COMMERCIAL BANK LOANS AND ECONOMIC ACTIVITY IN NONMETROPOLITAN ARIZONA: A QUESTION OF CAUSALITY.

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COMMERCIAL BANK LOANS AND ECONOMIC ACTIVITY IN NONMETROPOLITAN ARIZONA: A QUESTION OF CAUSALITY

by

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David Lane Barkley — Date

Professor of Aricultural Economics

In memory of my father

Arthur W. Helander

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ABSTRACT

Previous studies investigating the causal relationship between commercial bank lending and nonmetropolitan economic activity have failed to reach an unanimity. The definitive answer to this question of "causality" lies within a dynamic model specification; which previous studies neglected to consider. Hence, to determine the role commercial bank lending has had on nonmetropolitan economic development, the Granger test for causality was applied to 1975 through 1980 loan and retail sales data for twenty-seven nonmetropolitan Arizona communities. The maximum-likelihood estimates generated for Arizona provided no evidence that commercial bank lending initiated nonmetropolitan development.

CHAPTER I

INTRODUCTION

The role banks play in promoting economic growth at the rural level has received much interest over the past ten years. At issue is whether commercial bank lending intiates local economic growth or reacts passively to past economic growth. This is of particular interest for three reasons: (1) to attain a fuller understanding of the economic growth process within nonmetropolitan communities, thus enabling decision-makers to reverse the economic deterioration of some rural communities within their jurisdiction (e.g. Community Reinvestment Act of 1979), (2) to ascertain the role and importance of commercial banks in the growth process, and (3) to discern the effects of the liberalization of branch bank legislation on the banks' ability to encourage economic growth (e.g. Depository Institutions Deregulation and Monetary Control Act of 1980).

The lending behavior of commercial banks has welfare implications for the nonmetropolitan areas they serve. Presumably, commercial banks provide loans at competitive rates of interest to finance increases in

public and private goods. However, nonmetropolitan banks have often demonstrated a preference for investing loanable funds in low risk securities' markets rather than lend to local businesses and residents. This risk minimization policy is the basis on which many researchers and community leaders alike blame the commercial banking system for the disinvestment experienced in these communities. Thus bank financing is seen as an important ingredient of nonmetropolitan growth.

The purpose of this study is twofold: (1) to determine if commercial bank lending intiates economic growth in nonmetropolitan areas, and (2) to generate a reservoir of knowledge from which policy-makers, public and private, can draw in reassessing the role of commercial banks in nonmetropolitan growth. This research is designed to be regional in nature and attempts to analyze those factors which influence nonmetropolitan bank lending policies in Arizona. The time period selected for this study, 1975 to 1980, saw volatile movement in interest rates and the inception of a national recession which provided an interesting context of study. In addition the data collected for Arizona banks was by branch office which differs from studies that traditionally used aggregate loan data for multi-office branches.

The following chapters will demostrate that the lending behavior of Arizona's nonmetropolitan branch banking system is a passive influence on the regional development process. In other words, although nonmetropolitan commercial banks in Arizona facilitate economic growth, they do not initiate it. In addition to economic activity, local economic and demographic conditions were found to modify commercial bank conduct towards customers.

The research supporting the above findings is organized as follows. Chapter 2 reviews the data, methodologies and conclusions drawn from previous studies. Chapter 3 provides the methodology and nature of the data used in this analysis to address the issue of "causality" between commercial bank loans and nonmetropolitan economic activity. Chapter 4 documents the direction of "causality" between bank lending and economic activity. Finally, Chapter 5, summarizes the findings of Chapter 4 and considers policy implications.

CHAPTER II

REVIEW OF THE LITERATURE

To understand fully the credit and economic growth relationship one must first understand the role money plays in economic growth. Thus, studies on the regional impact of monetary policy in the United States will be reviewed first. A review of the studies concerning the relationship between commercial bank lending and economic growth will then follow.

The Regional Impact of Monetary Policy in the United States

While the study of regional economics has developed rapidly over the last thirty years, relatively little attention has been given to the impact of monetary policy on the regional growth process. However, because of the regional structure of the Federal Reserve System, interest in the regionality of monetary policy does exsit. According to the Record of the Federal Reserve System Conference on the Interregional Flow of Funds [1955], the Federal Reserve Board was analyzing individual district sources and uses of reserves as early as 1931. Other early studies concentrating on the regional characteristics of

the money supply process were those by Scott [1950] and Bowsher, Dane and Einzig [1958].

In the late 1960s, the principle emphasis of monetary policy shifted to an analysis of regional reserve adjustment lags with respect to open market operations. Ruffin [1968] used ordinary least squares regression on patterns of change in unborrowed reserves and the principal sources of unborrowed reserves. He concluded that most of the long-run impact of open-market operations occurs within one month. Bonomo and Schotta [1967] applied cross spectral analysis to time series of total reserves and United States Government Security holdings and they detected a lag of eight days between open-market operations and changes in reserves. Barth, Phaup, and Pierce [1975] analyzed regional reserve adjustment lags by implementing the dynamic time series modeling procedures of Box-Jenkins. Their results supported those reported by Ruffin, and Bonomo and Schotta. In summary, these regional adjustment lag studies suggest a diffused one month short-run impact of open market purchases among all bank classes and regions.

A formal theoretical framework for modeling the basic pattern of regional and interregional impacts of monetary policy actions in the United States was then developed by Miller [1979]. According to Miller, the

process begins with an exogenous monetary shock by the Federal Reserve Board (FRB). This shock generates a change in the flow of net source base money to a region[1] which is then amplified by that region's money multiplier. This produces a change in a region's money supply which in turn influences the level of economic activity, e.g. changes in price and employment, the interest rate, and income level. Movement in a region's level of economic activity influences its interregional trade and money flows. Moreover, these interregional money flows change a region's net source base and hence its money supply which encourages further economic activity. With the dynamic properties of his two-region model Miller then attempts empirically to link monetary policy to regional and interregional economic activity. He believes there are two major strengths to his model. First, the model is able to track the flow of net source base to the region in question and the rest of the country as described by his theoretical framework. Second, the model is useful in describing the impacts of the regional money supply change on regional and interregional economic activity and the impact of monetary action on the regional net source base.

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1. The flow of regional net source base is defined in terms of its uses as the sum of regional member bank reserves less discounts and advances, currency held by the banks in the region and currency held by the public in the region.

The impact of monetary policy on regional economic activity has also been analyzed within a Keynesian framework. Dow [1982] takes the Keynesian methodological perspective in an attempt to determine the role of money in the regional composition of income and employment. She further attempts to determine whether regional financial conditions can affect income and employment. Although some Keynesians reject money multipliers because they tend to hide "portfolio behavior," Dow introduces portfolio analysis into a money multiplier framework. She concludes that financial variables can change regional income levels and that regional financial development can also alter income and employment.

The results of these studies demonstrate that monetary policy is a vital component in regional growth and development. Thus, an intermediary role is created in that these monetary resources must be channeled into appropriate uses for the benefit of the overall region. Of the many entities that may play this intermediary role, commercial banks are presumed to assist in the growth process by providing loans at competitive rates of interest. The role of commercial bank lending in economic growth will be reviewed next.

Bank Perfomance-Economic Growth

The Role of Banks in Local Economic Growth

Financial capital is created when households, businesses or governments consume less than their income; this difference is called savings. When created, financial capital initiates or facilitates productive activities. An increase in the number of productive activities is synonymous with regional growth. Inadequacy in the sources of financial capital will retard regional growth. Savings move to investors in three different ways: (1) direct transfer, from savers to investors, (2) direct sale of bonds or equity instruments to savers, and (3) intermediation by financial institutions who can collect money from savers and use it for loans or the purchase of bonds and securities in the capital market.

Small businesses, characteristic of nonmetropolitan economies, are dependent on the intermediation process of local banks since they generally do not have access to organized financial capital markets. From this perspective Minsky [1965, p101] stated that commercial banks play a central role in the regional growth process and he noted that:

> The current importance of an adequate commercial bank growth to a rapidly growing region centers not around banks' direct role in abetting the import of capital, but rather their significance as a source of financing

> for those enterprises not able to tap national credit markets yet whose growth is necessary for rapid growth of the local economy.

Minsky proposes that growth in a region is based on a leading export sector. This creates local employment, increases spending and income, thus providing for increased deposits and reserve flows to local banks. From these increased deposits a larger pool would be available for local loans, which, in turn, encourages continued local spending, output and income. Of the importance of credit availability to rapidly growing regions Minsky [1965, p.101] concluded that

> ... the essential role of commercial banks in the growth process is that they supply "loan" capital to (a) these local enterprises which must grow at least at the same rate as the local economy, and (b) those export enterprises which are too small, and perhaps too new, to be able to generate nationally acceptable liabilities.

Furthermore, he contents that big banks and liberal branching laws are associated with rapid economic growth. However, the causality between bank behavior and economic growth was not statistically tested.

Macesich's [1965] analysis of 402 banks in the southern region of the United States discerned that, in the short run, the type of assets held by any bank was determined by the attitudes and policies peculiar to that bank, rather than by general economic conditions. He calculated a negative correlation been county per capita income and the percentage of bank assets held as cash and

real estate loans. He also showed that commercial banks in the higher per capita income counties of the southeast held a higher percentage of their assets in goverment and other securities than was prevalent in the lower income counties. Macesich infers from this that the holding of liquid assets by banks could hinder regional development.

Dreese [1974] set out to see if bank lending and investing facilitated economic growth as demonstrated by an increase in regional employment levels. Using a single equation regression model Dreese found that employment growth is a better explainer of lagged loan levels than lending is of lagged employment growth. Based on a high correlation between lending and deposits, Dreese suggests that banks expand their loan portfolios as their deposits grow, apparently actuated by the motive of profit rather than community progress. Therefore, he concludes that banks have no significant role in the growth process. Dreese found, moreover, that bank size and liberal branching laws are not significant in explaining employment growth yet are significantly related to bank loan growth. That is, structural factors which may make banks more profitable but not more potent in the economic growth process.

Gessaman and Jansen [1975] studied the polices and practices of selected lenders in two regions of rural

Nebraska. After interviews with managers of sixteen commercial banks and four savings and loan associations Gessaman and Jansen made three general observations. First, the institutions in the study had a tendency to minimize risk, as demonstrated by the high percentage of their assets in cash and real estate. This type of policy does not contribute to new productive capital that yields permanent jobs or higher incomes. Second, the institutions expressed a preference for financing the seasonal credit needs of agriculture and local businesses to other forms of loans and investments. Finally, the banks followed investment policies that exported financial capital from the region in three ways: (1) thirteen of the sixteen banks preferred to direct any surplus funds they had to the purchase of treasury securities, (2) all respondent banks used services of neighboring banks to handle peak seasonal loan demand, overline agricultural loans, and purchase securities from, and (3) many of these banks invested a high porportion of depositor's funds in state and municiple securities.[2] They selected this option because of high yields, low risk, ease of

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2. Hopper [1971] and Gilbert and Longbrake [1973] describe a fourth way to export capital, in which small banks keep non-interest bearing deposits with large metropolitan banks in return for services thus transferring capital from rural to metropolitan banks.

management, and the desire to support local improvement efforts. Gessaman and Jansen's results corroborate an earlier study by Edwards [1965], who reports that small banks, many of which are in rural areas, make fewer loans and hold a larger proportion of assets in safe securites than do larger banks. Horvitz and Shull [1964] interpret these low risk policies as a means of maximizing profits where a bank has monopoly power.

Verbrugge [1975] argues in defense of low risk short-term lending policies of small banks on the basis that a small bank should not be expected to incur the high risk and lesser liquidity of liberal long term lending practices. In fact, most large banks do not accept this responsibility. The basic premise here is that a bank has liabilities payable on demand which cannot be met if its assets are tied up in long term vehicles. As a result, a bank needs to maintain liquidity through a continual and substantial cash flow which can be obtained only through short-term lending activities or investments in liquid assets such as United States Government

securties.[3]

Shaffer [1978] analyzed the operating ratios of fourty-seven banks in west central Wisconsin and obtained results similar to those of Gessaman and Jansen. Shaffer noted that: (1) banks in west central Wisconsin held a more liquid position in order to meet the seasonal demands of agriculture, (2) loans to agriculturally oriented concerns took precedence over housing or business loans, (3) bankers admitted that their loan policy was passive and not aggressive in stimulating local jobs and income, and (4) banks felt that financial capital which left the community earned them a higher return. Movever, this capital outflow eliminated the process and enforcement costs connected with lending funds. Shaffer suggests, however, that the export of capital imposes a cost on the community in the form of slower long run growth. Based on the profit rate, capital position and the strength of the banks studied, Shaffer concluded that what was lacking in the financial economy of communities was not the funds, but the incentive for bank officials to use the funds

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3. This lending behavior follows Mints' [1945] Commercial Loan Theory which states that a risk minimization bank will lend only on three conditions: (1) when a loan matures in less than one year from when it is first made (short term), (2) the very nature of the loan generates the funds necessary to pay it off (self-liquidating), (3) the loan is soley based on "real" goods as opposed to loans for speculative or purely financial purposes (commercial paper).

locally.

Like Gessman and Jansen and Shaffer, Dreese [1971] found commercial banks in slower growing Appalachian counties had a greater part of their assets in secured holdings (real estate) and liquid assets (cash, government securities, etc). Furthermore, slower growing counties had a higher percentage of bank assets composed of federal and state securites. Unlike, Gressman and Janson, Dreese believes that this export of financial capital is a response to weak local demand for credit rather than a technique for minimizing risk.

Ho and Shaffer [1979] tested the quantitative link between commercial bank lending and economic activity in a sample of rural Wisconin areas. They divided the local economy into a production sector, described by a modified linear production equation, and a financial sector, described by three asset demand equations. The conceptual framework for the model is based on a simultaneous interaction of bank performance and economic growth. As the economy grows, income and the demand for bank deposits grow, which increases the amount banks will be able to make available for loans, which, in turn, will increase investment and fuel economic growth. It is this quantitative simultaneous relationship that Ho and Shaffer believe is lacking in the methodology of previous studies.

From Ho and Shaffer's study three conclusions emerge: (1) aggregate loans had a positive and significant impact on the change in per capita income, especially in nonmetropolitian areas, (2) the lower the time and savings deposit interest rate the more loans available for local lending, and (3) there was only a weak indication that purchase of United States securities may hurt the local economy.

Branch Banking-Regional Growth

Kreps and Wacht [1970] inferred that statewide branching led to faster regional economic growth than would existed under alternative banking systems. Lombardi and Zink [1971] concurred the same results. They found greater growth in income, employment, and higher loan-to-deposit ratios in four states with statewide branching (AZ, ID, NV, VT) than in four states that do not permit unlimited branching (NM, CO, MT, WY). Hooker [1970], on the other hand, asserts that branching is not important in explaining economic growth at he state level. Although he found that branch banking does increase the availability of credit, he hypothesized that the direction of causality is from economic growth to branching. Hooker based his conclusion on the premise that it is easier for growing states to liberalize branching laws that allow banks to grow within the state. Darnell [1972] reached a similar

conclusion in a study comparing all the states grouped according to their type of branching structure. Based on the rates of change from 1961 to 1971 for several measures of economic growth (per capita personal income, total personal income, and nonagricultural employment) Darnell calculated no significant difference between the branching structures.

Summary

Banks can play either a passive or active role in allocating financial capital for the support of local economic activity. McGee [1970] defines these roles as follows: If banks merely respond to a rise in demand for their services resulting from increased economic activity, they are considered passive. If, on the other hand, banks allocate funds to induce economic growth they play an active role. He concludes that in a given locale, either role may be consistent with a bank's basis function in the economy to gather funds and distribute them to their most productive uses. For Arhart and Wrohlage [1975] efficient intermediation is not the only purpose of banks. They contend that banks have a social responsibility for the economic activities within their communities.

All these studies agree that bank performance and local economic activity are related. These earlier studies, however, generally employed a static cross-

sectional data base. Although a static framework was able to provide insight in the banking activities among communities it was incapable of testing the direction of "causality" between bank performance and economic activity. In other words, cross-sectional analysis is only capable of examining how bank lending varies among communities with varying levels of economic activity. That is, time is held constant in cross sectional analyisis. Time-series analysis, on the other hand, is capable of examining the lending behavior of bank, or alternatively, the aggregate bank lending behavior of all units over time. The answer to this question of "causaltiy" lies in a dynamic model specification requiring time series data. This study uses a dynamic data base within a methodological framework derived from Granger [1969]. Its purpose is to delineate the inducement path between commercial bank loans and nonmetropolitan growth in order to answer the question -- in which direction does the "causality" between commercial bank loans and economic activity operate?

CHAPTER III

METHODOLOGY AND DATA SOURCES

The Granger Statistical Test for Causality [1969]

Granger has provided a testable definition of "causality" based on the supposition that a time series, X_t will "cause" a time series Y_t, in the Granger sense, if the current value Y_t can be better predicted when using lagged values of X_t than it can when those values are absent.[1] The model for Granger "causality" estimated through an autoregressive time series may be represented in the following form:

$$X_t = b_0 + \Sigma a_{1i}X_{t-i} + \Sigma a_{2i}Y_{t-i} + u_{1t} \quad (1)$$

$$Y_t = b_0 + \Sigma a_{3i}Y_{t-i} + \Sigma a_{4i}X_{t-i} + u_{2t} \quad (2)$$

where u_{1t} and u_{2t} are taken to be uncorrelated white noise series. To test if Y "causes" X in the Granger sense is analogous to testing the null hypothesis that $\Sigma a_2 = 0$.

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1. For example of applications of Granger's test of "causality" see: (1) Steinnes [1978] (found that "jobs follow people" but "people do not follow jobs") (2) Sims [1972] (determined that the money supply affects future GNP but not vice versa) (3) Noble and Fields [1982] (found that GNP and wholesale prices neither "cause" nor are not "caused" by sunspots).

Conversely, to test if X "causes" Y is equivalent to testing the null hypothesis that $\Sigma a_4 = 0$. If both Σa_2's and Σa_4's are jointly significantly different from zero, then bidirectional "causality," or feedback occurs. If neither Σa_2 or Σa_4 are significantly different than zero then no information concerning "causality" is available.

To detect "causality" in the Granger sense the exogenous variables as a group must be statistically tested for significance. The F-test statistic does this by determining if the group of exogenous variables in question explain significant variation in the endogenous variable. The determination of significance for this exogenous group is achieved by removing them from the original unrestricted models (equations (1) and (2)) thus deriving their restricted forms. For the given null hypothesis the restricted form was:

IF $H_o: \Sigma a_{2i} = 0$

THEN 1) $X_t = b_o + \Sigma a_{1i} X_{t-i} + u_{1t}$ (3)

IF $H_o: \Sigma a_{4i} = 0$

THEN 2) $Y_t = b_o + \Sigma a_{3i} Y_{t-i} + u_{2t}$ (4)

If the error sum of squares in the restricted case (ESS_R) is only slightly higher than in the unrestricted case (ESS_{UR}), then omission of the exogenous variables, as prescribed by the null hypothesis, has little or no effect

on the explanatory power of the equation, and the null hypothesis is accepted. The test statistic used to measure the increase in the error sum of squares under the null (equation 5) takes into account the number of restrictions and the number of degrees of freedom available in the unrestricted regression model:[2]

$$\frac{(ESS_R - ESS_{UR}) / q}{ESS_{UR}/(N-K)} \qquad (5)$$

The test statistic has an F distribution where:

q = the difference in the number of parameters between the restricted and unrestricted regression models.

K = the parameters in the unrestricted model.

N = total observations.

The previous discussion of Granger's test for "causality" indicates that the underlying concept of causality testing is relatively straightforward. Care must be taken, however, in the specification and interpretation of the Granger technique if valid results are to be obtained. There are four principle criteria for the correct application and interpretation:

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2. For a further discussion of testing hypotheses involving more than one regression parameter, see H. Kelejian and W. Oates, Introduction to Econometrics Principle and Applications [1981, pp. 190-192] and Arthur Goldberger, Econometric Theory [1971, pp. 622-627].

1. The model must be represented within a time series framework with a linear autoregressive representation. The occurence of "causality" is essentially one of dynamic specification in which the endogenous variable depends on the weighted sums of its past values and those past (and possibly current) values of the hypothesized group of lagged exogenous variables.

2. "Causality" in the Granger sense is not capable of distinguishing between spurious and causal relationships. The Granger "causality" methodology is sensitive to misspecification, and thus it must be assumed that all the information needed to explain the possible relationship exists in the present and lagged values of the structural equation. The omission of informative variables in the structural equation creates a non-zero covariance between the specified exogenous and disturbance term, violating one of the OLS assumptions. Intuitively, if an omitted variable has a positive effect on an endogenous variable, then estimates of the other exogenous variables are biased upward and are inconsistent, possibly resulting in the detection of Granger "causality" where in fact none exists. The opposite bias results from overlooking a negative influence on the endogenous variable. Local economic and bank market variables were included in this study to ensure proper model specification.

3. The behavioral parameters in which the question of "causality" is being addressed must be jointly covariance stationary. Stationarity is vital; only if the stochastic process is fixed in time is it possible to model the process via an OLS equation with fixed coefficients that can be estimated from past data. In other words, the coefficients derived from ordinary least squares are assumed to be in equilbrium over time about a constant mean level. A linear time trend parameter (t) was included to capture the possible trend term in the time series which was not explained by the specified model.[3]

4. Jacobs, Leamer, and Ward [1979], Sargent [1976] and Sims [1972] have all agreed that care must be taken when Granger's test for causality is implemented within a simultaneous framework. If one of the independent variables in either equation (1) or (2) is itself a function of the dependent variable then the system of equations implies a violation of the OLS assumption that the disturbance term is independent of all of the values of the regressors; $E(u_t X_{1t}) = cov(u_t, X_{1t}) = 0$. Any attempt to employ ordinary least squares will result in simultaneous equation bias yielding biased and

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3. The problem with trend-curve fitting is the lack of any real theory underlying the forecasts. The trend curve fitting is arbitary and is based on the blind hope that whatever mechanism generated the trend in the past will continue to work in the future.

inconsistent estimators of all the parameters in the equation.

Hence, a test for Granger causality estimated via ordinary least squares in this study took the following form:

$$S_{i(t)} = a_0 + \Sigma a_k S_{i(t-k)} + \Sigma b_k L_{i(t-k)} + c(TE + MM + Z_i + H77_i + SLD + t) + u_{it} \quad (6)$$

$$L_{i(t)} = a_0 + \Sigma a_k L_{i(t-k)} + \Sigma b_k S_{i(t-k)} + c(TE + MM + Z_i + H77_i + SLD + t) + u_{it} \quad (7)$$

where S is retail sales, L is commercial bank loan totals, TE, MM, Z, SLD, and H77 are local economic and bank market variables (to be discussed later), t is a linear time trend term and the distrubance term u_{1t} is indistinguishable from white noise.

Data Sources

Coterminous time series for economic activity and bank lending are necessary for testing the causal relationship between bank loans and economic development. Since traditional measures of economic activity were not available by community, the level of community retail sales was selected as a proxy. The level of retail sales was computed as the quotient of annual transaction privilege sales tax collections and the retail sales tax rate for each of the twenty-seven nonmetropolitan Arizona communities for the fiscal years of 1975-76, 1976-1977, 1977-78, 1978-79, 1979-80, and 1980-81. Sales tax rates and sales tax receipts were provided by the Statistical

Statement, Sales and Use Tax Division, published by the Arizona Department of Revenue.

Banks in Arizona operate under statewide branching restrictions. The study includes eighty-seven bank offices representing eight bank organizations with the three largest banks accounting for all but nine of the offices and 85% of the state's deposits. The home offices of the banking organizations provided bank data by branch offices. The bank loan data was provided by year-end balances of outstanding loans for the years of 1975, 1976, 1977, 1978, 1979, 1980 from the nonmetropolitan bank branch offices.[4] The availability of bank credit was also represented by the commercial and agricultural loans portion of those above year end balances. It was hypothesized that commercial and agricultural loans could provide specific information concerning the possible role

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4. There is one major shortcoming to the use of outstanding loans to represent the local lending behavior by commercial banks. A certain part of the loaned funds leaving or entering the nonmetropolitan area may not appear in the reported local bank data. This is not a concern in this analysis, since Arizona is a branch banking state allowing for commercial loans to be obtain through local bank branches thus loan totals will be accounted for by specific community.

of commercial banking local industrial credit.[5]

Community Related Variables

Nonbanking data that identified community characteristics were taken from the latest available Census of Population, Census of Ariculture, and Directories of Manufactures. When community data was not available county data were substituted. Economic and bank market variables were used to ensure proper model specification and they were:

1. Demographic Variable (Z). It is hypothesized that a community's propinquity to communities of equal or greater size may influence lending by rural bank offices and retail sales. Specifically, the residents of rural communities may acquire credit or make retail purchases in urban markets. Z, accounts for any potential leakages by measuring the highway mileage to the nearest city of equal or greater population. Thus the greater the distance

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5. The retail sales and loan data were deflated to constant 1972 dollars in an attempt to eliminate inflationary trend. The GNP deflator was selected over the CPI and the WPI, since it measures the current flow of market prices of newly produced final goods and services, in other words, the GNP. There are two advantages of the GNP deflator: it eliminates double-counting and it focuses on the pricing of currently produced goods. It does not, however, focus on the existing consumer assets and thus does not reflect the exact buying power of consumers. Although it is true that the GNP deflator does not represent actual consumer experience, its ability to focus on the flow of newly produced goods favored the loan and retail sales relationship.

measured by Z the less the leakage that is assumed to occur.

2. Bank Market Characteristics (H77,SLD). The Herfindahl Index for 1977, H77, is a static measure of the competitive structure of local financial markets. It is defined as :

$$H77 = \sum_{i=1}^{N} \left(\frac{S_i}{S}\right)^2 \qquad 0 < H < 1 \qquad (7)$$

where N = number of firms in the market
S = summed sizes of the firms
S_i = size of the ith firm

A market with one bank will have a Herfindahl Index of 1.0 and as the number of banks increase that value will approach zero. The higher the index, the greater the concentration level of market competition. The Herfindahl Index accounts for the differences in competitive levels of local financial markets through measurement of the linear relationship between local economic growth and loan activity.

It was hypothesized that the credit needs of a community may be satisified through alternative sources of loanable funds. The dummy variable, SLD, assigns the value of one to communitites with one or more savings and loan institutions or credit unions, and zero otherwise. SLD measures the possible shift in the OLS intercept between communities which have savings and loans and

credit unions and those who do not.

3. Employment Structure (MM,TE) The 1980 percentage of county employment in manufacturing and mining (MM) is included to control for differences in industrial structure. It is hypothesized that the demand for business credit generated from these areas will be low since most credit needs will be met through home offices located in large cities with access to financial national markets.

The climate and beauty of Arizona promotes a tourist industry that generates billions of dollars in revenue per year. TE, the tourist expenditure per capita on a county basis for 1979 was used to measure tourism as an explainor of inter-community variation in loans or sales.

Prior to 1978 savings in communities were relatively sluggish. From 1978 to 1980 the nation's credit markets tightened and interest rates rose sharply. In 1978, rates on new six-month certificates of deposits were tied to treasury-bill rates. With high inflation rates, the Federal Reserve tightened credit, which resulted in a dramatic rate increase on certificates of deposits. Local savers responded by channeling their money out of local banks to money-market funds and certificates of deposit. Along with financial instability this period saw a definite downward trend in economic

indicators beginning in 1980, at the same time that the nation as a whole was experiencing recession. Along with these financial events of the period, Arizona experienced a dramatic increase in population. Although great variation occurred among these parameters during this period the relationship between commercial bank loans and economic activity can be discerned.

The sample of twenty-seven nonmetropolitan Arizona communties used in this study experienced a wide diversity of economic growth. This variability in the cross sectional sample is summarized in table 1. Table 1 documents the range, mean, and standard deviation of certain measures that characterize the twenty-seven nonmetropolitan community sample area. For example, the 1975 to 1980 percentage change in deflated commercial and agricultural loan sub-totals reflect the most significant variability experienced within the twenty-seven studied communities. The 1980/1970 population ratio, PR, the 1980 manufacturing and mining employment percentage by county and the 1979 tourist expenditure, as well reflected the variability of the cross sectional sample in the study. This substantial variability provided an interesting data base for econometric analysis.[6]

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6. Appendix A includes a mapping of the twenty-seven nonmetropolitan city sample and their propinquity to the Tucson and Phoenix metropolitan areas.

TABLE 1

Variable Comparison Schedule

VARIABLES	RANGE	AVERAGE	STANDARD DEVIATION
H77	.28 to 1.00	.66	.28
PR	.78 to 3.73	1.41	.67
Z	15.00 to 181.00	74.07	45.27
MM	4.10 to 59.40	16.16	12.72
TE	164.00 to 5537.00	1419.59	1301.66
CP	603 to 42481	8960	10414
% d DIS	-20.07 to 114.82	18.03	29.88
% d DIL	-31.02 to 291.12	47.05	73.46
% d DIC	-67.98 to 701.07	103.36	153.57

Where: H77 = Herfindahl Index for 1977 By Community
PR = Population Ratio (1980/1970) By Community
Z = Distance From A Community of Equal Size
MM = Manufacturing and Mining Employment Total By County
TE = Per Capita Tourist Expenditures By County
CP = City Population in 1980 for the twenty seven city sample: (1)Benson (2)Bisbee (3)Casa Grande (4)Coolidge (5)Douglas (6)Duncan (7)Gila Bend (8)Globe/Miami (9)Hayden (10)Holbrook (11)Kingman (12)Parker (13)Payson (14)Prescott (15)Safford (16)Show Low (17)Sierra Vista (18)Somerton (19)Springerville (20)Tombstone (21)Welton (22)Wickenberg (23)Willcox (24)Williams (25)Winslow (26)Flagstaff (27)Yuma
% d DIS = Percentage Change in Deflated Index Retail Sales (1975 to 1980)
% d DIL = Percentage Change in Deflated Index Loans (1975 to 1980)
% d DIC = Percentage Change in Deflated Index Commercial and Agricultual Loans (1975 to 1980)

Pooling of Cross-Sectional and Time-Series Data

The relationship between nonmetropolitan economic activity and commercial bank loans was specified through a dynamic model. However, sufficient observations were not available to estimate a time-series equation so a pooled time series-cross section sample was formed by combining data from each of the six years for twenty-seven nonmetropolitan Arizona communities. When combining time-series and cross-sectional variables two concerns arise. First, the structure of the disturbance term is complex, since it is likely to consist of time-series related disturbances, and cross sectional distrubances, or a combination of both. Retail sales and loan indices were developed to help eliminate the potential non-zero covariance between city size and the disturbance term (hetroscedastic conditions). The indices were computed as follows:[7]

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7. OLS weights each observation equally in the process of generating estimated coefficients. This weighting is inappropriate when there is a nonconstant variance since OLS essentially puts more weight on the large observed deviations from the mean. The index suggests that a redistribution of weight from larger to smaller variances should occur, since the smaller the deviations from the mean of an observation, the more likely it is to be located near the true regression line. This procedure still produces unbiased and consistant parameter and variance estimates.

RETAIL SALES TRANFORMATION

INDEX YEAR	TRANSFORMATION FORMULA
1975	DIS75 = (DS75/DS75) * 100
1976	DIS76 = (DS76/DS75) * 100
1977	DIS77 = (DS77/DS75) * 100
1978	DIS78 = (DS78/DS75) * 100
1979	DIS79 = (DS79/DS75) * 100
1980	DIS80 = (DS80/DS75) * 100

where D = Deflated (via the GNP deflator)
I = Indexed as prescribed above
S = Retail Sales

TOTAL COMMUNITY LOAN TRANSFORMATION

INDEX YEAR	TRANSFORMATION FORMULA
1975	DIL75 = (DL75/DL75) * 100
1976	DIL76 = (DL76/DL75) * 100
1977	DIL77 = (DL77/DL75) * 100
1978	DIL78 = (DL78/DL75) * 100
1979	DIL79 = (DL79/DL75) * 100
1980	DIL80 = (DL80/DL75) * 100

where D = Deflated (via the GNP deflator)
I = Indexed as prescribed above
L = Total Community Loans

COMMERCIAL AND AGRICULTURAL SUB-TOTALS TRANFORMATIONS

INDEX YEAR	TRANSFORMATION FORMULA
1975	DIC75 = (DC75/DC75) * 100
1976	DIC76 = (DC76/DC75) * 100
1977	DIC77 = (DC77/DC75) * 100
1978	DIC78 = (DC78/DC75) * 100
1979	DIC79 = (DC79/DC75) * 100
1980	DIC80 = (DC80/DC75) * 100

where D = Deflated (via the GNP deflator)
I = Indexed as prescribed above
C = Commercial and Agricultural Loan Sub-Totals

A second concern with pooling, more specifically

associated with the implementation of the OLS procedure, is the unreasonable assumption of a constant intercept. A nonconstant intercept term may result from the omission of necessary variables within the model specification. The disturbance term is assumed to result in part from the effects of these omitted explanatory variables. This assumption was controlled for by the community related variables introduced earlier. Essentially the community related variables allowed for the intercept term to vary over time and over cross-sectional units by measuring the structural differences of sales and loans among communities. The use of these community related parameters provides information which might "cause" the regression line to shift over time and over cities thus ensuring proper model specification. The inclusion of the community variables is an important alternative, considering the 29 additional degrees of freedom ((N - 1) + (T - 1)) that would have been lost if the Covariance Model with 29 dummy variables had been implemented.[8]

Granger Sense Regression Model Interpretations

Within a pooled time series-cross sectional framework, by means of OLS regression analysis, four

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8. For further details see. Theil [1971, pp 622-627].

alternative coterminous Granger sense specifications for the "causal" interaction between economic activity and bank lending were tested. These four alternative systems of equations are outlined in table 2.

Specification A, in table 2, represented a distributed lag relationship between loans and sales. It was hypothesized that the value of the endogenous variable at any given time depends partially on a weighted sum of the past values of the exogenous variable. Specification B, on the other hand, controlled for the possible existance of causal information within the exogenous time lag of less than one year. Thus the endogenous variable was partially specified as a weighted sum of past and current values of the exogenous variable. Specification C and D where created from an economic perspective. It was hypothesized that the informative relationship between loans and retail sales could have been expressed more rigorously through a rate of change specification. To capture this possibility first differencing was employed, first exogenously -- system C and then both endogenously and exogenously -- system D.

TABLE 2

Granger Sense Regression Model Interpretations

A. Lagged Causality

$$L_{it} = f(L_{it-1}, L_{it-2}, RS_{it-1}, RS_{it-2}, TE_i, Z_i, SLD_i, H77_i, t_i, u_{it}) \quad (8)$$

$$RS_{it} = f(RS_{it-1}, RS_{it-2}, L_{it-1}, L_{it-2}, TE_i, Z_i, SLD_i, H77_i, t_i, u_{it}) \quad (9)$$

B. Contemporaneous Causality

$$L_{it} = f(L_{it-1}, L_{it-2}, RS_{it}, RS_{it-1}, TE_i, Z_i, SLD_i, H77_i, t_i, u_{it}) \quad (10)$$

$$RS_{it} = f(RS_{it-1}, RS_{it-2}, L_{it}, L_{it-1}, TE_i, Z_i, SLD_i, H77_i, t_i, u_{it}) \quad (11)$$

C. First Differenerences of Exogenous Variables

$$L_{it} = f(L_{it-1}, L_{it-2}, dRS_{it-1}, dRS_{it-2}, TE_i, Z_i, SLD_i, H77_i, t_i, u_{it}) \quad (12)$$

$$RS_{it} = f(RS_{it-1}, RS_{it-2}, dL_{it-1}, dL_{it-2}, TE_i, Z_i, SLD_i, H77_i, t_i, u_{it}) \quad (13)$$

D. First Differences of Lagged Exogenous and Endogenous Variables

$$dL_{it} = f(dL_{it-1}, dL_{it-2}, dRS_{it-1}, dRS_{it-2}, TE_i, Z_i, SLD_i, H77_i, t_i, u_{it}) \quad (14)$$

$$dRS_{it} = f(dRS_{it-1}, dRS_{it-2}, dL_{it-1}, dL_{it-2}, TE_i, Z_i, SLD_i, H77_i, t_i, u_{it}) \quad (15)$$

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where:

- i = 1,...,27 (number of cross-sectional units)
- t = 1,...,4 (number of time periods)
- L_{it} = index of GNP deflated loans for community i and time period t.
- RS_{it} = index of GNP deflated retail sales for community i, and time period t.
- dL_{it-1} = first difference transformation = $L_{it} - L_{it-1}$.
- dRS_{it-1} = first difference transformation = $RS_{it} - RS_{it-1}$.
- TE = tourist expenditure per capita per county.
- MM = mining and manufacturing employment % per county.
- SLD = dummy variable representing alternative credit sources.
- Z_i = measurement of leakage of sales and loan activities proxied by propinquity to major city.
- $H77_i$ = the 1977 Herfindahl Index.
- t = linear trend term.
- u_{it} = disturbance term of a BLUE estimator.

RETAIL SALES FIRST DIFFERENCING

FIRST DIFFERENCE SEQUENCE	TANSFORMATION FORMULA
1	FDIS1 = DIS76 - DIS75
2	FDIS2 = DIS77 - DIS76
3	FDIS3 = DIS78 - DIS77
4	FDIS4 = DIS79 - DIS78
5	FDIS5 = DIS80 - DIS79

Where F = first-order homogenous non-stationary process
D = deflated (via the GNP deflator)
I = indexed
S = retail sales

COMMUNITY TOTAL LOAN FIRST DIFFERENCING

FIRST DIFFERENCE SEQUENCE	TANSFORMATION FORMULA
1	FDIL1 = DIL76 - DIL75
2	FDIL2 = DIL77 - DIL76
3	FDIL3 = DIL78 - DIL77
4	FDIL4 = DIL79 - DIL78
5	FDIL5 = DIL80 - DIL79

Where F = first-order homogenous non-stationary process
D = deflated (via the GNP deflator)
I = indexed
L = community total loans

COMMERCIAL AND AGRICULTURAL LOAN FIRST DIFFERENCING

FIRST DIFFERENCE SEQUENCE	TANSFORMATION FORMULA
1	FDIC1 = DIC76 - DIC75
2	FDIC2 = DIC77 - DIC76
3	FDIC3 = DIC78 - DIC77
4	FDIC4 = DIC79 - DIC78
5	FDIC5 = DIC80 - DIC79

Where F = first-order homogenous non-stationary process
D = deflated (via the GNP deflator)
I = indexed
C = commercial and agricutural loan sub-totals

From a statistical perspective, first differencing is an example of first-order homogenous non-stationary process. That is, first differencing often is used in forecasting to eliminate linear trend resulting in fixed regression coefficients over time. It should be noted that the procedure may create a condition of serial correlation that was not originally present, or eliminate such a condition that was. Also, the initial time series is dropped from the OLS estimation procedure in the course of first differencing resulting in the loss of degrees of freedom.

CHAPTER IV

SUMMARY OF THE RESULTS

Economic Activity Versus Loans

Table 3 provides the strongest evidence that commercial bank lending is influenced by current and past economic activity. The regression coefficients in all cases (table 3, A,B,C,D) were relatively larger when lagged exogenous retail sales (S) explained total loans (TL) than the reverse. Moverever, the F-tests on the lagged retail sales parameters were significant at the 5% and 10% level. In the other direction, evidence existed supporting the alternative hypothesis that economic activity was sensitive to the volume of total lending and changes in loan volume. The contemporaneous (table 3,B.), as well as the first differences of the exogenous variable (table 3,C.), supported the hypothesis that economic activity was sensitive to loans. Thus these two cases suggest the existence of bidirectional causality between economic activity and loans. However, where total loans was endogenous, the lagged exogenous coefficients in both the contemporaneous and first difference systems were larger than when retail sales was endogenous. Thus while

TABLE 3

Tests for Causality Between Total Loans (TL) and Retail Sales (S)

$$Y_{i(t)} = a_0 + \Sigma a_k Y_{i(t-k)} + \Sigma b_k X_{i(t-k)} + c(TE + MM + Z_i + H77_i + SLD + t) + u_{it}$$

	EQUATIONS:							
	A.		B.		C.		D.	
Y	TL	S	TL	S	TL	S	dTL	dS
X	S	TL	S	TL	dS	dTL	dS	dTL
a_0	-10.50	18.98	-17.21	22.44	22.94	21.45	21.00	23.41
	(1.29)	(2.78)	(.90)	(2.46)	(.30)	(2.36)	(.99)	(1.75)
a_1	1.33	.75	1.30	.69	1.42	.70	.38	-.19
	(10.74)	(6.58)	(10.79)	(6.04)	(12.05)	(6.16)	(2.90)	(-1.35)
a_2	-.82	.14	-.79	.14	-.78	.16	-.31	.12
	(-4.01)	(.95)	(-4.00)	(.97)	(-3.77)	(1.18)	(2.03)	(.72)
b_0			.37	.13				
			(2.27)	(2.32)				
b_1	.44	.07	.16	.08	.33	.19	.33	.05
	(2.33)	(.95)	(.82)	(-1.21)	(1.94)	(2.11)	(1.44)	(.56)
b_2	.05	-.07			.41	.05	.64	-.03
	(.21)	(.35)			(2.16)	(.70)	(2.43)	(-.27)
TE	.00	.00	.00	.00	.00	.00	.00	.00
	(-.43)	(-.10)	(-.42)	(-.01)	(-.42)	(-.06)	(-.10)	(.45)
MM	.67	.12	.72	-.21	.44	-.18	.48	-.03
	(2.81)	(-.86)	(3.13)	(-1.45)	(2.01)	(-1.29)	(1.74)	(-.19)
Z	.15	.02	.14	.00	.12	.00	.14	.00
	(1.69)	(.29)	(1.68)	(-.06)	(1.33)	(.07)	(1.39)	(.05)
H77	7.00	6.66	4.55	5.84	8.36	6.18	10.05	-4.14
	(.49)	(.77)	(.33)	(.69)	(.58)	(.73)	(.59)	(-.39)
SLD	-1.39	7.06	-4.00	7.23	2.41	7.01	-3.37	.42
	(-.19)	(1.59)	(-.55)	(1.67)	(.34)	(1.62)	(-.39)	(.08)
t	-3.91	-4.42	-2.28	-3.82	-.81	-3.63	-14.15	-7.02
	(-1.49)	(-2.77)	(-.91)	(-2.45)	(-.30)	(-2.35)	(-3.70)	(-2.93)
R^2	.83	.67	.84	.69	.83	.69	.42	.14
F	4.748**	.514	7.553**	3.053*	3.521**	2.755*	3.18**	.159

NOTE: t statistics for coefficients appear in parentheses below relevant coefficients.
* significant at the 10% level
** significant at the 5% level
F statistic on all b
d represents first difference transformations

evidence of feedback does exist in the form of significant F-scores, the sizes of the coefficients indicate that there is a greater influence of economic activity on total lending than total lending on economic activity.

When commercial and agricultural lending was used instead of total lending (table 4), only a unidirectional relationship was apparent. The evidence indicates that economic activity "Granger-caused" commercial and agriculture lending. In all cases (table 4, A,B,C,D) the regression coefficients were relatively larger when lagged exogenous retail sales explained commercial and agricultural lending than when the explanation was reversed. Although the F-statistics are not significant at the 10% level when commerical lending was endogenous, they were in all cases larger than when economic activity was endogenous. There was no evidence to suggest that commercial and agricultural lending could be informative about economic activity.

A priori, a positive correlation between loans and retail sales was expected. In one case, however, when commercial and agricultural loans were endogeous (system D.) two negative lagged exogenous coefficients were generated. There are three possible sources for these negative lagged exogenous coefficients: (1) conditions of multicollinearity within the autoregressive structure, (2) the downward trend created with the inception of the 1980

TABLE 4

Tests for Causality Between Commercial and Agricultural Loans (CL) and Retail Sales (S)

$$Y_{i(t)} = a_0 + \Sigma a_k Y_{i(t-k)} + \Sigma b_k X_{i(t-k)} + c(TE + MM + z_i + H77_i + SLD + t) + u_{it}$$

	EQUATIONS							
	A.		B.		C.		D.	
Y / X	CL / S	S / CL	CL / S	S / CL	CL / dS	S / dCL	dCL / dS	dS / dCL
a_0	-30.98 (-.37)	13.25 (2.55)	-15.18 (-1.09)	12.96 (2.79)	-37.87 (-.64)	13.43 (2.88)	-50.63 (-.75)	22.73 (1.74)
a_1	1.11 (5.97)	.77 (6.97)	1.11 (5.98)	.80 (7.12)	1.10 (6.07)	.80 (7.08)	.21 (.95)	-.18 (-1.28)
a_2	-.25 (-.80)	.17 (1.20)	-.21 (-.67)	.15 (1.04)	-.24 (-.77)	.15 (1.05)	-.32 (-1.05)	.15 (.95)
b_0			.57 (1.17)	.02 (1.06)				
b_1	-.92 (-1.70)	.01 (.32)	-.93 (-1.62)	-.02 (-.54)	.51 (1.04)	.02 (1.05)	-1.51 (2.13)	.01 (.32)
b_2	.88 (1.30)	-.02 (-.36)			-.80 (-1.49)	.01 (.25)	-.34 (-.43)	.01 (.16)
TE	.00 (.22)	.00 (-.18)	.00 (-.20)	.00 (-.15)	.00 (-.21)	.00 (-.15)	.00 (-.35)	.00 (.46)
MM	.52 (.78)	-.07 (-.56)	.47 (.71)	-.88 (-.63)	.56 (.89)	-.09 (-.67)	.36 (.43)	-.02 (-.13)
z	.31 (1.24)	.02 (.48)	.29 (1.15)	.02 (.35)	.30 (1.20)	.02 (.35)	.46 (1.40)	.01 (.09)
H77	51.90 (1.24)	6.76 (.78)	50.40 (1.20)	5.62 (.65)	48.29 (1.17)	5.65 (.65)	90.81 (1.66)	-4.46 (-.42)
SLD	10.26 (.48)	6.68 (1.50)	7.51 (.35)	6.48 (1.46)	6.66 (.33)	6.49 (1.46)	20.74 (.74)	.22 (.04)
t	2.92 (.36)	-4.24 (-2.54)	8.46 (1.09)	-4.43 (-2.79)	4.99 (.63)	-4.41 (-2.87)	-7.62 (-.63)	-6.89 (-2.93)
R^2	.46	.66	.46	.67	.47	.67	.11	.14
F	1.463	.070	1.315	.571	2.017	.597	2.28	.16

NOTE: t statistics for coefficients appear in parentheses below relevant coefficients.
* significant at the 10% level
** significant at the 5% level
F statistic on all b
d represents first difference transformation

national recession, and/or (3) the aggregation within the same statistical sample of vibrant and stagnant nonmetropolitan communities.

As expected, the regressions using commercial and agricultural loans (table 4) had lower relative coefficient of multiple determinations and F-scores than the equations using total lending (table 3). This condition was expected since commercial and agricultural lending is traditionally more volatile than consumer lending. Table 1 demonstrates that the twenty-seven community sample was no exception to that tradition. When total loans were endogenous the coefficient of multiple determinations were consistently larger than when retail sales assumed the role since past loans were a better predictor of current loans than past retail sales were of current retail sales.

Community and Bank Market Variables

Linear Trend Term

The loan and retail sales data contained an upward trend from 1975 to 1979 which tailed off with the inception of the national recession into 1980. The 1980 recession reflected in a negative coefficient on the linear time trend variable, t. The linear autoregressive Granger interpretation used in this study was capable of

explaining the linear trend which occurred within the 1975 to 1979 time period. With the inception of the national recession in 1980 the linear autogressive model was unable to account for the downward tail of the parabolic movement of the market creating the negative time trend coefficient. Furthermore, economic activity was more sensitive to the recession than bank loans. This sensitivity was reflected by a statistically significant linear trend term when retail sales were endogenous.

The Percentage of Mining and Manufacturing Employment in 1979

The percentage of employment in mining and manufacturing in 1979 (MM), was, at a 90% level of confidence, directly related to total lending. This may suggest that the large volume of consumer lending in Arizona's mining communities offsetts the negative affect of external credit sources on local loan activity. Although not statistically significant, an inverse relationship between retail sales and MM was generated. This implies that a leakage of retail sales outside Arizona's mining communities may occur.

Highway Mileage to a Community of Equal or Greater Population

The highway mileage between a given sample test city to the nearest city of equal or greater population (Z), was related to movements in TL and CL at the 80%

confidence level. Thus, the greater the highway mileage to potential credit markets the greater potential dependence on local lending sources. Credit is expensive to secure, so that those seeking it will shop in neighboring coummunities if they can do so conveniently. Retail sales may be less vulnerable to leakages than are credit needs, as demonstrated by the insignificant t scores.

The 1977 Herfindahl Index

The 1977 Herfindahl Index (H77) for community bank deposits was correlated with CL, at a 80% level of confidence. In other words, as bank market concentration or H77 increases, CL increases. From an economic perspective this result was unexpected. It could be hypothesized that as the market shares of the largest commercial banks increase, the resources from which banks could draw increase, enhancing their ability to satisfy the credit needs for the commercial and agricultural sectors. Although this result may be expected in a unit banking state, it should not be expected in a branch banking state such as Arizona; where 85% of all current deposits are held by three banking organizations.

Savings and Loan Dummy Variable

Although no correlation was found between loans

and the savings and loan dummy (SLD) a positive relationship between SLD and retail sales was present. This positive relationship may have resulted from the propensity of savings and loans and credit unions to locate their branches in the faster growing nonmetropolitan communties.

Sims [1972] and Steinnes [1978] Granger Sense Interpretation

An alternate interpretation of Granger's definition of causality, introduced by Sims [1972] and applied by Steinnes [1978], was tested to provide additional evidence for the economic activity to lending behavior hypothesis. The basic premise of the Sims/Steinnes framework is that the past can cause the future but the future cannot cause the past. Sims and Steinnes modeled this methodology in the following autoregressive system.

$$Y_t = a_0 + \Sigma a_{1i}X_{t-i} + a_{2i}X_t + \Sigma a_{3i}X_{t+i} + u_{1t} \qquad (16)$$

$$X_t = a_5 + \Sigma a_{6i}Y_{t-i} + a_{7i}Y_t + \Sigma a_{8i}Y_{t+i} + u_{2t} \qquad (17)$$

In equation (1), if X affects Y but the "causality" is not reversed, the coefficients of future distributed lags are expected to be statistically insignificant as a group while past distributed lags are expected to be significant as a group. The underlying postulate is that the future cannot cause the past. On the other hand, if the

coefficients are insignificant on past distributed lags while the future is significant, the "causality" will be expected to be reversed. If both the past and future are significant the causality runs both ways, reflecting bidirectional causality, or feedback. The same test as just described may be applied in equation (2). The test for group significance used was the future F test statistic.[1] Table 5 generalizes the Sims and Steinnes' interpretation of Granger's definition of causality.

Results

Implementing the Sims-Steinnes framework, as specified in the earlier indexed form, provided additional evidence that past economic activity was informative about the conduct of commercial bank lending. The findings presented in table 6, A, provide evidence that current and past economic activity "causes" total community loans. The coefficients, as well as the t-scores for a_1 and a_2, were relatively larger when retail sales as opposed to when commercial loans was exogenous. No evidence could be found in future t-scores to support the alternative hypothesis that current economic activity was sensitive to

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1. In this analysis since only one past and one future parameter is specified, future t-scores were substituted for future F test statistics. For the proof that these two tests are equivalent ways of testing the basic hypothesis of no linear relationship between Y and X, see Johnson [1972].

TABLE 5

Summary of Four Possible Sims/Steinnes Interpretations of Granger Causality

DIRECTION OF CAUSALITY	FUTURE F-TEST ON Y in X=f(Y)		FUTURE F-TEST ON X in Y=f(X)
1) Unidirectional Causality from Y to X	Insignificant	&	Significant
2) Undirectional Causality from X to Y	Significant	&	Insignificant
3) Bidirectional Feedback	Significant	&	Significant
4) No Causality	Insignificant	&	Insignificant

TABLE 6

The Use of Distributed Future and Past Lags to Test for Causality Between Total Loans (TL), Commercial and Agricultural Loans (CL) and Retail Sales (S)

$$Y_{i(t)} = a_0 + a_1X_{i(t-1)} + a_2X_{i(t)} + a_3X_{i(t+1)} + c(TE + MM + Z_i + H77_i + SLD + t) + u_t$$

EQUATIONS

	A.		B.	
Y	TL	S	CL	S
X	S	TL	S	CL
a_0	-101.94	77.66	-7.21	80.57
	(-3.68)*	(6.49)*	(-.16)	(6.01)*
a_1	.95	.77	.62	-.26
	(3.14)*	(.55)	(1.28)	(-.26)
a_2	.42	.02	.30	.12
	(1.41)	(.16)	(.63)	(2.32)*
a_3	.18	.19	.04	-.29
	(.83)	(3.08)*	(.11)	(-1.11)
TE	-.00	.13	-.00	-.79
	(-1.02)	(.09)	(-.81)	(-.50)
MM	1.31	-.69	1.28	-.49
	(4.56)*	(-4.95)*	(2.78)*	(-2.95)*
Z_i	.25	-.06	.03	.46
	(2.29)*	(-1.07)	(.16)	(.70)
$H77_i$	6.35	7.29	-8.93	17.92
	(.33)	(.80)	(-.29)	(1.64)
SLD	-11.52	15.93	-8.66	20.55
	(-1.17)	(3.63)*	(-.55)	(3.94)*
t	7.18	1.52	14.86	3.31
	(2.05)*	(.94)	(2.66)*	(1.68)**
R^2	.54	.52	.27	.32

NOTE: t statistics for coefficients appear in parentheses below relevant coefficients
* significant at the 10% level
** significant at the 5% level

the volume of total lending.

When only commercial and agricultural loans were used (table 5, B) no evidence of a "causal" relationship existed in the form of significant t-scores or coefficient size. This result was not surprising given the volatility of commercial and agricultural loan totals over the period.

Of the community related variables, MM, the percentage of employment in mining and manufacturing in 1979 was significant in all cases. This may suggest that as the percentage of mining and manufacturing employment increases, total and commercial and agricutural lending increase. With respect to commercial and agricultural sectors this result may infer that local credit sources help fulfill their credit needs rather than outside concerns. This result conflicts with the autoregressive version analyzed earlier which generated insignificant t-scores when CL was endogenous.

In the past-future distributed lag form a statistically significant inverse relationship existed between MM and S. A possible explanation may lie within the characteristics unique to communities with a high percentage of employment in mining and manufacturing, MM. In nonmetropolitan Arizona most of the communities with high MM are mining towns. Traditionally, the mining

industry in Arizona has provided a capricious employment history for its workers resulting in the mining communities' inability to provide higher ordered goods and services. This condition may exist because there is little incentive for non-basic community activities to occur in such an unstable employment environment. As a result, a high rate of leakage may occur to larger communities that provide higher ordered goods and services.

When retail sales were endogenous, SLD was significant at the 95% level of confidence. This possibily suggests that savings and loans institutions prefer to locate in rapidly growing communities.

The trend variable, t, was significantly different from zero in all cases except when TL attempted to predict S. The stronger significance of linear trend in the Sims/Steinnes' model relative to the earlier distributed lag version was due to the absence of the autoregressive framework in the Sims-Steinnes' model. The autoregressive structure used earlier contributed to the partial explanation of the parabolic trend based on its ability to draw on past information. Since the Sims-Steinnes structure used here was limited in capturing such past information, OLS assigned more weight to the linear trend parameter.

Econometric Considerations

As mentioned earlier the Granger methodology is sensitive to misspecification. It was assumed that all information needed to explain the possible bank performance-economic activity relationship exists in its proper form. To assure this assumption's accuracy three potential econometric problems were considered. The two most critical problems, created when pooling the time-series and cross-sectional measures, were autocorrelation and hetroscedasticity. The remaining statistical consideration was the possibility of multicollinearity within the autoregressive representation used to define Granger "causalty" in this study.

Multicollinearity

When multicollinearity occurs, each variable in the collinear set may share in the informative function. How this explanitory role is delegated between the collinear variables is arbitrary since they measure the same thing. Multicollinearity results in large variances for the estimators creating larger than normal confidence

intervals.[2] As a result, if this wider confidence interval encompasses a range of negative and positive values the signs of the parameters could be other than those which make economic sense. Therefore, it was impossible to make any economic interpretation of the lagged endogenous and exogenous coefficient signs since high multicollinearity allowed OLS to estimate an inflated confidence interval.[3]

Beyond the inability to make an economic interpretation of the lagged endogenous and exogenous regression coefficients signs multicollinearity was not of major concern in causality testing. The testable definition of the Granger sense of "causality" implies that one variable is useful or informative in predicting another. In other words, the purpose for the model was to forecast values for the endogenous variable based on lagged endogenous and exogenous variables. Although the effect of severe multicollinearity may result in

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2. It should be noted that the properties of the estimators of the coefficients and their variances which are collinear are unbiased. Recall, an estimator is unbiased if the mean of its sampling distribution equal its true parameter i.e. the value of the estimate on the average but does not imply that a particular estimate is the true value. Nor does efficiency imply that the variance of an estimator is necessarily the smaller X, rather a minimal variance among alternative estimators of the same class (linear and unbiased in this case).

3. The occurance of multicollinearity between the distributed lagged retail sales and loan data, used to specify the loan versus economic activity question, (as measured by their correlation coefficients) ranged from .67 to .91.

individual insignificant coefficients, the joint effect of all the exogenous variables in the model may be highly significant coupled with relatively high R^2s. Furthermore, it is assumed that the multicollinearity continues into 1980 leaving its individual estimates unbiased. As a result, the "Granger sense" model of causality used in this analysis was not upset by collinearity among its explanatory variables, generating estimates close to the observed values.

Hetroscedasticity

Hetroscedasticity, refers to the violation of the OLS assumption that the disturbance terms have a constant variance resulting in a non-zero covariance between the heteroscedastic term and one of the regressors. With heteroscedasticity, the OLS parameter estimates are unbiased and consistent, but inefficient. In other words, the estimated variances of the parameters are biased; leading to incorrect statistical tests and biased confidence intervals.

It could be hypothesized that smaller communities would spend and acquire loans at a rather steady rate, while the spending and lending pattern of larger cities would be relatively volatile. It is possible that as city size rises so to does the variance of retail sales and aggregate loan totals. As mention earlier, an index was

calculated to adjust for this possibility. The Goldfeld-Quandt test [1965] confirmed that hetroscedasticity was nonexistent.

Serial Correlation

Serial correlation refers to the violation of the OLS assumption that the values of the disturbance term are independent of one another so that the covariance between the disturbance terms corresponding to any two observations is zero. In conditions where lagged endogenous variables do not occur, the presence of autocorrelation leads to biased and inefficient estimates of only the standard errors. However, the Granger sense interpretation specifies lagged endogenous variables. Under this specification, the presence of serial correlation generates biased and inconsistent estimators since the use of OLS does not consider how much the parameter estimates reflect the coefficient value or to what extent serial correlation is in the model.

The testing for serial correlation within a pooled framework does not lend itself to traditional methods, specifically the Durbin-Watson, for two reasons. First, the Durbin-Watson statistic depends not only on the sequence of the error terms but also on the the sequence of all the values of the variables. When pooling, the form of the data is determined by the researcher and not

randomly. Secondly, the Granger sense interpretation specification calls for the presence of lagged endogenous variables. When one or more lagged endogenous variables are present the Durbin-Watson is biased toward 2.0 and toward the acceptance of the null hypothesis of no autocorrelation.

The test for serial correlation within a pooled framework is complex. Essentially the structure of the data contains 27 short times series. Considering the detrimental effects of serial correlation and the impotency of the Durbin-Watson, a proxy test was formed. After regressing a pooled possibility, a lagged pair-wise regression was run on the residuals of the equation. The distributed two year lag in the study was stacked four times resulting in a four year time series with 108 observations. Then the 27 residuals for each of the four years were then regressed pairwise on their one year lagged residual counterpart. The form of the regression was:

$$e_t = pe_{t-1} + u_t \quad (18)$$

Where:

e_t = the residuals from year t as theendogenous base of 27 observations.

e_{t-1} = the residuals from year t-1 as the exogenous base of 27 observations.

The coefficient in the above simple regression represents

the relationship between the residuals which provides a proxy for the measurement of serial correlation. The "proxy test" determines if the disturbance terms follow a first-order autocorrelated scheme in a pair-wise fashion. However, this procedure does not allow simultaneous testing of the null hypthesis that $p_1=p_2=\ldots=p_n$. As expected, in no situation did the proxy test generate a p significantly different than zero.

CHAPTER V

CONCLUSION AND IMPLICATIONS

Proponents of the export base theory attribute growth in a region to a leading export sector. It is hypothesized that export or basic activity encourages local or nonbasic employment, increases regional income and thus bank deposits and reserves. Commercial banks assume an intermediary role in the regional growth process by providing loans to existing and potential basic and nonbasic industries to finance increases in local employment, spending, output and income. As intermediaries, commercial banks can play either an active or passive role in allocating a community's financial capital to support local economic growth. A passive role is defined by a commercial bank lending history that responds only to a rise in demand for its services resulting from an increase in nonmetropolitan economic activity. An active role, is then defined by a bank lending history which intiates nonmetropolitan economic growth. Hence, a seperation between these two roles is a question of the timing of lending activity.

The role of commercial bank loans in the regional

economic growth process was the subject of this study. The results of the study strongly suggest that economic growth depends on factors beyond the lending behavior of local commercial banks. Although the nonmetropolitan Arizona banking system facilitates the economic growth process, only limited evidence supports the alternative hypothesis that commercial bank lending initiates the growth process. That is, while commercial bank lending is a necessary condition for nonmetropolitan development, it is not a sufficient condition. Thus it was concluded that the lending behavior of Arizona's nonmetropolitan branch banking system is passive in the regional development process.

A possible explanation for the passive lending behavior of commercial banks at the nonmetropolitan level may stem from the banks' need to reconcile three conflicting goals: (1) solvency, (2) liquidity, and (3) profitabilty. This philosophy may not allow itself to provide sufficient capital expansion necessary for regional growth.

One attempt to encourage the availability of bank venture capital in depressed rural areas is outlined in

the Community Reivestment Act (CRA) in 1979.[1] The passage of CRA infers that the commercial banking system is responsible for the shortage of venture capital in depressed rural areas. However, to date there is no empirical evidence to support this normative contention. Moveover, legislation forcing banks to provide venture capital, as prescribed by the CRA, may put undo strain on the system's profit margin.

Thus two implications may be drawn from the study outlined within the pages of this thesis: First, before making any type of policy decision with respect to nonmetropolitan growth and commercial bank lending it is necessary to resolve the causality question. That is, it is necessary to determine those financial resources that commence and/or perpetuate nonmetropolitan growth. Given the passive role of commercial banks drawn from this study, it follows that other financing alternatives should be considered (for example, the insurance industry, imports of capital by private concerns, and organized public lending programs).

Second, a free transfer of funds that a

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1. The Community Reinvestment Act (CRA) passed by Congress in 1979 states that all banks and savings associations must meet the credit needs of all communities its serves, including low and moderate income communities. The mechanism of enforcement of the CRA is a quota loan system to nonmetropolitan areas which must be fulfilled before new branches are granted.

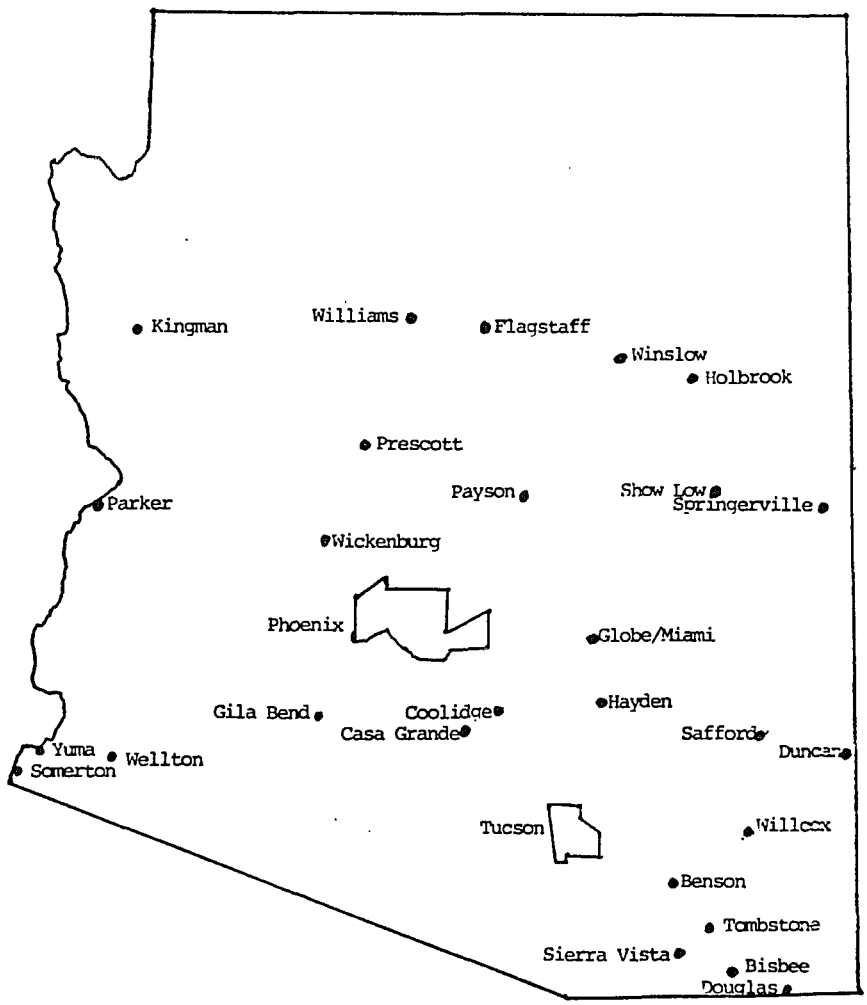
liberalization of banking legislation provides, should not be miscontrued as a potential avenue for the initiation of regional growth. The liberalizing of bank laws permitting statewide branching has had four major effects: (1) a decrease in the number of banking enterprises operating at the state level, (2) an increase in individual bank asset size, (3) an increasing proportion of total deposits held in the state by a decreasing number of banks, and (4) a relatively freer transfer of funds from one area branch office to another. Arizona has permitted unlimited branching for more than forty years, and yet, no evidence surfaced in this study supporting the hypothesis that branching initiates the nonmetropolitan growth process.

Although this study supports the alternative hypothesis that commercial bank lending does not intiate nonmetropolitan economic growth, it does not test or support any hypothesis with regard to what faction holds such a responsibilty. As a result, it is recommended that future studies and policy decisions be centered on the utilization of all sources of venture capital to achieve the desired level of regional growth. In this way researchers and decision-makers may escape the normative legislative trap of the CRA, and the idea that liberal branching laws encourage banks to assume an active role in nonmetropolitan growth. Rather, reseachers and decision-

makers should strive for an incentive plan directed at all potential private and public providers of venture capital to depressed nonmetropolitan areas.

APPENDIX A

A MAP OF THE TWENTY-SEVEN ANALYZED NONMETROPOLITAN ARIZONA COMMUNITIES



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