsea	First National Bank of Chelsea
Cherokee	Alfalfa County Bank
Chickasha	Chickasha Bank and Trust Company
Chickasha	First National Bank and Trust Company
Chickasha	Oklahoma National Bank and Trust Company of Chickasha
Choctaw	Choctaw State Bank
Chouteau	Bank of Commerce
Claremore	First National Bank in Claremore
Cleo Springs	Cleo State Bank
Clinton	Oklahoma Bank and Trust Company
Comanche	Security State Bank
Cordell	Farmers National Bank of Cordell
Coweta	Security National Bank of Coweta
Crescent	Bank of Crescent
Crescent	Farmers and Merchants Bank
Custer	First National Bank of Custer
Cyril	Cyril State Bank

TABLE XXXI (Continued)

Town	Bank
Davenport	Security State Bank
Davis	First National Bank of Davis
Del City	Del State Bank and Trust Company
Drummond	Bank of Drummond
Drumright	Citizens Bank
Edmond	Central State Bank
Elgin	Bank of Elgin
Elk City	First National Bank of Elk City
Elmore City	First State Bank
El Reno	First National Bank and Trust Company of El Reno
Enid	Central National Bank and Trust
Enid	Community Bank and Trust Company
Enid	First National Bank and Trust Company of Enid
Enid	Northwest Bank of Enid
Enid	Security National Bank of Enid
Fairfax	First State Bank
Fairview	Fairview State Bank
Fletcher	First National Bank of Fletcher
Gibson	First National Bank of Fort Gibson
Fort Sill	Fort Sill National Bank
Frederick	First National Bank in Frederick
Gracemont	First National Bank of Gracemont
Grandfield	First State Bank
Grove	State Bank of Grove
Guthrie	First National Bank of Guthrie
Haileyville	Bank of Haileyville
Harrah	First State Bank
Hartshorne	Bank of Hartshorne
Healdton	Bank of Healdton
Hennessey	First National Bank of Hennessey
Hinton	First State Bank
Hobart	Home State Bank
Holdenville	First National Bank and Trust Company of Holdenville
Holdenville	Poeples State Bank and Trust Company
Hollis	First State Bank and Trust Company
Hopeton	Hopeton State Bank
Hydro	Bank of Hydro
Inola	Bank of Inola
Jay	Delaware County Bank
Jenks	Bank of Commerce
Jones	First State Bank
Ketchum	First State Bank
Konawa	First National Bank of Konawa
Konawa	Oklahoma State Bank
Langley	Bank of the Lakes

TABLE XXXI (Continued)

Town	Bank
Lawton	Citizens National Bank of Lawton
Lawton	City National Bank and Trust Company
Leedey	First National Bank of Leedey
Lindsay	American Exchange Bank
Lone Wolf	First State Bank
Luther	First National Bank of Luther
McAlester	American Bank of Commerce
McAlester	First National Bank and Trust Company of McAlester
Mcloud	Bank of Commerce
Mangum	First National Bank of Mangum
Mannford	Mannford State Bank
Marshall	Bank of Marshall
Maud	Citizens State Bank
Meeker	Bank of Meeker
Meno	Meno Guaranty Bank
Miami	First National Bank of Miami
Miami	Security Bank and Trust Company
Midwest City	Security Bank and Trust Company
Morrison	Citizens State Bank
Muldrow	Sequoyah State Bank of Muldrow
Muskogee	American Bank of Muskogee
Muskogee	Commercial Bank and Trust Company
Mustang	First Mustang State Bank
Newcastle	Bank of Newcastle
Noble	First State Bank
Norman	City National Bank and Trust
Okeene	First National Bank in Okeene
Okeene	State Guaranty Bank
Okemah	Citizens State Bank
Oklahoma City	Capital Hill State Bank and Trust Company
Oklahoma City	Central National Bank
Oklahoma City	City National Bank and Trust Company
Oklahoma City	Fidelity Bank
Oklahoma City	First National Bank and Trust
Oklahoma City	First National Bank of Britton
Oklahoma City	Friendly National Bank
Oklahoma City	First Security Bank and Trust Company
Oklahoma City	Founders Bank and Trust Company
Oklahoma City	Grant Square Bank and Trust Company
Oklahoma City	Oklahoma National Bank and Trust Company
Oklahoma City	Quail Creek National Association
Oklahoma City	Penn Square Bank
Oklahoma City	Shepherd Mall State Bank
Oklahoma City	Southwestern Bank and Trust Company
Oklahoma City	Republic Bank
Oklahoma City	United Oklahoma Bank
Oklahoma City	Union Bank and Trust Company
Oklahoma City	Will Rogers Bank and Trust Company

TABLE XXXI (Continued)

Town	Bank
Oologah	Lakeside State Bank
Pauls Valley	First National Bank of Pauls Valley
Pawhuska	First National Bank in Pawhuska
Pawhuska	National Bank of Commerce in Pawhuska
Ponca City	Security Bank and Trust Company
Poteau	Poteau State Bank
Prague	Prague National Bank
Pryor	American Bank of Oklahoma
Purcell	First American Bank and Trust
Purcell	McClain City National Bank
Quapaw	Bank of Quapaw
Quinton	Farmers State Bank
Red Oak	Bank of Red Oak
Ringling	Ringling State Bank
Rocky	State Bank of Rocky
Sallisaw	First National Bank
Sand Springs	First Bank and Trust Company
Sand Springs	Sand Springs State Bank
Sapulpa	American National Bank and Trust
Sayre	City National Bank of Sayre
Seminole	First National Bank of Seminole
Sentinel	Southwest State Bank
Shawnee	Federal National Bank and Trust
Shidler	Shidler State Bank
Skiatook	Exchange Bank
Snyder	Bank of the Wichitas
Stonewall	Case State Bank
Stratford	First National Bank of Stratford
Stroud	First State Bank
Stroud	Stroud National Bank
Sulphur	Sulphur Community Bank
Tahlequah	First National Bank of Tahlequah
Taloga	Dewey County State Bank
Temple	First National Bank of Temple
Temple	First State Bank in Temple
The Village	The Village Bank
Thomas	First National Bank of Thomas
Tipton	First National Bank of Tipton
Tonkawa	Service Bank of Tonkawa
Tulsa	Bank of Commerce and Trust Company
Tulsa	Admiral State Bank
Tulsa	Boulder Bank and Trust Company
Tulsa	American Bank of Tulsa
Tulsa	City Bank and Trust Company
Tulsa	Eastland Bank
Tulsa	First National Bank and Trust Company of Tulsa
Tulsa	Guaranty National Bank

TABLE XXXI (Continued)

Town	Bank
Tulsa	Mercantile Bank and Trust Company
Tulsa	North Side State Bank
Tulsa	Southwest Tulsa Bank
Tulsa	Security Bank
Tulsa	Republic Bank and Trust Company
Tulsa	United Bank
Tulsa	Utica National Bank and Trust Company
Tuttle	Bank of Tuttle
Verden	Bank of Verden
Wagoner	American Bank of Wagoner
Wagoner	First Wagoner Bank and Trust Company
Wakita	Citizens Bank
Walters	Walters Bank and Trust Companu
Warr Acres	Community Bank
Watonga	First State Bank
Waurika	First Farmers National Bank of Waurika
Weatherford	Security State Bank
Welch	Welch State Bank
Westville	Peoples Bank
Wilburton	Wilburton State Bank
Willow	First State Bank
Wyandotte	Bank of Wyandotte
Atoka	First Bank in Atoka
Broken Bow	American State Bank
Broken Bow	First Bank and Trust
Caddo	Bryan County National Bank
Coalgate	First National Bank in Coalgate
Durant	Durant Bank and Trust Company
Idabel	First State Bank of Idabel
Kingston	Texoma Bank
Madill	First National Bank in Madill
Valliant	First State Bank
Wright City	Wright City State Bank

TABLE XXXII

BANKS WHICH ARE CHAIN MEMBERS--1975
TENTH FRS DISTRICT

Town	Bank
Ada	Citizens Bank and Trust Company of Ada
Alex	First National Bank of Alex
Allen	Farmers State Bank
Alva	Alva State Bank and Trust Company
Alva	Central National Bank of Alva
Anadarko	Anadarko Bank and Trust Company
Ardmore	Exchange National Bank and Trust Company
Barnsdall	Barnsdall State Bank
Bartlesville	First National Bank in Bartlesville
Bartlesville	Plaza National Bank of Bartlesville
Bartlesville	Union Bank and Trust
Beggs	Bank of Beggs
Binger	Binger Community Bank
Bixby	Citizens Security Bank and Trust Company
Blair	Peoples State Bank
Blanchard	First State Bank
Bristow	American National Bank of Bristow
Broken Arrow	Arkansas Valley State Bank
Calumet	First National Bank of Calumet
Canton	Bank of Canton
Canute	First State Bank
Catoosa	First Bank of Catoosa
Cement	First State Bank
Chandler	Union National Bank of Chandler
Chattanooga	First National Bank of Chattanooga
Chelsea	First National Bank of Chelsea
Cherokee	Alfalfa City National Bank
Chickasha	Chickasha Bank
Chickasha	First National Bank and Trust Company
Chickasha	Oklahoma National Bank and Trust Company of Chickasha
Choctaw	Choctaw State Bank
Chouteau	Bank of Commerce
Claremore	First National Bank in Claremore
Cleo Springs	Cleo State Bank
Clinton	Oklahoma Bank and Trust Company
Comanche	Security State Bank
Cordell	Farmers National Bank of Cordell
Coweta	Security National Bank of Cordell
Crescent	Bank of Crescent
Crescent	Farmers and Merchants Bank
Custer	First National Bank of Custer
Cyril	Cyril State Bank
Davenport	Security State Bank
Davis	First National Bank of Davis
Del City	Del State Bank

TABLE XXXII (Continued)

Town	Bank
Drummond	Bank of Drummond
Drumright	Citizens Bank
Elk City	First National Bank of Elk City
Elmore City	First State Bank
El Reno	First National Bank of El Reno
Enid	Central National Bank and Trust
Enid	Community Bank and Trust Company
Enid	First National Bank and Trust Company of Enid
Enid	Northwest Bank of Enid
Enid	Security National Bank of Enid
Fairfax	First State Bank
Fairview	Fairview State Bank
Fletcher	First National Bank of Fletcher
Fort Gibson	First National Bank in Fort Gibson
Fort Sill	Fort Sill National Bank
Frederick	First National Bank in Frederick
Gracemont	First National Bank of Gracemont
Grandfield	First State Bank
Grove	State Bank of Grove
Guthrie	First National Bank of Guthrie
Haileyville	Bank of Haileyville
Harrah	First State Bank
Hartshorne	Bank of Hartshorne
Healdton	Bank of Healdton
Hennessey	First National Bank of Hennessey
Hinton	First State Bank
Hobart	Home State Bank
Holdenville	First National Bank and Trust Company of Holdenville
Holdenville	Peoples State Bank and Trust Company
Hollis	First State Bank and Trust Company
Hopeton	Hopeton State Bank
Hydro	Bank of Hydro
Inola	Bank of Inola
Jay	Delaware County Bank
Jenks	Bank of Commerce
Jones	First State Bank
Ketchum	First State Bank
Konawa	First National Bank of Konawa
Konawa	Oklahoma State Bank
Lawton	Citizens National Bank of Lawton
Lawton	City National Bank and Trust Company
Leedey	First National Bank of Leedey
Lindsay	American Exchange Bank
Lone Wolf	First State Bank
Luther	First National Bank of Luther
McAlester	American Bank of Commerce

TABLE XXXII (Continued)

Town	Bank
McAlester	First National Bank and Trust Company of McAlester
McLoud	Bank of Commerce
Mangum	First National Bank of Mangum
Mannford	Mannford State Bank
Marshall	Bank of Marshall
Maud	Citizens State Bank
Meeker	Bank of Meeker
Meno	Meno Guaranty Bank
Miami	First National Bank of Miami
Miami	Security Bank and Trust Company
Midwest City	Security Bank and Trust Company
Morrison	Citizens State Bank
Muldrow	Sequoyah State Bank of Muldrow
Muskogee	American Bank of Muskogee
Muskogee	Commercial Bank and Trust Company
Mustang	First Mustang Stage Bank
Newcastle	Bank of Newcastle
Noble	First State Bank
Norman	City National Bank and Trust
Okeene	First National Bank in Okeene
Okeene	State Guaranty Bank
Okemah	Citizens State Bank
Oklahoma City	Capitol Hill State Bank and Trust Company
Oklahoma City	Central National Bank
Oklahoma City	City National Bank and Trust Company
Oklahoma City	Crossroads State Bank
Oklahoma City	Fidelity Bank
Oklahoma City	First National Bank and Trust
Oklahoma City	First National Bank of Britton
Oklahoma City	Friendly National Bank
Oklahoma City	First State Bank and Trust Company
Oklahoma City	Founders Bank and Trust Company
Oklahoma City	Grant Square Bank and Trust Company
Oklahoma City	May Avenue Bank and Trust Company
Oklahoma City	Oklahoma National Bank of Oklahoma City
Oklahoma City	Quail Creek Bank
Oklahoma City	Penn Square Bank
Oklahoma City	Shepherd Mall State Bank
Oklahoma City	Southwestern Bank and Trust Company
Oklahoma City	Republic Bank
Oklahoma City	Stock Yards Bank
Oklahoma City	Will Rogers Bank and Trust Company
Pauls Valley	First National Bank of Pauls Valley
Pawhuska	First National Bank in Pawhuska
Pawhuska	National Bank of Commerce in Pawhuska
Ponca City	Security Bank and Trust Company
Poteau	Poteau State Bank
Prague	Prague National Bank

TABLE XXXII (Continued)

Town	Bank
Pryor	American Bank of Oklahoma
Purcell	First American Bank and Trust
Purcell	McClain City National Bank
Quapaw	Bank of Quapaq
Quinton	Farmers State Bank
Red Oak	Bank of Red Oak
Ringling	Ringling State Bank
Rocky	State Bank of Rocky
Sallisaw	First National Bank
Sand Springs	First National Bank and Trust Company
Sapulpa	American National Bank and Trust
Sayre	City National Bank of Sayre
Seminole	First National Bank of Seminole
Sentinel	Southwest State Bank
Shawnee	Federal National Bank and Trust
Shidler	Shidler State Bank
Skiatook	Exchange Bank
Snyder	Bank of the Wichita
Stratford	First National Bank of Stratford
Stroud	First State Bank
Stroud	Stroud National Bank
Sulphur	Sulphur Community Bank
Tahlequah	First National Bank of Tahlequah
Taloga	Dewey County State Bank
Temple	First National Bank of Temple
Temple	First National Bank in Temple
The Village	The Village Bank
Thomas	First National Bank of Thomas
Tipton	First National Bank of Tipton
Tonkawa	Service Bank of Tonkawa
Tulsa	Bank of Commerce of Tulsa
Tulsa	Admiral State Bank
Tulsa	Boulder Bank and Trust Company
Tulsa	American Bank of Tulsa
Tulsa	City Bank and Trust Company
Tulsa	First National Bank and Trust of Tulsa
Tulsa	Guaranty National Bank
Tulsa	Mercantile Bank and Trust Company
Tulsa	North Side State Bank
Tulsa	Southwest Tulsa Bank
Tulsa	Security Bank
Tulsa	Republic Bank and Trust Company
Tulsa	United Bank
Tulsa	Utica National Bank and Trust Company
Tuttle	Bank of Tuttle
Verden	Bank of Verden
Wagoner	American Bank of Wagoner
Wagoner	First Wagoner Bank and Trust Company
Wakita	Citizens Bank

TABLE XXXII (Continued)

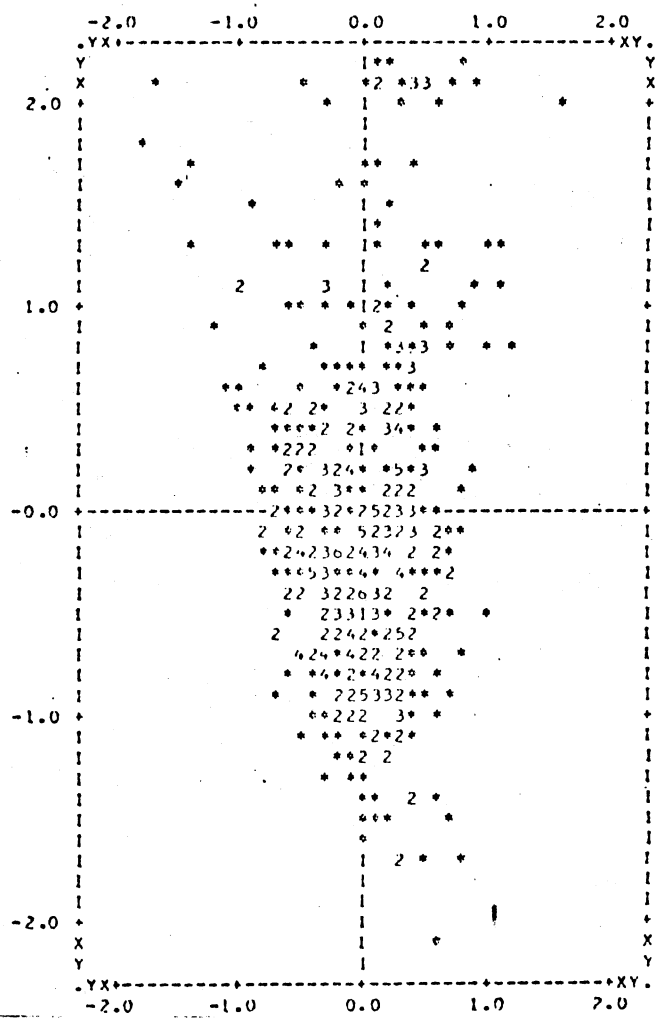
Town	Bank
Walters	Bank of Walters
Warr Acres	Community National Bank of Warr Acres
Watonga	First State Bank
Waurika	First Farmers National Bank of Waurika
Weatherford	Security State Bank
Welch	Welch State Bank
Westville	Peoples Bank
Wilburton	Wilburton State Bank
Willow	First State Bank
Wyandotte	Bank of Wyandotte
Atoka	First Bank in Atoka
Broken Bow	First Bank and Trust
Caddo	Bryan County National Bank
Coalgate	First National Bank in Coalgate
Durant	Durant Bank and Trust Company
Idabel	First State Bank of Idabel
Kingston	Texoma Bank
Madill	First National Bank in Madill
Valliant	First State Bank
Wright City	Wright City State Bank

APPENDIX B

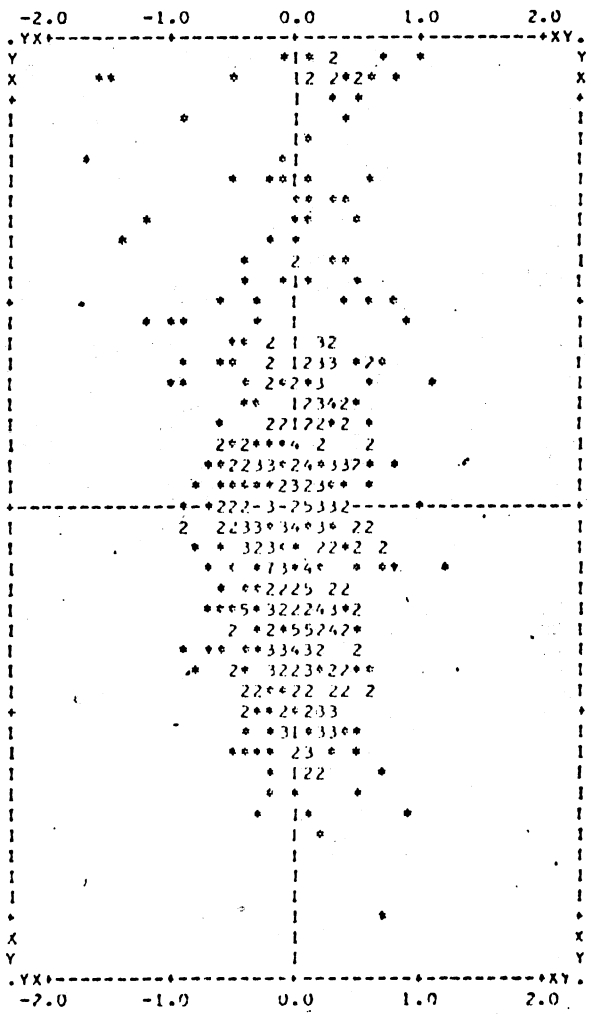
SCATTERPLOTS OF ALL REGRESSION EQUATIONS WHICH PRODUCED SIGNIFICANT F-RATIOS FOR COEFFICIENTS OF CHAINBK VARIABLE

* * * * * * * PLOT: STANDARDIZED RESIDUAL (DOWN) -- PREDICTED STANDARDIZED DEPENDENT VARIABLE (ACROSS) * * * * * * *

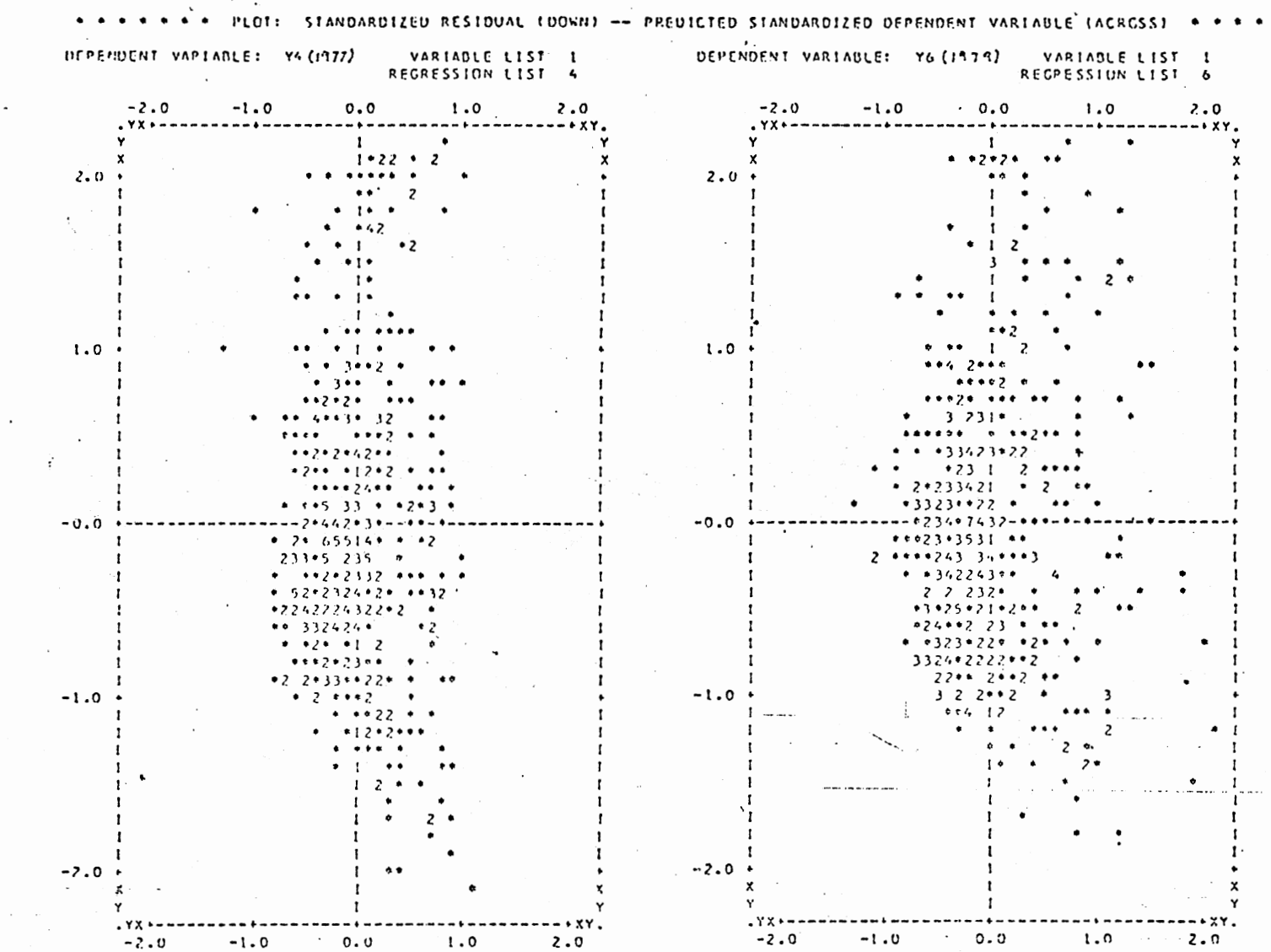
DEPENDENT VARIABLE: Y1 (1979) VARIABLE LIST 1
REGRESSION LIST 1



DEPENDENT VARIABLE: Y1 (1979) VARIABLE LIST 1
REGRESSION LIST 1

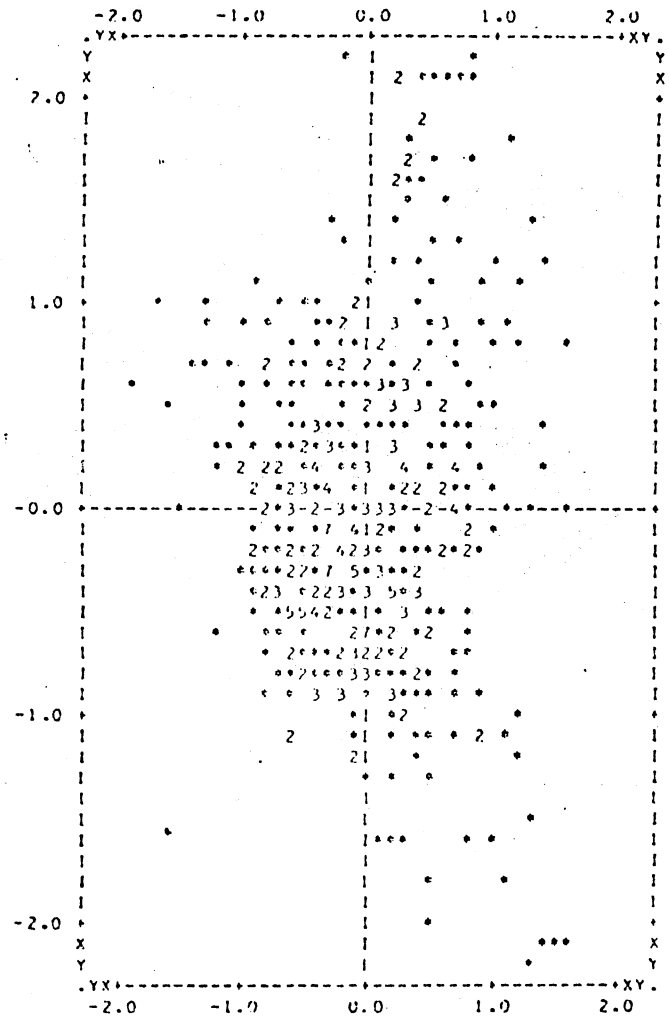


ROWS,COLUMNS Y: VALUES OUTSIDE (-3.0,3.0) ROWS,COLUMNS X: VALUES IN (-3.0,-2.05) OR (2.05,3.0)

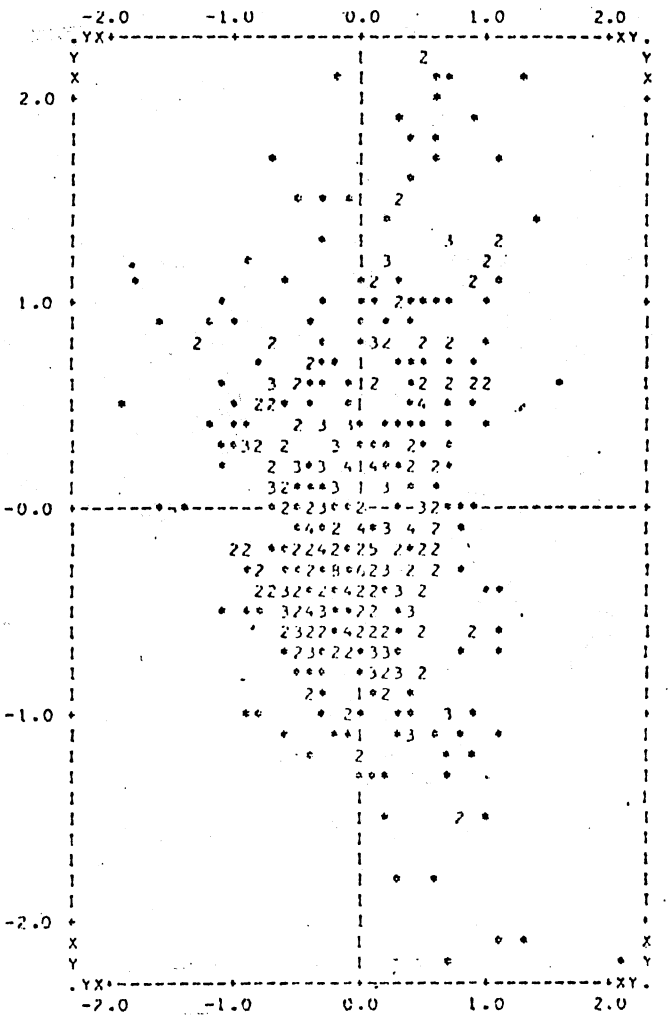

* * * * * * * PLOT: STANDARDIZED RESIDUAL (DOWN) -- PREDICTED STANDARDIZED DEPENDENT VARIABLE (ACROSS) * * * * *
DEPENDENT VARIABLE: Y4 (1977)
VARIABLE LIST 1
REGRESSION LIST 4
DEPENDENT VARIABLE: Y6 (1979)
VARIABLE LIST 1
REGRESSION LIST 6
-2.0
-1.0
0.0
1.0
2.0
ROWS,COLUMNS Y: VALUES OUTSIDE (-3.0,3.0)
ROWS,COLUMNS X: VALUES IN (-3.0,-2.05) OR (2.05,3.0)

* * * * * * PLOT: STANDARDIZED RESIDUAL (DOWN) -- PREDICTED STANDARDIZED DEPENDENT VARIABLE (ACROSS) * * * * * *

DEPENDENT VARIABLE: Y9 (1979) VARIABLE LIST 1
REGRESSION LIST 9



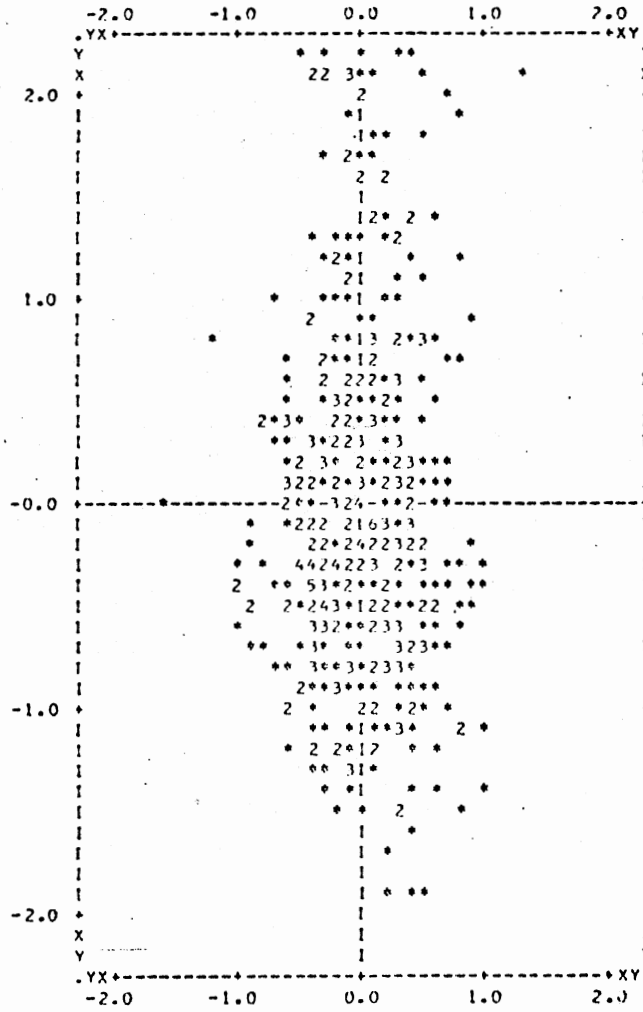
DEPENDENT VARIABLE: Y9 (1977) VARIABLE LIST 1
REGRESSION LIST 9



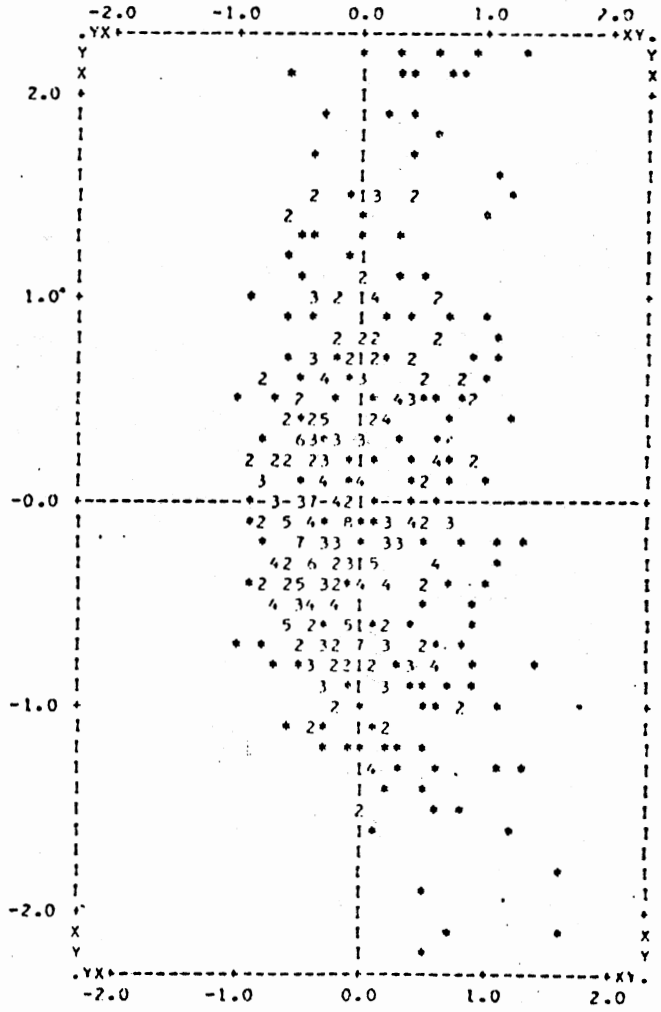
ROWS,COLUMNS Y: VALUES OUTSIDE (-3.0,3.0) ROWS,COLUMNS X: VALUES IN (-3.0,-2.05) OR (2.05,3.0)

* * * * * * * PLOT: STANDARDIZED RESIDUAL (DOWN) -- PREDICTED STANDARDIZED DEPENDENT VARIABLE (ACROSS) * * * *

DEPENDENT VARIABLE: Y8 (1977) VARIABLE LIST 1
REGRESSION LIST 9

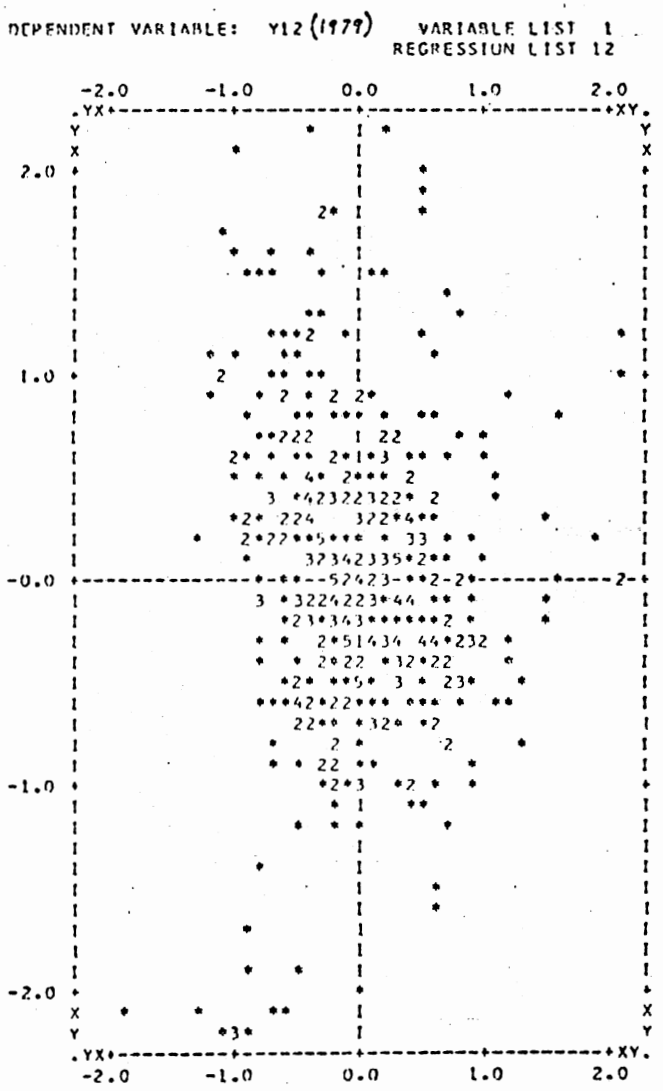


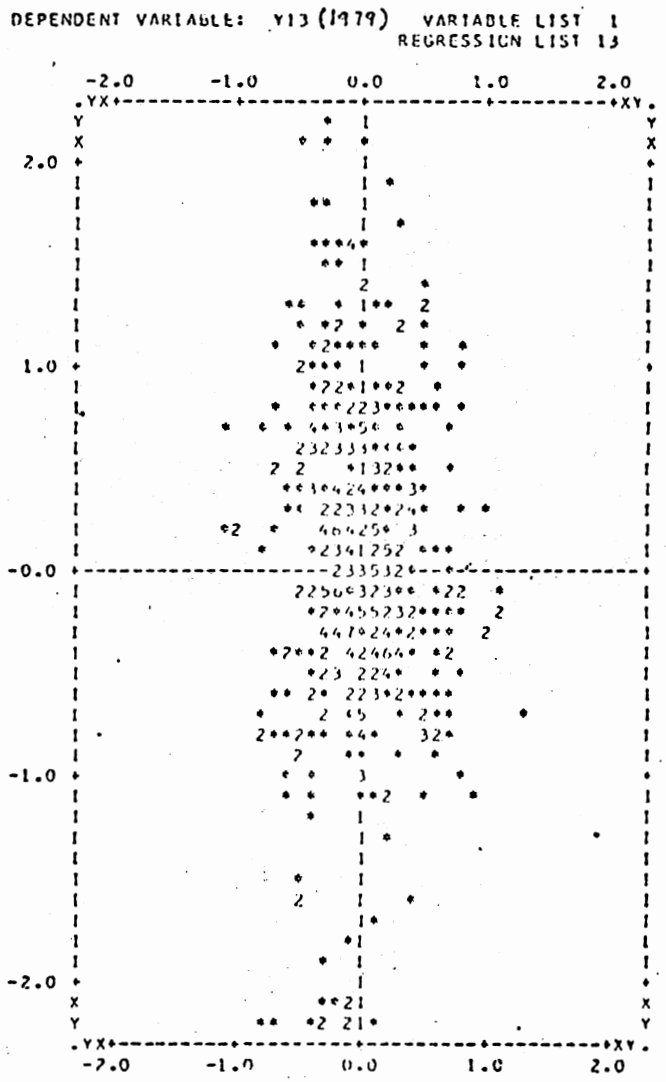
DEPENDENT VARIABLE: Y10 (1975) VARIABLE LIST 1
REGRESSION LIST 10



ROWS,COLUMNS Y: VALUES OUTSIDE (-3.0,3.0)

ROWS,COLUMNS X: VALUES IN (-3.0,-2.05) OR (2.05,3.0)



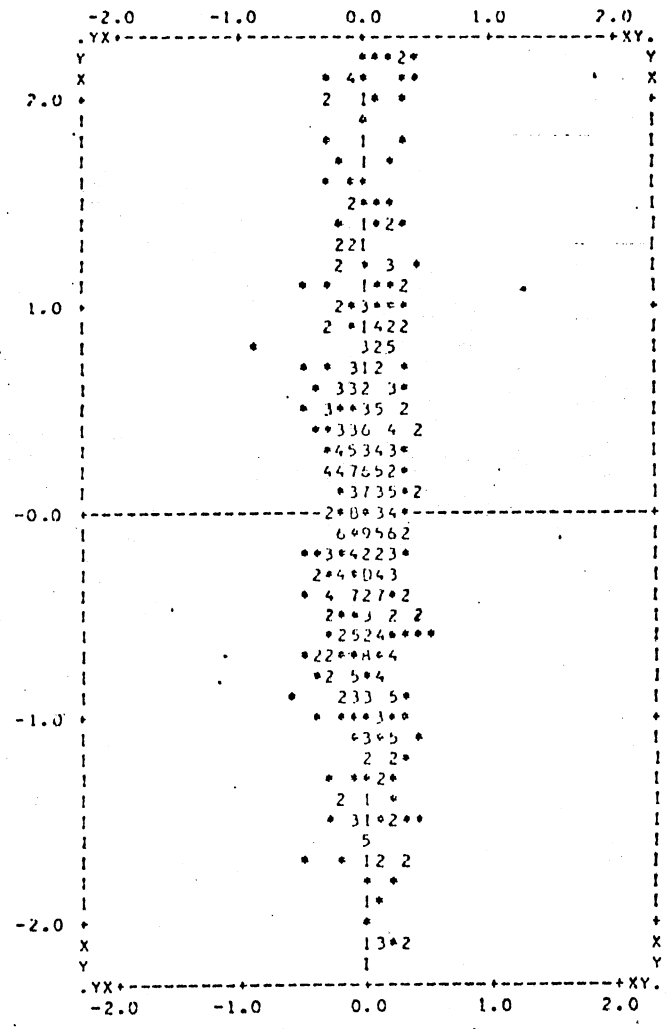


ROWS,COLUMNS Y: VALUES OUTSIDE (-3.0,3.0)

ROWS,COLUMNS X: VALUES IN (-3.0,-2.05) OR (2.05,3.0)

* * * * * * PLOT: STANDARDIZED RESIDUAL (DOWN) -- PREDICTED STANDARDIZED DEPENDENT VARIABLE (ACROSS) * * * * * *

DEPENDENT VARIABLE: Y16 (1977) VARIABLE LIST 1 REGRESSION LIST 16



ROWS,COLUMNS Y: VALUES OUTSIDE (-3.0,3.0) ROWS,COLUMNS X: VALUES IN (-3.0,-2.05) OR (2.05,3.0)

VITA 2

Kendall Patrick Hill

Candidate for the Degree of

Doctor of Philosophy

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