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Regional Financial and Monetary Policy Model

By the Chase Econometric Associates
and the Economic Research Service

Final Report

REGIONAL FINANCIAL AND MONETARY POLICY ANALYSIS MODEL

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THE ECONOMIC RESEARCH SERVICE
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ABSTRACT

A multiregional econometric model is presented for evaluating the differences in impact of monetary and financial policy changes on economic development in metropolitan and nonmetropolitan regions in the United States. The model is demonstrated using the four principal U.S. Census regions, each of which is disaggregated into metropolitan and nonmetropolitan components. The model indicates that nonmetropolitan regions generally are less affected by overall changes in monetary policy than are metropolitan areas. However, significant differences are found among both metropolitan and nonmetropolitan reactions in different parts of the United States, depending on the economic structure of the region. The model also indicates that increases in credit to rural areas financed from metropolitan areas increases rural economic activity; however, the decrease in metropolitan activity more than offsets the rural gains, and the rural gains tend to dissipate over time. Special features of the model permit it to be easily changed to test alternative policies and assumptions regarding economic structure.

KEYWORDS: Multiregional econometric model, monetary policy sensitivity, urban-rural comparisons, regional development, regional monetary model

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AT USDA/ERS, Richard French was directly responsible for managing the contract effort and providing liaison between ESS and Chase Econometrics. In addition, valuable recommendations and assistance to the effort were provided by Clark Edwards, Fred Hines, Daniel Milkove, James Mikesell, David Weisblat and other members of the Economic Development Division Staff.

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SUMMARY

This report describes a project carried out by Chase Econometrics, under contract to the U.S. Department of Agriculture's Economic Research Service (ERS), to develop an analytical model capable of assessing the similarities and differences in the effects of monetary and other national policies on different geographic regions of the country and upon both the metropolitan and non-metropolitan parts of those regions. The model represents a synthesis of the knowledge of regional and monetary models evolved in the late 1970's by Chase Econometrics and others, with policy analysis requirements of USDA and others concerned with the issues of regional and urban-rural differences in response to governmental policies.

The model divides the U.S. into four major census regions, each of which is divided into metropolitan and non-metropolitan subregions. Each of the eight regions has both a financial and a non-financial sector, which are linked together. In addition, there are linkages from the regions to the national financial markets and to national aggregate demand.

The model has been demonstrated by an analysis of three alternative situations:

- Differences among regions in the effects of a temporary tightening of monetary policy;

- Differences among regions in the effects of a permanent tightening of monetary policy; and

- Differences in regional effects of a sustained expansion of credit to non-metropolitan areas from the metropolitan areas, with no change in overall monetary policy.

These analyses were performed by simulation of the model over the period 1974:3 to 1977:4, and the simulation results were compared to baseline values of selected variables during that period. The results of these simulations produced the following three major policy implications:

- Changes in overall monetary policy, as measured by changes in the federal funds rates, tend to have a slightly greater impact on metropolitan areas than on rural areas.

- There are important regional variations in the impacts of national economic policy.

- Increases in credit to rural areas financed from metropolitan areas increase rural economic activity; however, the decrease in metropolitan activity more than offsets the rural gains, and the rural gains tend to dissipate over time.

These results, obtained in demonstration of this model, should be considered preliminary. More detailed testing and evaluation is needed to determine the sensitivity of the model to changes in the specification of individual equations. In addition, since complete data were available only through 1977, the model does not presently reflect changes in the structure of financial institutions resulting from recent deregulatory activities. It is expected that such further testing and enhancement of the model will occur as its existence becomes known among researchers and policy-makers concerned with regional economic development.

1. INTRODUCTION

1.1 BACKGROUND

During the 1970's the historical migration of people into metropolitan areas was reversed. The rate of economic growth, as measured by changes in income and employment, is now greater in non-metropolitan areas than in the SMSA's; and the economic development of non-metropolitan areas is of great interest to the federal government. In order to better understand the process of regional and subregional economic growth it is useful to examine the relationships that exist between real variables and monetary variables which contribute to that growth. While some markets affecting regional growth are national, others are primarily regional in character. Thus, the interaction between monetary and real, national and regional, and metro and non-metro economic activity is of great importance to those who have responsibility for regional economic development policy. The Rural Development Act of 1972 has given such responsibility to the Secretary of Agriculture.

U.S. Department of Agriculture's Economic Research Services (ERS) conducts a broad pattern of studies relating to economic development of rural areas of the United States. Subjects analyzed include population, manpower, incomes, health and education, housing, state and local government services and finance, and regional economics. A current area of emphasis is to build a program on capital and credit. Such a program is intended to explore a wide range of factors affecting the sources and uses of credit in the economic development of rural America, and to determine and study the manner in which the availability of money and credit differentially affect the economic growth of metropolitan and non-metropolitan areas. USDA has a multi-billion dollar loan and grants program for such rural development pursuits as housing, community facilities, and business and industrial activities. In order to properly evaluate lending programs and policies for rural areas, over the long run, a better understanding is needed of the institutional and economic relationships which exist between Federal Reserve Policy,

Treasury deposits, and private commercial balances and their transfer and their impact on the reserves of commercial banks located in both metropolitan and non-metropolitan areas is needed.

Generally, economists have explained regional economic growth in real terms and have ignored the monetary aspects of the regional growth process. One explanation is that most income-expenditure models of growth are national in scope, and are designed to examine closed economic systems. These closed, one-region models are inappropriate for analyzing regional growth for several reasons: they do not account for relative price differentials and their changes between regions; they ignore determinates of regional inflation rates; and they omit observation of the determinates of interest rate differentials, capital market segmentation, and the institutional and behavioral differences which exist between regions and their monetary sectors. No simple model can be constructed which will expose all aspects of regional and subregional financial markets. However, it is necessary and possible to delineate a regional structure which will increase our understanding of the flow of credit and capital between regions and its regional availability, and the differential effects which national monetary policy has on regional and subregional growth rates.

1.2 SCOPE

This report describes a project carried out by Chase Econometrics, under contract to the U.S. Department of Agriculture's Economic Research Services (ERS), to develop an analytical model capable of assessing the similarities and differences in the effects of monetary and other national policies on different geographic regions of the country and on their metropolitan and non-metropolitan (rural) parts. The model represents a synthesis of the knowledge of regional and monetary models evolved in the late 1970's by Chase Econometrics and others, with the policy analysis requirements of USDA and others concerned with the issues of regional and urban-rural differences in responses to governmental policies.

In the past, the development of regional models incorporating monetary policy has been inhibited by two principal factors: first, by serious limitations in the availability of data and, second, by the computational complexity of multiregional models. The extensive data bases of regional statistics maintained by Chase Econometrics greatly facili-

tated the development of the present model. Extensive assistance and data were made available by the Economic Development Division of ERS.

Computational complexity is an ever-present problem in multiregional modeling. The model presented here divides the U.S. into four major census regions, each of which is divided into metropolitan and non-metropolitan subregions. Each of the eight regions has both a financial and a non-financial sector, which are linked together. In addition, there are linkages among the regions and to the national financial markets and aggregate demand. To capture these relationships the model includes over 160 statistical equations, plus additional identities needed to calculate various accounting relationships at the regional and national levels. The structure of the model is such that the U.S. could be divided into a larger number of regions than those used in this project. However, for each additional region, 36 additional statistical equations have to be included, along with additional accounting identities. For example, expanding the number of geographic regions from four to eight would increase the number of statistical equations from 164 to 308. The four census regions used to demonstrate the model provide sufficient diversity to validate the concept without the greater computational complexity that additional regions would have created during this initial development effort.

Changes in the specification of individual equations or other alternatives can be tested with relative ease, making the model a powerful general purpose tool for policy analysis. With further enhancement and revision, the model could also be used to evaluate the effects of deregulation on financial institutions; however, since deregulation began to occur after the project was nearly half complete, the model does not incorporate the deregulation of financial institutions and the resulting changes in financial infrastructure that have emerged since the project was begun in late 1979.

The chapters which follow provide a detailed description of the model and the results obtained in its application to the question of metropolitan/non-metropolitan differences in regional response to national monetary and financial policies. Chapter 2 describes the conceptual foundations from which the model was developed. Chapter 3 discusses equation specification and the empirical estimates obtained for each part of the model. Chapter 4 describes the results of policy simulations using the model, while Chapter 5 summarizes the conclusions resulting from this initial analysis and presents recommendations for further refinement and development of the model.

2. CONCEPTUAL FOUNDATION

Regional macroeconomic models are similar to national macroeconometric models of open economies with extensive in- and out-flow of goods, services, and funds. One of the earliest such models for use in modeling an individual state was developed in Bell (1967). Others have subsequently extended the effort in various ways. These developments are reviewed in Klein and Glickman (1977).

Chase Econometrics (1980) describes the approach it used to construct an integrated system of state and SMSA models for all fifty states, the District of Columbia, and the 110 largest SMSA's. The Chase Econometrics approach is essentially the same as that taken earlier in the construction of a model of Delaware described by Latham, Lewis, and Landon (1979).

Most of the models constructed to date have not included financial variables, although Roberts and Fishkind (1979) have included a state financial sector in their econometric model of Florida. Miller (1978) developed a model to examine the linkage between national monetary policy and regions within the country; however, little attention is given to production variables in that model. Other references to the regional monetary literature are given in the bibliography.

In order to evaluate the effects of national monetary and financial policies on regional economies, it is essential that both financial and production variables be considered. The discussion in this chapter of the theoretical framework for such a model consists of three major sections:

- modeling regional activity
- role of finance in the economy
- relationship between regional financial conditions and national monetary policy

2.1 MODELING REGIONAL ACTIVITY

To build a model of a regional economy, many economists begin with the demand side of the product and income accounts. Consumption, investment, government expenditures, and net exports must be determined for each region. This sum is identically equal to gross product for the region and can be used to determine employment. In turn, income can be determined from employment and the wage rate. To complete the model, the components of gross product are determined as functions of income, previous-period gross product, and other variables.

A critical step in the development of a regional model is the computation of net exports from the region. To understand how net exports must be treated, let us analyze the sectors which engage in production for both local use and export:

- Manufacturing
- Mining
- Agriculture
- Government

Because of its importance for economic growth, we will examine manufacturing in some detail. The other export sectors are given less attention, primarily because their growth and decline is not as closely related to economic determinants.

Residential construction is a sector that, while not engaged in the production of exports, is affected by national conditions -- most importantly credit conditions -- and also local economic activity. This sector is discussed at length below.

Manufactured goods flow between regions. Services, on the other hand, are primarily produced and consumed within a region. Production and employment in these local sectors are thus closely related to local demand. On the other hand, production and employment in manufacturing are related to manufacturing capacity in the region and the demand for manufactured goods in other regions, as well as local demand.

Thus, we have delineated four principal components needed in our analysis:

- Regional Manufacturing Activity
- Regional Residential Construction
- Regional Employment and Income
- Interregional Flows

In the following sections, we treat each of these topics at length.

2.1.1 Regional Manufacturing Activity

The U.S. is a relatively closed economy, with limited (although growing) interaction with other worldwide economies. Regional economies, on the other hand, are almost entirely open. "Imports" from other regions are readily available. Thus, a region's prosperity is greatly affected by the extent to which its goods and services can compete with those from other regions. Regions with a comparative advantage, whether due to factor costs, productivity, natural resources, labor pool skills, etc., will prosper relative to regions with a comparative disadvantage. For this reason, the emphasis in a regional model must be on export industries. These are usually manufacturing, but may include agriculture and mining, and even such service industries as finance and insurance.

Over the long run, manufacturing investment is the key to understanding the growth or decline of a region. Firms maximize profits by investing in those regions where the anticipated costs of production, including labor costs, energy costs, and tax costs are relatively low. In the shorter run, however, manufacturing activity within a region is primarily determined by the national demand for the products produced in the region. As national demand turns down and the economy moves away from full utilization of existing capital resources, the regions with the oldest and least efficient plants lose production first and are most affected by a recession. Regions with relatively new plants experience less severe swings in manufacturing activity over the business cycle.

Regional credit conditions also are likely to influence the pattern of manufacturing activity. First, even if there is little variation in credit conditions across regions, those regions with relatively credit-sensitive industries suffer more when credit markets tighten. Second, credit conditions may vary across regions.

2.1.2 Regional Residential Construction

Perhaps surprisingly for an economic sector as much studied as construction, there is not a standard approach nor specification for modeling residential construction. We follow Rosen and Jaffee (1979) and divide decision making in the housing market into two parts: stock-level and flow-level. The desired stock is the demand of households for housing units, and this is measured by number rather than value. The rate of adjustment depends on the divergence of actual from desired stock, and on economic conditions and is measured by housing starts. There are two parts to this decision making process: household formation and the demand of households for housing.

Household formation is a result of both demographic and economic conditions. The potential number of households is given by demographics, such as the population over a certain age; but the age at which young people choose to leave home and form new households is influenced by economic factors. Consequently, there is a cyclical component to household formation. Further, there is a cohort size effect of the type discussed by Easterlin (1960); relatively large cohorts -- groups of individuals born in the same year -- tend to have a proportionately smaller share of total income and thus form proportionately fewer households. Beyond this, there is a marked increasing long-term secular trend in rates of household formation for all groups, regardless of age.

The demand of households for housing is economically determined by household income and the price of housing, including the interest rate for mortgage loans. The flow rate of adjustment of the actual to the desired stock of housing is given by the simultaneous clearing of the housing and mortgage markets. If we assume that housing supply is perfectly elastic, then we need only consider mortgages. Traditionally, housing starts have been thought to be limited by mortgage availability, and the effect of the demand for housing on the demand for mortgages has been ignored. However, this feedback effect has become so important in recent years that mortgage demand should be considered as simultaneous with housing demand. Mortgage supply is determined as simultaneous with mortgage demand and the supply of funds for other purposes.

2.1.3 Regional Employment and Income

Employment within a region is primarily determined by the region's production activity. In the long run, there may be changes in employment due to substitution between the factors of production. With the stock of plant and equipment firmly in place in the short run, it is generally believed that the elasticity of substitution between labor and the other factors is low. In the long run, as the existing capital stock is replaced with new capital embodying different production technologies, factor substitution is greater. As a consequence, relative factor prices have a greater effect on regional employment in the long run than in the short run.

The largest component of income is wages. Regional wages are the product of regional employment and the regional wage rate. Aside from composition effects, if local prices and labor market conditions follow the national trend, then local wage rates should follow the national wage rate. If the local labor market is tighter than the national market, or if local prices are rising faster than national prices, then the local

wage rate should increase faster than the national wage rate. The other components of income are similarly affected by both regional and national variables. Other labor income is directly related to wages. Contributions to social insurance depend on wages and the effective social security payroll tax rate. Transfer payments vary with national non-cyclical transfer payments and national cyclical transfer payments modified by local conditions. Local proprietor's income is related to national proprietor's income, while property income depends on regional savings and the interest rate.

The greater part of employment is engaged in providing goods and services directly for the local market and is therefore directly affected by the local income level. For this reason, wage income, property income, proprietor's income, and transfer payments, as well as other components of personal income, all have to be treated separately.

2.1.4 Interregional Flows of Output, Labor and Income

Regions within the U.S. are completely open to flows of practically any quantity. We have already mentioned exports of output, but labor and income flow almost as freely. The labor force moves from one region to another in response to differing economic opportunities. Flows of income derive from persons providing both their labor services and their funds in one region while living in another. Commuting as a flow is usually relatively small for the large regions. In the case at hand, namely non-metro to metro commuting, this flow can be expected to be significant. Technically, commuting is also a labor flow, but for purposes of clarity, we are speaking of labor by place of work, of income by place of residence, and of commuting as an income flow but not a labor flow. Commuting is a labor market effect and thus is related to employment opportunities in one region relative to another and to the labor supply in one region relative to another.

Property income is expected to be dependent on the local supply of funds, the local return on funds, and returns nationally. However, it is possible that funds flow preferentially between adjacent urban and rural areas, and this can be tested both on the income side and the deposit side.

Because of transportation costs, flows of output are more constrained than flows of income. The examination of output flows forms the entire foundation for regional economic-base theory (see, for example, Richardson (1973)). It is these flows which drive the manufacturing sector as it is described in Section 3.1.1. In the short run, they are

determined by capacity and cost. In the long run, capacity will change -- it will decrease in regions where production costs are relatively high and it will increase in regions where they are relatively low.

2.2 THE ROLE OF FINANCE IN THE ECONOMY

In the previous sections, we have discussed the theory of output, employment, and income in regional economy. In this section, we develop the role of finance. Our focus will at first be on a closed economy, such as that of one region. Later we address the question of open economies in which finance can flow between regions. Our approach follows the work of Tobin (1969).

2.2.1 The Theory of Finance

The basic reason that finance exists is that spending and income often occur at different times and in different places. The building of a plant must occur before the products it produces can be sold. Thus, the spending occurs before the income becomes available. Similarly, the purchase of a house typically precedes the income flows of the resident. On the other hand, households often receive income flows which are not immediately spent, but are saved for future spending by current members and perhaps by later generations. Similarly, businesses may retain earnings over a period in advance of a planned expansion later.

Since one economic unit's need for funds to accommodate spending is often not synchronized with the availability of funds to it, a mechanism has developed to transfer funds between economic units. This mechanism, termed finance, improves economic efficiency by allowing individuals or firms to reallocate funds intertemporally and interspacially, thereby removing a constraint from economic decisions. As a result, productivity rises, output and income increase, and economic welfare is enhanced.

2.2.2 The Credit Market

Economic units resolve temporal and spacial imbalances between the need and availability of funds through transactions in the credit market. In any time period and in any region, some units find that their spending preferences exceed currently available funds. Other units find that their funds exceed their current spending. The credit market is the vehicle for the latter to sell this commodity to the former. The transaction involves the granting of a specific amount of credit at a specified price, the interest rate.

2.2.3 The Interest Rate

The price at which funds change hands is the interest rate. Specified as a percentage of the loan, the interest rate determines the sum which the borrower must pay the lender for the use of funds. In general, the interest rate operates like prices in other markets. When the price of funds rises, the quantity of credit demanded falls because borrowers find some spending uneconomic. Spending is then postponed or cancelled. A rising price of funds increases the quantity supplied because the higher income to be earned on the loan encourages saving. Thus, the interest rate equilibrates demand and supply in the credit markets.

2.2.4 Differentiated Credit Markets and Arbitrage

So far, credit has been assumed to be a homogenous commodity for which transactions are made in a single market. In practice, however, the demands and supplies of credit are so varied that the general credit market is actually comprised of a variety of submarkets. Each submarket involves transactions more specifically related to the requirements of a group of borrowers or lenders. There are markets for mortgages, for corporate bonds, for savings accounts, for auto loans, and for a variety of other transactions.

While these markets appear rather independent, they are in fact highly interdependent because of arbitrage. Funds are considerably more fungible than other commodities. The demand and supply in any one market is affected both by considerations in that market and by considerations in other markets. To make profits, financiers engage in arbitrage by investing funds in markets where interest rates are high and borrowing funds in markets where interest rates are low. As a consequence, interest rates across markets tend to closely follow one another.

This does not mean that all differences between markets are arbitraged away. Indeed, the specific requirements of various borrowers and lenders can impose a market segmentation that persists through time. These distinctions have been found to reflect the risk preferences of borrowers and also the location preferences of lenders. Furthermore, one of the purposes of this study is to test whether rural and urban regional markets exist with different credit conditions.

2.2.5 Financial Market Participants

Virtually all economic units participate in the financial markets as borrowers, lenders, or both. Their behavior with respect to finance typically reflects economic considerations of spending and income.

2.2.6 Financial Intermediaries

The household sector supplies the bulk of the funds in the credit markets, but in most cases, the supply is not directly to the markets. Financial intermediaries -- banks, thrift institutions, insurance companies, and pensions funds -- have arisen to invest household funds. Financial intermediation is generally considered to improve the efficiency of the credit markets.

In general, financial intermediaries provide three things to households: (1) a return on invested funds, (2) safety through diversification and, in come cases, insurance, and (3) convenience as reflected in low transactions costs. Households must weigh these advantages of financial intermediation relative to the net return and risk associated with other means of investment. Financial intermediation provides convenience and more attractive terms for investors as well as for borrowers.

2.2.7 Imperfections in Credit Markets

Interest rate adjustments need not fully equilibrate the demand and supply for funds in the credit markets. In practice, institutional and legal factors operate as constraints which limit the complete equilibration of the markets. Chief among these are interest rate ceilings -- on payments financial intermediaries make to depositers -- and state usury laws.

The existence of these imperfections adds another factor to the role of finance in spending decisions -- the availability of credit. Due to market imperfections, credit may not be available at the market price.

2.2.8 Interregional Financial Flows

The discussion above applies to the credit markets of a closed economy. In a universe comprised of two or more economies, so defined, the question of interregional financial flows arises as does the question of interregional flows of output and income.

A national economy can exist with no external financial flows. But one may consider subnational, regional flows. In the U.S., the currency of the various regions is

exchangeable at a fixed rate from region to region. Not all finance may be fully interregional, however, and this may affect regional production, employment, and income. Furthermore, some markets may be less nationally integrated than others. An early analysis of interregional financial flows appears in Bowsher, Daane, and Einzig (1957).

Based on the role of financial intermediaries discussed above, interregional flows are most likely to occur between intermediaries. These institutions provide specialization, diversification, and lower costs for these transactions. In addition to intermediation, other factors tending to support interregional financial flows are availability of information, frequency of travel, and the presence of secondary markets for both financial and real commodities.

2.2.9 Regional Balances of Private Commercial Firms

Since the availability of deposit funds is an important factor in the ability of a bank to provide credit, the distribution of a corporation's deposit balances among the banks it deals with can affect regional credit conditions. Corporations can be expected to maintain balances in banks in regions where its business activity and borrowing is the greatest. Thus, the economic variables which are used to model the demand for deposits will capture the factors which determine the geographical distribution of commercial balances.

2.2.10 Treasury Deposits and Regional Financial Conditions

The U.S. Treasury has deposit accounts at financial institutions throughout the country. These accounts increase over the year as businesses deposit payments for taxes, particularly withheld income taxes of individuals. When the Treasury needs funds to pay for federal expenditures, it calls these deposit funds out of its accounts at commercial banks and into its accounts at Federal Reserve Banks. It then disburses the funds by checks drawn on the Federal Reserve Banks. Thus, the accounts at commercial banks are essentially a nationwide network for collecting tax receipts.

Treasury deposits at commercial banks must be collateralized by government securities. That is, as funds flow into the Treasury's account, the bank must use the funds to purchase a like amount of government securities. As a result, Treasury deposits do not increase the availability of credit to the bank's customers.

The transfer of Treasury deposits from commercial banks to Federal Reserve Banks will result in a reserve drain on the banking system until the funds are spent by the

Treasury or unless the drain in reserves is offset by open market operations. In practice, the Treasury generally does not call in funds until it is ready to spend, and the Federal Reserve typically smooths any system-wide imbalances caused by this procedure.

These transfers may result in different reserve drains from bank to bank. While this could result in differential credit effects between banks or regions, banks use the federal funds market and loans from correspondent banks to offset these temporary imbalances.

2.3 REGIONAL FINANCIAL CONDITIONS AND NATIONAL MONETARY POLICY

In the previous section, we discussed the demand and supply of credit as if they both stemmed entirely from private decisions. In fact, another source, the U.S. central bank, must also be considered a supplier of funds. In this section, we discuss how the Federal Reserve develops and implements monetary policy, the effect of this policy on financial markets, and the avenues by which differential regional effects could result from such policy.

2.3.1 The Goals of Monetary Policy

In developing its policy, the Federal Reserve seeks to attain goals of full employment, stable prices, balance in international payments, and economic growth; see Hurley (1979). Each of these goals is important, but at any time, one or another may have greater influence because it is deviating more from acceptable levels.

These variables are all national in scope. The Federal Reserve does not intentionally follow a policy aimed at influencing any particular region of the country differently than another. This does not mean that the results of Fed policy do not differ from region to region. Rather, it means that such effects are unintentional.

2.3.2 Implementation of Monetary Policy

At least prior to October, 1979 -- the period analyzed in this study -- the Federal Reserve employed a two-stage implementation procedure to attain its goals. First, it used an intermediate target variable, the money stock, as an indicator of the likely performance of its goal variables. Second, it used a short-term operating variable to alter its stance between expansiveness and restrictiveness as measured by the federal funds rate. The operating variable is the supply of bank reserves relative to the demand. Bank reserves are the deposits commercial banks hold at Federal Reserve banks

plus vault cash. Banks must hold reserves to meet reserve requirements, and therefore, they demand reserves for this purpose. By buying and selling government securities in the open market, the Fed can increase or decrease the supply of reserves. However, reserves do not explicitly appear in the model described in Chapter 3.

Banks actively trade reserves among each other, and in these transactions, reserves are called federal funds. The price of borrowing federal funds is the federal funds rate. This rate naturally reflects the demand relative to the supply of reserves, so the Fed's open market operations are mirrored by changes in the funds rate. An expansive policy increases the supply of reserves and lowers the rate. A restrictive action reduces the supply of reserves and raises the rate.

2.3.3 Transmission of Monetary Policy to the Real Sector

The effect of monetary policy on the real sector of the economy is transmitted through the cost and availability of credit. The sequence of events begins with a change in the federal funds rate. The funds rate is the single most important interest rate in the economy because it is the basis for financing inventories of securities of all types. A change in the cost of financing inventories causes dealers to adjust their holdings. Dealers' transactions change the interest rates on the securities bought and sold.

Changes in the funds rate trigger a sequence of portfolio adjustments which shift the supply of credit relative to the demand for it, causing corresponding shifts in interest rates. These changes alter the spending and saving decisions in the economy.

2.3.4 Transmitting National Monetary Policy to Regions

The markets in which the Federal Reserve operates are among the most national of any in the country. Coordinated through brokers and dealers in New York City, transactions in government securities and in federal funds are made nationwide. Large borrowers and lenders in money centers make transactions directly. Smaller participants in more remote locations use correspondent banks and offices of national brokerage firms. Daily quotations for these financial instruments appear in papers nationwide.

The subsequent portfolio adjustments, however, are more likely to have a regional character. Depositors in different states, for example, have been found to respond differently to changes in interest rates. Table 2.1 shows the differences in response computed by Horwitz and Greenberg (1979). It was found that the sensitivity of thrift deposits to changes in interest rates tended to be positively related to the degree of

TABLE 2.1

STATE RANKINGS OF INTEREST SENSITIVITY OF THRIFT DEPOSITS

RANK	STATE	BETA VALUE	PCT. URBAN
1	DC	-0.849	100.000
2	NY	-0.788	78.108
3	MA	-0.762	89.173
4	MD	-0.715	52.128
5	MN	-0.650	51.343
6	CA	-0.601	86.322
7	CT	-0.571	84.561
8	HI	-0.555	79.944
9	WA	-0.546	52.079
10	PA	-0.541	82.890
11	GA	-0.534	35.438
12	IL	-0.533	65.930
13	CO	-0.522	55.914
14	IN	-0.517	33.478
15	NH	-0.487	0.000
16	OH	-0.487	71.752
17	OK	-0.487	49.142
18	DE	-0.486	90.313
19	NJ	-0.480	49.703
20	MO	-0.479	77.864
21	MI	-0.476	66.112
22	WI	-0.470	31.604
23	FL	-0.443	64.830
24	ME	-0.438	0.000
25	NC	-0.432	33.764
26	AL	-0.426	33.096
27	TN	-0.423	58.783
28	OR	-0.421	47.913
29	SC	-0.419	44.396
30	ID	-0.418	0.000
31	AK	-0.411	0.000
32	VT	-0.403	0.000
33	NV	-0.401	56.011
34	SD	-0.398	0.000
35	TX	-0.398	59.277
36	VA	-0.390	26.856
37	KS	-0.389	16.693
38	IA	-0.371	12.000
39	UT	-0.370	66.090
40	LA	-0.357	48.549
41	KY	-0.356	26.488
42	MT	-0.356	0.000
43	NE	-0.298	37.342
44	AR	-0.291	17.044
45	NM	-0.275	33.347
46	ND	-0.260	0.000
47	WV	-0.243	0.000
48	AZ	-0.238	74.520
49	MS	-0.236	0.000
50	WY	-0.180	0.000
51	RI	-0.123	89.684

urbanization in the state. In turn, banks in different regions will respond differently to a change in the Treasury bill rate based on the availability of deposits and demand for loans in their respective regions. Hence, the impact on regional spending and saving decisions of national monetary policies will depend on regional financial practices and regional economic conditions.

2.3.5 The Use of National Markets to Offset Regional Regional Differences

The discussion above of regional differences in the effect of national policy is a partial equilibrium analysis. Regional market participants may be able to offset differences by dealing directly in the national market. If, for example, a tighter monetary policy falls particularly hard on a region suffering from weak saving and slow deposit flows, borrowers in the region may turn to national lending markets to satisfy their financial needs. To the extent that national markets are perfect, regional financial conditions will not be found to have an impact on regional economic activity. This study tests for imperfections in the national credit markets which permit persistent regional variations in response to national financial conditions.

2.3.6 Alternative Approaches

A number of attempts have been reported in the literature to analyze the regional impact of monetary policy dating back to the work of Scott (1955). Recent work has followed three major paths. The relative composition and competitiveness of the regional economy as a reason for differential effects of monetary policy was analyzed by Fishkind (1979). Others have followed the lead of Bonomo and Schotta (1967) in attempting to measure the different speeds of adjustment among regions. Their work was extended by Hogan and Kaufman (1977).

An alternative conceptual structure for modeling regional financial conditions and Federal Reserve policy takes a monetarist approach; see Miller (1978). In that structure, the determination of production, employment, and income depends for the most part on the money stock. Regional differences in economic activity, therefore, depend on relative money stocks. The Federal Reserve system is specified to control the regional money stocks through the quantities of reserves at the various district Federal Reserve Banks. Thus, regional economic differences are modeled as a direct result of Federal Reserve policy.

In our structure, both real and monetary components are included. Production, employment, and income are largely determined by real phenomena, but financial conditions, as captured by cost and availability of credit, also have an effect. The Federal Reserve influences the cost and availability of credit through changes in the availability of reserves and associated changes in the federal funds rate. The structure and equation specifications used in our model are discussed in the next chapter.

3. MODEL DESIGN: EQUATION SPECIFICATIONS AND ESTIMATION RESULTS

This chapter describes the model used to evaluate the regional effects of monetary policy. We have attempted to base the specification of the equations on the conceptual foundations of regional modeling discussed in Chapter 2.

Before discussing equation structure, a discussion of the geographic structure of the model is in order. Ideally, one would like to have a very fine partition of the country. The less fine the partition, the more likely it is that differential regional effects of policy changes will be missed. The model builder must balance this ideal against the computational requirements of such a large model and, more importantly, the costliness of collecting the needed data. An important consideration in our partitioning decision was the desire to capture the differences between metropolitan and non-metropolitan regions. We elected to use the four major census regions (see Figure 3.1), dividing each region into metropolitan and non-metropolitan subregions.* Thus, the country is partitioned into eight regions. The structure we describe below could be used, however, for a more finely partitioned regional model. The data we use to estimate the model is discussed in Appendix A.4.

The model's structure includes a financial block as well as a real block. Each block in turn is split into a set of regional equations and a set of national equations. We divide our presentation of the model into four components:

- National Financial Markets (Section 3.1)
- Regional Financial Markets (Section 3.2)
- The Real Side of the Regional Economies (Section 3.3)
- The Real Side of the National Economy (Section 3.4)

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* The metropolitan area definition used is that of April, 1973.

FIGURE 3.1 GEOGRAPHIC REGIONS OF THE UNITED STATES

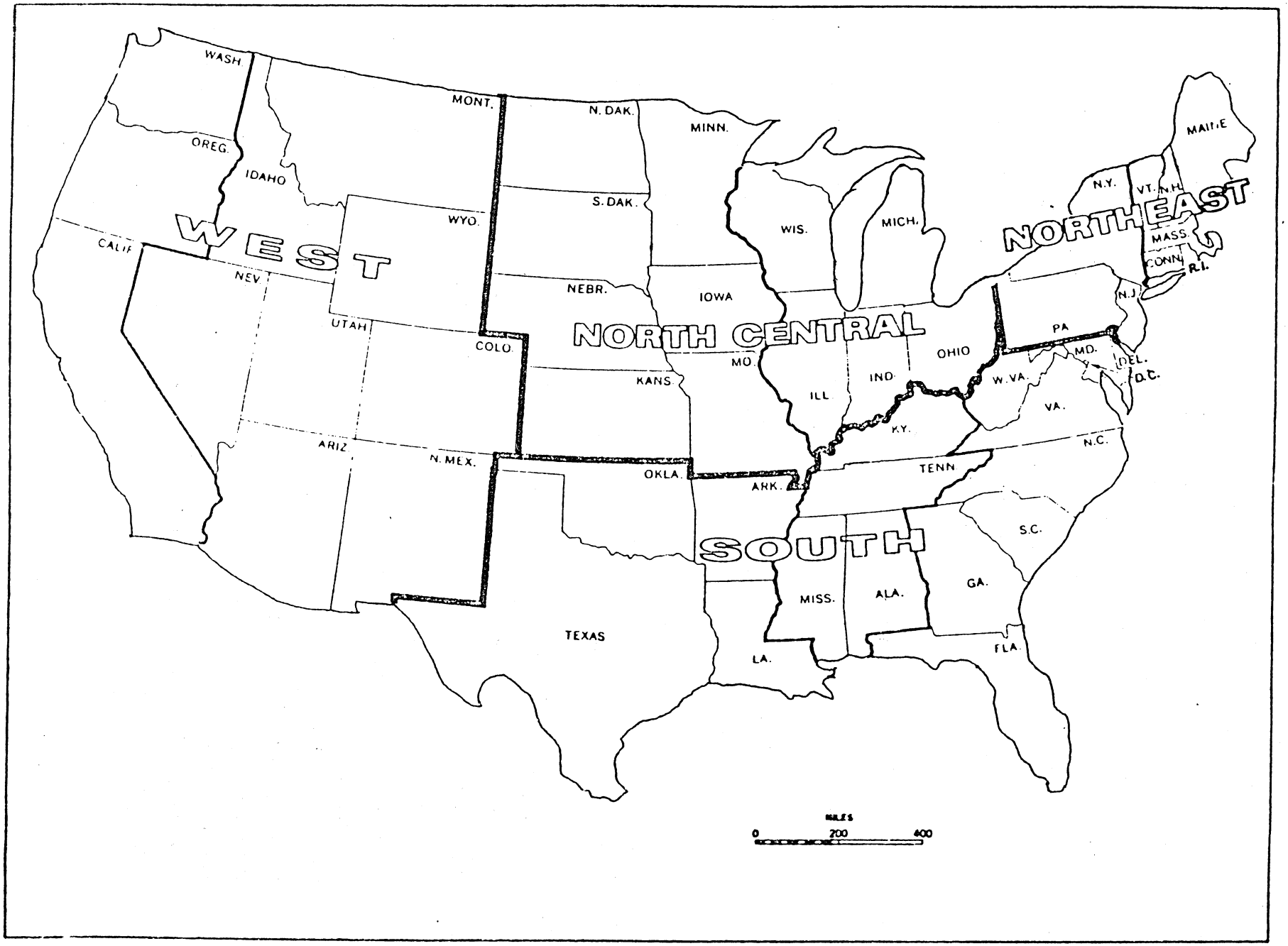
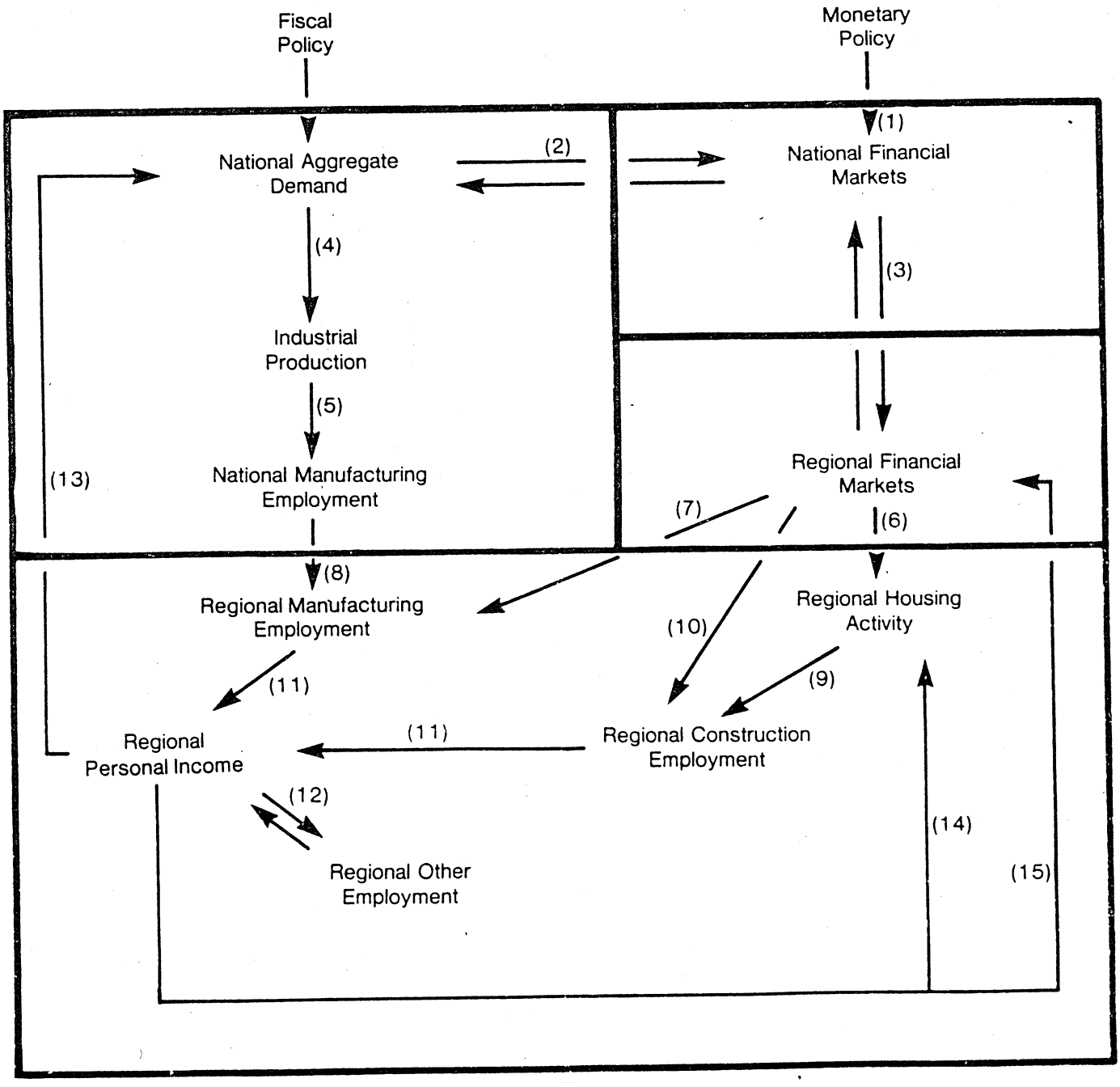


Figure 3.2 gives the reader a general understanding of how the component parts of the model fit together. It reveals the existence of substantial simultaneity within and between the blocks of the model. Without going into great detail, we describe with the aid of Figure 3.2 how the model evaluates the effect of a tightening of monetary policy as an example of the model's capabilities. The numbers contained in the following paragraph refers to the numbered relationships presented in Figure 3.2.

The first impact of a tightening of monetary policy occurs in the national financial markets: (1) interest rates rise. Rising national interest rates have two effects: (2) the investment component of aggregate demand contracts, and (3) there are changes in regional deposits -- demand, savings, and thrift deposits contract and time deposits expand. As national aggregate demand contracts, (4) national industrial production drops, (5) causing a reduction in manufacturing employment. The overall decline in deposits results in (6) a drop in new mortgages causing housing starts to decline. Similarly, (7) the changing loan to deposit ratios at regional banks causes the (8) decline in manufacturing employment to be spread differentially across regions. The decline in housing starts at the regional level (9) reduces construction employment regionally. Commercial construction employment (10) also affected by the changing regional financial conditions (10). With employment declining, (11) regional personal income declines, reducing other locally oriented employment which simultaneously leads to (12) further declines in personal income. The decline in regional personal income causes a (13) further (second round) drop in national aggregate demand, (14), regional housing demand (14), and (15) regional deposits, with subsequent effects filtering through all the components of the model. It is clear that there are several channels through which monetary policy can affect the separate regions differently.

Appendix A.1 presents the stochastic or behavioral equations in the model, compiled in the same order as they are presented below. The signs above the explanatory variables indicate the estimated direction of their effects on the dependent variable. The identities included in the model are reported in Appendix A.2. Appendix A.3 contains a glossary describing each variable. Each variable is categorized -- endogenous to the model, an identity, or exogenous -- and its source is given. A discussion of the construction of the regional data series is contained in Appendix A.4. Finally, Appendix A.5 contains a matrix that indicates in a compact form exactly where each of the variables enters the model.

Figure 3.2
The Major Relationships Among the Sectors of the Model



3.1 NATIONAL FINANCIAL MARKETS

The model includes three endogenous national financial variables: the federal funds rate, the utility Aa bond rate, and internally generated corporate funds. Figure 3.3 displays the relationships among these variables, as well as their relations to the rest of the model. The arrows only illustrate the channels of influence from other sectors to the national financial sector. In other figures presented below, the influences flowing out of this sector to others is illustrated.

3.1.1 Federal Funds Rate

The federal funds rate (RFF) is a key indicator of monetary policy. Our specification assumes that the monetary authorities choose a policy course that attempts to achieve the national goals of full employment and price stability. The Federal Reserve is expected to take monetary actions which will reduce the federal funds rate when there is a downturn in economic activity as measured by an increase in the unemployment rate (ΔUN). It is also expected to tighten credit when the inflation rate, as measured by the consumption goods deflator, increases (ΔPct(Pc)).

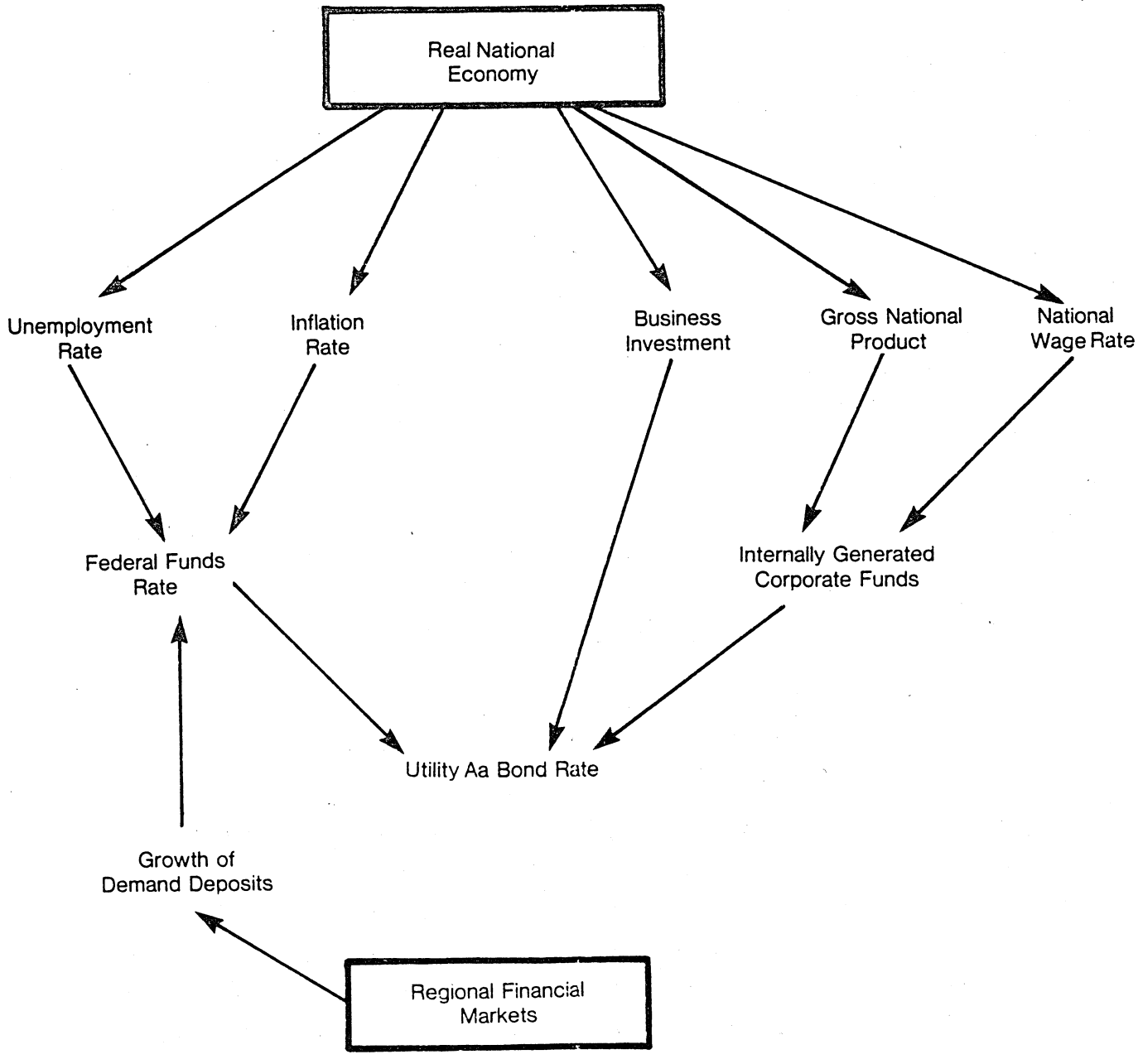
The Fed may also respond to changes in the growth rate of demand deposits (ΔPct(DDEP)) as a shorter run indicator of the performance of the economy. It may increase the federal funds rate to slow the economy down when there is an increase in the rate of growth of demand deposits.

The estimated equation in the model is:

$$\Delta RFF = \underset{(-0.12)}{-.05} - \underset{(-4.08)}{1.42}\,\Delta UN + \underset{(1.84)}{1.56}\,\Delta Pct(PC_{-1}) + \underset{(2.58)}{0.12}\,\Delta Pct(DDEP)$$

$$\bar{R}^2 = .628 \qquad DW = 1.70$$

The numbers in parentheses are t-ratios. The sample period is 1974:1 to 1977:4.


Real National Economy
Unemployment Rate
Inflation Rate
Business Investment
Gross National Product
National Wage Rate
Federal Funds Rate
Internally Generated Corporate Funds
Utility Aa Bond Rate
Growth of Demand Deposits
Regional Financial Markets

3.1.2 Utility Aa Bond Rate

We have chosen the utility Aa bond rate RAAU as the market interest rate variable used in the national investment equation. Because of the presence of arbitrage in the financial markets, an increase in short-term interest rates as measured by the federal funds rate (ΔRFF) should increase RAAU. An increase in the demand for long-term loanable funds as measured by an increase in the ratio of fixed busines investment to corporate cashflow Δ(IPZ/CSHFLW) should also increase the bond rate. A decrease in the real supply of loanable funds (at a given nominal interest rate) caused by a rise in the expected inflation rate as measured by the lagged percentage change in the deflator for personal consumption expenditures (ΔPct (PC(-3)), reducing the expected real interest rate, should result in an increase in the bond rate. The estimated equation in the model is:

$$\Delta RAAU = \underset{(1.49)}{.05} + \underset{(7.55)}{.28}\,\Delta RFF + \underset{(1.84)}{.005}\,\Delta(IPZ/CSHFLW) + \underset{(4.5)}{1.4}\,\Delta Pct(PC_{-3})$$

$$\bar{R}^2 = .447 \quad DW = 2.15$$

The numbers in parentheses are t-ratios. The sample period is 1954:2 to 1980:3.

3.1.3 Internally Generated Corporate Funds

Internally generated corporate funds (CSHFLW) substitute for borrowed funds in financing investment. The growth of these funds (Pct(CSHFLW)) should follow the growth of the gross national product (Pct(GNPZ)). If, however, real wage rate growth increases without an offsetting increase in productivity growth, the return to capital declines. Since productivity growth was relatively constant over the period of estimation, real wage rate growth (Pct (WR/PGNP)) and cashflow growth are inversely related. Since the Nixon wage-price program may have impeded the growth of corporate cashflow through several channels, we have included a dummy variable for that program in our estimated equation:

$$\text{Pct(CSHFLW)} = \underset{(-3.8)}{-5.1} + \underset{(6.25)}{3.8\ \text{Pct(GNPZ)}} - \underset{(-3.1)}{3.5\ \text{Pct(WR/PGNP)}}$$

$$\underset{(-7.5)}{-8.1\ \text{DWPFR}}$$

$\bar{R}^2 = .692 \quad DW = 2.00$

The numbers in parentheses are t-ratios. The sample period is 1962:2 to 1977:4.

3.2 REGIONAL FINANCIAL MARKETS

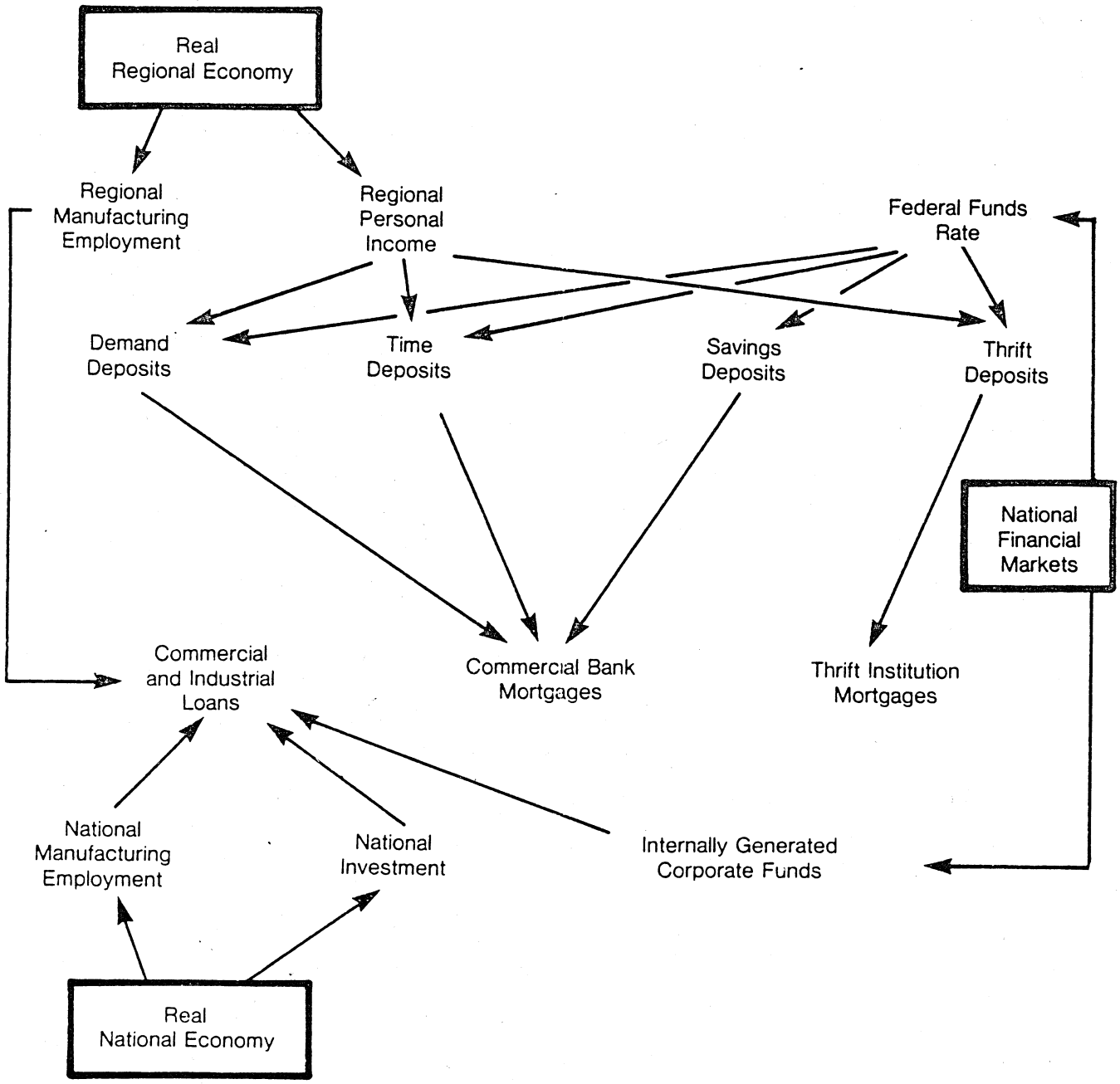
The regional financial sector provides the linkages between national financial markets and the regional economies. The direct linkages into this sector from national financial markets are the Federal funds rate and the interest rate ceiling imposed by Regulation Q. From the regional economies, income and employment provide linkages. Regional deposits and loans, the variables modeled in this block, in turn, affect the other national and regional sectors. The general relationships among the variables in this sector and to the rest of the model are shown in Figure 3.4. It should be noted that all regional equations for a particular variable were assumed to have the same specification across regions. This was to provide consistency to the overall model. A consequence was that some variables entered with intuitively incorrect signs and were sometimes statistically insignificant. Furthermore, this consistency constraint led to poorer fits than otherwise might have been obtained.

The regional subscript (r) runs over four census regions and the rural-urban dicotomy. Hence, there are eight equations for each specification.

3.2.1 Deposits

Four types of deposits are included in the model: demand deposits (DDEPr), savings deposits (SDEPr), time deposits (TDEPr), and thrift deposits (THDEPr). The first three are held at commercial banks while the fourth is held at thrift institutions. The four deposits compete among themselves and with other savings vehicles as alternative means of holding financial wealth. We have found it fruitful to model the deposit equations by using the four-quarter change in deposits as the dependent variable. The explanatory variables are regional personal income (PIZr), the federal funds rate (RFF),

Figure 3.4
Regional Financial Markets



and the interest rate ceiling imposed by Regulation Q (RQ). Tables 3.1 through 3.4 present our estimates of the equations. Generally, we found that for all four types of deposits, rural areas are less responsive to changes in income and interest rates than are metropolitan areas.

a. Demand Deposits at Commercial Banks

The flow of financial wealth into demand deposits depends positively on changes in regional personal income -- personal income was used rather than disposable income to extend the sample period -- and negatively on the federal funds rate. The negative coefficient on the federal funds rate indicates (except for the rural North Central region where it is positive but insignificant), that depositors squeeze non-interest-bearing demand deposits when the interest rate on alternative uses of funds increases. The equations are presented in Table 3.1.

b. Savings Deposits at Commercial Banks

Personal income was not a statistically significant determinant of flows into savings deposits. What determines this flow is the difference between interest rates on alternative assets, measured by the federal funds rate, and the interest rate earned by savings accounts, measured by the Regulation Q ceiling. When this difference increases savings deposits become less attractive and depositors switch to alternative wealth-holding vehicles. This behavior pattern is reflected in the negative coefficient on (RFF-RQ) in Table 3.2.

c. Time Deposits at Commercial Banks

Time deposits are the longer-run, higher-yield accounts held at commercial banks. The interest paid here can vary with the market, so as the interest rates rise, funds will be pulled from other uses and invested in these accounts.

The specification for this equation is similar to those for other deposits in that the four-quarter change in time deposits is the dependent variable, and personal income has been substituted for disposable income to increase the time period covered. The federal funds rate now enters positively, but not significantly, as is seen in Table 3.3.

TABLE 3.1

DEMAND DEPOSITS AT COMMERCIAL BANKS

Region	Co	Δ(4:PIZr)	RFF	DW	$\bar{R}^2$	RHO*
Metro						
North Central	-769.72 (-0.56)	0.15 (2.21)	-150.68 (-1.47)	1.03	.747	.799
Northeast	-1928.51 (-0.99)	0.27 (2.21)	-250.34 (-1.50)	1.15	.580	.749
South	1420.49 (0.05)	0.11 (0.86)	-162.40 (-1.48)	1.13	.776	.999
West	-1175.43 (-0.68)	0.26 (2.92)	-155.07 (-1.86)	1.09	.855	.899
Non-metro						
North Central	648.40 (1.63)	0.04 (2.53)	29.97 (0.88)	.99	.851	.899
Northeast	-48.55 (-0.34)	0.02 (1.87)	-16.73 (-1.89)	.82	.714	.899
South	1044.93 (1.28)	0.03 (1.39)	-24.95 (-0.58)	.91	.786	.949
West	220.44 (0.11)	0.01 (1.21)	-4.50 (-0.63)	.80	.815	.999

Dependent variable: Demand Deposits at Commercial Banks in Region r, change over four quarter period, (Δ(4:DDEPr))

Independent variables:

PIZr -- Personal Income in Region r, current dollars, change over four quarter period

RFF -- Federal Funds Rate

Period -- 1970:2 to 1978:2
T-statistic is in parentheses under the coefficient.

*Hildreth-Lu First Order Autocorrelation Correction Used

TABLE 3.2

SAVINGS DEPOSITS AT COMMERCIAL BANKS

Region	Co	RFF-RQ	DW	$\bar{R}^2$
Metro				
North Central	1147.91 (7.94)	-271.19 (-6.42)	.86	.489
Northeast	971.07 (7.44)	-215.95 (-5.66)	.85	.425
South	1014.55 (9.38)	-216.42 (-6.84)	.73	.522
West	1068.75 (7.27)	-246.88 (-5.74)	.56	.432
Non-metro				
North Central	586.13 (8.74)	-107.67 (-5.49)	.45	.409
Northeast	151.85 (10.24)	-31.41 (-7.24)	.79	.550
South	443.19 (10.88)	-87.06 (-7.31)	.48	.566
West	100.79 (9.34)	-18.39 (-5.83)	.34	.440

Dependent variable: Savings Deposits at Commercial Banks in Region r, change over four quarter period, (Δ(4:SDEPr))

Independent variables:

RFF -- Federal Funds Rate

RQ -- Regulation Q Ceiling for Interest Rates Payable (exogenous)

Period -- 1969:2 to 1979:4
T-statistic is in parentheses under the coefficient.

TABLE 3.3

TIME DEPOSITS AT COMMERCIAL BANKS

Region	Co	Δ(4:PIZr)	RFF	DW	$\bar{R}^2$	RHO*
Metro						
North Central	-2185.63	0.203	209.96	0.67	.860	.999
	(-0.07)	(1.65)	(1.52)			
Northeast	-3536.93	0.358	442.51	0.95	.780	.899
	(-0.70)	(1.63)	(1.24)			
South	-2571.01	0.237	117.26	0.71	.875	.949
	(-1.15)	(3.06)	(1.25)			
West	-7476.71	0.556	288.28	0.60	.853	.949
	(-1.59)	(2.70)	(1.51)			
Non-metro						
North Central	1940.48	0.007	16.89	0.96	.893	.999
	(0.32)	(0.86)	(0.67)			
Northeast	310.07	8.3E-04	17.74	0.87	.766	.849
	(2.54)	(0.07)	(1.86)			
South	2052.96	0.008	7.21	0.91	.868	.999
	(0.28)	(0.65)	(0.24)			
West	307.73	0.002	0.32	0.48	.887	.999
	(0.30)	(0.47)	(0.08)			

Dependent variable: Time Deposits at Commercial Banks in Region r, change over four quarter period, (Δ(4:TDEPr))

Independent variables:

PIZr -- Personal Income in Region r, current dollars, change over four quarter period

RFF -- Federal Funds Rate

Period -- 1974:1 to 1977:4
T-statistic is in parentheses under the coefficient.

*Hildreth-Lu First Order Autocorrelation Correction Used

TABLE 3.4

DEPOSITS AT THRIFT INSTITUTIONS

Region	Co	Δ(4:PIZr)	RFF-RQ	DW	$\bar{R}^2$
Metro					
North Central	5234.38 (8.58)	0.21 (9.05)	-814.75 (-10.99)	1.14	.926
Northeast	11808.1 (5.36)	0.27 (2.09)	-1774.92 (-8.26)	0.79	.777
South	4704.61 (4.50)	0.26 (6.76)	-834.04 (-8.14)	0.89	.849
West	6021.94 (5.09)	0.31 (6.07)	-1395.67 (-10.79)	1.28	.894
Non-metro					
North Central	1962.52 (8.20)	0.075 (4.58)	-159.74 (-4.02)	.96	.688
Northeast	-767.79 (-0.90)	0.21 (2.32)	-321.95 (-3.64)	.94	.422
South	796.02 (0.89)	0.17 (3.20)	-475.49 (-3.99)	.93	.545
West	-233.45 (-1.09)	0.12 (4.96)	-22.58 (-0.83)	.63	.544

Dependent variable: Deposits at Thrift Institutions in Region r, change over four quarter period, (Δ(4:THDEPr))

Independent variables:

PIZr — Personal Income in Region r, current dollars, change over four quarter period

RFF — Federal Funds Rate

RQ — Regulation Q Ceiling on Interest Rates Payable (exogenous)

Period — 1974:1 to 1978:4
T-statistic is in parentheses under the coefficient.

d. Deposits at Thrift Institutions

The deposits held at thrift institutions are treated similarly to savings deposits at commercial banks, except that the change in personal income is included in the specification (Table 3.4). The interest rate again enters as the difference between the federal funds rate and the Regulation Q ceiling rate. Personal income enters positively and the interest rate difference enters negatively, as expected.

3.2.2 Loans

The model includes three variables measuring regional loans: commercial and industrial loans by commercial banks (CIr), mortgage loans made by commercial banks (MORCr), and mortgage loans made by thrift institutions (MORTr). The determinants for commercial and industrial loans are the demand for loans based on investment and the alternative means of financing that investment through internal cashflow. Neither investment nor cashflow are modeled here at the regional level, so the share of regional to national manufacturing employment is used to scale the national variables. Regional investment enters positively and cashflow negatively, with one exception, as expected (see Table 3.5). Note that here, as with all commercial bank data, the change over four quarters is used as the dependent variable.

For both commercial banks and thrift institutions, mortgages depend positively on the deposits available for lending. Our specification assumes that the demand for mortgages is great enough that all funds supplied will be used. In the original specifications, it was assumed that mortgages would be driven by housing starts and the interest rate; however, after the preliminary estimations, it was found that the direction of flow of this sector should be reversed, and housing starts are now in part driven off of the availability of mortgages. Our estimated equations are presented in Tables 3.6 and 3.7.

3.3 THE REAL SIDE OF THE REGIONAL ECONOMIES

This section discusses the real side of the model at the regional level. The eleven endogenous variables for each of the eight regions are employment (manufacturing, construction, and other), personal income built up from its component parts, and housing starts. An important feature of a regional model is the distinction between industries which produce for national markets and industries which produce for local markets. Manufacturing employment is the measure of export activity in this model. It results in

TABLE 3.5

COMMERCIAL AND INDUSTRIAL LOANS AT COMMERCIAL BANKS

Region	Co	$\Delta(4:(IINF+IP)*PIP*(\frac{MFEMr}{MFEM}))$	$\Delta(4:CSHFLW*(MFEMr/MFEM))$	DW	$\bar{R}^2$	RHO*
Metro						
North Central	257.55 (0.08)	2.09 (4.09)	-221.88 (-2.66)	.80	.905	.949
Northeast	4645.89 (0.88)	5.07 (4.41)	-776.37 (-4.50)	.89	.908	.899
South	-659.88 (-0.37)	1.95 (4.12)	-101.99 (-1.39)	.96	.900	.949
West	-960.37 (-0.05)	3.36 (4.65)	-272.99 (-2.33)	.86	.905	.999
Non-metro						
North Central	-110.77 (-0.41)	0.82 (4.17)	-5.64 (-0.19)	1.13	.922	.899
Northeast	34.67 (0.32)	0.58 (2.52)	-50.14 (-1.60)	.90	.730	.799
South	-20.79 (-0.07)	0.17 (1.58)	32.71 (1.87)	1.02	.906	.949
West	149.81 (0.21)	0.46 (2.59)	-33.92 (-1.23)	.85	.957	.999

Dependent variable: Commercial and Industrial Loans at Commercial Banks, change over four quarter period, ($\Delta(4:CIr)$)

Independent variables: Change over four quarter period

- IINF -- Investment in Inventories
- IP -- Investment in Plant and Equipment
- PIP -- Implicit Deflator, Investment in Plant and Equipment
- MFEMr -- Manufacturing Employment in Region r
- MFEM -- U.S Total, Manufacturing Employment
- CSHFLW -- Internally Generated Corporate Funds

Period -- 1970:1 to 1977:4
T-statistic is in parentheses under the coefficient.

*Hildreth-Lu First Order Autocorrelation Correction Used

TABLE 3.6

MORTGAGES AT COMMERCIAL BANKS

Region	Co	Δ(4:CBTOTDEPr(-2))	DW	$\bar{R}^2$	RHO*
Metro					
North Central	2115.08 (.22)	0.03 (1.61)	0.33	.958	.999
Northeast	2018.07 (0.14)	0.04 (1.79)	0.43	.933	.999
South	1601.42 (0.13)	0.02 (1.30)	0.55	.916	.999
West	2445.88 (0.15)	0.15 (2.73)	0.38	.954	.999
Non-metro					
North Central	846.7 (0.22)	0.01 (4.23)	0.36	.960	.999
Northeast	237.63 (0.15)	0.03 (1.62)	0.57	.912	.999
South	865.03 (0.19)	0.01 (1.47)	0.44	.952	.999
West	128.73 (0.13)	0.02 (2.82)	0.92	.907	.999

Dependent variable: Mortgages Held at Commercial Banks, change over four quarter period, (Δ(4:MORCr))

Independent variable: CBTOTDEPr -- Total Deposits Held at Commercial Banks, the sum of DDEPr + SDEPr + TDEPr, change over four quarter period lagged two quarters

Period -- 1970:3 to 1979:4
T-statistic is in parentheses under the coefficient.

*Hildreth-Lu First Order Autocorrelation Correction Used

TABLE 3.7

MORTGAGES AT THRIFT INSTITUTIONS

Region	Co	Δ(4:THDEPr(-1))	DW	$\bar{R}^2$	RHO*
Metro					
North Central	2653.34 (1.05)	0.68 (4.24)	1.10	.967	.975
Northeast	2704.63 (1.73)	0.37 (4.23)	1.20	.893	.899
South	2758.13 (0.91)	0.64 (4.63)	1.91	.955	.975
West	4506.03 (0.18)	0.58 (4.55)	1.53	.974	.999
Non-metro					
North Central	1274.01 (1.86)	0.48 (2.63)	1.27	.923	.949
Northeast	242.78 (3.50)	0.424 (7.58)	1.83	.753	.200
South	1075.74 (2.85)	0.583 (6.13)	2.08	.907	.799
West	493.47 (2.04)	0.446 (2.14)	1.60	.730	.799

Dependent variable: Mortgages Held at Thrift Institutions, change over four quarter period, (Δ(4:MORTr))

Independent variable: THDEPr -- Deposits at Thrift Institutions, change over a four quarter period, lagged one quarter

Period -- 1974:2 to 1979:4
T-statistic is in parentheses under the coefficient.

*Hildreth-Lu First Order Autocorrelation Correction Used

local wage income that leads to a demand for local goods and services. Employment in local industries similarly results in wage income which leads to further local demand in a simultaneous manner. Figure 3.5 displays the major relationships within the regional real side component of the model, as well as its linkages with the rest of the model.

3.3.1 Employment

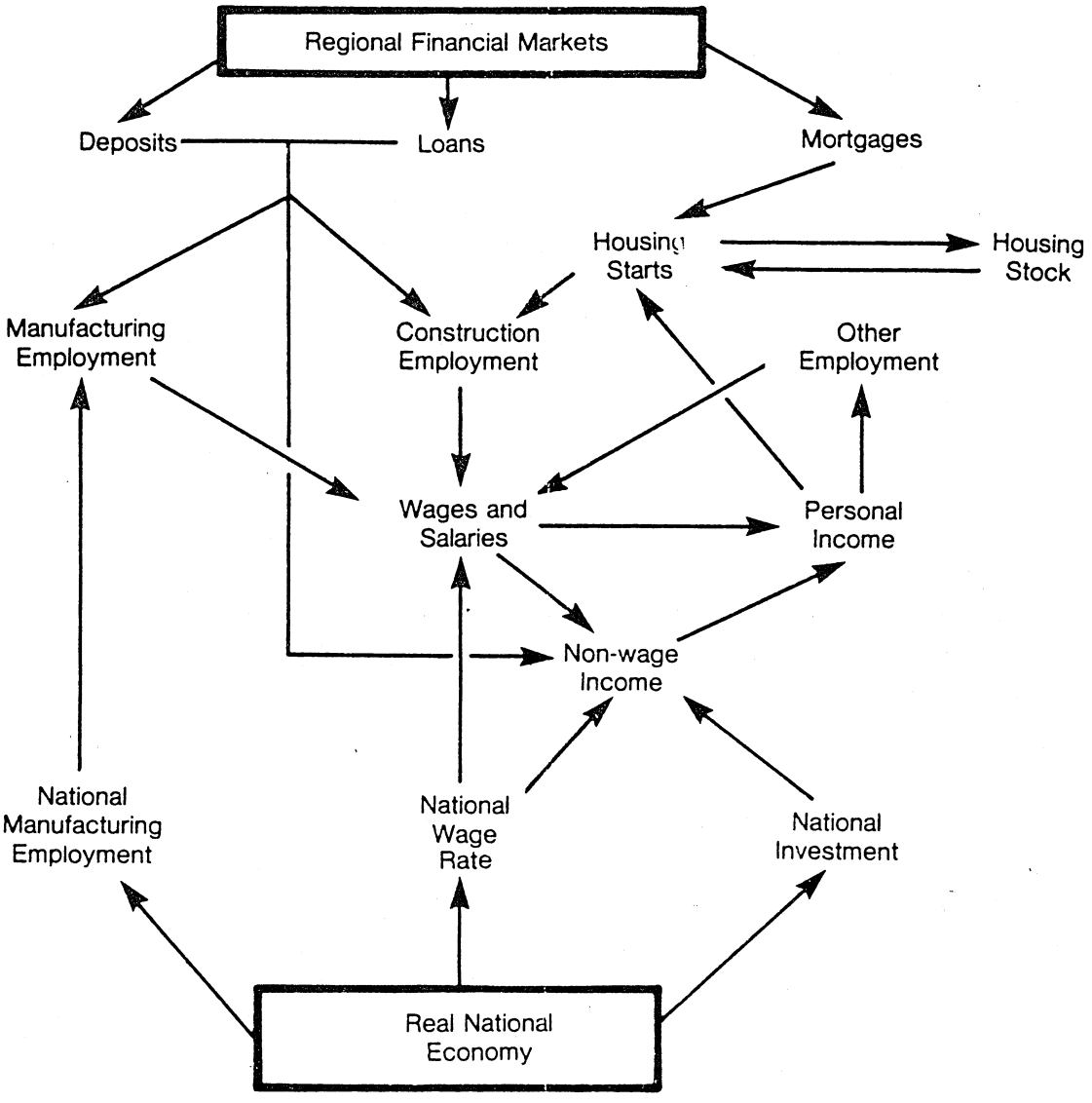
Regional employment is an important measure of regional economic activity. Regional activities can be roughly divided into those that are primarily determined by national conditions and those primarily determined by regional conditions. Our measure of the former, often referred to as the export sector, is regional manufacturing employment. Our measures of more locally-oriented activities are construction employment and other employment, the latter including all non-manufacturing, non-construction employment except for government employment.

a. Manufacturing Employment

Since manufacturers mostly produce for a national market, manufacturing employment in a region (MFEMr) closely follows national manufacturing employment (MFEM). If all regions were identical, we would expect a one percent downturn in national manufacturing employment to result in a one percent decline in the manufacturing employment of each region. Not all regions are identical, however, and the regional responses to national conditions vary. In other models, the regional response has been shown to depend on the composition of manufacturing within the region, the age of the region's capital stock used in manufacturing relative to that of other regions, and the costs of doing business within a region also compared to other regions. Typically, relative labor costs, tax costs, and energy costs have been used in empirical studies.

A unique feature of this model is that we have used relative regional financial conditions to determine manufacturing employment. We measure relative financial conditions by two variables: the commercial loans in the region as a fraction of national commercial loans (CIr/CI) and the region's commercial loan-to-deposit ratio compared to the same national ratio: (CLDEPRr/CLDEPR). The former variable measures relative credit availability and should be positively related to regional manufacturing employment. That is, if credit is more available in one region than another, then that region's competitive positive is relatively strong and

Figure 3.5
Real Regional Economy



manufacturing employment should be stronger. The relative loan deposit ratio variable is an indicator of the relative cost of credit. An increase in this ratio worsens the competitive position of a region and should reduce manufacturing employment.

Our empirical analysis suggests that regional financial conditions, as captured by these two variables, are significant determinants of regional manufacturing employment. We were unable to find statistically meaningful effects from relative labor, energy, or tax costs in our empirical work. We did not test for differing responses due to differences in the ages of capital stocks across regions -- the model does not include regional investment equations and thus we could not compute the region's capital stock and its age. We also did not test for composition effects. As a consequence, the estimated coefficients on the financial variables embody relative age and industrial composition effects. That is, regions may respond differently to relative financial conditions because of differences in industry mix and capital stock ages, as well as other factors.

Table 3.8 presents our estimated equations. The equations are in log-log form where the dependent variable is the log of the ratio of regional to national manufacturing employment. The coefficients on the log of relative credit availability are all positive as expected and range from a low of about .1 in the rural Northeastern region to a high of almost 1.4 in the metro Western region. Also note that the rural area coefficients are generally smaller than the coefficients for the adjoining metropolitan areas, except for the South. The coefficients on the relative cost of credit variable are all negative. Again note that the rural area coefficients are generally smaller in absolute value than the corresponding metro area coefficients (except for the South). Our empirical analysis implies that credit tightening directly affects manufacturing employment less in rural areas than in metropolitan areas.

b. Construction Employment

Contract construction employment (COEMr) is a function of local residential and commercial construction activity. Residential construction is measured by the number of housing starts in the region (HSr), while real regional commercial and industrial loans (CIr/PGNP) are a proxy for business investment in structures. Both commercial and residential construction activity capture longer-run investment

TABLE 3.8

MANUFACTURING EMPLOYMENT

Region	Co	ln(CIr/CI)	$\ln\left(\frac{CLDEPRr}{CLDEPR}\right)$	DW	$\bar{R}^2$
Metro					
North Central	.279 (2.12)	1.0453 (12.93)	-0.763 (-19.69)	0.85	.929
Northeast	-.377 (-5.04)	.9117 (19.98)	-.467 (-4.21)	0.19	.930
South	-.991 (-13.25)	.478 (11.17)	-.407 (-4.25)	0.18	.824
West	-0.308 (-0.78)	1.357 (6.29)	-1.52 (-10.95)	0.95	.808
Non-metro					
North Central	-1.71 (-7.51)	0.3024 (2.88)	-.108 (-0.76)	0.12	.699
Northeast	-3.04 (-25.09)	0.1229 (4.13)	-0.297 (-10.95)	0.82	.806
South	-.0299 (-0.19)	.7695 (11.29)	-0.534 (-5.06)	0.19	.864
West	-1.766 (3.77)	.492 (4.32)	-.123 (-0.67)	0.09	.911

Dependent variable: Natural Log, Ratio of Manufacturing Employment in Region r to U.S. Total Manufacturing Employment, (ln(MFEMr/MFEM))

Independent variables:

CIr -- Commercial and Industrial Loans at Commercial Banks in Region r

CI -- U.S. Total, Commercial and Industrial Loans at Commercial Banks

CLDEPRr -- Ratio of Commercial and Industrial Loans to Commercial Bank Deposits in Region r, four quarter distributed lag

CLDEPR -- U.S. Average, Ratio of Commercial and Loans to Commercial Bank Deposits, four quarter distributed lag

Period -- 1969:4 to 1977:4
T-statistics are in parentheses under the coefficients.

decisions based on the regional financial conditions, making employment in this sector indirectly influenced by monetary policy. An additional variable, the relative commercial loan-to-deposit ratio (CLDEPRr/CLDEPR), is added to bring in the short-run effects of relative regional credit costs on construction activity. Although the long-run decision to invest in a region may remain fixed, the timing of the actual investment may vary depending on the relative cost of borrowing in the region where the construction is to occur.

Our empirical results are presented in Table 3.9. Both housing starts and real commercial loans variables enter positively, and the relative credit cost variable enters negatively as expected. As with manufacturing employment, credit conditions within most regions have statistically significant effects on construction employment. Except for the West, the metropolitan areas were more affected by relative credit tightening than the corresponding rural area. For instance, the elasticity (at the mean values of the variables) of construction employment with respect to the relative loan deposit ratio is -1.2 in the metro North Central region -- a 1 percent increase in the relative loan deposit ratio reduces construction employment by 1.2 percent -- while it is only -0.6 in the rural North Central region.

c. Other Employment

Other employment (OTEMr) is comprised of all employment categories except construction, manufacturing, and government. The latter is not included in the model. The activities in this sector primarily depend on local conditions which we have measured by regional real personal income. We have separated property income (YPTr/PC) and non-property income (PIZr-YPTr/PC) to allow for varying propensities to spend income locally. Except for the Metro Northeast region, an additional dollar of property income added more to other employment than a dollar of non-property income. Financial variables were found to have no direct effect on other employment. Our estimated equations are presented in Table 3.10.

3.3.2 Personal Income

Regional personal income in current dollars by place of residence (PIZr) is determined by the following identity:

$$PIZr = PIWr + ADJr$$

TABLE 3.9
CONTRACT CONSTRUCTION EMPLOYMENT

Region	Co	HSr	$\frac{CLDEPRr}{CLDEPR}$	CIr/PGNP	DW	$\bar{R}^2$
Metro						
North Central	180.35 (2.65)	0.88 (10.82)	-218.80 (-3.16)	0.55 (11.06)	1.08	.931
Northeast	157.59 (0.68)	2.41 (6.87)	-198.10 (-1.34)	0.41 (12.29)	0.64	.971
South	581.09 (1.89)	1.23 (7.45)	-881.40 (-3.05)	1.98 (4.91)	0.47	.866
West	68.42 (1.86)	0.74 (13.98)	-140.73 (-3.52)	0.77 (7.42)	0.91	.910
Non-metro						
North Central	43.49 (5.40)	1.08 (6.87)	-108.72 (-3.61)	0.92 (7.64)	1.13	.914
Northeast	-4.55 (-0.21)	0.93 (12.38)	-8.55 (-0.36)	1.85 (2.66)	0.57	.897
South	106.69 (3.72)	0.83 (7.25)	-285.62 (-4.33)	2.24 (4.77)	0.69	.769
West	71.48 (5.73)	1.75 (3.51)	-140.00 (-3.15)	3.12 (2.89)	0.67	.416

Dependent variable: Contract Construction Employment in Region r (COEMr)

Independent variable:

HSR -- Housing Starts in Region r, four quarter linear distributed lag

CLDEPRr -- Commercial Bank Loan Deposit Ration in Region r

CLDEPR -- U.S. Average, Commercial Bank Loan Deposit Ratio

CIr -- Commercial and Industrial Loans in Region r, four quarter linear distributed lag

PGNP -- Implicit Deflator, Gross National Product, four quarter linear distributed lag

Period -- 1972:4 to 1977:4
T-statistic is in parentheses below the coefficient.

TABLE 3.10

OTHER EMPLOYMENT

Region	Co	(PIZr-YPTr)/PC	YPTr/PC	DW	$\bar{R}^2$
Metro					
North Central	2465.33	1.99	26.89	0.53	.982
	(11.72)	(5.14)	(9.41)		
Northeast	5278.05	4.63	4.06	0.41	.941
	(16.56)	(14.85)	(2.32)		
South	4985.66	3.64	17.13	0.39	.995
	(32.21)	(5.68)	(4.48)		
West	2263.62	4.69	13.10	0.43	.993
	(14.56)	(9.45)	(5.08)		
Non-metro					
North Central	2159.18	0.19	15.53	0.35	.966
	(21.41)	(0.68)	(11.95)		
Northeast	25.08	1.83	3.21	0.24	.960
	(0.41)	(9.13)	(3.31)		
South	3127.13	1.46	11.26	0.66	.995
	(59.17)	(9.54)	(15.90)		
West	638.20	2.98	5.76	0.29	.987
	15.14	(8.67)	(3.18)		

Dependent variable: Other Employment in Region r (OTEMr)

Independent variables:

PIZr -- Nominal Personal Income in Region r, four quarter linear distributed lag

YPTr -- Property Income in Region r, four quarter linear distributed lag

PC -- U.S. Deflator, Personal Consumption Expenditure, four quarter linear distributed lag

Period - 1969:1 to 1977:4
T-statistic is in parentheses below the coefficient.

where PIWr is regional personal income in current dollars by place of work and ADJr is an adjustment for residence that accounts for the fact that some persons reside in one region and work in another. Personal income by place of work is determined by the following identity:

$$PIWr = Wr + OLIr + TRPr + YPr + YPTr - SOCIr$$

where Wr is wages and salaries, OLIr is other labor income, TRPr is transfer payments, YPr is proprietor's income, YPTr is property income, and SOCIr is contributions for social insurance. All of the components of PIWr as well as ADJr are stochastic in the model.

Wage and salary disbursements are the largest component of personal income, as well as the most important in a regional model because of its simultaneity with employment. Disposable income is constructed by multiplying personal income by one minus a personal tax rate constructed with state and SMSA tax data.

a. Wages and Salaries

We originally intended to estimate an equation explaining regional wages per employee. Multiplying this variable by total regional employment would then produce the regional wage bill as an identity. The wages per employee series, however, had substantial unexplainable noise. We abandoned that approach and simply estimated an equation explaining the growth of the regional wage bill (Pct(Wr)).

Because of competition in the national labor market, regional and national wage rates should grow at approximately the same rates. Short-run differences may arise, however, when regional and national labor market conditions differ. For example, if labor markets are tighter in the metro West than in the rest of the nation, we would expect metro West wage rates to grow faster than the national wage rate. We have employed the growth of regional employment relative to national employment (Pct (EMr/EM)) as a measure of relative labor market tightness. The coefficient on this variable includes the direct contribution of the growth of regional employment relative to national employment. Table 3.11 presents our estimations of the regional wage bill equations. When the constant term was

TABLE 3.11

WAGE AND SALARY DISBURSEMENTS

Region	PCT(W)	PCT $(\frac{EMr}{EM})$	DW	$\bar{R}^2$
Metro				
North Central	0.89 (15.74)	0.14 (.25)	1.52	.447
Northeast	0.91 (15.94)	0.87 (2.98)	2.58	.763
South	0.88 (14.22)	2.26 (3.74)	1.97	.005
West	0.87 (16.15)	0.89 (3.29)	1.81	.149
Non-metro				
North Central	1.13 (6.8)	3.53 (2.4)	1.99	.444
Northeast	0.92 (26.61)	0.44 (1.18)	2.10	.777
South	1.32 (10.05)	0.43 (.47)	2.33	.541
West	1.33 (5.85)	0.95 (1.25)	1.96	.364

Dependent variable: Wage and Salary Disbursements in Region r, PCT(Wr)

Independent variables:

W -- US Total, Wage and Salary Disbursements

EMr -- Total Employment in Region r

EM -- US Total, Total Employment

Period -- 1969:2 to 1977:4
T-statistic is in parentheses below the coefficient.

included in the equation, unreasonable coefficients on the national wage variable were produced; hence, it was suppressed. In all cases, the coefficient on Pct(W) is close to 1, although it is significantly greater than 1 in the nonmetro South and West, and relative employment growth enters with a positive sign as we expected.

b. Other Labor Income

Regional other labor income, primarily employer contributions to private pension and insurance funds, is modeled as a share of the regional wage bill. Table 3.12 presents our equation estimates where the change in other labor income (Δ(OLIr)) is regressed on the change in wages (Δ(Wr)) with the constant term suppressed. The coefficient on wages is approximately 0.10 for all regions, indicating that other labor income adds an additional 10% of the wage bill to personal income. Because of the extensive noise in the other labor income series, the $\bar{R}^2$ was low for these equations, but the wage bill variable was highly significant.

c. Contributions to Social Insurance

Regional contributions to social insurance (SOCIr) are based on the regional wage bill (Wr) and the social security tax rate (SSRATE). While this component of income is nearly an identity, as contributions to social insurance are covered wages and salaries times the social security tax rate, we treat it as a stochastic equation because of measurement error. Note from Table 3.13 that the coefficients on the independent variable are in fact close to 1, but five of the constant terms are significantly different from zero.

d. Transfer Payments

Regional transfer payments (TRPr) are built up from a proxy for regional unemployment benefits (TUW · Wr/W) and national transfer payments other than unemployment compensation (TRO). The construction of the regional unemployment benefits variable is based on scaling national unemployment benefits to a regional magnitude by multiplying it by the ratio of regional to national wages. We do not scale TRO since it does not clearly depend on any endogenous regional variables. Table 3.14 presents our estimates of this set of equations.

TABLE 3.12

OTHER LABOR INCOME

Region	ΔWr	DW	$\bar{R}^2$
Metro			
North Central	0.13 (18.13)	0.39	.610
Northeast	0.12 (15.55)	0.91	.332
South	0.12 (27.39)	0.35	.724
West	0.11 (28.66)	0.36	.829
Non-metro			
North Central	0.10 (10.10)	1.61	.334
Northeast	0.12 (15.44)	0.85	.384
South	0.09 (10.09)	1.57	.177
West	0.07 (7.52)	1.54	.050

Dependent variable: Other Labor Income in Region r, one quarter change, (Δ(OLIr))

Independent variables: Wr -- Wage and Salary Disbursements in Region r, one quarter change

Period -- 1969:2 to 1978:4
T-statistic is in parentheses below the coefficient.

TABLE 3.13

CONTRIBUTIONS TO SOCIAL INSURANCE

Region	Co	Wr*SSRATE	DW	$\bar{R}^2$
Metro				
North Central	21.48 (0.27)	1.02 (97.89)	0.41	.994
Northeast	139.64 (2.02)	1.00 (97.73)	0.34	.994
South	230.48 (3.46)	1.02 (131.49)	0.88	.998
West	118.85 (3.50)	1.09 (175.10)	0.91	.998
Non-metro				
North Central	-66.1 (-1.18)	1.12 (59.56)	1.56	.985
Northeast	-64.88 (-2.37)	1.05 (107.46)	0.42	.995
South	117.4 (1.35)	1.06 (49.20)	1.85	.984
West	81.72 (2.17)	1.07 (52.97)	1.84	.981

Dependent variable: Contributions to Social Insurance in Region r, (SOCIr)

Independent variables: Wr -- Wage and Salary disbursements in Region r

SSRATE -- Social Security Tax Rate (exogenous)

Period -- 1965:1 to 1978:4
T-statistic is in parentheses under the coefficient.

TABLE 3.14

TRANSFER PAYMENTS

Region	Co	TRO	TUW . $\frac{Wr}{W}$	DW	$\bar{R}^2$
Metro					
North Central	499.43 (2.67)	147.51 (60.59)	998.01 (9.62)	1.73	.998
Northeast	1792.66 (16.67)	166.21 (122.97)	1170.85 (17.57)	0.22	.999
South	-2075.11 (-9.61)	182.69 (65.88)	720.18 (6.28)	1.83	.998
West	369.13 (1.99)	134.19 (56.03)	921.51 (6.67)	1.36	.998
Non-metro					
North Central	584.73 (3.01)	92.56 (37.01)	1084.21 (4.13)	2.02	.994
Northeast	361.96 (8.23)	79.56 (141.72)	1596.13 (24.59)	0.28	1.000
South	-1289.61 (-6.11)	137.82 (50.66)	1122.97 (4.70)	1.65	.997
West	-379.36 (-2.33)	60.68 (29.70)	416.61 (1.31)	1.94	.991

Dependent variable: Transfer Payments in Region r, (TRPr)

Independent variables:

TRO -- U.S. Total, Transfer Payments other than Unemployment Benefits

TUW -- U.S. Total, Unemployment Benefits

Wr -- Wage and Salary Disbursements in Region r

W -- U.S. Total, Wage and Salary Disbursements

Period -- 1969:1 to 1977:4
T-statistic is in parentheses below the coefficient.

e. Proprietor's Income

Regional proprietor's income (YPr) is modeled as a function of the sum of national fixed non-residential investment (IP) plus additions to non-farm inventories (IINF), with the sum scaled to the region by multiplying it by the ratio of regional to national personal income (PIZr/PIZ). Table 3.15 presents our estimates of this set of equations.

f. Property Income

Regional property income (YPTr) is assumed to depend upon the stock of total deposits in region (TOTDEPr) and regional interest rates. We use the regional loan-to-deposit ratio LDEPRr as a proxy for regional interest rates. Table 3.16 presents our estimates of this set of equations.

g. Residence Adjustment

We assumed that the ratio of personal income by place of residence (PIZr) to personal income by place of work (PIWr) is a linear function of time (TIME) -- the ratio is allowed to drift upward or downward over time:

$$\frac{PIZr}{PIWr} = Co + C_1 \cdot TIME$$

The equation was estimated for the four total regions to capture interregional differences between income by place of work and place of residence. It was also estimated for the four metro regions to capture within region differences. The residence adjustments for the total region and the metro subregions implied by the estimated equations shown in Table 3.17 are:

$$ADJr = (Co + C_1 \cdot TIME - 1) \cdot PIWr$$

Since the rural residence adjustment is the difference between the total region adjustment and the metro adjustment, it was computed as an identity:

$$ADJr = ADJr^{adjT} - ADJr^{adjM}$$

where r refers to one of the four rural regions and the superscripts adjT and adjM refer to the adjoining total and metro regions, respectively.

TABLE 3.15

PROPRIETORS INCOME

Region	Co	((IINF+IP)*PIP)*(PIZr/PIZ)	DW	$\bar{R}^2$
Metro				
North Central	4737.75 (15.78)	2.37 (24.20)	0.39	.942
Northeast	5600.19 (22.57)	1.61 (17.67)	0.38	.896
South	4868.11 (16.10)	2.69 (27.00)	0.25	.953
West	1670.95 (5.93)	4.30 (35.30)	0.23	.972
Non-metro				
North Central	7163.00 (4.34)	4.83 (4.83)	0.44	.383
Northeast	3233.31 (30.99)	1.84 (24.36)	0.62	.943
South	5893.97 (7.98)	4.09 (9.58)	0.42	.716
West	2413.63 (5.44)	4.95 (9.60)	0.50	.717

Dependent variable: Proprietor's Income in Region r, (YPr), in 1972 dollars

Independent variables: (in a four quarter linear distributed lag)

IINF -- Investment in Inventories, in 1972 dollars

IP -- Investment in Plant and Equipment, in 1972 dollars

PIP -- Implicit Deflator, Investment in Plant and Equipment

PIZr -- Personal Income in Region r in Current Dollars

PIZ -- U.S. Total, Personal Income in Current Dollars

Period -- 1969:4 to 1978:4
T-statistic is in parentheses under the coefficient.

TABLE 3.16

PROPERTY INCOME

Region	Co	TOTDEPr	LDEPRr	DW	$\bar{R}^2$
Metro					
North Central	-13257.10	0.14	25603.6	0.42	.991
	(-6.15)	(39.07)	(6.76)		
Northeast	-32078.9	0.15	28737.2	0.72	.991
	(-6.90)	(30.22)	(5.60)		
South	-12274.9	0.17	23265.8	0.65	.996
	(-6.14)	(63.51)	(6.67)		
West	-1104.59	0.15	1715.97	0.27	.990
	(-0.30)	(43.16)	(0.33)		
Non-metro					
North Central	-5284.28	0.19	18309.5	0.76	.975
	(-5.89)	(20.08)	(13.26)		
Northeast	-13349.70	0.75	20603.80	0.38	.972
	(-7.18)	(24.26)	(6.16)		
South	-8903.42	0.25	21572.40	0.60	.969
	(-7.52)	(17.52)	(8.83)		
West	-5217.29	0.54	12160.70	1.02	.947
	(-5.58)	(11.07)	(6.34)		

Dependent variable: Property Income in Region r, (YPTr)

Independent variables:

TOTDEPr -- Total Deposits in Region r, four quarter distributed lag

LDEPRr -- Total Loan-Deposit Ratio in Region r

Period -- 1973:4 to 1978:4
T-statistic is in parentheses under the coefficient.

TABLE 3.17

RESIDENCE ADJUSTMENT

Region	Co	Time	DW	$\bar{R}^2$
Total				
North Central	0.99919 (4E+04)	2.01E-05 (21.70)	0.59	.914
Northeast	1.00005 (7E+04)	6.23E-06 (11.33)	0.33	.743
South	1.00037 (1E+04)	-1.74E-05 (-5.50)	0.18	.400
West	0.99938 (8E+03)	-1.21E-05 (-2.46)	0.12	.103
Metro				
North Central	0.98695 (9E+03)	-3.36E-05 (-7.54)	0.09	.589
Northeast	0.95592 (5E+05)	1.26E-04 (14.41)	0.17	.841
South	0.98645 (5E+03)	-3.76E-05 (-4.68)	0.09	.349
West	0.99590 (4E+03)	1.14E-05 (1.14)	0.10	.008

Dependent variable: Personal Income by Residence in Region r over Personal Income by Place of Work in Region r, (PIZr/PIWr)

Independent variable: Time Trend

Period -- 1969:1 to 1978:4
T-statistic is in parentheses under the coefficient.

3.3.3 Housing Starts

The regional housing sector is sensitive to fluctuations in monetary variables. We measure activity by regional housing starts (HSr).

Using a stock adjustment approach, housing starts in a region should increase when the gap between the desired and existing stocks of housing widens. The existing housing stock in a region (KSr) is computed by adding gross housing starts to the last period's housing stock. The desired stock of housing, however, is not observable and must be modeled. Our final specification uses real regional personal income (PIr) and the real flow of new mortgages as the determinants of the desired housing stock. New mortgage flows, defined as the change in the stock of mortgages, held by commercial banks and by thrift institutions for both the region (MORr/PIH) and the adjoining region ($MORr^{adj}/PIH$) were included. We included both mortgage flows to test whether mortgages for an overall region -- both metropolitan and rural -- moved freely within the region.

Our estimated equations are presented in Table 3.18. Except for the rural North Central and rural West, the coefficients on personal income are positive as expected. In five of the eight equations, the coefficient on the lagged housing stock variable -- theoretically equal to the negative of the speed of adjustment coefficient -- is negative and of reasonable magnitude. (A coefficient of -.2, as in the metropolitan West, implies that 20 percent of the gap between the desired and actual housing stocks is filled in the period by new housing investment.) The coefficients on the mortgage flow variables were mostly insignificant -- one of the most disturbing results of our investigation. The results indicate that rural housing starts tend to be associated with nearby urban mortgages. Other specifications were tried in order to capture monetary effects on regional housing starts, but we were unable to locate one that dominated the admittedly weak specification presented here. As we stress in the conclusion to this report, a re-examination of the regional housing sector should be given high priority in future development efforts.

3.4 THE REAL NATIONAL ECONOMY

The last major block of the model includes equations explaining several national non-financial variables including the components of aggregate demand, wages and prices, industrial production, manufacturing employment, and the labor force. This block pro-

TABLE 3.18

HOUSING STARTS

Region	Co	PIr	$\Delta \frac{MORr}{PIH}$	$\Delta \frac{MORr^{adj}}{PIH}$	KSr(-1)	DW	$\bar{R}^2$
Metro							
North Central	529.8	.2105	.92	-2.34	-0.07	1.55	.788
	(7.37)	(5.81)	(3.75)	(-3.23)	(-3.03)		
Northeast	1098.76	.2446	-0.03	-.201	-.113	1.62	.724
	(3.32	(5.04)	(-0.31)	(-0.64)	-3.77		
South	1248.47	.719	.268	1.35	0.196	0.92	.813
	(4.57)	(7.35)	(.98)	(-2.73)	(5.55)		
West	931.44	.980	.364	.835	-.21	1.42	.901
	(6.40)	(9.48)	(2.01)	(0.72)	(-7.78)		
Non-metro							
North Central	-237.62	-3.7E-03	-0.66	.247	.042	0.76	.468
	(-3.08)	(-0.09)	(-1.36)	(1.50)	(2.52)		
Northeast	162.89	.098	-.21	4.75E-04	-.072	1.69	.632
	(2.33)	(3.28)	(-1.78)	(0.01)	(-2.61)		
South	1292.17	.3220	-.754	0.23	-.166	0.84	.674
	(2.12)	(3.90)	(-3.13)	(1.28)	(-2.28)		
West	-125.29	-.0231	0.327	0.086	0.059	0.90	.816
	(-1.21)	(-0.18)	(1.05)	(1.67)	(0.91)		

Dependent variable: Housing Starts in Region r

Independent variables:

PIr -- Personal Income in Region r, four quarter distributed lag, in 1972 dollars

PIH -- Implicit Deflator, Residential

KSr -- Housing Stock in Region r

MORr -- Total mortgages at Commercial Banks and Thrift Institutions in Region r, one quarter change

$MORr^{adj}$ -- Total Mortgages at Commercial Banks and Thrift Institutions in Region adjoining Region r, one quarter change

Period -- 1973:2 to 1978:4
T-statistic is in parentheses under the coefficient.

vides many indirect paths for the effects of Federal policies to be felt at the regional level. Figure 3.6 shows the major relationships within the block, as well as with the rest of the model. The variables here are national because there is no data for them for the metro-nonmetro breakdown used in the model.

3.4.1 The Components of Aggregate Demand

Aggregate demand is the sum of consumption (durables, non-durables, and services), investment (non-residential fixed business, residential structures, and additions to inventories), government expenditures, and net exports. The six components of consumption and investment are endogenous to the model while government spending and net exports are exogenous.

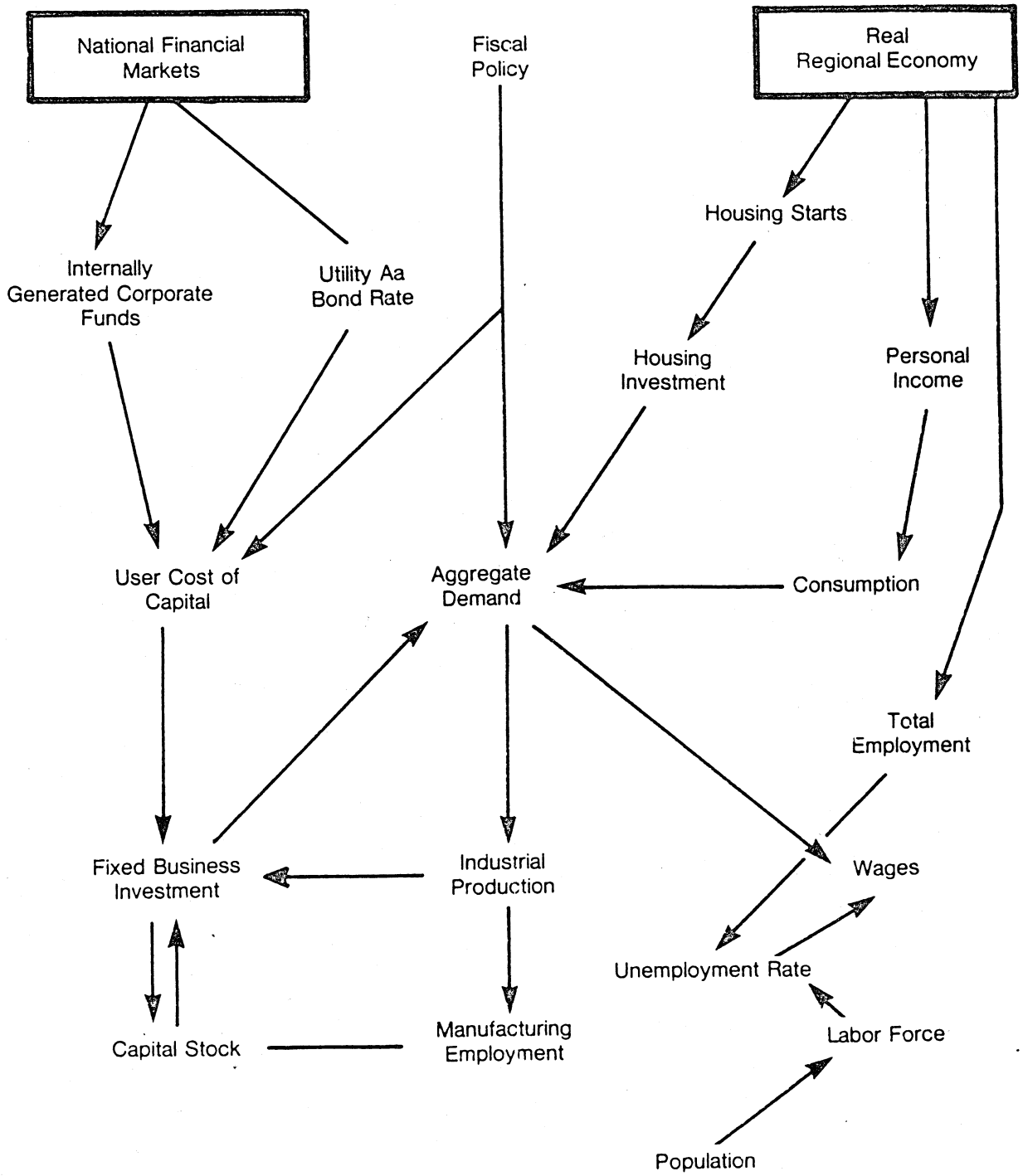
a. Consumption

Real consumption demand is divided into its three major components: durables (CD), non-durables (CO), and services (CS). In all three, the primary determinant is real disposable income (DIZ/PC) entered as a six-quarter distributed lag. For durables and non-durables, the relative price comes in negatively indicating that some substitution away from these components occurs when they become more expensive. For services, the relative price did not enter negatively and so has not been included. The estimated equations are:

$$\begin{aligned} CD = {} & 105.19 - 369.1\,(PCD/PC) \\ & \quad (.96) \quad (-3.46) \\ & + .0004\,(DIZ/PC) + .0061\,(DIZ(-1)/PC(-1)) \\ & \quad (.15) \qquad\qquad (5.82) \\ & + .0094\,(DIZ(-2)/PC(-2)) + .0195\,(DIZ(-3)/PC(-3)) \\ & \quad (11.67) \qquad\qquad (7.63) \\ & + .0093\,(DIZ(-4)/PC(-4)) + .0058\,(DIZ(-5)/PC(-5)) \\ & \quad (6.24) \qquad\qquad (5.60) \end{aligned}$$

$\bar{R}^2 = .954 \quad DW = 2.05$

Figure 3.6
Real National Economy*



*For simplicity, prices have been suppressed.

The numbers in parentheses are t-ratios. The sample period is 1974:2 to 1977:4.

$$CO = \underset{(5.83)}{771.7} - \underset{(-6.62)}{594.2}\,(PCO/PC)$$

$$+ \underset{(2.53)}{.004}\,(DIZ/PC) + \underset{(4.57)}{.004}\,(DIZ(-1)/PC(-1))$$

$$+ \underset{(3.64)}{.004}\,(DIZ(-2)/PC(-2)) + \underset{(2.65)}{.003}\,(DIZ(-3)/PC(-3))$$

$$+ \underset{(2.15)}{.003}\,(DIZ(-4)/PC(-4)) + \underset{(1.86)}{.001}\,(DIZ(-5)/PC(-5))$$

$\bar{R}^2 = .988$ DW = 1.95

The numbers in parentheses are t-ratios. The sample period is 1974:2 to 1977:4.

$$CS = \underset{(-4.02)}{-170.39} + \underset{(2.62)}{.01}\,(DIZ/PC)$$

$$+ \underset{(8.04)}{.01}\,(DIZ(-1)/PC(-1)) + \underset{(9.81)}{.01}\,(DIZ(-2)/PC(-2))$$

$$+ \underset{(5.16)}{.01}\,(DIZ(-3)/PC(-3)) + \underset{(3.73)}{.01}\,(DIZ(-4)/PC(-4))$$

$$+ \underset{(3.07)}{.01}\,(DIZ(-5)/PC(-5))$$

$\bar{R}^2 = .935$ DW = .50

The numbers in parentheses are t-ratios. The sample period is 1974:2 to 1977:4.

b. Investment

Real investment demand is broken down into three categories: residential, industrial plant and equipment, and inventories. Residential investment (IH) is a function of housing starts (HS), the relative price of housing (PIH/PGNP), and real personal income (PI). The weights on the housing starts variable are the standard census bureau conversion from starts to value put in place taking into account the mix of single- and multi-family units. Real personal income (PI) is included to account for investment in housing other than new construction, such as any non-permit regulated improvements. The national housing starts variable is constructed by summing housing starts for each region. The estimated equation is:

$$IH = \underset{(.18)}{-1.3} + \underset{(21.36)}{.07}\,(.25 * HS + .4 * HS(-1) + .35 * HS(-2))$$

$$\underset{(-2.39)}{-66.59}\,(PIH/PGNP) + \underset{(3.54)}{.01}\,(PI)$$

$\bar{R}^2 = .965 \quad DW = .99$

The numbers in parentheses are t-ratios. The sample period is 1972:3 to 1978:4.

Real fixed business investment (IP) is based on final demand, cyclical variables and the cost of capital. Final demand, as measured by the sum of durable and non-durable consumption (CD + CO), enters positively because an increase in current consumption is assumed to increase expected future consumption and the consequent need to expand productive capacity to meet the new demand. The unemployment rate (UN) and a measure of capacity utilization ($\frac{XIPM*100}{K}$) have been included to capture any cyclicality in investment demand. The cost of capital (KCOST) enters negatively, as expected. The cost of capital is an identity in the model and is a weighted average of the capital costs for structures (QS) and equipment (QE), the weights being the average relative size of the two components of fixed investment over the estimation period. The cost of each component is positively related to the relative price of fixed investment (PIP/PWIIND) and the utility Aa bond rate (RAAU). The federal corporate profits tax rate (TXRCF), the investment tax credit (DITC), and depreciation factors for equipment (ZE) and

structures (ZS) are also incorporated into the costs of the two types of capital. The estimated equation is:

$$IP = -16.98 - \underset{(4.38)}{3.76}\,(UN) + \underset{(16.68)}{.05}\,(CD(-1) + CO(-1)) + \underset{(1.81)}{.12}\,(CD(-2) + CO(-2)) + \underset{(92.98)}{.13}(CD(-3) + CO(-3)) + \underset{(8.82)}{.09}\,(CD(-4) + CO(-4)) + \underset{(6.26)}{.56}\,(XIPM(-2)*100/K(-2)) - \underset{(2.53)}{32.12}\,(KCOST)$$
$$(-3.18)$$

$\bar{R}^2 = .996 \quad DW = .66$

The numbers in parentheses are t-ratios. The sample period is 1955:4 to 1980:3.

The principal independent variables for investment (IINF) in inventories are capacity utilization (XIPM · 100/K), which positively affects inventory accumulation and consumption with a negative sign in the present period, representing unexpected changes in inventories, and a positive sign in lagged form, representing planned inventory accumulation. The remaining two terms are the national loan deposit ratio, which enters negatively, representing national credit availability, and a price expectations variable. The price term represents the desire of businesses to hold excess inventories when inflation is accelerating and unload them when it is decelerating. The estimated equation is:

$$IINF = -71.61 + \underset{(-4.27)}{.28}\,(PCT(PWIIND) - PCT(PWIIND(-2))) + \underset{(.67)}{6.04}\,(XIPM*100/K) - \underset{(7.29)}{138.17}\,(CI/(SDEP+DDEP+TDEP))$$
$$(-4.03)$$

$$+ .29\,(CD(-1) + CO(-1)) - .26\,(CD+CO)$$
$$(2.58) \qquad\qquad (-2.37)$$

$\bar{R}^2 = .686 \quad DW = 2.05$

The numbers in parentheses are t-ratios. The sample period is 1969:1 to 1979:4.

3.4.2 Wages and Prices

We intended to estimate a standard wage equation in this model where the percentage change in the national wage rate was a function of the unemployment rate and a distributed lag on the rate of price inflation. Our measure of the national wage rate, the sum of regional wages divided by the sum of regional employment totals, proved to have too much random noise and resulted in an unreasonable estimated equation. As a consequence, we have simply estimated a national wage bill equation with real gross national product (GNP), the GNP price deflator (PGNP), and the unemployment rate as explanatory variables. Our estimated equation is:

$$W = \underset{(-17.29)}{467870.0} + \underset{(25.79)}{7803.65\,PGNP(-1)} + \underset{(7.77)}{322.18\,GNP} - \underset{(-6.29)}{10540.7\,UN}$$

$\bar{R}^2 = .998 \quad DW = .62$

The numbers in parentheses are t-ratios. The sample period is 1969:1 to 1977:4.

a. Consumer Expenditure Deflators

The deflators for consumer expenditures, all estimated in percent change form, run primarily off of the national rate of change of the wage rate (WR), or unit labor costs (W/GNP). The coefficient on this should be approximately .7 which is labor's share of value-added. Other key component prices are introduced to reflect special factors in the individual sectors. The equation for the durables price deflator (PCD) includes the wholesale price index for industrial commodities. The deflator for non-durables (PCO) is determined by the producer wholesale price index for food (PWIF) and for petroleum products (PWI29), as well as unit labor costs. These two special price variables are exogenous to the model. Finally, the equation for the price deflator for services (PCS) includes the deflator for residen-

tial investment (PIH) to account for changes in the costs of housing services, and the wholesale price index for petroleum products (PWI29) to account for changes in the price of transportation services. Our estimated equations are:

$$\begin{array}{lll} \text{PCT(PCD)} = -.5 + .34\ \text{PCT(PWIIND(-1))} + .52\ \text{PCT(WR)} \\ \qquad\quad (-1.25)\ \ (6.49) \qquad\qquad\qquad\quad (2.19) \end{array}$$

$\bar{R}^2 = .634 \quad DW = 1.07$

The numbers in parentheses are t-ratios. The sample period is 1969:2 to 1977:4.

$$\begin{array}{lll} \text{PCT(PCO)} = .35 + .1\ \text{PCT(PWI29)} + .06\ \text{(PWIF)} \\ \qquad\quad (1.68)\ \ (6.85) \qquad\qquad\quad (3.20) \\ \qquad\qquad + .48\ \text{PCT(W/GNP)} \\ \qquad\qquad\ \ (3.17) \end{array}$$

$\bar{R}^2 = .784 \quad DW = 2.17$

The numbers in parentheses are t-ratios. The sample period is 1970:1 to 1977:4.

$$\begin{array}{lll} \text{PCT(PCS)} = -.06 + .83\ \text{PCT(WR)} + .03\ \text{PCT(PWI29)} \\ \qquad\quad (-.13)\ \ (2.74) \qquad\qquad\quad (2.90) \\ \qquad\qquad + .08\ \text{PCT(PIH)} \\ \qquad\qquad\ \ (1.57) \end{array}$$

$\bar{R}^2 = .460 \quad DW = .96$

The numbers in parentheses are t-ratios. The sample period is 1970:1 to 1977:4.

b. GNP Deflator

The GNP deflator (PGNP) is estimated in percentage change form as a function of the percentage change of its components that are endogenous to the model: the consumption deflators for durables (PCD), services (PCS), and other

non-durables (PCO), and the deflators for residential (PIH) and industrial investment (PIP). The estimated equation is:

$$\begin{aligned} PCT(PGNP) = {} & .16 + .33\ PCT(PCO) + .15\ PCT(PCD) \\ & (3.21)\ (9.99) \qquad\qquad (6.14) \\ & + .11\ PCT(PCS) + .10\ PCT(PIH) \\ & (1.88) \qquad\qquad (4.10) \\ & + .17\ PCT(PIP) \\ & (5.30) \end{aligned}$$

$\bar{R}^2 = .889 \quad DW = 1.77$

The numbers in parentheses are t-ratios. The sample period is 1948:2 to 1980:3.

c. Investment Deflators

Two implicit deflators for investment are estimated: residential (PIH) and fixed industrial (PIP). As with the consumption deflators, deflators run primarily off of unit labor costs and the producer price index for industrial production (PWIIND). The residential investment price equation also includes the percent change in construction employment (COEM). The industrial production price index covers changes in the costs of materials, and the percent change in employment is an excess demand variable. The estimated equations are:

$$\begin{aligned} PCT(PIH) = {} & .74 + .54\ PCT(W/GNP) + .17\ PCT(COEM) \\ & (2.42)\ (2.65) \qquad\qquad (3.14) \\ & + .19\ PCT(PWIIND(-1)) \\ & (1.73) \end{aligned}$$

$\bar{R}^2 = .427 \quad DW = 1.64$

The numbers in parentheses are t-ratios. The sample period is 1969:2 to 1977:4.

$$\text{PCT(PIP)} = .15 + .58\ \text{PCT(W/GNP)} + .38\ \text{PCT(PWIIND(-1))}$$
$$(.67)\quad (2.54)\qquad\qquad (5.08)$$

$\bar{R}^2 = .819$ DW = .73

The numbers in parentheses are t-ratios. The sample period is 1970:1 to 1977:4.

d. Industrial Production, Wholesale Price Index

Unit labor costs (W/GNP) and the price of petroleum products (PWI29) are the determinants of the producer price index (PWIIND). The estimated equation is:

$$\text{PCT(PWIIND)} = .12 + .4\ \text{PCT(W/GNP)} + .12\ \text{PCT(PWI29)}$$
$$(.56)\quad (3.10)\qquad\qquad (6.14)$$

$$+ .15\ \text{PCT(PWI29(-1))} + .22\ \text{PCT(W(-1)/GNP(-1))}$$
$$(7.06)\qquad\qquad (1.78)$$

$\bar{R}^2 = .921$ DW = 1.85

The numbers in parentheses are t-ratios. The sample period is 1969:3 to 1977:4.

3.4.3 Industrial Production and Manufacturing Employment

The index of national industrial production (XIPM) is a positive function of real output used by all sectors of the national aggregate demand. To allow for varying effects, we entered the demand components separately. The estimated equation is:

$$\text{XIPM} = -9.58 + .23\ \text{CD} + .03\ (\text{CO+CS}) + .4\ \text{IP}$$
$$(-8.19)\quad (6.47)\qquad (2.56)\qquad\qquad (13.60)$$

$$+ .13\ \text{IH} + .11\ \text{G} + .03\ \text{NEX} + .12\ \text{IINF(-1)}$$
$$(3.32)\qquad (9.51)\qquad (.99)\qquad\qquad (4.36)$$

$\bar{R}^2 = .998$ DW = 1.22

The numbers in parentheses are t-ratios. The sample period is 1948:2 to 1980:3.

National manufacturing employment (MFEM) is modeled using a labor requirements approach. The explanatory variables are output measured by the index of industrial production (XIPM), the stock of capital (K), and a time trend (t). The capital stock variable is computed in an identity where this period's capital stock equals last period's capital stock plus this period's net fixed business investment. An increase in production should result in an increase in employment, while an increase in the capital stock, holding output fixed, should result in a decrease in employment if capital and labor are substitutes. The time trend variable captures productivity growth. Higher productivity implies that less employment is required to produce a given level of output. Our estimated equation is:

$$\log(\text{MFEM}) = \underset{(10.12)}{9.36} + \underset{(19.45)}{0.75^{*}} \log(\text{XIPM}) - \underset{(-3.12)}{0.47} \log K - \underset{(-1.26)}{0.002} \cdot t$$

$\bar{R}^2 = .918$ DW = .33

The sample period is 1969:1 to 1977:4. The numbers in parentheses are t-ratios.

3.4.4 Labor Force

We have modeled the national labor force (LF) as a function of the total population of the U.S. (PT) and the share of population of working age -- age 18 through age 64 -- ($\frac{P64+P44}{PT}$). The estimated equation is:

$$LF = \underset{(-4.64)}{-83875.4} + \underset{(10.76)}{.51}\, PT + \underset{(6.30)}{103176}\,(P64+P44)/PT)$$

$\bar{R}^2 = .999$ DW = 1.76

---

* sum of four-quarter distributed lag

The numbers in parentheses are t-ratios. The sample period is 1950:1 to 1980:2.

The unemployment rate (UN) is computed as an identity:

$$UN = (1 - (EM/LF)) \cdot 100$$

where EM is the sum of employment totals at the regional level.

4. POLICY SIMULATIONS

This chapter presents an analysis of the regional effects of three alternative monetary policies. While we only discuss three policies, the model is capable of analyzing other types of policy changes -- fiscal policies as well as monetary policies.

A brief discussion of the methods of policy simulation is first in order. There are two types of simulations, within-sample and out-of-sample. Within-sample simulations produce timepaths of the endogenous variables (explained by the model) for some or all of the time period over which the model was estimated. If the actual values of the variables exogenous to the model are used for the within-sample simulation, then a comparison of the simulated and actual values of the endogenous variables is one means of evaluating the reliability of the model. This particular simulation is referred to below as the baseline. An out-of-sample simulation produces timepaths of the endogenous variables over a period of time not used in the estimation of the model, typically a forecast into the future. This type of simulation requires a forecast of all of the model's exogenous variables. The simulations discussed in this chapter are all within-sample. We did not produce out-of-sample simulations because the recent change in banking regulations almost certainly will result in changes in the structure of the regional financial equations in the model.

A key to using an econometric model for policy analysis is a clear statement of the policy questions. How much and in what direction will a given policy change affect a set of variables explained by the model? Note that the answer requires two simulations. First, a baseline simulation is run using the historical values of the policy variable (and all other exogenous variables). Second, an alternative simulation is run using the new values of the policy variable (the new value equals the historical value plus the policy change), holding the exogenous variables at their historical values. Comparing the second simulation with the baseline estimates the effect of the policy change. It should be noted that multi-equation econometric models are normally used to produce point estimates of the effects of a policy change. If the coefficients in the model are un-

biased, then these estimates are unbiased. In principle, the models could also be used to produce confidence interval estimates for the policy effects. This is costly, however, especially for large models, and is rarely done. We have produced point estimates for the simulations presented below.

Two specific policy questions were addressed using our model. First, over the period 1974:3 to 1977:4 -- a portion of the period over which the model was estimated -- what would have been the regional effects of a general tightening of monetary policy. More specifically, would some regions of the country have suffered more than others, and would rural areas suffer relatively more or less than metropolitan areas? There are two simulations of this question -- one a permanent change and the other a temporary change. Second, what would have been the regional effects of a general expansion of the rural credit system assuming the overall monetary policy unchanged?

4.1. THE OVERALL RELIABILITY OF THE MODEL

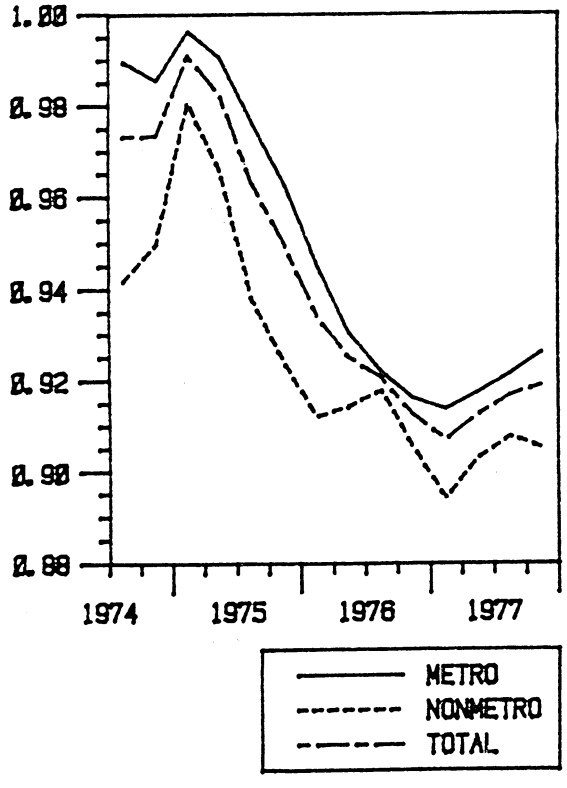
The validity of the policy simulations depends on the overall reliability of the model. Figures 4.1 through 4.5 plot the baseline values relative to the historical values of the key variables -- personal income, employment, total deposits, and the loan deposit ratio -- for the US as a whole and for each region. In the simulations discussed below we use the historical values of the federal funds rate to produce the baseline. This procedure is used in this validation exercise as well.

Figure 4.1 illustrates that the model underpredicts real personal income, employment, and total deposits, and overpredicts the loan deposit ratio for the US as a whole. For personal income, the underprediction is slightly larger for rural areas than for metropolitan areas. Underprediction is about the same for the two types of areas for employment and total deposits. The loan deposit ratio is significantly overpredicted for metropolitan areas, but almost correct for rural areas. Since the US totals are the sum of the regional totals, it is necessary to examine the individual regions to uncover the reasons for the misses.

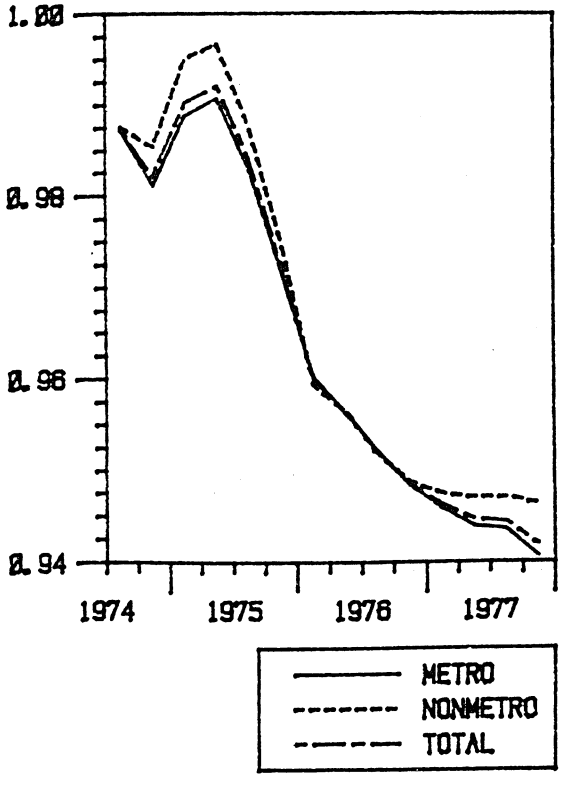
The largest prediction errors occur in the West, where by the fourth quarter of 1977 real personal income, employment, and total deposits are all underpredicted by over 20 percent (Figure 4.5). Notice especially the underprediction in the metropolitan area of the West. The loan deposit ratio in the metropolitan West is overpredicted by 60 percent by 1977:4.

FIGURE 4.1 US Total
Baseline Simulation

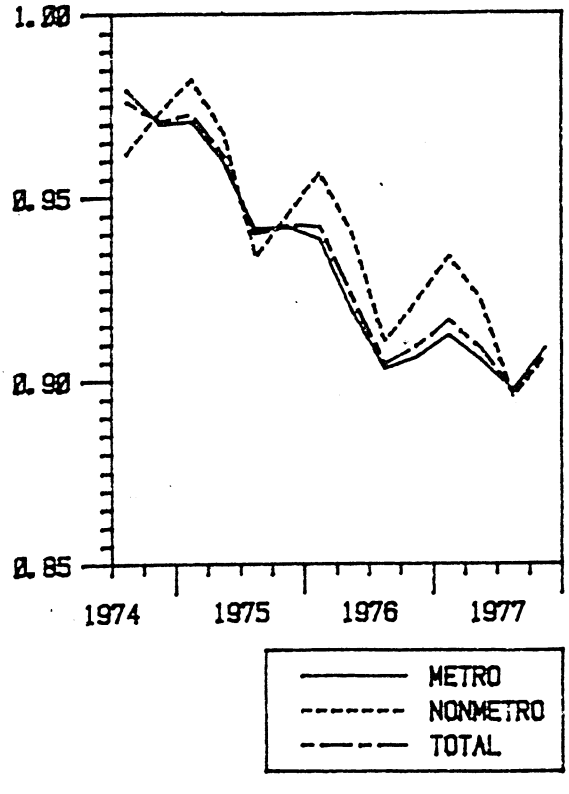
Personal Income, Relative to Historical



Employment, Relative to Historical



Total Deposits, Relative to Historical



Loan Deposit Ratio, Relative to Historical

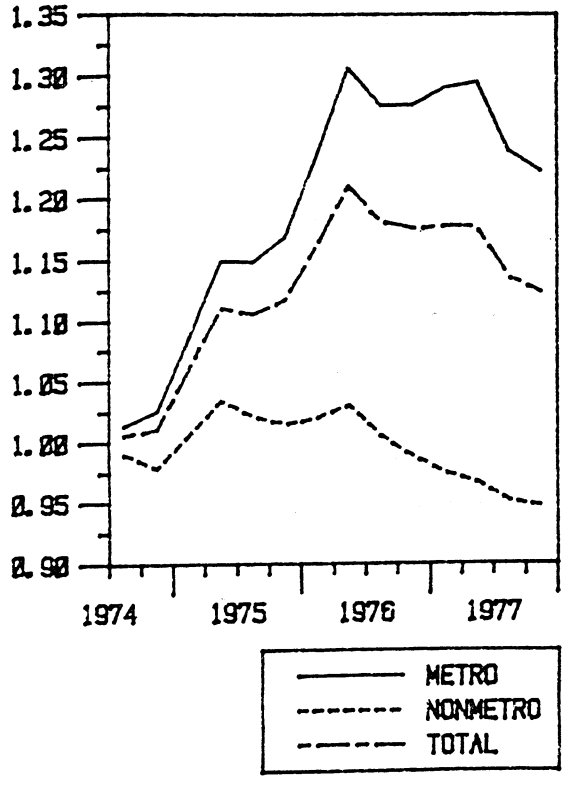
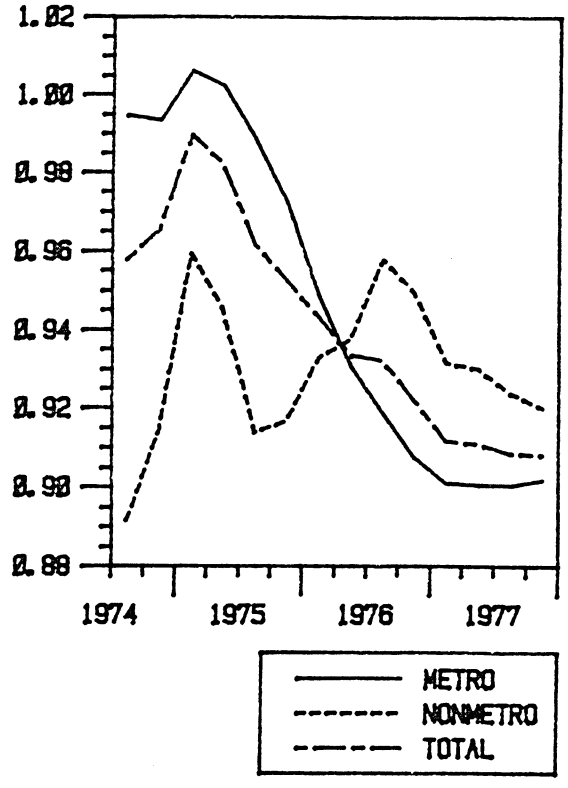
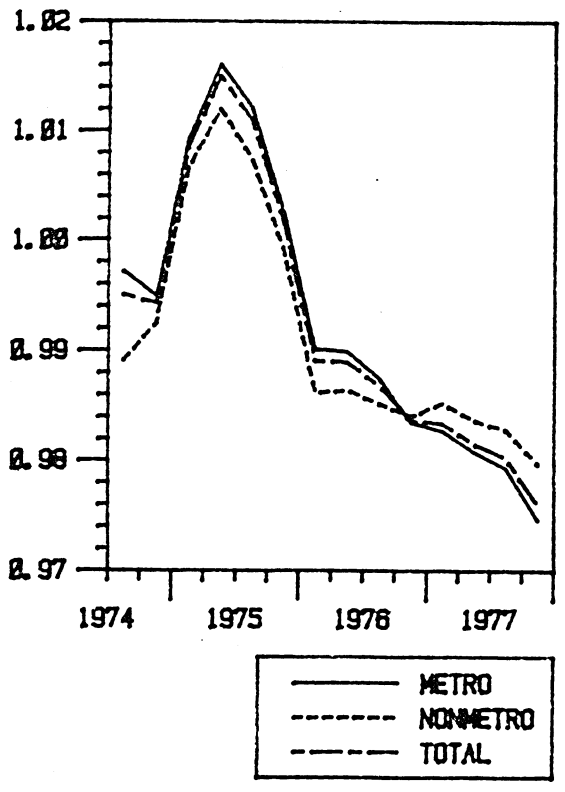


FIGURE 4.2 North Central
Baseline Simulation

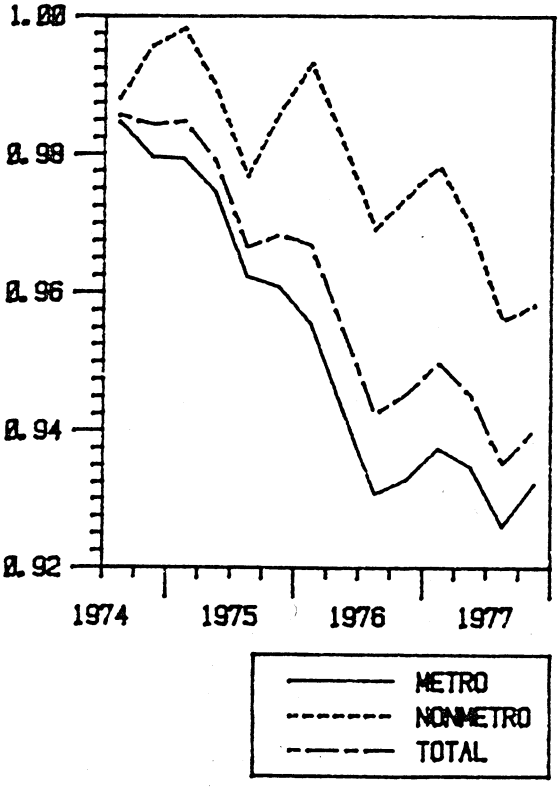
Personal Income, Relative to Historical



Employment, Relative to Historical



Total Deposits, Relative to Historical



Loan Deposit Ratio, Relative to Historic

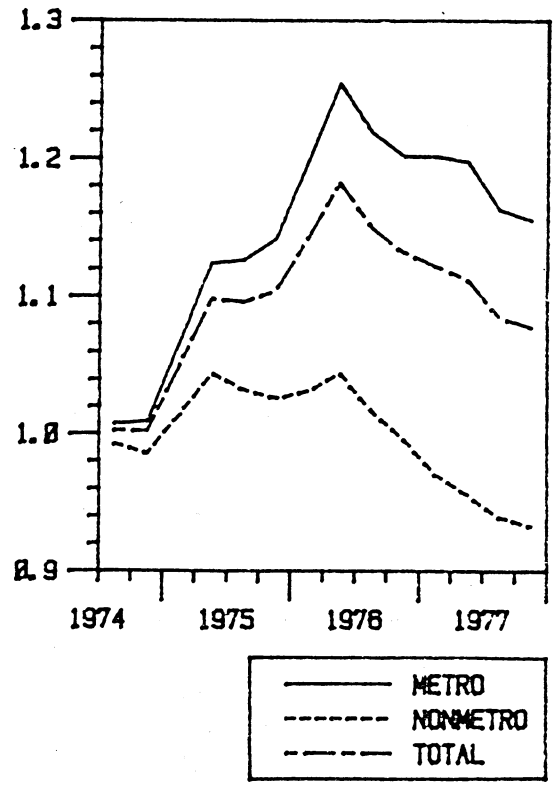
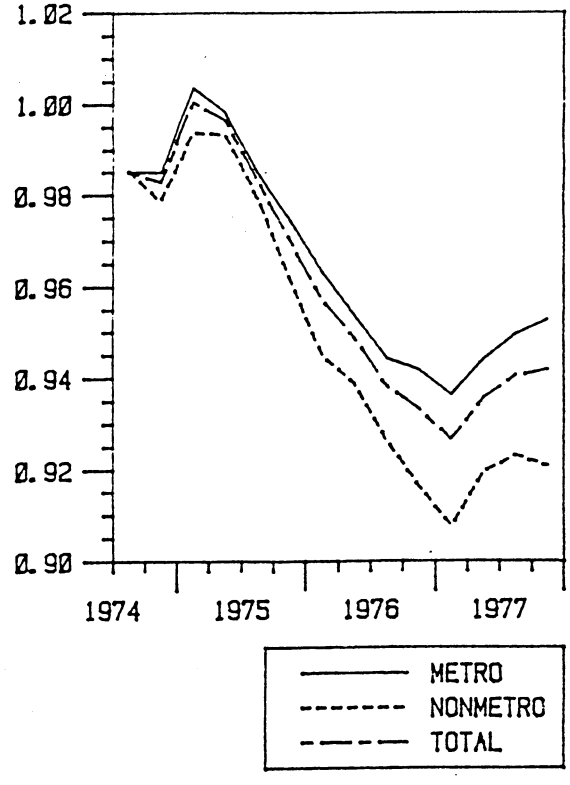
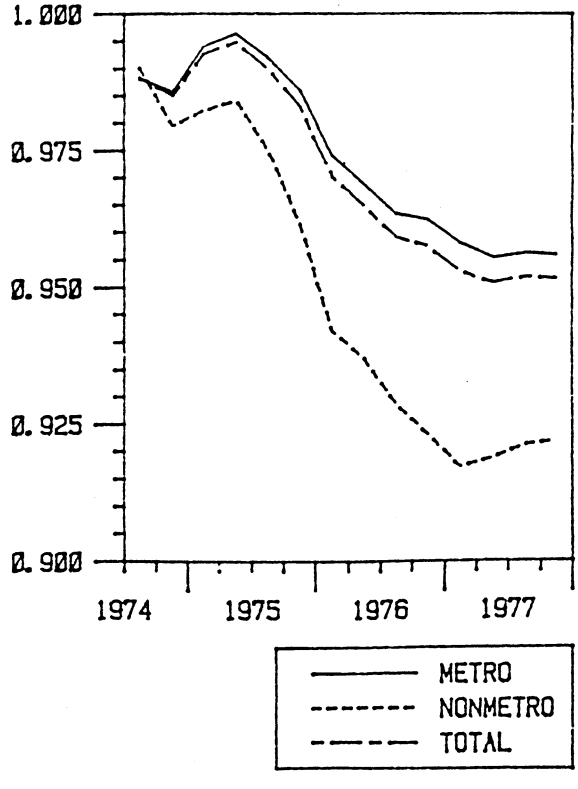


FIGURE 4.3 Northeast
Baseline Simulation

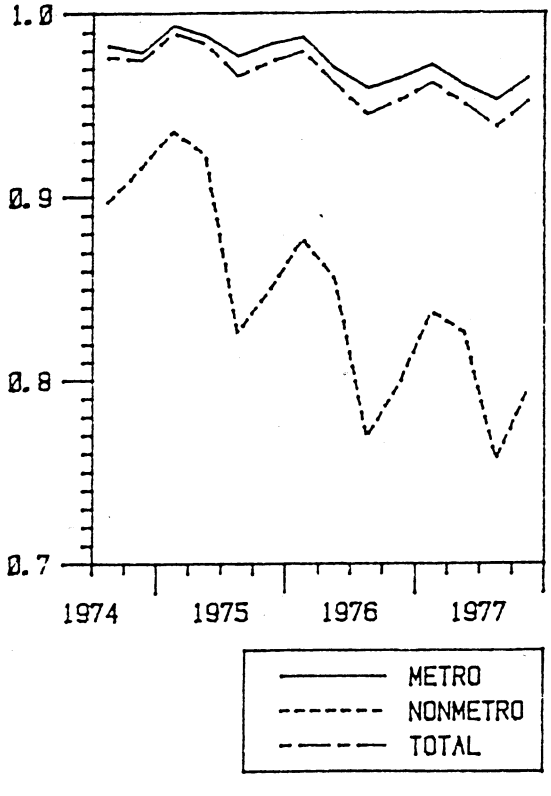
Personal Income, Relative to Historical



Employment, Relative to Historical



Total Deposits, Relative to Historical



Loan Deposit Ratio, Relative to Historical

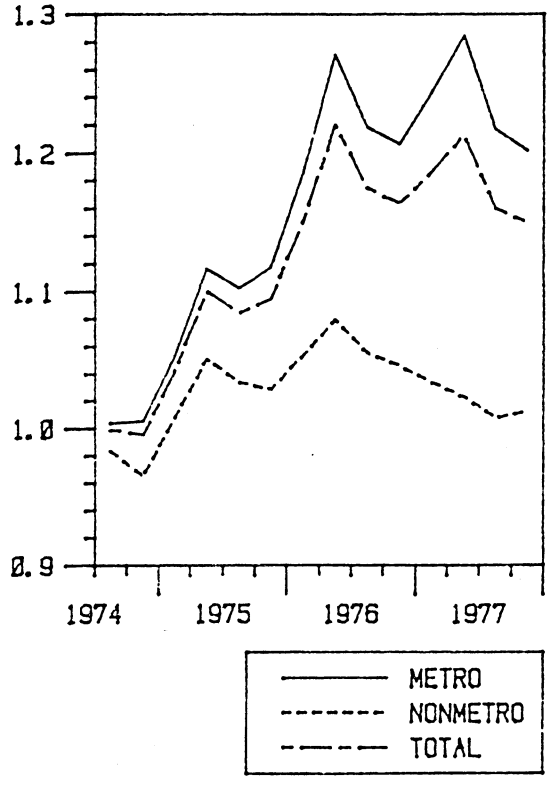
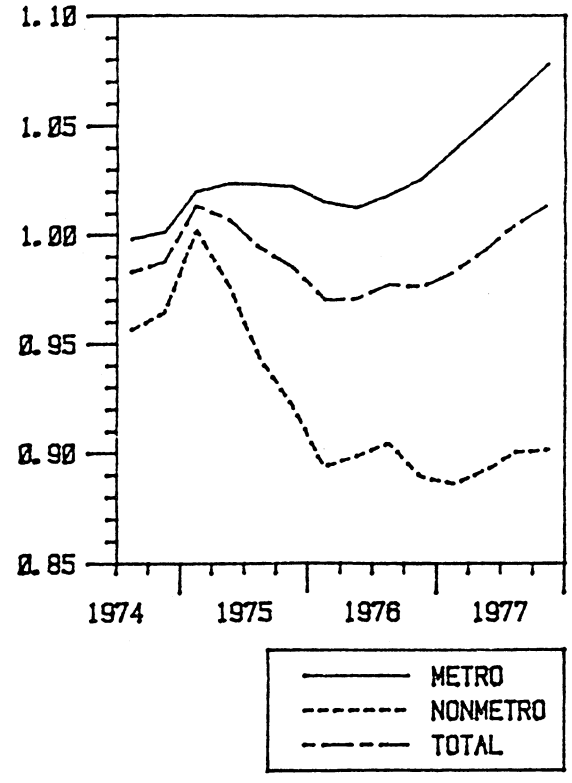
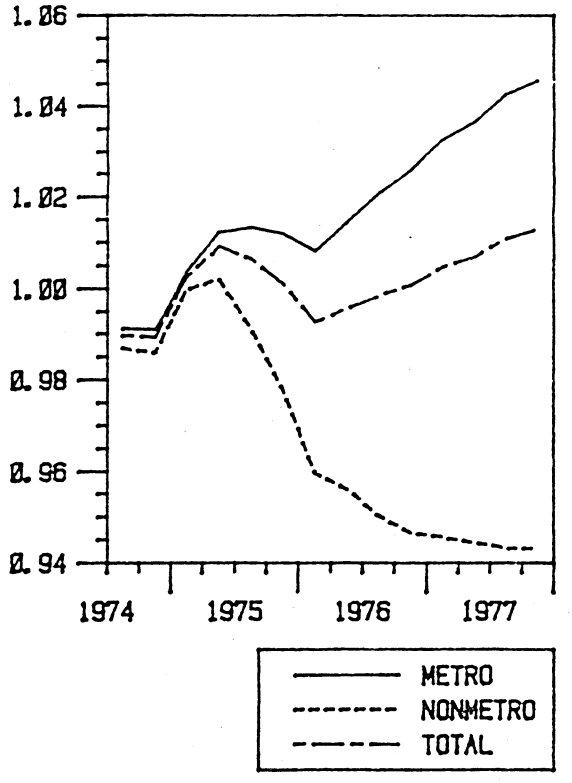


FIGURE 4.4 South
Baseline Simulation

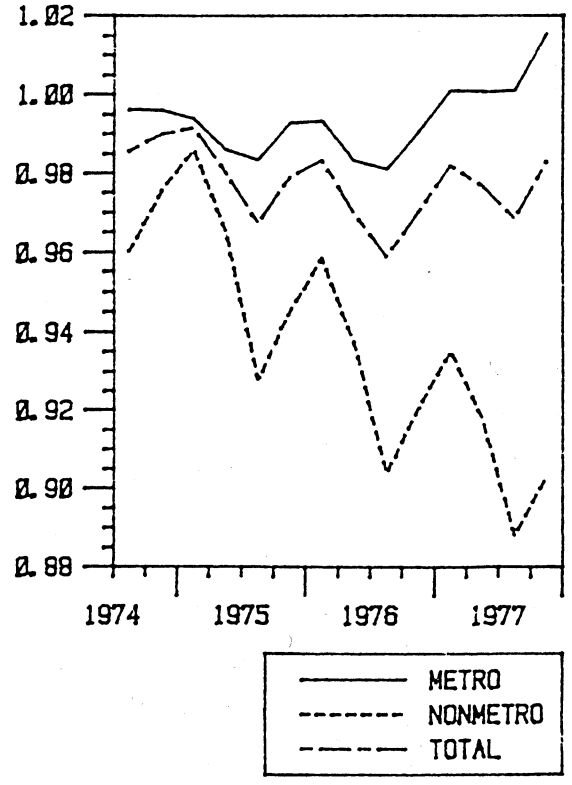
Personal Income, Relative to Historical



Employment, Relative to Historical



Total Deposits, Relative to Historical



Loan Deposit Ratio, Relative to Historical

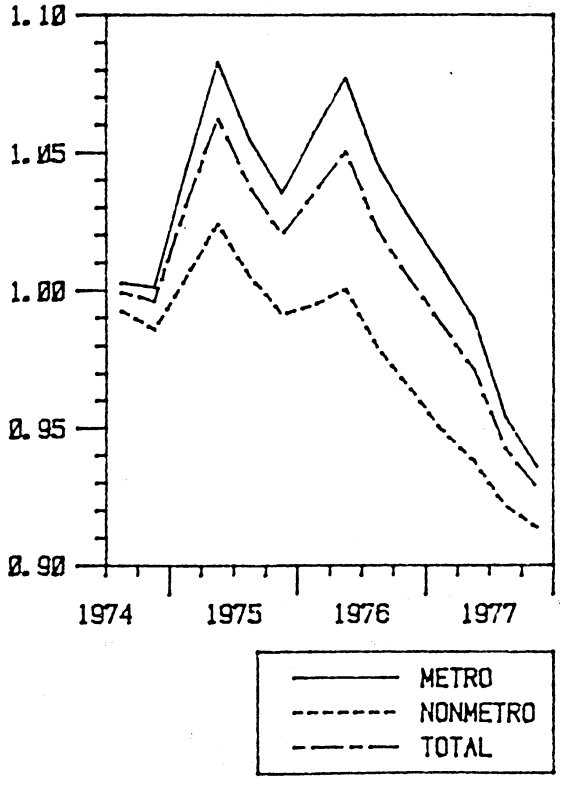
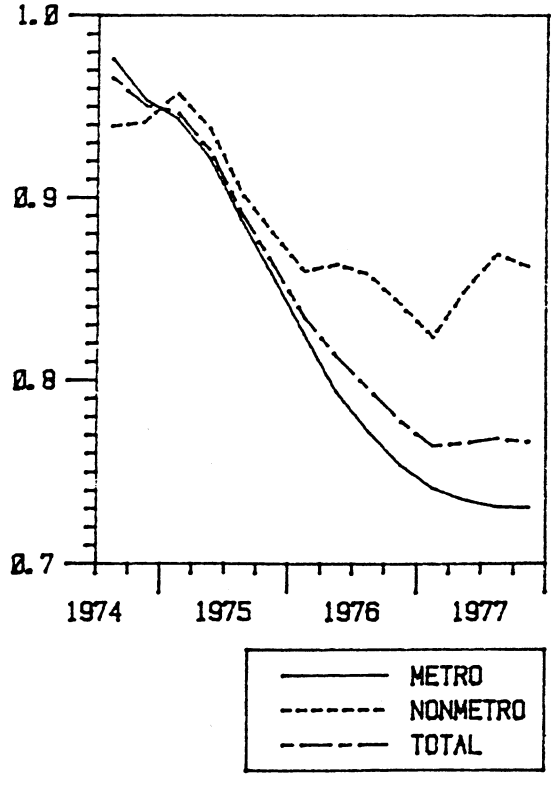
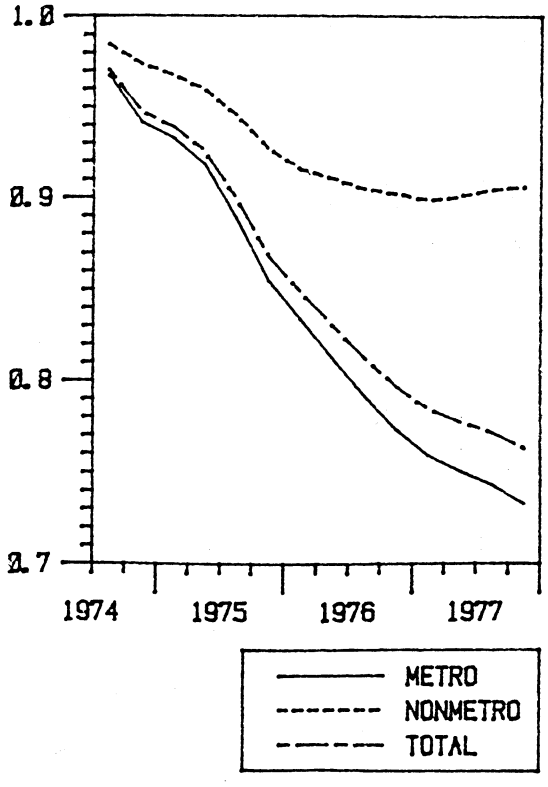


FIGURE 4.5 West
Baseline Simulation

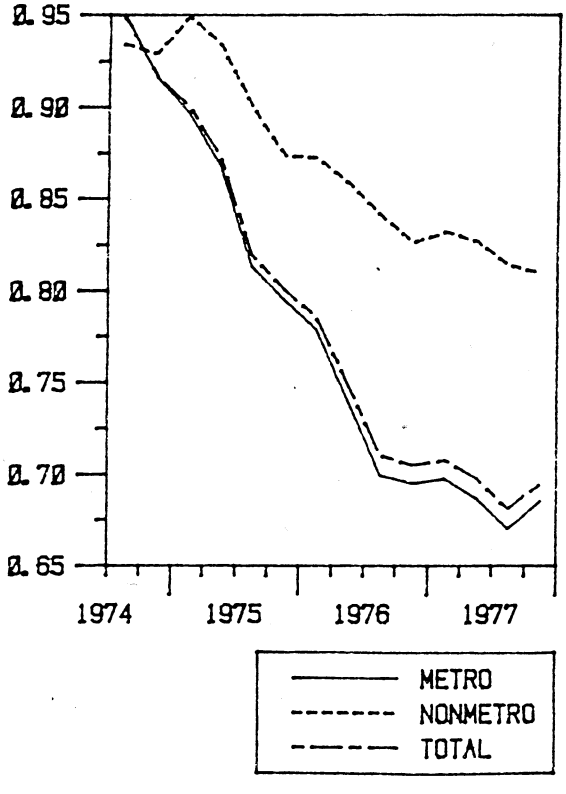
Personal Income, Relative to Historical



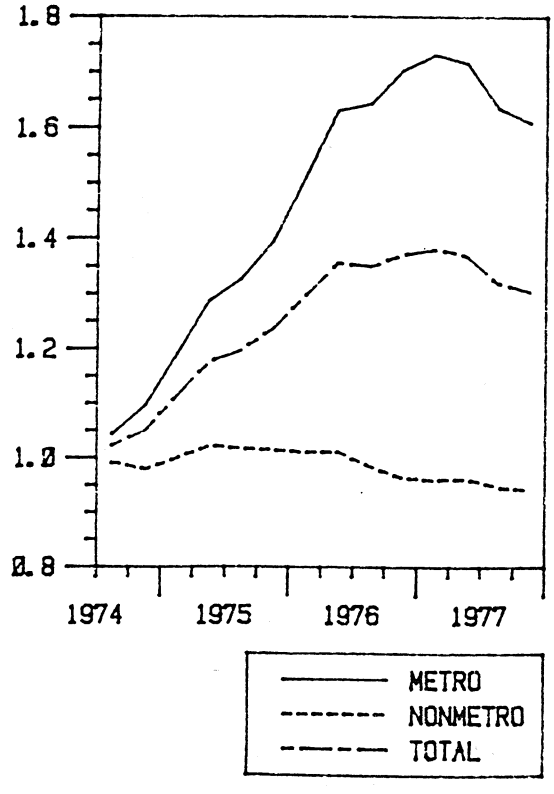
Employment, Relative to Historical



Total Deposits, Relative to Historical



Loan Deposit Ratio, Relative to Historical



The fits are generally better in the other regions of the country for each of the variables. In the North Central and Northeast regions the underpredictions for personal income mirror the US personal income underprediction (Figures 4.2 and 4.3). In the South the overprediction of personal income in metropolitan areas balances the underprediction in rural areas, making the overall region's prediction error for personal income quite small (Figure 4.4).

An assessment of the goodness-of-fit of the model is subjective and must be made by the reader. To make a judgment, a comparison with another similar model is necessary. In this case, however, there are no other regional financial models that are easily comparable to this model. We stress that the results of alternative policy simulations can be improved with further refinement of the model. However, comparisons of policy-induced changes to the baseline can be useful even at this early stage of model development.

4.2 THE REGIONAL EFFECTS OF A TIGHTENING OF MONETARY POLICY

The key indicator of monetary policy in the model is the federal funds rate, an endogenous variable. There are several ways we could implement a tightening of policy. We could change the coefficients on the variables assumed to be the targets for the Federal Reserve (see the discussion of the federal funds rate equation in Chapter 3). For example, by increasing the coefficient on the inflation variable, the increase in inflation over the simulation period would have led to a higher federal funds rate. Alternatively, we could increase the constant term of the federal funds equation and allow the Federal Reserve reaction coefficients to remain constant. This procedure, however, would build in contradicting behavioral assumptions as the constant term increase in the funds rate would lead to an increase in unemployment and thus an offsetting decrease in the funds rate (the coefficient on unemployment in the funds rate equation is negative). We could have set either total U.S. demand deposits or the federal funds rate exogenously depending on which of the two is taken as the target for monetary policy. We chose to exogenize the federal funds rate.

The baseline used the historical values of the funds rate, while the alternative simulation added 1 percentage point to the historical values of the funds rate. To compare the difference between a temporary and permanent tightening of monetary policy, Alternative 1 (A1) increases the funds rate by 1 percentage point only in the 4th quarter of 1974, while Alternative 2 (A2) increases it by 1 percentage point in all quarters

starting in 1974:4. The results of these experiments (and the third one discussed below) are presented in Tables 4.1 through 4.6. In all cases, the alternative simulations are expressed as a fraction of the baseline simulation. We have presented the effects on the key variables in the model: real personal income, total employment, manufacturing employment, housing starts, the commercial loan-to-deposit ratio, and total deposits.

As expected, the model estimates that the tightening of monetary policy leads to a decline in national real personal income. By 1977:4, three years after the increase in the federal funds rate, income is 3.5 percent below baseline when the tightening is permanent. When the interest rate increase is temporary, income only falls by .5 percent by 1977:4. The decline in real personal income is spread fairly evenly across metropolitan and rural areas. For the permanent tightening case, metropolitan income declines by 1977:4 by 3.7 percent, only slightly more than the rural decline of 3.2 percent. Moreover, the time patterns of the declines are quite similar (Table 4.1). There is more variation across census regions. The decline in the West is 7.3 percent, while the decline in the North Central and South is less than 3 percent. The 3.5 percent decline in the North East is exactly the national average.

The decline in national personal income is caused by the fall in employment. Tables 4.2 and 4.3 present the effects on total employment and manufacturing employment, respectively. By 1977:4, for Alternative 2 employment nationally is 2.4 percent below baseline, and manufacturing employment is 4.8 percent below baseline. Rural employment is affected much less than metropolitan employment. Note that while metropolitan manufacturing employment declines by 5.5 percent, it falls in rural areas by only 3.0 percent. As with income, the West loses relatively more jobs than the other regions when monetary policy is tightened. By 1977:4, employment in the West declines by almost 7.0 percent, while in the other regions it declines 2.0 percent or less. The Western decline in manufacturing employment is even more severe. Compared to declines of less than 4.0 percent in the other regions, it declines by more than 18.0 percent in the West.

Housing starts in different regions of the country are primarily determined by real personal income and the change in the stock of real mortgages, both in the region and the adjoining region. Mortgages were, in turn, determined by the stocks of deposits in commercial banks and thrift institutions. A rise in the federal funds rate is shown in Table 4.5 to result in a decline in the stock of total deposits, the sum of demand, time, savings, and thrift deposits. For Alternative 2, where monetary policy is permanently tightened,

TABLE 4.1

REAL PERSONAL INCOME, ALTERNATIVE SIMULATIONS*
(RELATIVE TO BASELINE)

DATE	TOTAL			METROPOLITAN			RURAL		
TOTAL US	A1	A2	A3	A1	A2	A3	A1	A2	A3
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	1.000	1.000	0.998	1.000	1.000	0.997	1.001	1.001	0.999
75 1	0.999	0.999	0.998	0.999	0.999	0.995	0.999	0.999	1.003
75 2	0.999	0.997	0.997	0.999	0.997	0.992	0.999	0.998	1.006
75 3	0.998	0.996	0.996	0.998	0.996	0.990	0.999	0.997	1.008
75 4	0.998	0.994	0.994	0.998	0.994	0.987	0.999	0.996	1.009
76 1	0.997	0.991	0.993	0.997	0.991	0.985	0.997	0.993	1.009
76 2	0.997	0.988	0.991	0.997	0.988	0.982	0.997	0.990	1.007
76 3	0.997	0.985	0.989	0.996	0.984	0.980	0.997	0.988	1.006
76 4	0.996	0.982	0.986	0.996	0.981	0.977	0.997	0.985	1.005
77 1	0.995	0.978	0.984	0.995	0.976	0.975	0.995	0.980	1.003
77 2	0.995	0.973	0.982	0.995	0.972	0.972	0.995	0.976	1.001
77 3	0.995	0.969	0.980	0.995	0.968	0.970	0.995	0.973	0.999
77 4	0.995	0.965	0.977	0.994	0.963	0.968	0.995	0.968	0.997
NORTH CENTRAL									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	1.000	1.000	1.000	1.000	1.000	0.999	1.000	1.000	1.002
75 1	0.999	0.999	1.002	0.999	0.999	0.998	1.000	1.000	1.010
75 2	0.999	0.999	1.004	0.999	0.998	0.996	1.000	1.000	1.019
75 3	0.999	0.998	1.006	0.998	0.996	0.994	1.000	1.000	1.027
75 4	0.999	0.997	1.006	0.998	0.995	0.993	1.000	1.000	1.033
76 1	0.998	0.995	1.007	0.997	0.992	0.991	1.000	1.000	1.036
76 2	0.998	0.993	1.006	0.997	0.989	0.989	1.000	1.000	1.038
76 3	0.998	0.991	1.005	0.996	0.986	0.987	1.000	1.001	1.039
76 4	0.998	0.989	1.004	0.996	0.982	0.985	1.000	1.001	1.040
77 1	0.997	0.986	1.003	0.995	0.977	0.982	1.000	1.001	1.041
77 2	0.997	0.983	1.002	0.995	0.973	0.980	1.000	1.001	1.042
77 3	0.996	0.980	1.001	0.994	0.969	0.978	1.000	1.001	1.042
77 4	0.996	0.977	1.000	0.994	0.964	0.976	1.000	1.001	1.042
NORTHEAST									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	1.001	1.001	0.998	1.000	1.000	0.998	1.001	1.001	0.998
75 1	0.998	0.999	0.997	0.999	0.999	0.996	0.997	0.998	0.999
75 2	0.999	0.998	0.996	0.999	0.998	0.995	0.998	0.997	1.000
75 3	0.999	0.997	0.995	0.999	0.997	0.993	0.998	0.995	0.999
75 4	0.999	0.995	0.994	0.999	0.996	0.991	0.999	0.994	0.998
76 1	0.997	0.992	0.992	0.997	0.994	0.990	0.996	0.990	0.997

* A1 is Alternative 1, a temporary tightening of monetary policy. A2 is Alternative 2, a permanent tightening of monetary policy. A3 is Alternative 3, a shift in funds from the metro to non-metro regions.

TABLE 4.1 (CONT.)

REAL PERSONAL INCOME, ALTERNATIVE SIMULATIONS*
(RELATIVE TO BASELINE)

DATE	TOTAL			METROPOLITAN			RURAL		
NORTHEAST	A1	A2	A3	A1	A2	A3	A1	A2	A3
76 2	0.997	0.989	0.990	0.997	0.991	0.988	0.996	0.986	0.995
76 3	0.997	0.987	0.988	0.997	0.988	0.986	0.996	0.983	0.992
76 4	0.997	0.983	0.986	0.997	0.985	0.984	0.997	0.980	0.990
77 1	0.995	0.978	0.984	0.995	0.981	0.982	0.993	0.973	0.988
77 2	0.995	0.974	0.982	0.995	0.977	0.980	0.994	0.968	0.986
77 3	0.994	0.970	0.980	0.995	0.973	0.979	0.994	0.964	0.983
77 4	0.995	0.965	0.978	0.995	0.968	0.977	0.994	0.959	0.981
SOUTH									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	1.000	1.000	0.999	1.000	1.000	0.999	1.000	1.000	1.000
75 1	0.999	0.999	0.998	0.999	0.999	0.996	0.998	0.998	1.003
75 2	0.999	0.998	0.997	0.999	0.998	0.993	0.998	0.997	1.004
75 3	0.999	0.996	0.994	0.999	0.997	0.990	0.998	0.995	1.004
75 4	0.999	0.995	0.992	0.999	0.997	0.987	0.998	0.993	1.002
76 1	0.998	0.993	0.989	0.998	0.995	0.984	0.996	0.988	1.000
76 2	0.998	0.991	0.987	0.999	0.994	0.982	0.996	0.985	0.997
76 3	0.998	0.989	0.984	0.999	0.992	0.979	0.995	0.981	0.994
76 4	0.998	0.986	0.982	0.999	0.991	0.977	0.995	0.976	0.992
77 1	0.996	0.983	0.979	0.998	0.989	0.974	0.993	0.970	0.989
77 2	0.997	0.980	0.977	0.998	0.987	0.972	0.993	0.964	0.986
77 3	0.997	0.977	0.974	0.999	0.986	0.970	0.993	0.959	0.983
77 4	0.997	0.974	0.972	0.999	0.984	0.968	0.993	0.953	0.980
WEST									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	0.999	0.999	0.993	0.999	0.999	0.993	1.000	1.000	0.994
75 1	0.998	0.997	0.991	0.998	0.997	0.989	0.999	1.000	0.996
75 2	0.997	0.995	0.987	0.997	0.993	0.983	0.999	0.998	0.996
75 3	0.997	0.991	0.983	0.996	0.989	0.978	0.998	0.997	0.995
75 4	0.996	0.988	0.980	0.995	0.985	0.974	0.998	0.995	0.994
76 1	0.994	0.982	0.976	0.993	0.978	0.969	0.997	0.992	0.992
76 2	0.993	0.976	0.971	0.992	0.970	0.964	0.996	0.988	0.988
76 3	0.993	0.969	0.968	0.991	0.963	0.960	0.995	0.984	0.985
76 4	0.992	0.962	0.964	0.990	0.955	0.956	0.995	0.979	0.982
77 1	0.990	0.953	0.960	0.989	0.945	0.952	0.993	0.973	0.979
77 2	0.989	0.944	0.956	0.988	0.934	0.948	0.993	0.967	0.976
77 3	0.988	0.936	0.953	0.987	0.925	0.945	0.992	0.960	0.973
77 4	0.988	0.927	0.950	0.986	0.915	0.941	0.991	0.953	0.969

* A1 is Alternative 1, a temporary tightening of monetary policy. A2 is Alternative 2, a permanent tightening of monetary policy. A3 is Alternative 3, a shift in funds from the metro to non-metro regions.

TABLE 4.2

TOTAL EMPLOYMENT, ALTERNATIVE SIMULATIONS*
(RELATIVE TO BASELINE)

DATE	TOTAL			METROPOLITAN			RURAL		
TOTAL US	A1	A2	A3	A1	A2	A3	A1	A2	A3
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	1.000	1.000	0.998	1.000	1.000	0.996	1.000	1.000	1.005
75 1	0.999	0.999	0.997	0.999	0.999	0.994	1.000	1.000	1.008
75 2	0.999	0.998	0.996	0.999	0.998	0.992	0.999	0.999	1.010
75 3	0.999	0.997	0.995	0.999	0.997	0.991	0.999	0.998	1.012
75 4	0.999	0.996	0.994	0.999	0.996	0.989	0.999	0.998	1.012
76 1	0.998	0.994	0.993	0.998	0.993	0.987	0.999	0.996	1.013
76 2	0.998	0.992	0.992	0.998	0.991	0.986	0.999	0.995	1.012
76 3	0.998	0.990	0.991	0.997	0.989	0.984	0.999	0.994	1.012
76 4	0.998	0.988	0.990	0.997	0.986	0.983	0.999	0.993	1.011
77 1	0.997	0.985	0.988	0.997	0.983	0.981	0.998	0.991	1.010
77 2	0.997	0.982	0.987	0.996	0.980	0.980	0.998	0.989	1.010
77 3	0.997	0.979	0.986	0.996	0.977	0.979	0.998	0.987	1.008
77 4	0.996	0.976	0.984	0.996	0.974	0.977	0.998	0.985	1.007
NORTH CENTRAL									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	1.000	1.000	0.998	1.000	1.000	0.997	1.000	1.000	1.001
75 1	0.999	1.000	0.998	0.999	0.999	0.996	1.000	1.000	1.003
75 2	0.999	0.999	0.998	0.999	0.999	0.995	1.000	0.999	1.006
75 3	0.999	0.998	0.998	0.999	0.998	0.995	1.000	0.999	1.010
75 4	0.999	0.997	0.999	0.999	0.997	0.994	1.000	0.999	1.012
76 1	0.999	0.996	0.998	0.998	0.995	0.993	1.000	0.998	1.013
76 2	0.999	0.995	0.998	0.998	0.994	0.993	1.000	0.998	1.013
76 3	0.999	0.994	0.998	0.998	0.992	0.992	1.000	0.998	1.014
76 4	0.999	0.993	0.998	0.998	0.991	0.992	1.000	0.998	1.014
77 1	0.998	0.991	0.997	0.998	0.988	0.991	1.000	0.997	1.015
77 2	0.998	0.989	0.997	0.997	0.986	0.990	1.000	0.997	1.015
77 3	0.998	0.987	0.996	0.997	0.983	0.989	1.000	0.997	1.015
77 4	0.998	0.985	0.995	0.997	0.981	0.988	1.000	0.996	1.015
NORTHEAST									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	1.000	1.000	0.998	1.000	1.000	0.997	1.001	1.001	1.004
75 1	1.000	1.000	0.997	1.000	1.000	0.996	0.999	1.000	1.004
75 2	1.000	1.000	0.996	1.000	1.000	0.995	0.999	0.998	1.004
75 3	0.999	0.999	0.995	0.999	0.999	0.994	0.998	0.997	1.005
75 4	0.999	0.998	0.994	0.999	0.999	0.993	0.999	0.996	1.004
76 1	0.999	0.997	0.993	0.999	0.997	0.992	0.998	0.993	1.003

* A1 is Alternative 1, a temporary tightening of monetary policy. A2 is Alternative 2, a permanent tightening of monetary policy. A3 is Alternative 3, a shift in funds from the metro to non-metro regions.

TABLE 4.2 (CONT.)

TOTAL EMPLOYMENT, ALTERNATIVE SIMULATIONS*
(RELATIVE TO BASELINE)

DATE	TOTAL			METROPOLITAN			RURAL		
NORTHEAST	A1	A2	A3	A1	A2	A3	A1	A2	A3
76 2	0.998	0.995	0.992	0.999	0.996	0.991	0.997	0.990	1.002
76 3	0.998	0.993	0.991	0.998	0.994	0.990	0.997	0.987	1.000
76 4	0.998	0.991	0.990	0.998	0.992	0.988	0.997	0.985	0.999
77 1	0.997	0.989	0.988	0.997	0.990	0.987	0.996	0.980	0.997
77 2	0.997	0.986	0.987	0.997	0.987	0.986	0.995	0.976	0.995
77 3	0.996	0.983	0.986	0.997	0.984	0.985	0.995	0.971	0.993
77 4	0.996	0.980	0.984	0.997	0.981	0.984	0.995	0.967	0.991
SOUTH									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	1.000	1.000	1.003	1.000	1.000	0.998	1.000	1.000	1.012
75 1	0.999	0.999	1.002	0.999	0.999	0.996	0.999	0.999	1.015
75 2	0.999	0.999	1.002	0.999	0.999	0.995	0.999	0.999	1.017
75 3	0.999	0.998	1.001	0.999	0.998	0.993	0.999	0.998	1.018
75 4	0.999	0.997	1.000	0.999	0.997	0.991	0.999	0.997	1.019
76 1	0.999	0.996	0.999	0.999	0.996	0.990	0.999	0.996	1.019
76 2	0.999	0.995	0.997	0.999	0.995	0.988	0.999	0.995	1.018
76 3	0.999	0.994	0.996	0.999	0.995	0.987	0.999	0.993	1.017
76 4	0.999	0.993	0.995	0.999	0.994	0.986	0.998	0.992	1.016
77 1	0.999	0.992	0.994	0.999	0.992	0.985	0.998	0.990	1.015
77 2	0.999	0.990	0.993	0.999	0.991	0.983	0.998	0.988	1.015
77 3	0.999	0.989	0.991	0.999	0.990	0.982	0.998	0.986	1.013
77 4	0.999	0.987	0.990	0.999	0.989	0.981	0.998	0.983	1.011
WEST									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	0.999	0.999	0.993	0.999	0.999	0.991	1.000	1.000	0.999
75 1	0.998	0.998	0.989	0.998	0.997	0.987	1.000	1.000	1.001
75 2	0.997	0.995	0.985	0.997	0.994	0.981	1.000	1.000	1.001
75 3	0.997	0.992	0.981	0.996	0.990	0.976	0.999	0.999	1.001
75 4	0.996	0.988	0.977	0.995	0.986	0.972	0.999	0.998	1.001
76 1	0.995	0.983	0.973	0.994	0.979	0.966	0.999	0.997	1.001
76 2	0.994	0.977	0.969	0.992	0.972	0.962	0.998	0.995	0.999
76 3	0.993	0.970	0.966	0.992	0.964	0.958	0.998	0.994	0.998
76 4	0.992	0.964	0.963	0.991	0.957	0.955	0.998	0.991	0.997
77 1	0.991	0.956	0.960	0.989	0.947	0.951	0.997	0.989	0.995
77 2	0.990	0.947	0.957	0.988	0.937	0.947	0.997	0.986	0.994
77 3	0.989	0.939	0.954	0.988	0.928	0.944	0.996	0.983	0.992
77 4	0.989	0.931	0.952	0.987	0.918	0.941	0.996	0.979	0.990

* A1 is Alternative 1, a temporary tightening of monetary policy. A2 is Alternative 2, a permanent tightening of monetary policy. A3 is Alternative 3, a shift in funds from the metro to non-metro regions.

TABLE 4.3

MANUFACTURING EMPLOYMENT, ALTERNATIVE SIMULATIONS*
(RELATIVE TO BASELINE)

DATE	TOTAL			METROPOLITAN			RURAL		
TOTAL US	A1	A2	A3	A1	A2	A3	A1	A2	A3
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	1.000	1.000	0.995	1.000	1.000	0.984	1.000	1.000	1.027
75 1	0.999	0.999	0.994	0.999	0.999	0.982	1.000	1.000	1.028
75 2	0.999	0.998	0.992	0.999	0.998	0.980	1.000	1.000	1.028
75 3	0.998	0.996	0.990	0.998	0.996	0.978	0.999	0.999	1.026
75 4	0.998	0.994	0.988	0.998	0.993	0.976	0.999	0.998	1.023
76 1	0.997	0.991	0.986	0.996	0.990	0.973	0.999	0.996	1.022
76 2	0.996	0.987	0.983	0.995	0.985	0.969	0.998	0.994	1.020
76 3	0.995	0.983	0.980	0.994	0.980	0.967	0.997	0.991	1.017
76 4	0.995	0.978	0.977	0.994	0.975	0.964	0.996	0.988	1.013
77 1	0.993	0.972	0.973	0.992	0.968	0.960	0.996	0.984	1.011
77 2	0.993	0.965	0.970	0.991	0.960	0.956	0.995	0.980	1.009
77 3	0.992	0.959	0.967	0.991	0.953	0.954	0.995	0.975	1.005
77 4	0.991	0.952	0.964	0.991	0.945	0.951	0.994	0.970	1.002
NORTH CENTRAL									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	1.000	1.000	0.991	1.000	1.000	0.986	1.000	1.000	1.007
75 1	1.000	1.000	0.991	1.000	1.000	0.986	1.000	1.000	1.007
75 2	0.999	0.999	0.990	0.999	0.999	0.986	0.999	0.999	1.006
75 3	0.999	0.998	0.990	0.999	0.998	0.985	0.999	0.998	1.004
75 4	0.998	0.996	0.988	0.998	0.996	0.984	0.998	0.997	1.002
76 1	0.998	0.994	0.986	0.998	0.994	0.982	0.998	0.994	1.000
76 2	0.997	0.992	0.984	0.997	0.991	0.980	0.997	0.992	0.997
76 3	0.996	0.988	0.982	0.996	0.988	0.978	0.996	0.988	0.994
76 4	0.996	0.984	0.979	0.996	0.984	0.975	0.996	0.984	0.991
77 1	0.995	0.979	0.976	0.995	0.979	0.973	0.995	0.979	0.988
77 2	0.994	0.974	0.974	0.994	0.974	0.970	0.994	0.974	0.985
77 3	0.993	0.968	0.971	0.993	0.968	0.968	0.993	0.968	0.982
77 4	0.993	0.962	0.969	0.993	0.962	0.966	0.993	0.962	0.979
NORTHEAST									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	1.001	1.001	0.993	1.001	1.001	0.989	1.000	1.000	1.017
75 1	1.000	1.001	0.992	1.000	1.001	0.988	1.000	1.000	1.017
75 2	1.000	1.000	0.991	1.000	1.000	0.987	0.999	0.999	1.016
75 3	0.999	0.999	0.990	0.999	1.000	0.986	0.999	0.998	1.015
75 4	0.999	0.998	0.988	0.999	0.999	0.985	0.999	0.997	1.013
76 1	0.998	0.996	0.986	0.998	0.997	0.982	0.998	0.995	1.011

* A1 is Alternative 1, a temporary tightening of monetary policy. A2 is Alternative 2, a permanent tightening of monetary policy. A3 is Alternative 3, a shift in funds from the metro to non-metro regions.

TABLE 4.3 (CONT.)

MANUFACTURING EMPLOYMENT, ALTERNATIVE SIMULATIONS*
(RELATIVE TO BASELINE)

DATE	TOTAL			METROPOLITAN			RURAL		
NORTHEAST	A1	A2	A3	A1	A2	A3	A1	A2	A3
76 2	0.997	0.994	0.984	0.997	0.994	0.980	0.998	0.992	1.009
76 3	0.996	0.990	0.981	0.996	0.990	0.978	0.997	0.989	1.006
76 4	0.996	0.986	0.978	0.996	0.986	0.975	0.996	0.985	1.003
77 1	0.995	0.981	0.975	0.995	0.981	0.972	0.995	0.981	1.000
77 2	0.994	0.976	0.973	0.994	0.975	0.969	0.995	0.976	0.998
77 3	0.993	0.970	0.970	0.993	0.970	0.967	0.994	0.970	0.994
77 4	0.993	0.964	0.968	0.993	0.964	0.964	0.993	0.965	0.991
SOUTH									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	1.000	1.000	1.014	1.000	1.000	0.991	1.000	1.000	1.044
75 1	1.000	1.000	1.014	1.000	0.999	0.990	1.000	1.000	1.046
75 2	1.000	0.999	1.013	0.999	0.999	0.988	1.000	1.000	1.047
75 3	0.999	0.999	1.012	0.999	0.998	0.987	1.000	1.000	1.045
75 4	0.999	0.997	1.009	0.998	0.996	0.985	0.999	0.999	1.041
76 1	0.999	0.996	1.008	0.998	0.994	0.982	0.999	0.998	1.041
76 2	0.998	0.994	1.006	0.998	0.992	0.980	0.999	0.997	1.040
76 3	0.997	0.991	1.003	0.997	0.989	0.977	0.998	0.995	1.036
76 4	0.996	0.987	0.999	0.996	0.984	0.974	0.997	0.991	1.031
77 1	0.996	0.984	0.997	0.995	0.980	0.971	0.997	0.989	1.030
77 2	0.996	0.980	0.994	0.995	0.975	0.968	0.996	0.985	1.029
77 3	0.995	0.975	0.991	0.994	0.970	0.966	0.996	0.981	1.025
77 4	0.994	0.969	0.988	0.993	0.964	0.963	0.995	0.976	1.021
WEST									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	0.999	0.999	0.966	0.998	0.998	0.958	1.000	1.000	1.010
75 1	0.995	0.994	0.956	0.995	0.993	0.947	1.000	1.000	1.010
75 2	0.993	0.987	0.945	0.992	0.985	0.934	0.999	0.999	1.009
75 3	0.991	0.978	0.936	0.990	0.974	0.921	0.999	0.998	1.007
75 4	0.991	0.969	0.928	0.989	0.962	0.911	0.998	0.997	1.005
76 1	0.985	0.953	0.914	0.982	0.943	0.894	0.998	0.995	1.003
76 2	0.982	0.934	0.901	0.978	0.920	0.877	0.997	0.992	1.001
76 3	0.980	0.918	0.894	0.976	0.900	0.867	0.997	0.989	0.998
76 4	0.980	0.900	0.886	0.976	0.877	0.857	0.996	0.985	0.995
77 1	0.974	0.875	0.874	0.968	0.846	0.841	0.995	0.981	0.992
77 2	0.971	0.852	0.865	0.965	0.819	0.831	0.995	0.976	0.990
77 3	0.970	0.836	0.863	0.964	0.800	0.829	0.994	0.971	0.987
77 4	0.971	0.819	0.859	0.965	0.779	0.825	0.994	0.966	0.985

* A1 is Alternative 1, a temporary tightening of monetary policy. A2 is Alternative 2, a permanent tightening of monetary policy. A3 is Alternative 3, a shift in funds from the metro to non-metro regions.

TABLE 4.4

HOUSING STARTS, ALTERNATIVE SIMULATIONS*
(RELATIVE TO BASELINE)

DATE	TOTAL			METROPOLITAN			RURAL		
TOTAL US	A1	A2	A3	A1	A2	A3	A1	A2	A3
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	0.999	0.999	0.984	0.997	0.997	0.974	1.001	1.001	1.001
75 1	0.976	0.974	0.951	0.964	0.961	0.915	0.994	0.994	1.003
75 2	0.995	0.966	0.883	0.994	0.946	0.794	0.997	0.991	0.991
75 3	0.976	0.947	0.881	0.961	0.912	0.773	0.994	0.987	1.003
75 4	0.966	0.895	0.803	0.932	0.793	0.558	0.994	0.978	1.001
76 1	0.947	0.856	0.802	0.900	0.728	0.581	0.988	0.969	0.997
76 2	0.973	0.819	0.762	0.948	0.630	0.460	0.992	0.961	0.989
76 3	0.960	0.820	0.799	0.926	0.666	0.593	0.990	0.958	0.986
76 4	0.955	0.758	0.758	0.917	0.549	0.516	0.990	0.943	0.974
77 1	0.950	0.769	0.805	0.921	0.631	0.668	0.986	0.936	0.970
77 2	0.974	0.765	0.810	0.962	0.646	0.697	0.990	0.927	0.964
77 3	0.970	0.793	0.847	0.958	0.709	0.773	0.989	0.929	0.966
77 4	0.972	0.777	0.844	0.963	0.703	0.783	0.989	0.914	0.957
NORTH CENTRAL									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	1.000	1.000	0.999	1.001	1.001	0.998	1.000	1.000	1.001
75 1	0.957	0.957	0.990	0.943	0.944	0.985	0.978	0.978	0.997
75 2	1.037	0.992	0.948	1.050	0.989	0.928	1.019	0.997	0.977
75 3	0.994	0.987	0.967	0.990	0.981	0.952	0.999	0.997	0.988
75 4	0.990	0.973	0.946	0.981	0.951	0.909	0.999	0.995	0.984
76 1	0.948	0.927	0.955	0.922	0.886	0.928	0.980	0.976	0.988
76 2	1.031	0.954	0.946	1.045	0.917	0.908	1.017	0.992	0.987
76 3	0.985	0.943	0.944	0.972	0.898	0.904	0.999	0.992	0.988
76 4	0.981	0.912	0.921	0.960	0.823	0.847	0.998	0.989	0.985
77 1	0.946	0.882	0.935	0.915	0.801	0.889	0.982	0.974	0.988
77 2	1.019	0.902	0.927	1.023	0.824	0.873	1.014	0.988	0.987
77 3	0.981	0.895	0.928	0.967	0.818	0.879	0.999	0.988	0.988
77 4	0.979	0.866	0.912	0.962	0.760	0.848	0.999	0.986	0.985
NORTHEAST									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	1.002	1.002	0.988	1.001	1.001	0.987	1.003	1.003	0.993
75 1	1.010	1.012	0.972	1.008	1.009	0.963	1.014	1.018	0.992
75 2	0.972	0.985	0.950	0.973	0.983	0.935	0.969	0.988	0.987
75 3	0.986	0.971	0.942	0.985	0.968	0.916	0.987	0.978	0.996
75 4	0.984	0.951	0.918	0.982	0.946	0.884	0.989	0.962	0.993
76 1	0.991	0.935	0.886	0.986	0.924	0.842	1.002	0.959	0.984

* A1 is Alternative 1, a temporary tightening of monetary policy. A2 is Alternative 2, a permanent tightening of monetary policy. A3 is Alternative 3, a shift in funds from the metro to non-metro regions.

TABLE 4.4 (CONT.)

HOUSING STARTS, ALTERNATIVE SIMULATIONS*
(RELATIVE TO BASELINE)

DATE	TOTAL			METROPOLITAN			RURAL		
NORTHEAST	A1	A2	A3	A1	A2	A3	A1	A2	A3
76 2	0.937	0.866	0.856	0.933	0.850	0.803	0.944	0.901	0.968
76 3	0.960	0.849	0.863	0.953	0.822	0.808	0.973	0.899	0.965
76 4	0.954	0.786	0.822	0.947	0.759	0.772	0.970	0.844	0.933
77 1	0.962	0.744	0.791	0.953	0.714	0.743	0.983	0.815	0.903
77 2	0.920	0.696	0.792	0.917	0.674	0.755	0.926	0.752	0.887
77 3	0.953	0.736	0.835	0.948	0.711	0.805	0.963	0.795	0.910
77 4	0.957	0.717	0.833	0.955	0.708	0.815	0.963	0.745	0.884
SOUTH									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	1.001	1.001	0.994	1.001	1.001	0.991	1.001	1.001	1.001
75 1	1.017	1.018	0.975	1.020	1.020	0.957	1.013	1.013	1.010
75 2	0.959	0.979	0.936	0.956	0.977	0.901	0.966	0.981	1.002
75 3	0.990	0.976	0.946	0.991	0.975	0.911	0.990	0.977	1.017
75 4	0.990	0.961	0.913	0.992	0.963	0.868	0.988	0.958	1.016
76 1	1.007	0.970	0.900	1.009	0.974	0.856	1.000	0.961	1.004
76 2	0.965	0.935	0.883	0.968	0.942	0.844	0.957	0.916	0.985
76 3	0.990	0.945	0.910	0.993	0.952	0.883	0.983	0.926	0.979
76 4	0.990	0.928	0.889	0.994	0.940	0.867	0.979	0.891	0.953
77 1	1.002	0.935	0.889	1.005	0.948	0.871	0.991	0.894	0.943
77 2	0.976	0.911	0.887	0.980	0.928	0.873	0.960	0.857	0.930
77 3	0.993	0.925	0.910	0.996	0.940	0.899	0.982	0.882	0.944
77 4	0.994	0.915	0.901	0.998	0.934	0.892	0.980	0.853	0.927
WEST									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	0.984	0.984	0.911	0.969	0.969	0.823	1.000	1.000	1.007
75 1	0.771	0.743	0.617	-9.359	-10.835	-19.093	0.970	0.970	1.004
75 2	1.215	0.138	-1.842	0.972	1.242	1.799	1.026	0.998	0.995
75 3	1.159	1.347	1.777	1.080	1.175	1.396	0.999	0.997	1.000
75 4	1.091	1.265	1.458	1.061	1.175	1.306	1.000	0.997	1.001
76 1	1.188	1.457	1.520	1.108	1.274	1.324	0.976	0.974	1.004
76 2	1.023	1.385	1.445	1.024	1.252	1.292	1.024	1.000	1.005
76 3	1.090	1.385	1.366	1.064	1.276	1.263	0.999	0.998	1.003
76 4	1.095	1.491	1.393	1.066	1.341	1.274	1.001	1.000	1.005
77 1	1.284	2.169	1.730	1.136	1.586	1.375	0.983	0.984	1.008
77 2	1.135	3.060	2.268	1.063	1.761	1.472	1.021	1.005	1.009
77 3	1.831	6.430	4.015	1.176	2.147	1.641	1.001	1.004	1.007
77 4	0.642	-1.672	-0.354	1.515	4.817	2.949	1.002	1.006	1.009

* A1 is Alternative 1, a temporary tightening of monetary policy. A2 is Alternative 2, a permanent tightening of monetary policy. A3 is Alternative 3, a shift in funds from the metro to non-metro regions.

TABLE 4.5

TOTAL DEPOSITS, ALTERNATIVE SIMULATIONS*
(RELATIVE TO BASELINE)

DATE	TOTAL			METROPOLITAN			RURAL		
TOTAL US	A1	A2	A3	A1	A2	A3	A1	A2	A3
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	0.993	0.993	0.998	0.993	0.993	0.985	0.993	0.993	1.057
75 1	0.998	0.991	0.996	0.998	0.990	0.982	0.998	0.991	1.056
75 2	0.997	0.988	0.993	0.997	0.988	0.979	0.998	0.989	1.056
75 3	0.997	0.985	0.991	0.997	0.985	0.976	0.998	0.987	1.056
75 4	0.992	0.978	0.989	0.992	0.977	0.974	0.993	0.981	1.053
76 1	0.996	0.974	0.986	0.995	0.973	0.971	0.997	0.978	1.051
76 2	0.995	0.969	0.984	0.995	0.968	0.968	0.997	0.976	1.049
76 3	0.995	0.965	0.981	0.994	0.963	0.966	0.997	0.973	1.048
76 4	0.990	0.957	0.979	0.990	0.955	0.964	0.992	0.966	1.045
77 1	0.994	0.952	0.977	0.993	0.949	0.962	0.996	0.964	1.042
77 2	0.993	0.947	0.974	0.993	0.943	0.959	0.996	0.960	1.040
77 3	0.993	0.942	0.972	0.993	0.938	0.957	0.996	0.957	1.039
77 4	0.989	0.934	0.971	0.988	0.930	0.956	0.992	0.951	1.036
NORTH CENTRAL									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	0.995	0.995	1.007	0.994	0.994	0.987	0.997	0.997	1.054
75 1	0.998	0.993	1.006	0.998	0.992	0.985	0.999	0.996	1.053
75 2	0.998	0.991	1.005	0.997	0.989	0.984	0.999	0.994	1.054
75 3	0.998	0.989	1.004	0.997	0.987	0.982	0.999	0.993	1.054
75 4	0.995	0.984	1.003	0.994	0.981	0.981	0.997	0.990	1.053
76 1	0.997	0.981	1.001	0.996	0.977	0.979	0.999	0.989	1.052
76 2	0.997	0.978	1.000	0.996	0.973	0.977	0.999	0.988	1.051
76 3	0.996	0.974	0.998	0.995	0.969	0.975	0.999	0.987	1.050
76 4	0.994	0.969	0.997	0.992	0.962	0.974	0.997	0.984	1.048
77 1	0.996	0.966	0.995	0.994	0.958	0.972	0.999	0.983	1.047
77 2	0.995	0.962	0.994	0.994	0.953	0.970	0.999	0.982	1.047
77 3	0.995	0.958	0.992	0.994	0.948	0.968	0.999	0.981	1.046
77 4	0.993	0.953	0.991	0.991	0.942	0.967	0.997	0.979	1.044
NORTHEAST									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	0.993	0.993	0.990	0.994	0.994	0.987	0.983	0.983	1.037
75 1	0.998	0.992	0.989	0.999	0.992	0.985	0.996	0.980	1.036
75 2	0.998	0.990	0.987	0.998	0.991	0.984	0.996	0.976	1.035
75 3	0.998	0.988	0.986	0.998	0.989	0.982	0.995	0.970	1.036
75 4	0.993	0.981	0.984	0.994	0.983	0.981	0.981	0.952	1.032
76 1	0.997	0.978	0.983	0.997	0.980	0.980	0.992	0.947	1.028

* A1 is Alternative 1, a temporary tightening of monetary policy. A2 is Alternative 2, a permanent tightening of monetary policy. A3 is Alternative 3, a shift in funds from the metro to non-metro regions.

TABLE 4.5 (CONT.)

TOTAL DEPOSITS, ALTERNATIVE SIMULATIONS*
(RELATIVE TO BASELINE)

DATE	TOTAL			METROPOLITAN			RURAL		
NORTHEAST	A1	A2	A3	A1	A2	A3	A1	A2	A3
76 2	0.997	0.975	0.981	0.997	0.977	0.978	0.993	0.940	1.024
76 3	0.996	0.971	0.979	0.996	0.974	0.976	0.992	0.928	1.021
76 4	0.991	0.964	0.977	0.992	0.967	0.975	0.978	0.910	1.016
77 1	0.995	0.960	0.976	0.995	0.964	0.973	0.989	0.905	1.011
77 2	0.995	0.955	0.974	0.995	0.959	0.972	0.989	0.896	1.007
77 3	0.994	0.951	0.972	0.995	0.956	0.970	0.988	0.879	1.002
77 4	0.990	0.943	0.971	0.991	0.949	0.969	0.976	0.864	0.998
SOUTH									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	0.993	0.993	1.008	0.993	0.993	0.984	0.991	0.991	1.068
75 1	0.998	0.991	1.006	0.998	0.991	0.981	0.998	0.989	1.066
75 2	0.998	0.989	1.003	0.998	0.989	0.978	0.998	0.987	1.066
75 3	0.998	0.986	1.000	0.998	0.987	0.975	0.998	0.985	1.065
75 4	0.993	0.980	0.998	0.993	0.981	0.973	0.991	0.977	1.061
76 1	0.997	0.977	0.995	0.997	0.978	0.970	0.997	0.974	1.057
76 2	0.997	0.974	0.992	0.997	0.975	0.967	0.997	0.971	1.056
76 3	0.997	0.971	0.989	0.997	0.972	0.965	0.997	0.968	1.054
76 4	0.992	0.965	0.987	0.993	0.966	0.963	0.990	0.960	1.050
77 1	0.996	0.961	0.985	0.996	0.963	0.961	0.996	0.958	1.046
77 2	0.996	0.958	0.982	0.996	0.959	0.959	0.996	0.954	1.044
77 3	0.996	0.955	0.980	0.996	0.957	0.957	0.995	0.950	1.042
77 4	0.992	0.949	0.978	0.993	0.952	0.956	0.990	0.943	1.038
WEST									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	0.989	0.989	0.984	0.988	0.988	0.978	0.996	0.996	1.056
75 1	0.996	0.984	0.979	0.995	0.983	0.972	0.998	0.994	1.055
75 2	0.994	0.978	0.972	0.994	0.977	0.964	0.998	0.992	1.054
75 3	0.993	0.971	0.964	0.993	0.969	0.956	0.997	0.989	1.053
75 4	0.984	0.956	0.959	0.983	0.953	0.950	0.995	0.985	1.050
76 1	0.990	0.946	0.952	0.989	0.943	0.944	0.996	0.981	1.047
76 2	0.988	0.934	0.945	0.987	0.930	0.935	0.995	0.977	1.043
76 3	0.986	0.921	0.938	0.986	0.916	0.928	0.995	0.972	1.040
76 4	0.978	0.903	0.935	0.976	0.897	0.925	0.993	0.966	1.036
77 1	0.984	0.892	0.930	0.983	0.885	0.920	0.993	0.961	1.032
77 2	0.982	0.877	0.924	0.981	0.869	0.914	0.993	0.955	1.028
77 3	0.981	0.863	0.919	0.980	0.854	0.909	0.992	0.949	1.024
77 4	0.974	0.847	0.917	0.972	0.838	0.907	0.991	0.942	1.020

* A1 is Alternative 1, a temporary tightening of monetary policy. A2 is Alternative 2, a permanent tightening of monetary policy. A3 is Alternative 3, a shift in funds from the metro to non-metro regions.

TABLE 4.6

COMMERCIAL LOAN DEPOSIT RATIO, ALTERNATIVE SIMULATIONS*
(RELATIVE TO BASELINE)

DATE	TOTAL			METROPOLITAN			RURAL		
TOTAL US	A1	A2	A3	A1	A2	A3	A1	A2	A3
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	1.001	1.001	0.994	1.001	1.001	1.023	1.002	1.002	0.929
75 1	1.003	1.004	0.997	1.003	1.004	1.027	1.002	1.004	0.929
75 2	1.003	1.007	1.000	1.003	1.008	1.031	1.002	1.005	0.929
75 3	1.003	1.011	1.003	1.004	1.012	1.035	1.002	1.007	0.931
75 4	1.002	1.013	1.006	1.002	1.015	1.038	1.001	1.008	0.934
76 1	1.004	1.018	1.010	1.006	1.022	1.043	1.001	1.009	0.934
76 2	1.005	1.023	1.014	1.007	1.029	1.048	1.001	1.010	0.933
76 3	1.005	1.028	1.016	1.007	1.036	1.050	1.001	1.010	0.935
76 4	1.004	1.032	1.018	1.005	1.042	1.052	1.000	1.010	0.936
77 1	1.006	1.039	1.021	1.008	1.052	1.056	1.000	1.009	0.935
77 2	1.006	1.045	1.022	1.008	1.060	1.058	0.999	1.009	0.934
77 3	1.005	1.047	1.020	1.008	1.064	1.056	0.999	1.007	0.935
77 4	1.004	1.048	1.018	1.006	1.067	1.054	0.998	1.005	0.935
NORTH CENTRAL									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	1.001	1.001	0.992	1.001	1.001	1.018	1.001	1.001	0.933
75 1	1.002	1.004	0.993	1.003	1.004	1.019	1.001	1.002	0.933
75 2	1.002	1.006	0.993	1.003	1.007	1.021	1.001	1.003	0.932
75 3	1.002	1.008	0.995	1.003	1.009	1.021	1.001	1.004	0.934
75 4	1.001	1.009	0.995	1.001	1.011	1.021	1.001	1.005	0.935
76 1	1.002	1.011	0.996	1.003	1.014	1.022	1.000	1.005	0.934
76 2	1.002	1.013	0.996	1.003	1.017	1.023	1.000	1.005	0.933
76 3	1.002	1.014	0.996	1.003	1.019	1.023	0.999	1.004	0.933
76 4	1.001	1.015	0.995	1.002	1.020	1.021	0.999	1.002	0.933
77 1	1.001	1.016	0.994	1.003	1.022	1.021	0.998	1.000	0.931
77 2	1.001	1.016	0.993	1.002	1.024	1.020	0.997	0.998	0.929
77 3	1.000	1.015	0.990	1.002	1.024	1.018	0.996	0.994	0.928
77 4	0.999	1.012	0.987	1.000	1.022	1.014	0.996	0.989	0.926
NORTHEAST									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	1.000	1.000	1.003	1.000	1.000	1.024	1.002	1.002	0.943
75 1	1.002	1.002	1.006	1.002	1.002	1.026	1.002	1.004	0.943
75 2	1.002	1.004	1.008	1.002	1.004	1.029	1.002	1.006	0.944
75 3	1.002	1.006	1.010	1.002	1.006	1.030	1.002	1.008	0.945
75 4	1.000	1.006	1.010	1.000	1.005	1.031	1.001	1.009	0.946
76 1	1.003	1.009	1.013	1.003	1.009	1.034	1.002	1.010	0.946

* A1 is Alternative 1, a temporary tightening of monetary policy. A2 is Alternative 2, a permanent tightening of monetary policy. A3 is Alternative 3, a shift in funds from the metro to non-metro regions.

TABLE 4.6 (CONT.)

COMMERCIAL LOAN DEPOSIT RATIO, ALTERNATIVE SIMULATIONS*
(RELATIVE TO BASELINE)

DATE	TOTAL			METROPOLITAN			RURAL		
NORTHEAST	A1	A2	A3	A1	A2	A3	A1	A2	A3
76 2	1.003	1.012	1.015	1.003	1.012	1.036	1.001	1.012	0.945
76 3	1.003	1.015	1.015	1.004	1.015	1.037	1.001	1.012	0.946
76 4	1.001	1.015	1.016	1.001	1.016	1.037	1.000	1.012	0.946
77 1	1.003	1.013	1.017	1.004	1.020	1.039	1.000	1.012	0.945
77 2	1.003	1.021	1.018	1.004	1.024	1.041	1.000	1.012	0.944
77 3	1.003	1.022	1.016	1.004	1.026	1.039	0.999	1.011	0.944
77 4	1.001	1.021	1.014	1.001	1.025	1.037	0.998	1.008	0.943
SOUTH									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	1.002	1.002	0.990	1.002	1.002	1.023	1.002	1.002	0.925
75 1	1.002	1.004	0.992	1.002	1.005	1.025	1.002	1.004	0.924
75 2	1.002	1.006	0.993	1.002	1.007	1.027	1.001	1.005	0.924
75 3	1.002	1.008	0.995	1.002	1.009	1.029	1.001	1.006	0.927
75 4	1.001	1.009	0.996	1.001	1.010	1.029	1.001	1.007	0.932
76 1	1.002	1.011	0.998	1.002	1.012	1.031	1.001	1.008	0.932
76 2	1.001	1.012	0.998	1.002	1.014	1.032	1.001	1.008	0.931
76 3	1.001	1.012	0.998	1.001	1.014	1.031	1.000	1.008	0.933
76 4	1.000	1.012	0.998	1.000	1.014	1.029	1.000	1.008	0.937
77 1	1.000	1.012	0.997	1.000	1.015	1.029	1.000	1.007	0.936
77 2	0.999	1.011	0.996	1.000	1.014	1.028	0.999	1.006	0.934
77 3	0.999	1.009	0.994	0.999	1.012	1.025	0.999	1.005	0.935
77 4	0.998	1.006	0.991	0.997	1.008	1.021	0.998	1.002	0.937
WEST									
74 3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
74 4	1.003	1.003	0.988	1.002	1.002	1.028	1.003	1.003	0.918
75 1	1.004	1.007	0.994	1.006	1.008	1.037	1.002	1.005	0.919
75 2	1.005	1.013	1.001	1.007	1.016	1.048	1.002	1.006	0.920
75 3	1.006	1.019	1.010	1.009	1.025	1.058	1.002	1.008	0.923
75 4	1.005	1.025	1.017	1.007	1.034	1.065	1.002	1.010	0.925
76 1	1.010	1.037	1.027	1.014	1.049	1.078	1.002	1.011	0.926
76 2	1.011	1.050	1.036	1.016	1.068	1.091	1.001	1.012	0.926
76 3	1.012	1.061	1.043	1.017	1.085	1.098	1.001	1.013	0.929
76 4	1.011	1.074	1.049	1.015	1.101	1.103	1.001	1.014	0.931
77 1	1.015	1.092	1.057	1.022	1.128	1.115	1.001	1.014	0.931
77 2	1.016	1.107	1.060	1.023	1.152	1.122	1.001	1.015	0.931
77 3	1.015	1.115	1.058	1.022	1.165	1.121	1.000	1.015	0.932
77 4	1.013	1.125	1.058	1.020	1.180	1.119	1.000	1.014	0.933

* A1 is Alternative 1, a temporary tightening of monetary policy. A2 is Alternative 2, a permanent tightening of monetary policy. A3 is Alternative 3, a shift in funds from the metro to non-metro regions.

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total national deposits decline by 6.6 percent below baseline by 1977:4. This decline in deposits, not offset by an equally large decline in the price level (the GNP deflator is 1.6 percent below baseline by 1977:4), leads to a decline in real mortgages and a corresponding decline in housing starts. National housing starts decline by more than 20 percent by 1977:4.

Before discussing the effect on housing starts across regions, it is useful to briefly review the full effect of monetary policy on housing in the model. Refer back to Figure 3.2 in Chapter 3. The first-round decline in housing caused by the drop in deposits and mortgages as the funds rate is raised generates feedback effects in the model. Construction employment declines, reducing personal income. The decline in personal income further reduces the demand for housing. It also reduces the flow of saving into deposits which causes a further contraction in mortgages and, therefore, housing starts. It is useful to keep these linkages in mind when looking at the regional changes in housing starts. It should also be recalled that the housing start equations were not completely satisfying. Hence, the regional pattern that emerges must be viewed with some caution.

The pattern for income and employment that was discussed above is accentuated for housing. Metropolitan starts decline by 30 percent, while rural starts decline by less than 10 percent by 1977:4. As is seen in Table 4.4, the equations for housing starts in the West produce apparently bizarre results. The reason for this is that both the baseline and the alternative simulations produce negative values for housing starts over the forecast period for the metropolitan West region. The values become negative in 1975:1 for the alternatives and become negative in 1975:2 for the baseline. As a consequence, the ratios switch from positive to negative to positive in the first four quarters of the simulation comparisons. In the other regions, note that while the Northeast experiences almost a 30 percent decline in housing starts, the South loses less than 10 percent.

Tables 4.5 and 4.6 present the effect of the monetary tightening on the total deposits and on loan-deposit ratios. Recall that the sub-national loan deposit ratios are a proxy for regional credit conditions in the model. A tightening of credit is reflected by an increase in the loan-deposit ratio. For Alternative 2 the national loan-deposit ratio is 4.8 percent above baseline by 1977:4. The ratio in rural areas peaks at 1.0 percent above baseline in 1976 and falls to only 0.5 percent above baseline by 1977:4. This indicates that rural credit conditions are affected only slightly by a general tightening of monetary policy. The metropolitan loan-deposit ratio rises smoothly to 6.7 percent above baseline by 1977:4, indicating that a general credit tightening mostly falls on metropolitan

areas. Table 4.6 also shows that the ratio increases much more in the West (over 12 percent) than in other regions (2 percent or less).

Figures 4.6 through 4.10 display the effects discussed above graphically for Alternative 2.

4.3 THE REGIONAL EFFECTS OF A CREDIT SHIFT

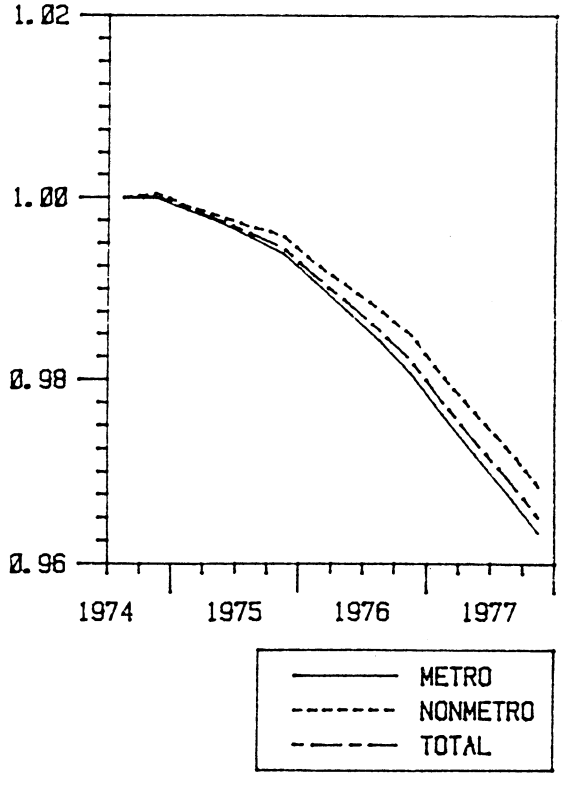
The second type of experiment we performed with the model was a shift of credit from metropolitan areas to rural areas. We made several assumptions. First, the increased credit to rural areas is initially distributed across rural demand deposits according to the relative size of the region's rural demand deposits. Hence, each of the four rural areas receive a 20 percent increase in demand deposits in 1974:4. Second, the increased credit to rural areas is not financed with expansionary monetary policy. Hence, we hold the federal funds rate in this experiment at its baseline values. We maintained this assumption to isolate the effects of a credit shift. Third, the increased credit to rural areas is financed instead by bond sales to holders of demand deposits in metropolitan areas with the sales distributed according to the relative size of the region's metropolitan demand deposits. Each of the four metropolitan areas incur a 5 percent decrease in demand deposits in 1974:4 since total metropolitan demand deposits were four times as large as rural demand deposits in 1974:4.

The effects of this experiment across census regions depend on the metropolitan-rural mix within the regions. Regions that have relatively large portions of their total demand deposits in metropolitan banks generally should tend to do worse than those with smaller portions. The South and North Central regions gain approximately 1.9 and 1.8 billion dollars of credit, respectively, as these regions had relatively less of their deposits in metropolitan banks. The Northeast and West lose approximately 2.5 and 1.1 billion dollars of credit, respectively, as their metropolitan deposits were relatively large. The overall shift of credit from metropolitan to rural areas is approximately 9.5 billion dollars.

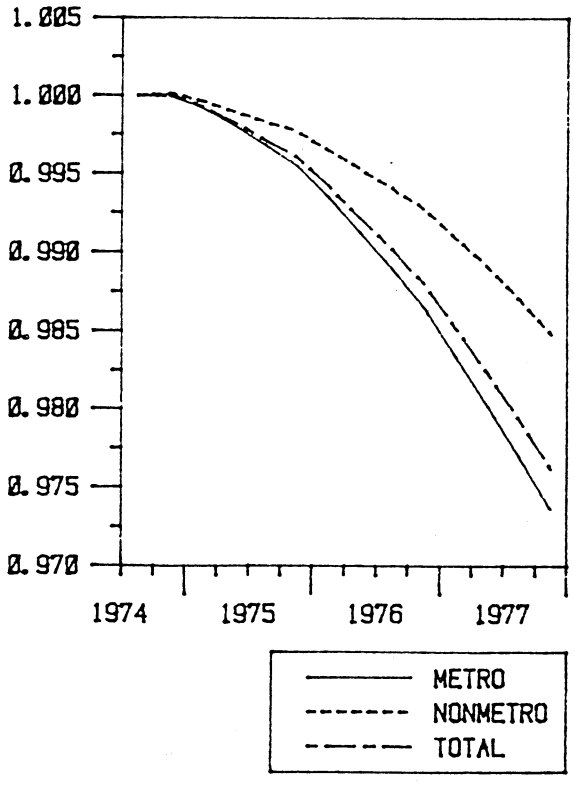
The results of this experiment -- Alternative 3 (A3) -- are presented in Tables 4.1 through 4.6. The most important finding is that national real personal income declines by more than 2 percent (compared to baseline) by 1977:4 as a result of the demand deposit shift. From Table 4.1, note that the small increase in personal income in rural areas -- about 1 percent above baseline by 1976, but back to zero by 1977:4 -- is more than offset by the more than 3 percent decline in personal income in metropolitan areas. The Table also shows that the West experiences relatively large declines in personal income, while there is almost no effect on personal income in the North Central region.

FIGURE 4.6 US Total
Permanent Tightening of Monetary Policy (Alternative 2)

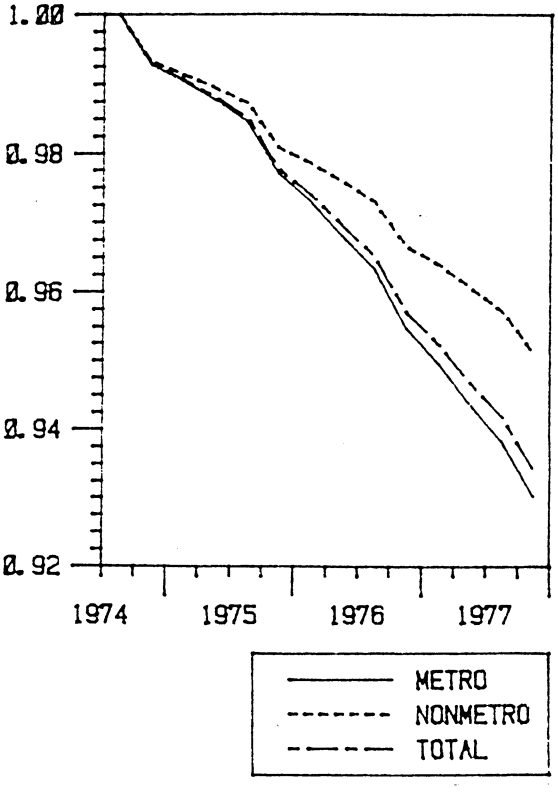
Personal Income, Relative to Baseline



Employment, Relative to Baseline



Total Deposits, Relative to Baseline



Loan Deposit Ratio, Relative to Baseline

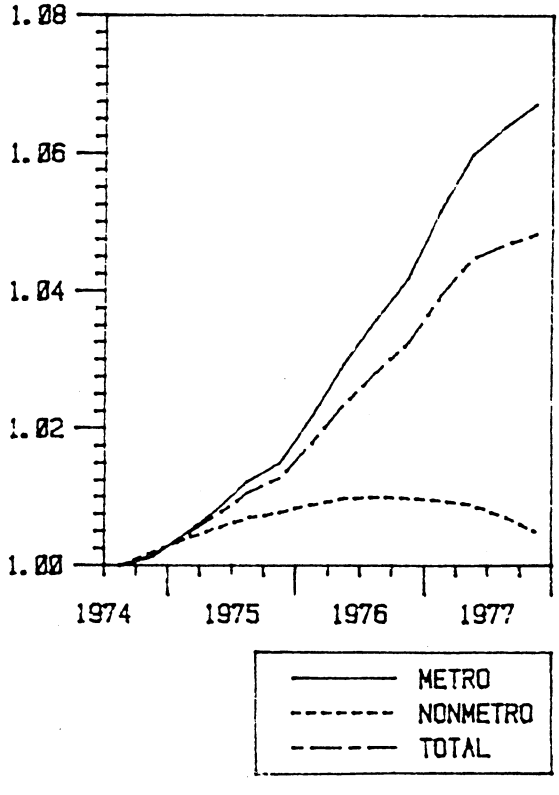
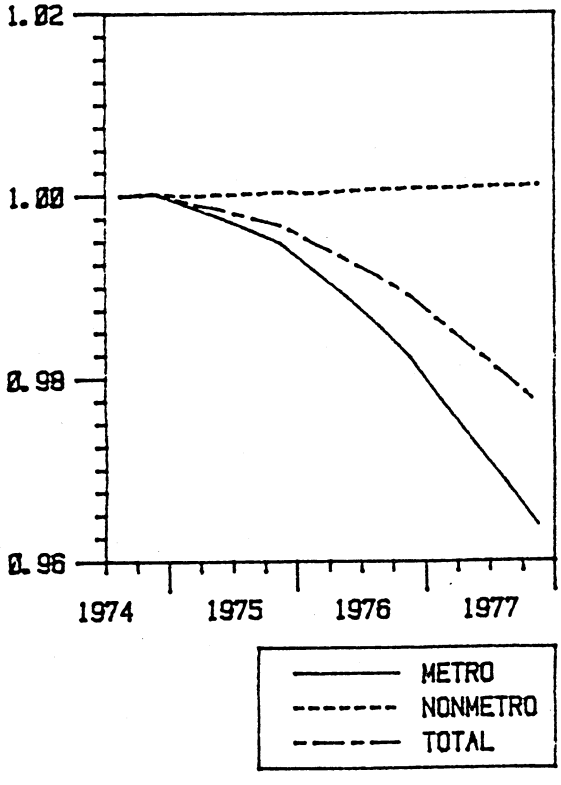
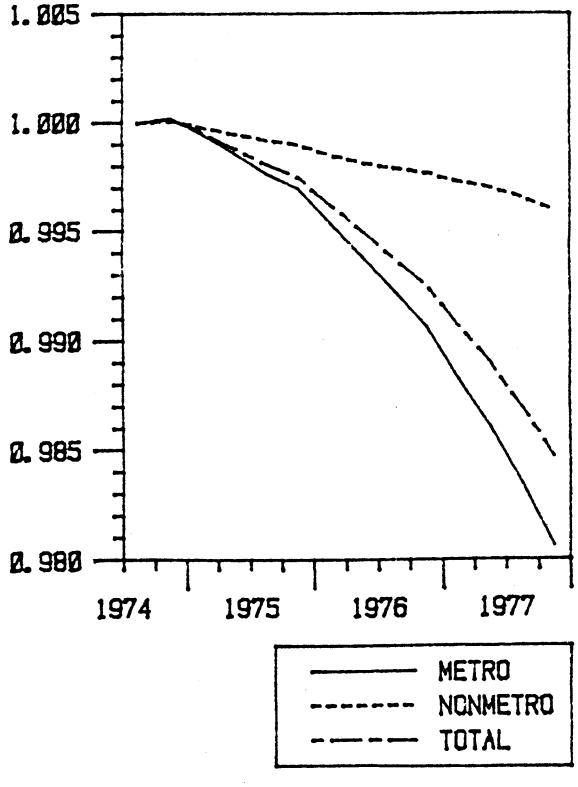


FIGURE 4.7 North Central
Permanent Tightening of Monetary Policy (Alternative 2)

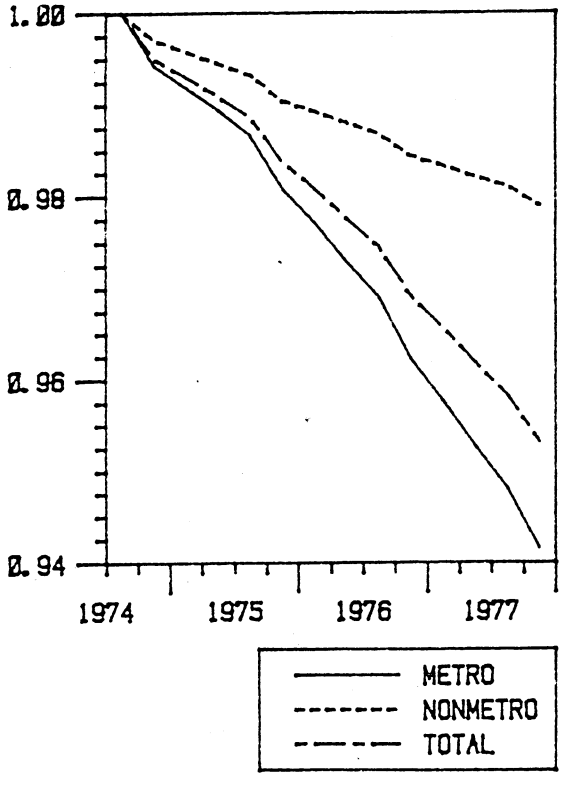
Personal Income, Relative to Baseline



Employment, Relative to Baseline



Total Deposits, Relative to Baseline



Loan Deposit Ratio, Relative to Baseline

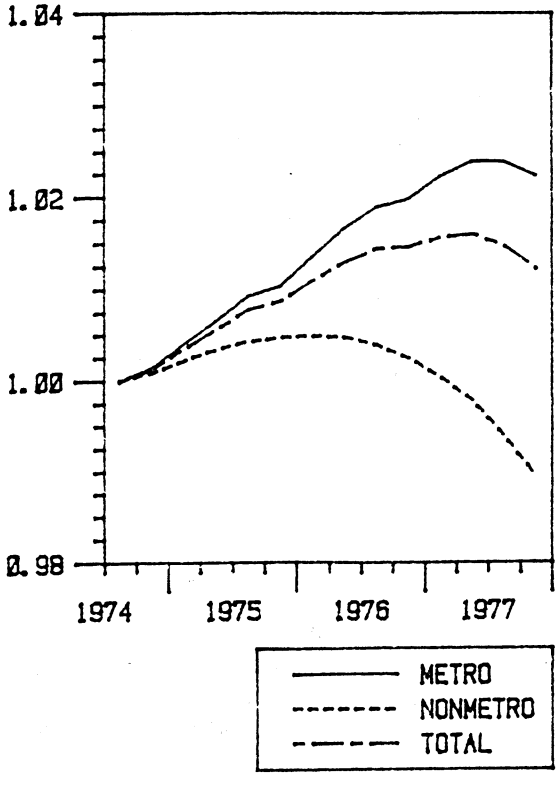
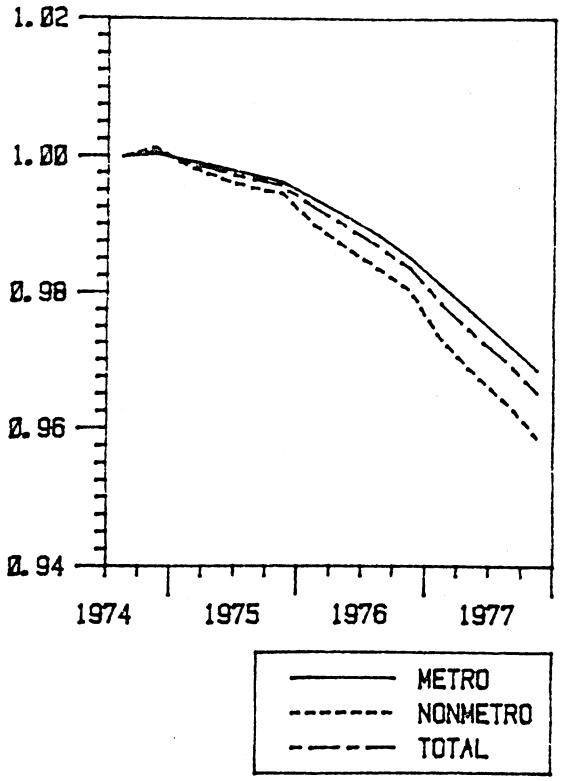
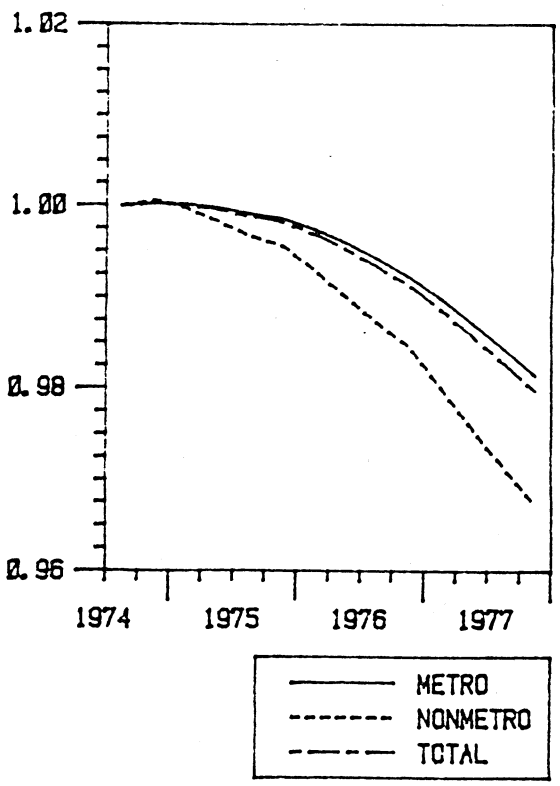


FIGURE 4.8 Northeast
Permanent Tightening of Monetary Policy (Alternative 2)

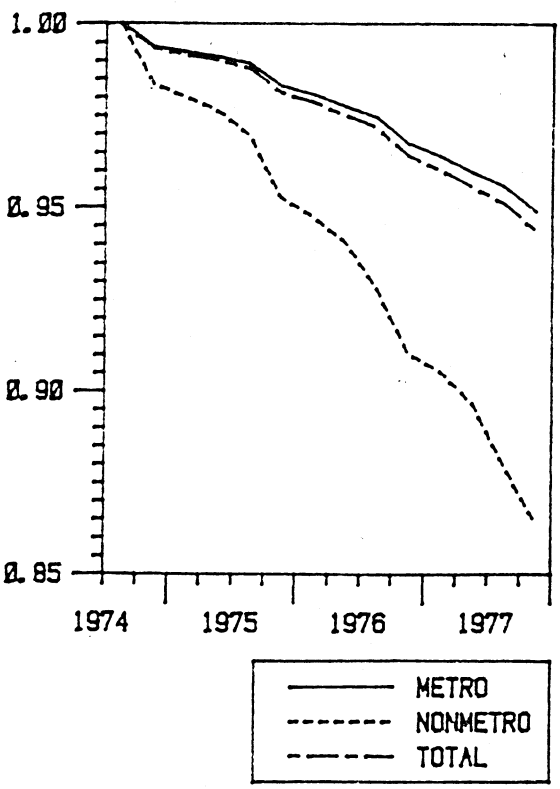
Personal Income, Relative to Baseline



Employment, Relative to Baseline



Total Deposits, Relative to Baseline



Loan Deposit Ratio, Relative to Baseline

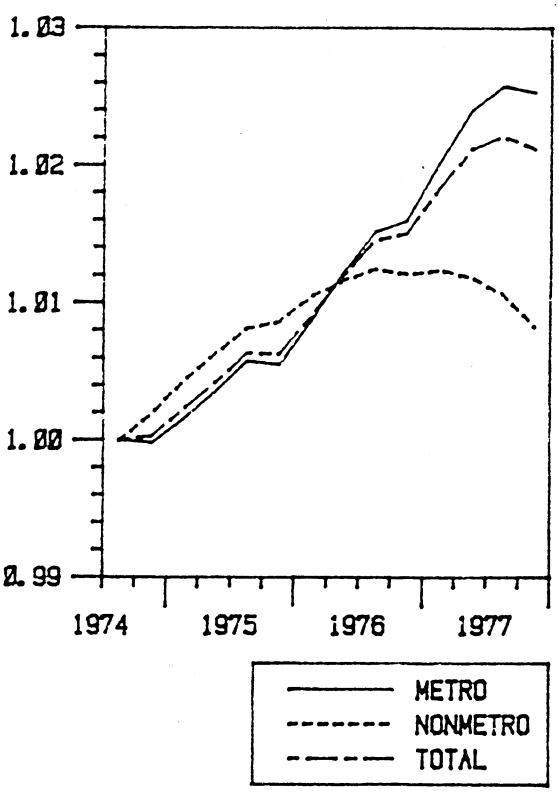
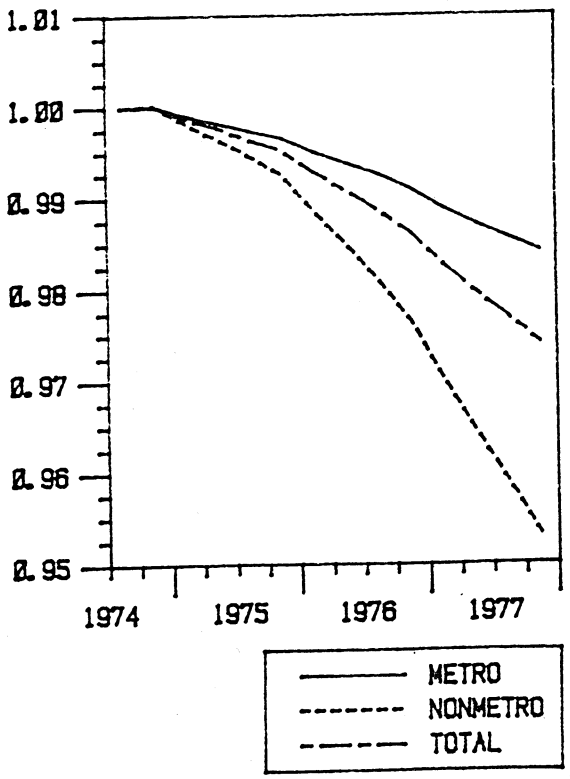
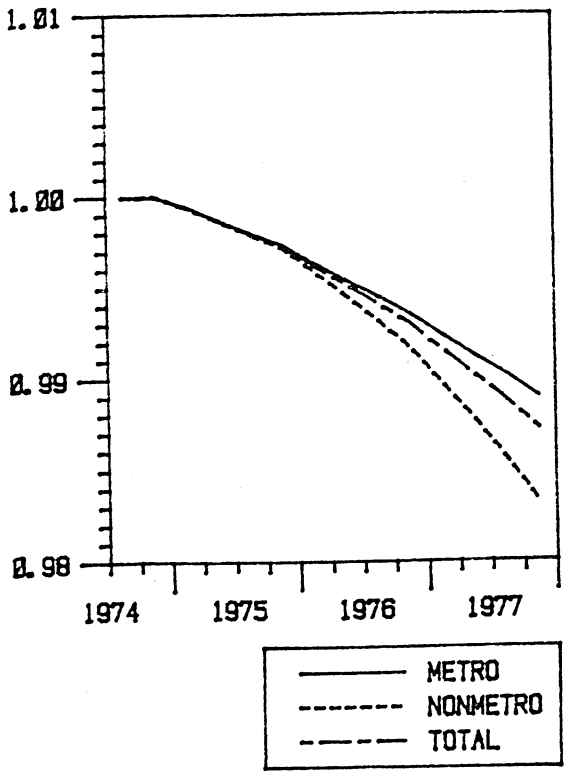


FIGURE 4.9 South
Permanent Tightening of Monetary Policy (Alternative 2)

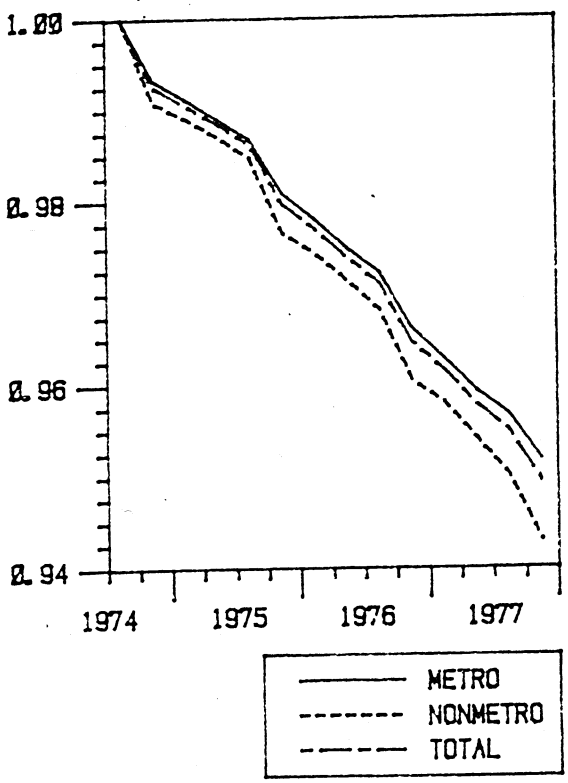
Personal Income, Relative to Baseline



Employment, Relative to Baseline



Total Deposits, Relative to Baseline



Loan Deposit Ratio, Relative to Baseline

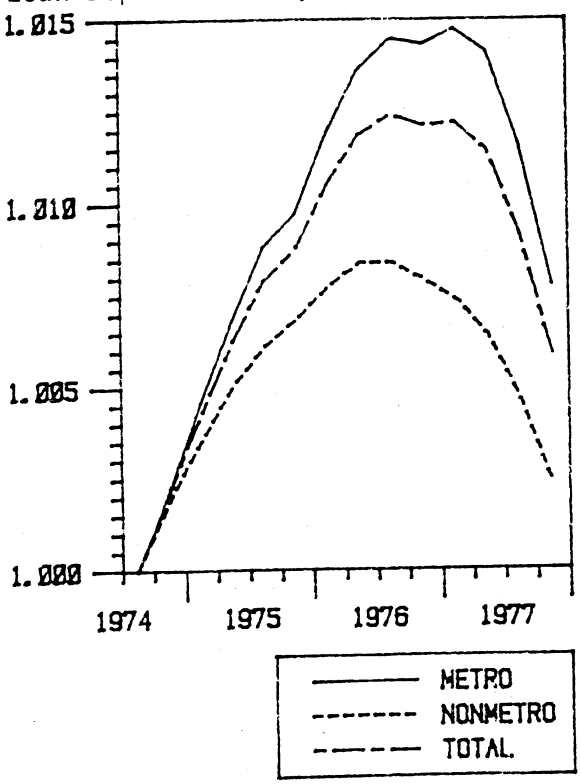
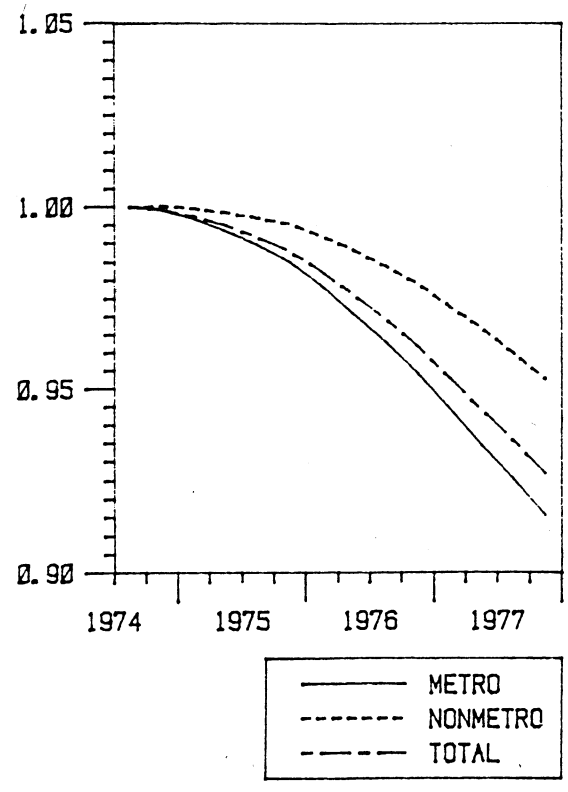
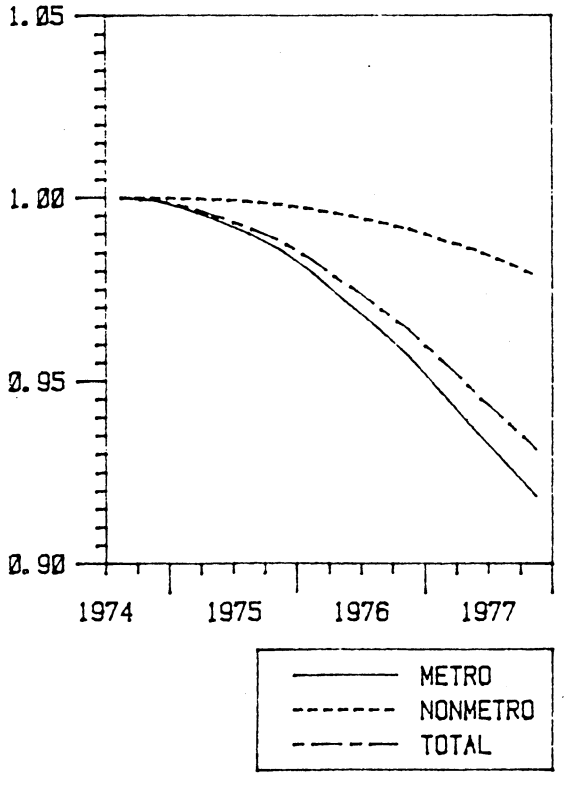


FIGURE 4.10 West
Permanent Tightening of Monetary Policy (Alternative 2)

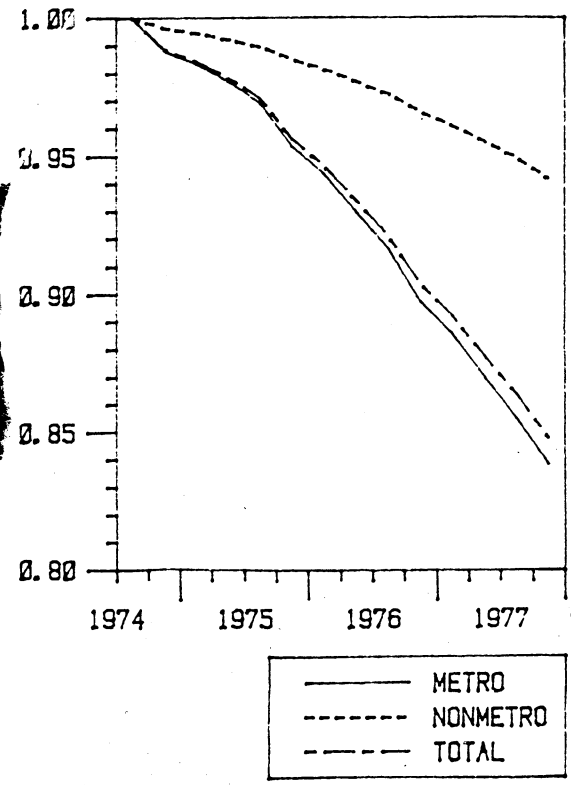
Personal Income, Relative to Baseline



Employment, Relative to Baseline



Total Deposits, Relative to Baseline



Loan Deposit Ratio, Relative to Baseline

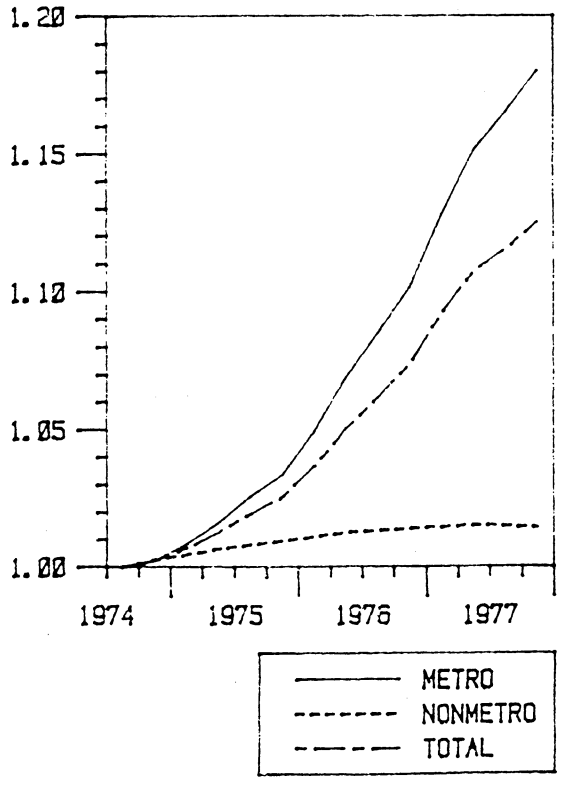


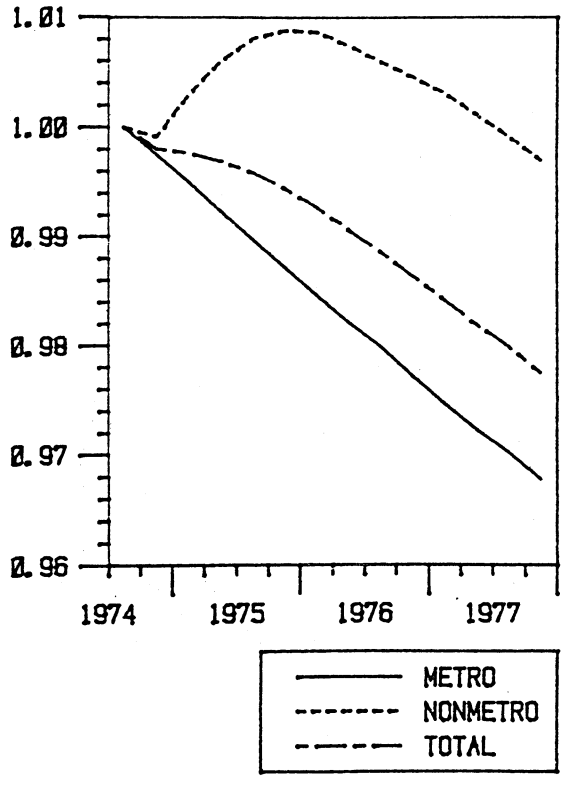
Table 4.2 tells essentially the same story. Total national employment declines in response to the deposit shift, although not quite as much as the decline in personal income. The relative decline in the loan-deposit ratio in rural areas (see Table 4.6) makes them more competitive in manufacturing and, as a consequence, manufacturing employment grows relative to baseline in rural areas. The decline in metropolitan manufacturing employment, however, is 5 percent. As with income, total employment in the South and West declines the most.

The behavior of housing starts and total deposits is shown in Tables 4.4 and 4.5. The increase in demand deposits in 1974:4 pulls up rural total deposits by almost 6 percent immediately. Similarly, total deposits decline by 1.5 percent in metropolitan areas in 1974:4. Since mortgages are driven by deposits, mortgages shift in a similar fashion. If mortgages flowed without interference across regions, a deposit-mortgage shift should have no effect on the distribution of housing starts. Note, however, that rural starts slightly increase in 1974:4 and 1975:1 while they sharply decrease in the same period in metropolitan areas. The overall decline in starts reflects again our finding that any rural expansionary effects from the deposit shift are more than offset by the contractionary effects in metropolitan areas.

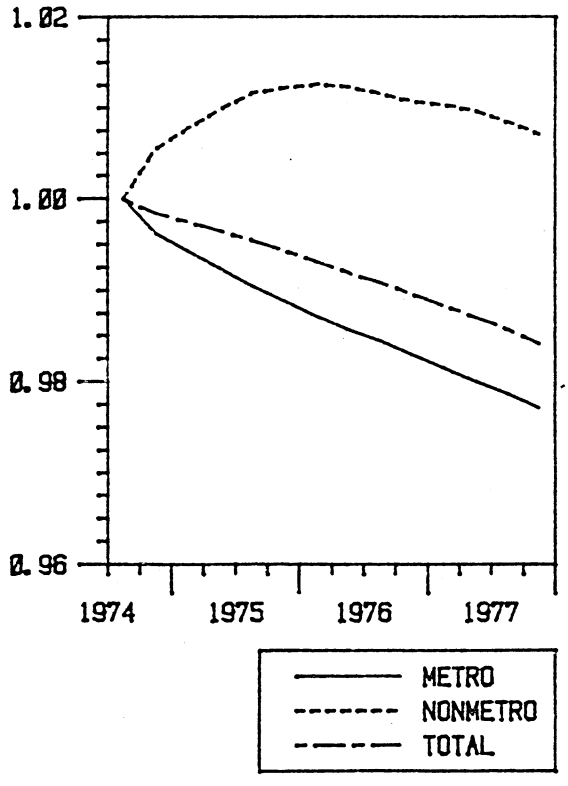
Figures 4.11 through 4.15 display this experiment graphically.

FIGURE 4.11 US Total
Shift of Funds to Rural Areas (Alternative 3)

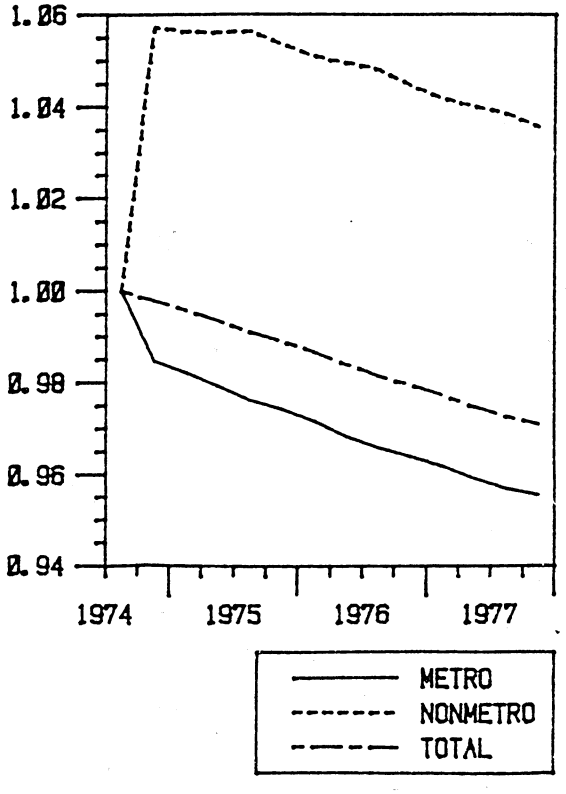
Personal Income, Relative to Baseline



Employment, Relative to Baseline



Total Deposits, Relative to Baseline



Loan Deposit Ratio, Relative to Baseline

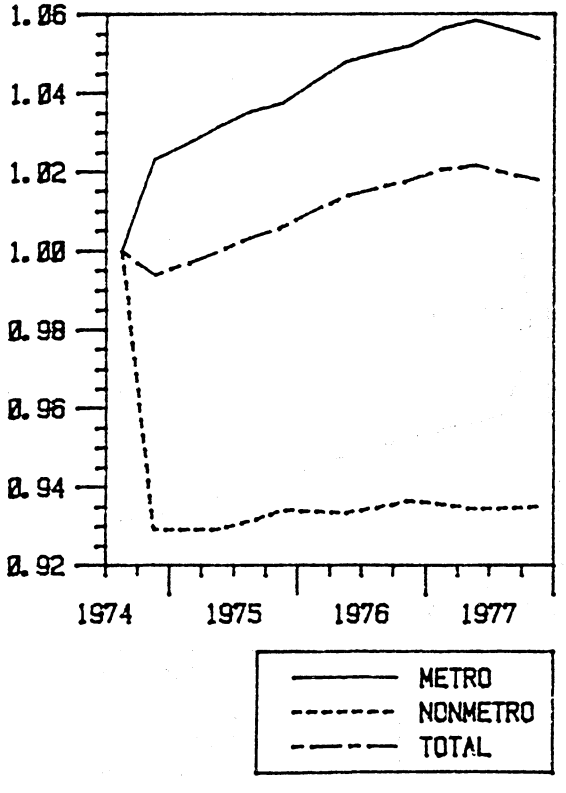
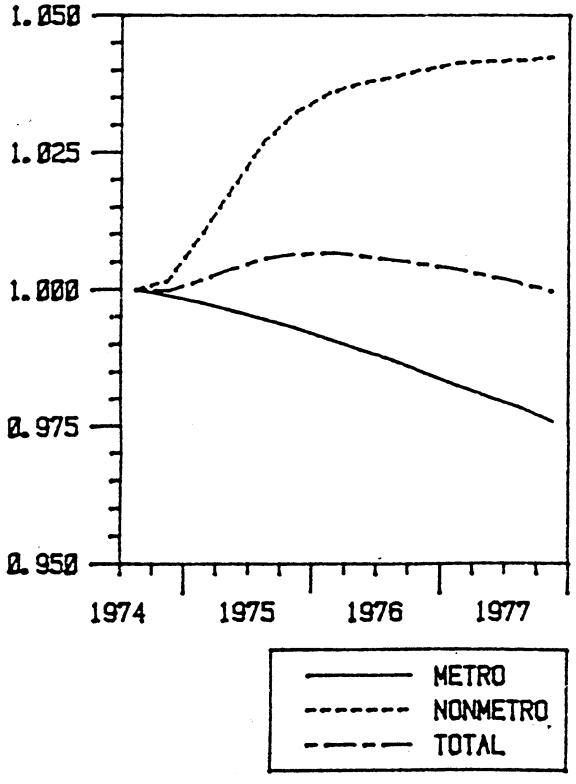
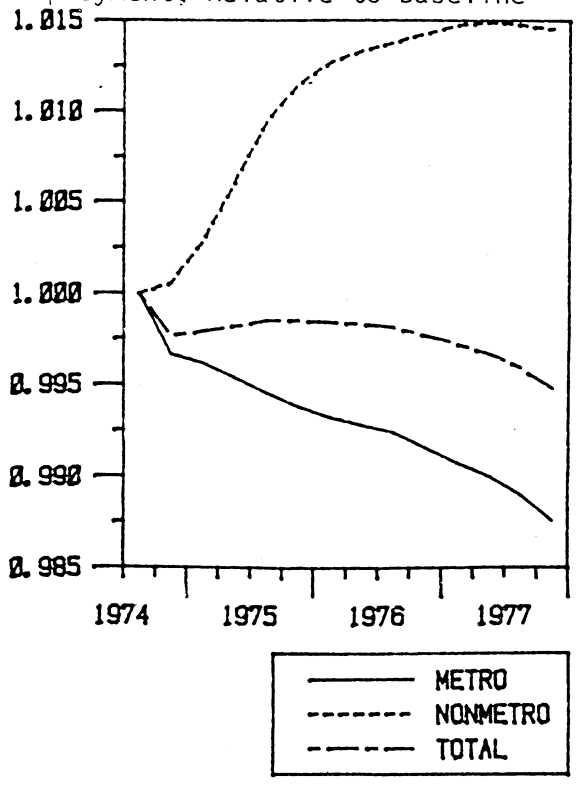


FIGURE 4.12 North Central
Shift of Funds to Rural Areas (Alternative 3)

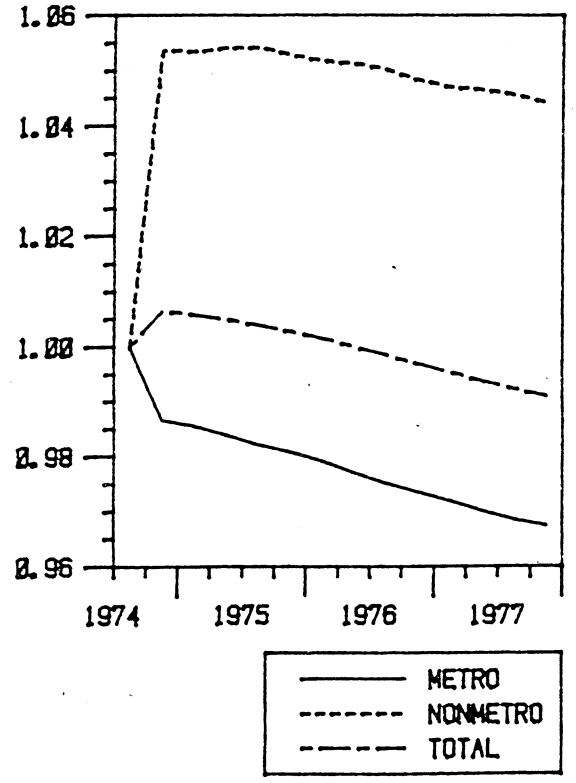
Personal Income, Relative to Baseline



Employment, Relative to Baseline



Total Deposits, Relative to Baseline



Loan Deposit Ratio, Relative to Baseline

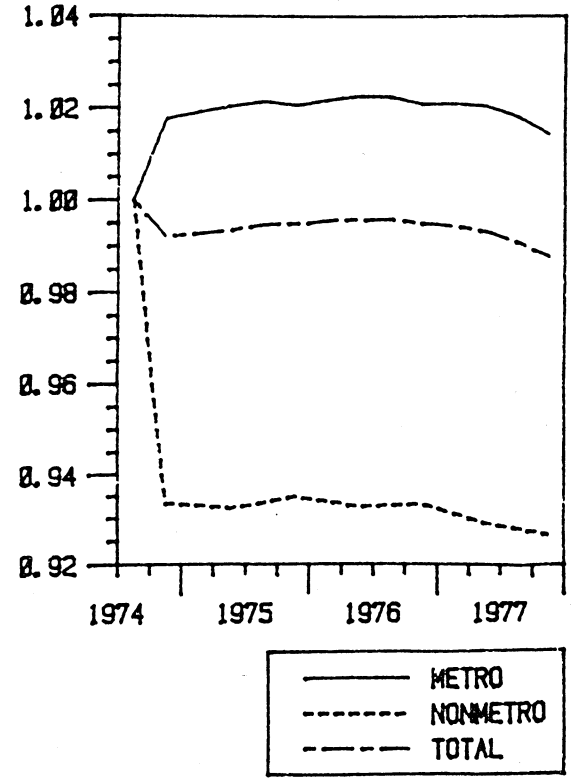
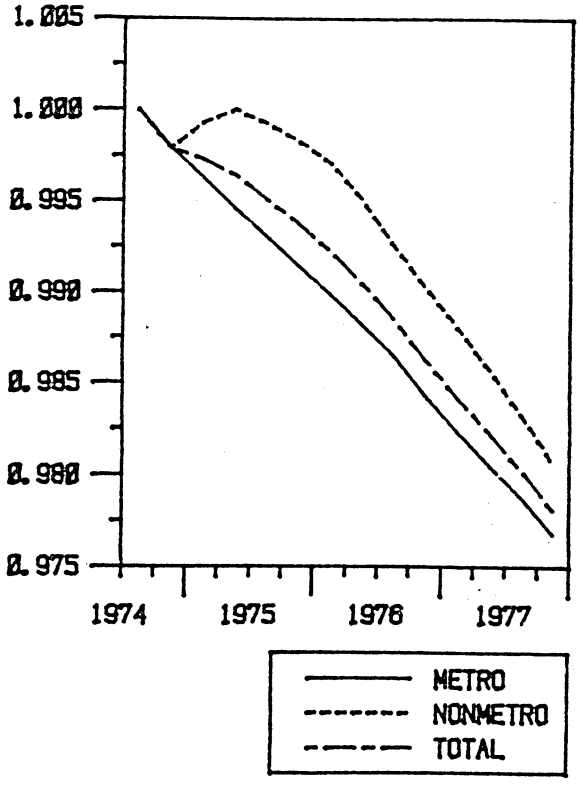
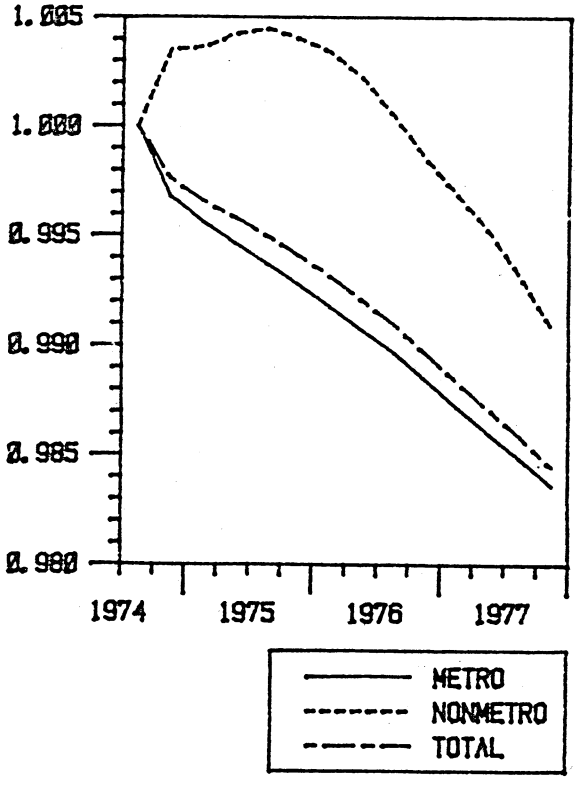


FIGURE 4.13 Northeast
Shift of Funds to Rural Areas (Alternative 3)

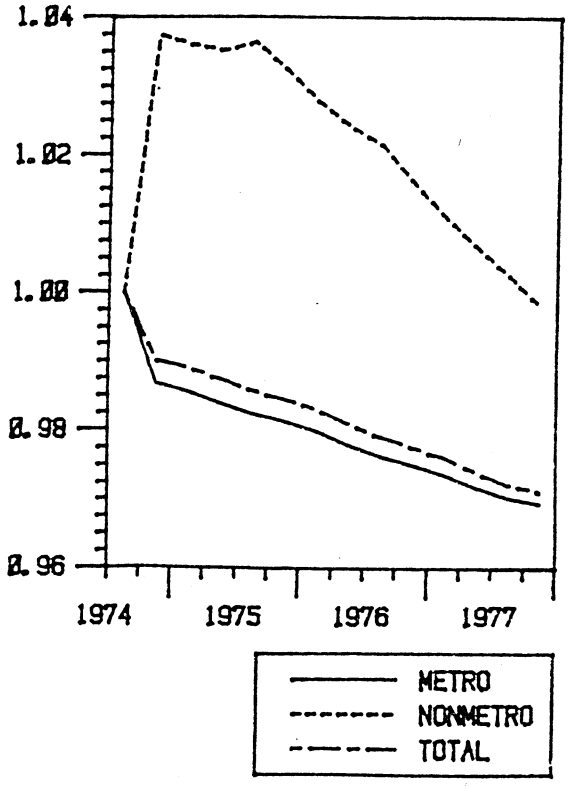
Personal Income, Relative to Baseline



Employment, Relative to Baseline



Total Deposits, Relative to Baseline



Loan Deposit Ratio, Relative to Baseline

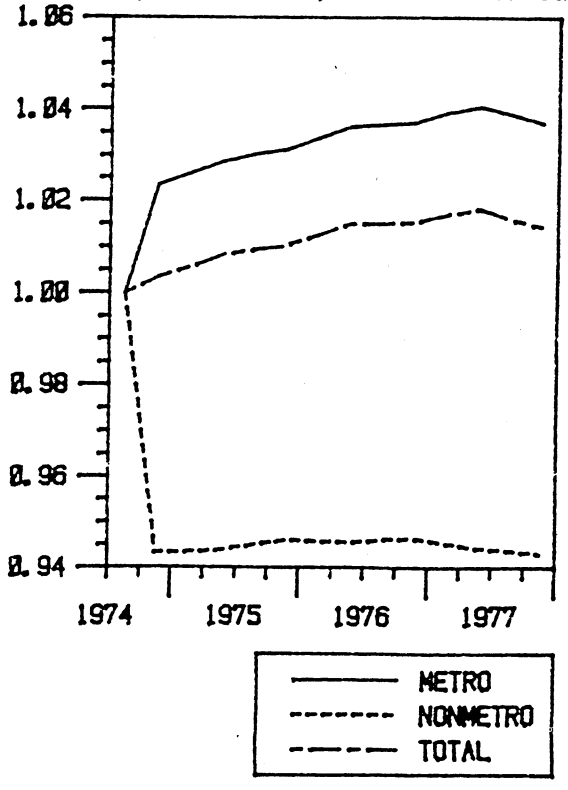
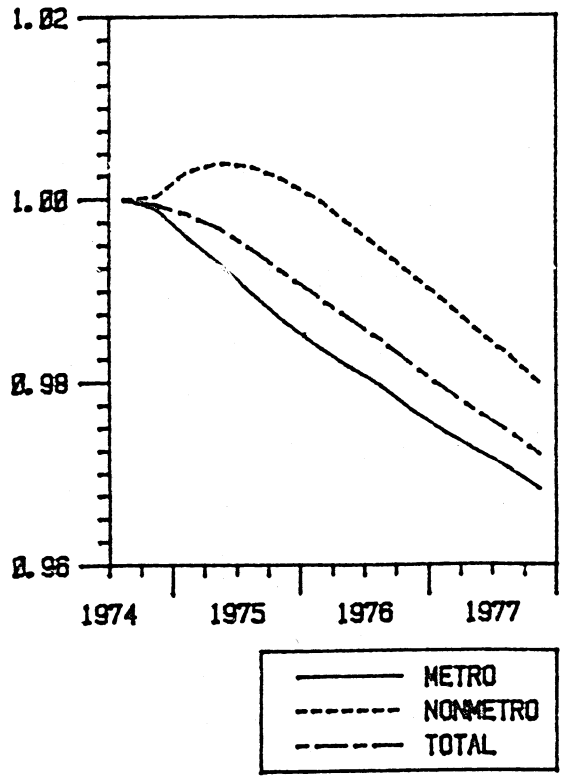
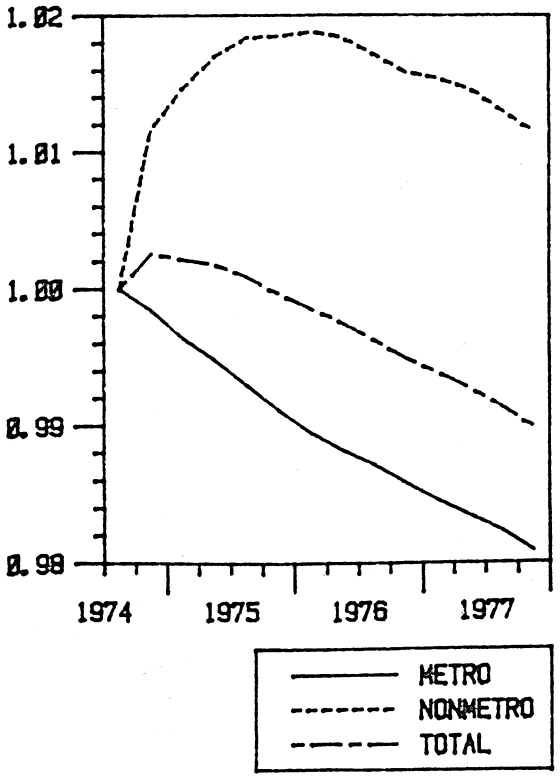


FIGURE 4.14 South
Shift of Funds to Rural Areas (Alternative 3)

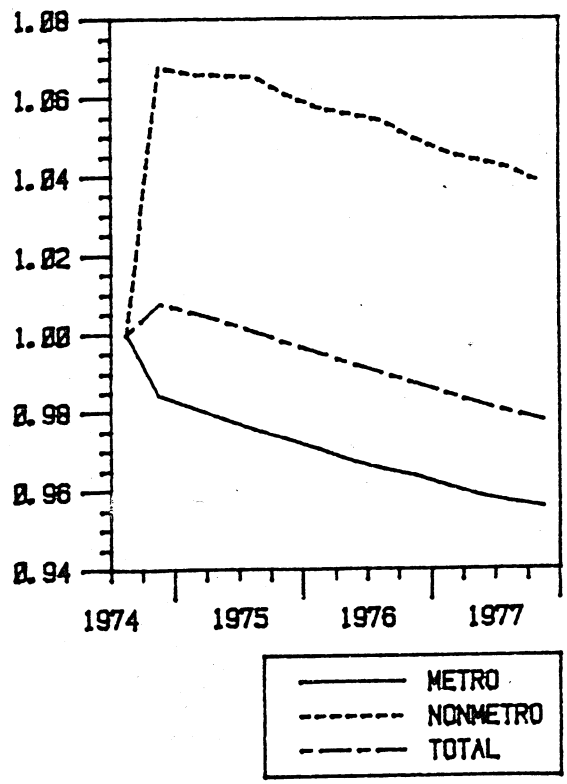
Personal Income, Relative to Baseline



Employment, Relative to Baseline



Total Deposits, Relative to Baseline



Loan Deposit Ratio, Relative to Baseline

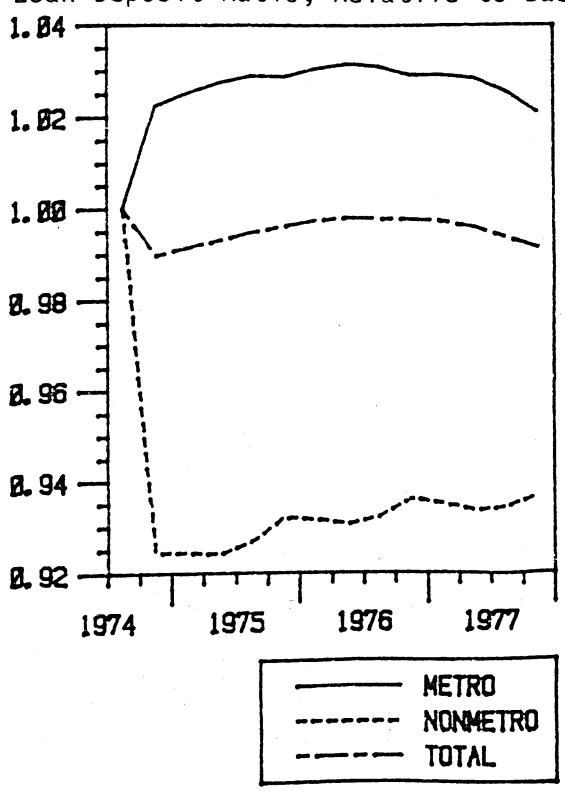
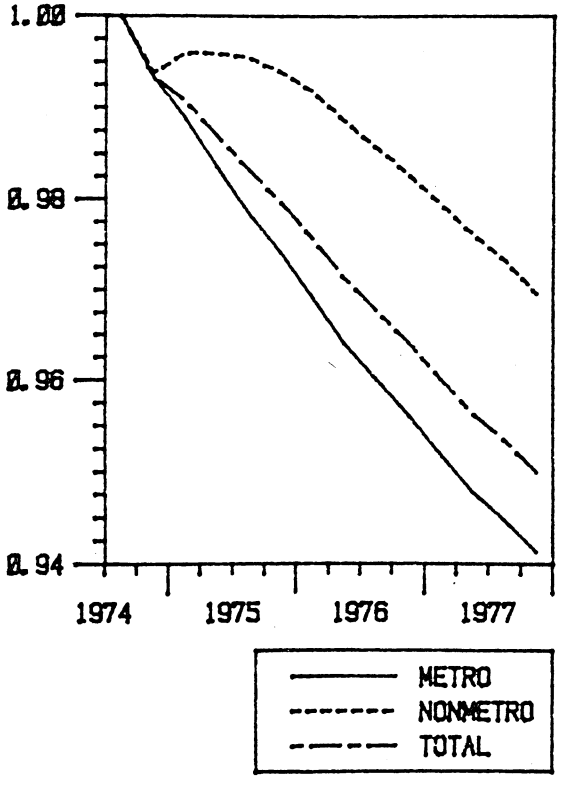
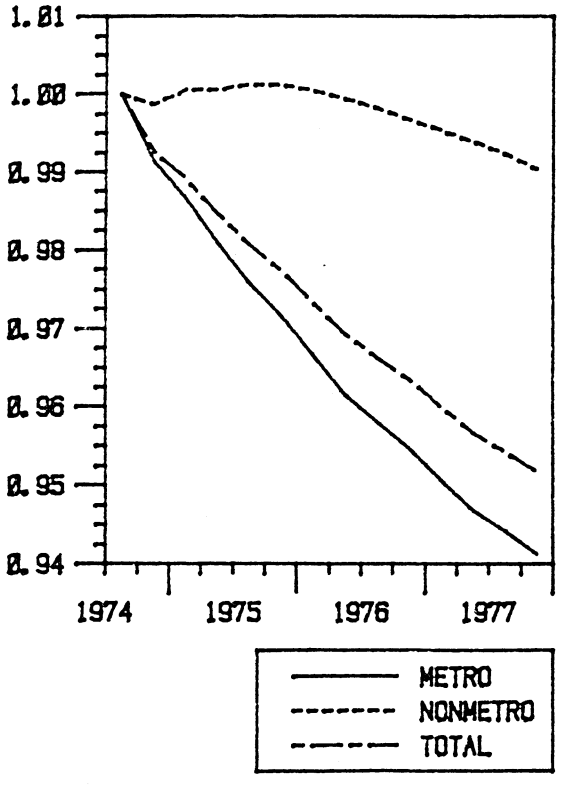


FIGURE 4.15 West
Shift of Funds to Rural Areas (Alternative 3)

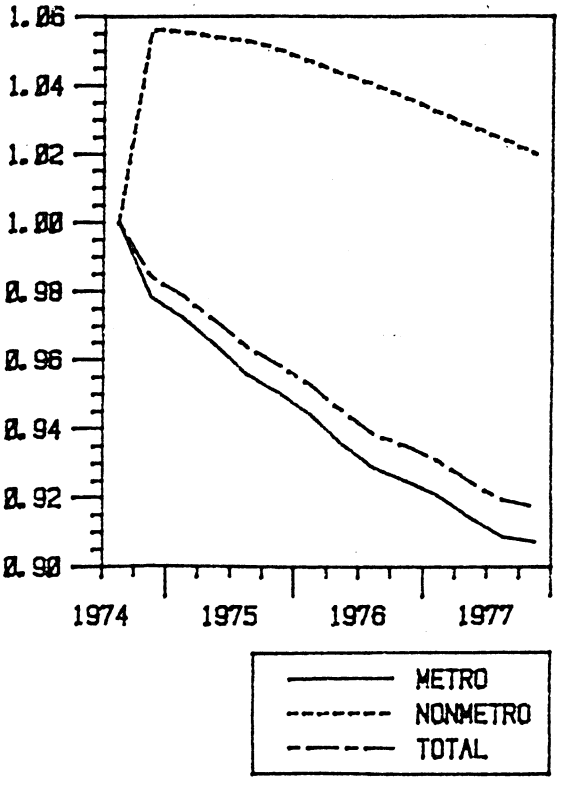
Personal Income, Relative to Baseline



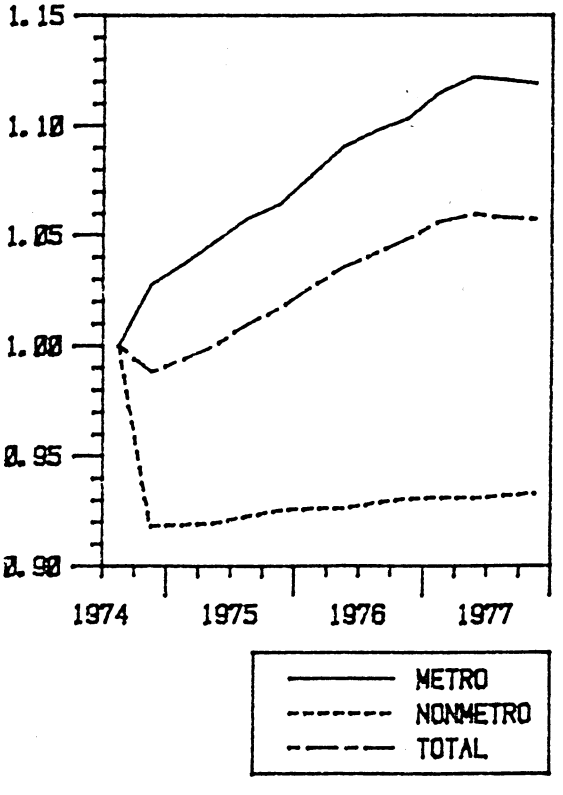
Employment, Relative to Baseline



Total Deposits, Relative to Baseline



Loan Deposit Ratio, Relative to Baseline



5. CONCLUSIONS AND RECOMMENDATIONS

The purpose of this project was to build and demonstrate a model capable of evaluating the intra- and inter-regional economic effects of changes in national financial policies. We discussed the conceptual foundations for the model in Chapter 2, the specification and estimation of its equations in Chapter 3, and a few simulations of the model using alternative financial policy assumptions in Chapter 4.

5.1 PRINCIPAL FINDINGS AND CONCLUSIONS

Two major policy conclusions can be drawn from this project:

(1) Changes in overall monetary policy -- as measured by changes in the federal funds rate -- tend to have a slightly greater impact on metropolitan areas than rural areas; and

(2) Increases in credit to rural areas financed from metropolitan areas increases rural economic activity, but (a) the decrease in metropolitan activity more than offsets the rural gains, and (b) the rural gains tend to dissipate over time.

The first result does not hold for each of the four census regions. While rural areas in the North Central region and the West are less affected by monetary changes, rural areas in the Northeast and the South are more affected. For the U.S. as a whole, deposit flows into rural area banks and thrift institutions were found to be less sensitive to interest rates. Consequently, the loan-deposit ratio -- the measure of regional credit conditions used in the model -- changes less in rural areas.

Reinforcing this difference is our finding that manufacturing employment, the measure of regional export activity in the model, generally responds less to credit conditions in rural areas than in metropolitan areas. When export activity within a region is less responsive to monetary conditions, the regional employment-income multiplier process results in a smaller overall change in the region's economic activity.

The second result -- in particular, part (a) -- follows from the first. The inelastic response of rural areas to monetary variables relative to metropolitan areas produces the finding that an increase in credit to rural areas increased rural activity less than it decreased metropolitan activity. The consequent overall decline in national activity then led to second round declines in rural activity -- the metropolitan demand for rural products decreased and was not fully offset by the increased rural demand for rural products -- ultimately more than offsetting the initial gains.

5.2 AREAS FOR FURTHER INVESTIGATION

The conclusions produced by this model have important implications for policy-makers. However, it is important to recognize that these results are only preliminary:

- More extensive testing is needed to determine how sensitive the results are to the way certain key equations (e.g., deposit flows, housing, manufacturing employment) are specified.

- The model is based on the structure of financial institutions that existed in the early and mid-1970's before deregulation of these institutions began. Changes in the behavior of financial institutions to reflect deregulation, which could be added to the model, might yield different results.

- Results may depend in part on the level of disaggregation chosen. Extension of the model to allow separate analysis of each Federal Reserve District might provide especially interesting insights. More detailed treatment of states allowing state-wide branching, versus states which do not, would be equally useful.

All of these efforts, which were beyond the scope of the present effort, merit priority attention. Widespread dissemination and discussion of the model among regional researchers and policy-makers will undoubtedly stimulate such efforts, as well as subjecting the model to the critical scrutiny which should be demanded of policy models before their results are accepted as convincing enough to support crucial policy choices. The model developed in this project represents a major step forward. However, it is only one step among many in our progress toward understanding the process of economic development. It is not a stopping point, but rather a new starting point for further work.

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APPENDIX A.1 STOCHASTIC EQUATIONS*

I. NATIONAL FINANCIAL MARKETS

1. $\Delta RFF = f(\Delta \bar{UN},\ \Delta PCT^{+}(PC),\ \Delta PCT(\overset{+}{DDEP}))$

2. $\Delta RAAU = f(\Delta \overset{+}{RFF},\ \Delta(IPZ/\overset{+}{CSHFLW}),\ \Delta PCT^{+}(PC))$

3. $PCT(CSHFLW) = f(PCT(\overset{+}{GNPZ}),\ PCT(WR/PGNP),\ \bar{DWPFR})$

II. REGIONAL FINANCIAL MARKETS

4. $\Delta DDEPr = f(\Delta \overset{+}{PIZr},\ \bar{RFF})$

5. $\Delta SDEPr = f(\bar{RFF}-RQ)$

6. $\Delta TDEPr = f(\Delta \overset{+}{PIZr},\ \overset{+}{RFF})$

7. $\Delta THDEPr = f(\Delta \overset{+}{PIZr},\ \bar{RFF}-RQ)$

8. $\Delta CIr = f(\Delta((IINF+IP)*\overset{+}{PIP}*(MFEMr/MFEM)),$

$(CSHFLW*(\bar{MFEM}r/MFEM)))$

9. $\Delta MORCr = f(\Delta(DDEPr + \overset{+}{TDEPr} + SDEPr))$

10. $\Delta MORTr = f(\Delta \overset{+}{THDEPr})$

III. THE REAL SIDE OF THE REGIONAL ECONOMIES

11. $MFEMr/MFEM = f(\overset{+}{CIr}/CI,\ \bar{CLDEPRr}/CLDEPR)$

* The signs above the independent variables indicate the qualitative effect on the dependent variable. Unless otherwise noted, r refers to one of the four rural or four metro regions. PCT(X) means percentage change in X, ΔX means change in X, and EXP(X) means e^X.

12. $COEM_r = f(\overset{+}{HS}_r, CLDEPR_r/CLDEPR, CI_r/\overset{+}{PGNP})$

13. $OTEM_r = f((\overset{+}{PIZ}_r - YPT_r)/PC, \overset{+}{YPT}_r/PC)$

14. $PCT(W_r) = f(\overset{+}{PCT}(W), PCT(\overset{+}{EM}_r/EM))$

15. $\Delta(OLI_r) = f(\overset{+}{\Delta}(W_r))$

16. $SOCI_r = f(W_r * \overset{+}{SSRATE})$

17. $TRP_r = f(\overset{+}{TRO}, TUW * \overset{+}{W}_r/W)$

18. $YP_r = f(((IINF + IP) * PIP) \overset{+}{*} (PIZ_r/PIZ))$

19. $YPT_r = f(\overset{+}{TOTDEP}_r, \overset{+}{LDEPR}_r)$

20.* $PIZ_r/PIW_r = f(\overset{+\ -}{TIME})$

21. $HS_r = f(\overset{+}{PI}_r, \Delta(\overset{+}{MOR}_r/PIH), \Delta(\overset{+}{MOR}^{adj}_r/PIH), \overset{-}{KS}_r)$

IV. THE REAL SIDE OF THE NATIONAL ECONOMY

22. $CD = f(\overset{-}{PCD}/PC, \overset{+}{DIZ}/PC)$

23. $CO = f(\overset{-}{PCO}/PC, \overset{+}{DIZ}/PC)$

24. $CS = f(\overset{+}{DIZ}/PC)$

25. $IH = f(\overset{+}{HS}, \overset{-}{PIH}/PGNP, \overset{+}{PI})$

26. $IP = f(\overset{-}{UN}, \overset{+}{CD+CO}, \overset{+}{XIPM} * 100/K, \overset{-}{KCOST})$

* where r refers to one of the four metro regions or one of the four total regions.

27. IINF = f((PCT(PWIIND) $\overset{+}{-}$ PCT(PWIIND(-2))),

XIPM$\overset{+}{*}$100/K, CD$\overset{-}{+}$CO, CD(-1)$\overset{+}{+}$CO(-1),

CI/(DDEP+SD$\bar{E}$P+TDEP))

28. W = f(PG$\overset{+}{N}$P, G$\overset{+}{N}$P, $\bar{U}$N)

29. PCT(PCD) = f(PCT(P$\overset{+}{W}$IIND), PCT($\overset{+}{W}$R))

30. PCT(PCO) = f(PCT($\overset{+}{P}$WI29), PCT($\overset{+}{P}$WIF), PCT($\overset{+}{W}$/GNP))

31. PCT(PCS) = f(PC$\overset{+}{T}$(WR), PCT(P$\overset{+}{W}$I29), PCT($\overset{+}{P}$IH))

32. PCT(PGNP) = f(PCT($\overset{+}{P}$CO), PCT($\overset{+}{P}$CD), PCT($\overset{+}{P}$CS), PCT($\overset{+}{P}$IH),

PCT($\overset{+}{P}$IP))

33. PCT(PIH) = f(PCT($\overset{+}{W}$/GNP), PCT($\overset{+}{P}$WIIND), PCT($\overset{+}{C}$OEM)

34. PCT(PIP) = f(PCT($\overset{+}{W}$/GNP), PCT($\overset{+}{P}$WIIND))

35. PCT(PWIIND) = f(PCT($\overset{+}{W}$/GNP), PCT($\overset{+}{P}$WI29))

36. XIPM = f($\overset{+}{C}$D, CO$\overset{+}{+}$CS, I$\overset{+}{P}$, I$\overset{+}{H}$, $\overset{+}{G}$, N$\overset{+}{E}$X, I$\overset{+}{I}$NF)

37. MFEM = f(X$\overset{+}{I}$PM, $\bar{K}$, TI$\bar{M}$E)

38. LF = f(P$\overset{+}{T}$, (P64+P$\overset{+}{4}$4)/PT)

APPENDIX A.2 IDENTITIES

*ADJr	=	PIZr - PIWr
**ADJr	=	$ADJr^{adjT} - ADJr^{adjM}$
CI	=	$\sum r(CIr)$
CLDEPR	=	CI/(DDEP+SDEP+TDEP)
CLDEPRr	=	CIr/(DDEPr+SDEPr+TDEPr)
COEM	=	$\sum r(COEMr)$
DDEP	=	$\sum r(DDEPr)$
DIZ	=	$\sum r(DIZr)$
DIZr	=	PIZr · (1-PTRr)
EM	=	$\sum r(EMr)$
EMr	=	MFEMr + COEMr + OTEMr
GNP	=	CD + CO + CS + IH + IP + IINF + G + NEX
GNPZ	=	GNP · PGNP
HS	=	$\sum r(HSr)$
IPZ	=	IP · PIP
K	=	K(-1) · (1-D) + (IP/4)
KCOST	=	0.2 · QS + 0.8 · QE
KSr	=	KSr(-1) · (1-Dr) + HSr
LDEPRr	=	(CIr+MORr)/TOTDEPr
MORr	=	MORTr + MORCr
PC	=	((PCD · CD) + (PCO · CO) + (PCS · CS))/(CD+CO+CS)
PI	=	PIZ/PGNP
PIr	=	PIZr/PGNP
PIWr	=	Wr + OLIr + TRPr + YPr + YPTr - SOCIr
PIZ	=	$\sum r(PIZr)$

* where r refers to one of the four metro regions or one of the four total regions.

** where r refers to one of the four rural regions and adjT and adjM refer to the adjoining total and metro regions, respectively.

```
*PIZr       =  PIWr + ADJr
QE          =  PIP * 0.96 * (RAAU * .01 + 0.181) * (1-TXRCF * ZE -
               DITC)/(PWIIND * (1-TXRCF))
QS          =  PIP * 1.1 * (RAAU * .01 + 0.095) * (1-TXRCF *
               ZS)/(PWIIND * (1-TXRCF))
RTE         =  RAAU * TE/100
RTS         =  RAAU * TS/100
SDEP        =  ∑r(SDEPr)
TDEP        =  ∑r(TDEPr)
THDEP       =  ∑r(THDEPr)
TOTDEPr     =  DDEPr+SDEPr+TDEPr+THDEPr
UN          =  ((LF-EM)/LF) * 100
WR          =  W/EM
WRr         =  Wr/EMr
ZE          =  DSL*(1-EXP(-(RTE)))/(RTE)+DSYD*2*(1-1/(RTE)*(1-EXP
               (-(RTE))))/(RTE)+DDDB*(2/(RTE+2)*(1-EXP((-(RTE))/2-
               1))+1/(RTE)*(EXP((-(RTE))/2)-EXP(-(RTE))))+DEMER*
               (1-EXP((-0.05)*RAAU))/(0.05*RAAU),

ZS          =  DSL*(1-EXP(-(RTS)))/(RTS)+DSYD*2*(1-1(RTS)*(1-EXP(-
               (RTS))))/(RTS)+DDDB*(2/(RTS+2)*(1-EXP((-(RTS))/2-
               1))+1/(RTS)*(EXP((-(RTS))/2)-EXP(-(RTS))))+DEMER*
               (1-EXP((-0.05)*RAAU))/(0.05*RAAU),
```

* where r refers to one of the four rural regions. See endogenous equation #20. This equation appears in Appendix A-4 with the endogenous equation as a function of time.

NOTE ON IDENTITIES

The reader should note that two variables modeled stochastically in the real national block of the model, national manufacturing employment (MFEM) and national wages and salaries (W), can be computed alternatively by summing regional manufacturing employment (MFEMr) and regional wages and salaries (Wr), respectively, across the eight regions. These identities, however, are not part of the model. In all equations in the model where W or MFEM appear as explanatory variables, the values simulated by stochastic equations (27) and (37) are used. In arriving at national employment (EM) and national personal income (PIZ), we sum regional employment (EMr) and regional personal income (PIZr), respectively. These regional variables are computed with identities that include regional manufacturing employment (MFEMr) and regional wages and salaries (Wr). Hence, the simulated values of MFEM from stochastic equation (27) are not a component of EM, and the simulated values of W from stochastic equation (37) are not a component of PIZ.

APPENDIX A.3 GLOSSARY OF VARIABLES AND DATA SOURCES

SERIES	DESCRIPTION
ADJr	RESIDENCE ADJUSTMENT FOR PERSONAL INCOME, $MCUR, REGION R, IDENTITY.
CLDEPR	US AVERAGE, COMMERCIAL BANK LOAN DEPOSIT RATIO, IDENTITY.
CLDEPRr	COMMERCIAL BANK LOAN DEPOSIT RATIO, REGION R, IDENTITY.
CD	PERSONAL CONSUMPTION EXPENDITURES, DURABLE GOODS, $B72, TABLE 1, SURVEY OF CURRENT BUSINESS, DEPARTMENT OF COMMERCE.
CI	US TOTAL, COMMERCIAL AND INDUSTRIAL LOANS AT COMMERCIAL BANKS, $MCUR, IDENTITY.
CIr	COMMERCIAL AND INDUSTRIAL LOANS AT COMMERCIAL BANKS, $MCUR, REGION R, ITEM 1600, COMMERCIAL BANK STATEMENT OF INCOME AND STATEMENT OF CONDITION SUBSCRIPTION SERVICE, FEDERAL DEPOSIT INSURANCE CORPORATION.
CO	PERSONAL CONSUMPTION EXPENDITURE, NON-DURABLES, $B72, TABLE 1, SURVEY OF CURRENT BUSINESS, DEPARTMENT OF COMMERCE.
COEM	US TOTAL, CONTRACT CONSTRUCTION EMPLOYMENT, THOU, IDENTITY.
COEMr	CONTRACT CONSTRUCTION EMPLOYMENT, THOU, REGION R, UNPUBLISHED DATA, BUREAU OF ECONOMIC ANALYSIS, PROVIDED BY USDA.
CS	PERSONAL CONSUMPTION EXPENDITURE, SERVICES, $B72, TABLE 1, SURVEY OF CURRENT BUSINESS, DEPARTMENT OF COMMERCE.
CSHFLW	INTERNALLY GENERATED CORPORATE FUNDS, $BCUR, TABLE 7, 8, SURVEY OF CURRENT BUSINESS, DEPARTMENT OF COMMERCE.
D	DEPRECIATION RATE, FIXED CAPITAL INVESTMENT, EXOGENOUS.
DDDB	DOUBLE DECLINING BALANCE DEPRECIATION FACTOR, EXOGENOUS, CREATED BY CEA.
DDEP	US TOTAL, DEMAND DEPOSITS AT COMMERCIAL BANKS, $MCUR, IDENTITY.

SERIES	DESCRIPTION
DDEPr	DEMAND DEPOSITS AT COMMERCIAL BANKS, $MCUR, REGION R, ITEM 2240, COMMERCIAL BANK STATEMENT OF INCOME AND STATEMENT OF CONDITION SUBSCRIPTION SERVICE, FEDERAL DEPOSIT INSURANCE CORPORATION.
DEMER	KOREAN WAR EMERGENCY DEPRECIATION ALLOWANCE, EXOGENOUS, CREATED BY CEA.
DITC	STATUTORY RATE, INVESTMENT TAX CREDIT, EXOGENOUS, CREATED BY CEA.
DIZ	US TOTAL, DISPOSABLE PERSONAL INCOME, $MCUR, IDENTITY.
DIZr	DISPOSABLE PERSONAL INCOME, $MCUR, REGION R, IDENTITY.
Dr	DEPRECIATION RATE FOR HOUSING, REGION R, TABLE B, "ESTIMATES OF THE CHANGE IN INVENTORY:1973," ANNUAL HOUSING SURVEY, DEPARTMENT OF COMMERCE, EXOGENOUS.
DSL	STRAIGHT LINE DEPRECIATION FACTOR, EXOGENOUS, CREATED BY CEA.
DSYD	SUM OF YEARS DIGITS DEPRECIATION FACTOR, EXOGENOUS, CREATED BY CEA.
DWPFR	DUMMY VARIABLE, WAGE+PRICE CONTROLS, EXOGENOUS, CREATED BY CEA.
EM	US TOTAL, TOTAL EMPLOYMENT, IDENTITY.
EMr	TOTAL EMPLOYMENT, THOU, REGION R, IDENTITY.
G	GOVERNMENT PURCHASES OF GOODS & SERVICES, TABLE 1, SURVEY OF CURRENT BUSINESS, DEPARTMENT OF COMMERCE, EXOGENOUS.
GNP	GROSS NATIONAL PRODUCT, $B72, IDENTITY.
GNPZ	GROSS NATIONAL PRODUCT, $BCUR, IDENTITY.
HS	US TOTAL, HOUSING STARTS, THOU, IDENTITY.
HSr	TOTAL HOUSING STARTS, THOU, REGION R, "NEW PRIVATELY OWNED HOUSING UNITS STARTED INSIDE STANDARD METROPOLITAN AREAS," UNPUBLISHED DATA, AND TABLE 7, "NEW HOUSING UNITS STARTED BY LOCATION AND TYPE OF STRUCTURE," BUREAU OF THE CENSUS, DEPARTMENT OF COMMERCE.
IH	GROSS PRIVATE DOMESTIC INVESTMENT: FIXED RESIDENTIAL INVESTMENT, $B72, TABLE 1, SURVEY OF CURRENT BUSINESS, DEPARTMENT OF COMMERCE.

SERIES	DESCRIPTION
IINF	GROSS PRIVATE DOMESTIC INVESTMENT: CHANGE IN BUSINESS INVENTORIES, NONFARM, $B72, TABLE 1, SURVEY OF CURRENT BUSINESS, DEPARTMENT OF COMMERCE.
IP	GROSS PRIVATE DOMESTIC INVESTMENT: FIXED RESIDENTIAL INVESTMENT, $B72, TABLE 1, SURVEY OF CURRENT BUSINESS, DEPARTMENT OF COMMERCE.
IPZ	GROSS PRIVATE DOMESTIC INVESTMENT: FIXED NONRESIDENTIAL INVESTMENT, $BCUR, IDENTITY.
K	STOCK: FIXED BUSINESS INVESTMENT, $B72, IDENTITY.
KCOST	RENTAL COST OF CAPITAL, EQUIPMENT AND STRUCTURES, IDENTITY.
KSr	HOUSING STOCK, THOU, REGION R, IDENTITY. INITIAL VALUE FROM "CURRENT HOUSING REPORT, SERIES H-150-77: GENERAL CHARACTERISTICS FOR THE UNITED STATES AND REGIONS," BUREAU OF THE CENSUS AND ANNUAL HOUSING SURVEY:1977, PART A, IDENTITY.
LDEPRr	TOTAL LOAN DEPOSIT RATIO, REGION R, IDENTITY.
LF	TOTAL CIVILIAN LABOR FORCE, THOU, "EMPLOYMENT AND EARNINGS," BUREAU OF LABOR STATISTICS.
MFEM	US TOTAL, MANUFACTURING EMPLOYMENT, THOU, UNPUBLISHED DATA, BUREAU OF ECONOMIC ANALYSIS, PROVIDED BY USDA.
MFEMr	MANUFACTURING EMPLOYMENT, THOU, REGION R, UNPUBLISHED DATA, BUREAU OF ECONOMIC ANALYSIS, PROVIDED BY USDA.
MORr	MORTGAGES HELD AT COMMERCIAL BANKS AND THRIFT INSTITUTIONS, $MCUR, REGION R, IDENTITY.
MORCr	MORTGAGES HELD AT COMMERCIAL BANKS, $MCUR, REGION R, NORTH CENTRAL, ITEM 1430, 1460, COMMERCIAL BANK STATEMENT OF INCOME AND STATEMENT OF CONDITION SUBSCRIPTION SERVICE, FEDERAL DEPOSIT INSURANCE CORPORATION.

SERIES	DESCRIPTION
MORTr	MORTGAGES HELD AT THRIFT INSTITUTIONS, $MCUR, REGION R, MUTUAL SAVINGS BANK STATEMENT OF CONDITION SUBSCRIPTION SERVICE, FEDERAL DEPOSIT INSURANCE CORPORATION. SAVINGS AND LOAN ASSOCIATION STATEMENT OF CONDITION, FEDERAL HOME LOAN BANK BOARD.
NEX	NET EXPORTS OF GOODS & SERVICES, TABLE 1, SURVEY OF CURRENT BUSINESS, DEPARTMENT OF COMMERCE, EXOGENOUS.
OLIr	OTHER LABOR INCOME, $MCUR, REGION R, TABLE 5, "PERSONAL INCOME BY MAJOR SOURCES AND TOTAL LABOR INCOME BY TYPE AND INDUSTRY, US, STATES, AND COUNTIES," REGIONAL MEASUREMENT DIVISION, BEA.
OTEMr	OTHER EMPLOYMENT, THOU, REGION R, UNPUBLISHED DATA, BUREAU OF ECONOMIC ANALYSIS, PROVIDED BY USDA.
PC	PRICE DEFLATOR, PERSONAL CONSUMPTION EXPENDITURE, TOTAL, 72 = 100, IDENTITY.
PCD	PRICE DEFLATOR, PERSONAL CONSUMPTION EXPENDITURE, DURABLES, 72 = 100, TABLE 19, SURVEY OF CURRENT BUSINESS, DEPARTMENT OF COMMERCE.
PCO	PRICE DEFLATOR, PERSONAL CONSUMPTION EXPENDITURE, NON-DURABLES, 72 = 100, TABLE 19, SURVEY OF CURRENT BUSINESS, DEPARTMENT OF COMMERCE.
PCS	PRICE DEFLATOR, PERSONAL CONSUMPTION EXPENDITURE, SERVICES, 72 = 100, TABLE 19, SURVEY OF CURRENT BUSINESS, DEPARTMENT OF COMMERCE.
PGNP	IMPLICIT DEFLATOR, GROSS NATIONAL PRODUCT, 72 = 100, TABLE 19, SURVEY OF CURRENT BUSINESS, DEPARTMENT OF COMMERCE.
PI	US TOTAL, PERSONAL INCOME, $M72, IDENTITY.
PIH	IMPLICIT DEFLATOR, RESIDENTIAL INVESTMENT, 72 = 100, TABLE 19, SURVEY OF CURRENT BUSINESS, DEPARTMENT OF COMMERCE.
PIr	PERSONAL INCOME, $M72, REGION R, IDENTITY.
PIP	IMPLICIT DEFLATOR, FIXED BUSINESS INVESTMENT, 72 = 100, TABLE 19, SURVEY OF CURRENT BUSINESS, DEPARTMENT OF COMMERCE.
PIWr	PERSONAL INCOME BY PLACE OF WORK, $MCUR, REGION R, IDENTITY.

SERIES	DESCRIPTION
PIZ	US TOTAL, PERSONAL INCOME, $MCUR, IDENTITY.
PIZr	PERSONAL INCOME, $MCUR, REGION R, TABLE 5, "PERSONAL INCOME BY MAJOR SOURCES AND TOTAL LABOR INCOME BY TYPE AND INDUSTRY, US, STATES, AND COUNTIES," REGIONAL MEASUREMENT DIVISION, BEA.
PT	TOTAL POPULATION INCLUDING ARMED FORCES OVERSEAS, THOU, "EMPLOYMENT AND EARNINGS," BUREAU OF LABOR STATISTICS, EXOGENOUS.
PTRr	PERSONAL TAX RATE, REGION R, EXOGENOUS, CREATED BY CEA.
PWIF	PRODUCER PRICE INDEX, FARM PRODUCTS, 67 = 100, PRODUCER (WHOLESALE) PRICE INDEXES, BUREAU OF LABOR STATISTICS, EXOGENOUS.
PWIIND	PRODUCER PRICE INDEX, INDUSTRIAL COMMODITIES, 67 = 100, PRODUCER (WHOLESALE) PRICE INDEXES, BUREAU OF LABOR STATISTICS.
PWI29	PRODUCER PRICE INDEX, PETROLEUM PRODUCTS, 67 = 100, PRODUCER (WHOLESALE) PRICE INDEXES, BUREAU OF LABOR STATISTICS, EXOGENOUS.
P44	POPULATION AGED 18-44, THOU, "EMPLOYMENT AND EARNINGS," BUREAU OF LABOR STATISTICS, EXOGENOUS.
P64	POPULATION AGED 45-64, THOU, "EMPLOYMENT AND EARNINGS," BUREAU OF LABOR STATISTICS, EXOGENOUS.
QE	RENTAL COST OF CAPITAL, EQUIPMENT, IDENTITY.
QS	RENTAL COST OF CAPITAL, STRUCTURE, IDENTITY.
RAAU	RATE: NEW ISSUE AA UTILITY BONDS, DEFERRED CALL, %, SALOMAN BROTHERS.
RFF	RATE: FEDERAL FUNDS, %, FEDERAL RESERVE BULLETIN, FEDERAL RESERVE BOARD.
RQ	CEILING RATE ON PASSBOOK DEPOSITS, %, EXOGENOUS.
RTE	RTE = RAAU*TE/100, IDENTITY.
RTS	RTS = RAAU*TS/100, IDENTITY.
SDEP	US TOTAL, SAVINGS DEPOSITS AT COMMERCIAL BANKS, $MCUR, IDENTITY.

SERIES	DESCRIPTION
SDEPr	SAVINGS DEPOSITS AT COMMERCIAL BANKS, $MCUR, REGION R, ITEM 2370, COMMERCIAL BANK STATEMENT OF INCOME AND STATEMENT OF CONDITION SUBSCRIPTION SERVICE, FEDERAL DEPOSIT INSURANCE CORPORATION.
SOCIr	CONTRIBUTIONS TO SOCIAL INSURANCE, $MCUR, REGION R, NORTH CENTRAL, TABLE 5, "PERSONAL INCOME BY MAJOR SOURCES AND TOTAL LABOR INCOME BY TYPE AND INDUSTRY, US, STATES, AND COUNTIES," REGIONAL MEASUREMENT DIVISION, BEA.
SSRATE	SOCIAL SECURITY TAX RATE, EXOGENOUS.
TDEP	US TOTAL, TIME DEPOSITS AT COMMERCIAL BANKS, $MCUR, IDENTITY.
TDEPr	TIME DEPOSITS AT COMMERCIAL BANKS, $MCUR, REGION R, NORTH CENTRAL, ITEM 2420, COMMERCIAL BANK STATEMENT OF INCOME AND STATEMENT OF CONDITION SUBSCRIPTION SERVICE, FEDERAL DEPOSIT INSURANCE CORPORATION.
TE	ACCOUNTING TAX LIFE FOR EQUIPMENT, EXOGENOUS, CREATED BY CEA.
THDEP	US TOTAL, DEPOSITS AT THRIFT INSTITUTIONS, $MCUR, IDENTITY.
THDEPr	DEPOSITS AT THRIFT INSTITUTIONS, $MCUR, REGION R, NORTH CENTRAL, MUTUAL SAVINGS BANK STATEMENT OF CONDITION SUBSCRIPTION SERVICE, FEDERAL DEPOSIT INSURANCE CORPORATION. SAVINGS AND LOAN ASSOCIATION STATEMENT OF CONDITION, FEDERAL HOME LOAN BANK BOARD.
TIME	LINEAR TIME TREND, EXOGENOUS, CREATED BY CEA.
TOTDEPr	TOTAL DEPOSITS AT COMMERCIAL BANKS AND THRIFT INSTITUTIONS, REGION R, IDENTITY.
TRO	TRANSFER PAYMENTS TO PERSONS EXCLUDING UNEMPLOYMENT BENEFITS, $BCUR, TABLE 10, SURVEY OF CURRENT BUSINESS, DEPARTMENT OF COMMERCE, EXOGENOUS.
TRPr	TRANSFER PAYMENTS, $MCUR, REGION R, TABLE 5, "PERSONAL INCOME BY MAJOR SOURCES AND TOTAL LABOR INCOME BY TYPE AND INDUSTRY, US, STATES, AND COUNTIES," REGIONAL MEASUREMENT DIVISION, BEA.

SERIES	DESCRIPTION
TS	ACCOUNTING TAX LIFE FOR STRUCTURES, EXOGENOUS, CREATED BY CEA.
TUW	GOVERNMENT UNEMPLOYMENT INSURANCE BENEFITS, $BCUR, TABLE 10, SURVEY OF CURRENT BUSINESS, DEPARTMENT OF COMMERCE, EXOGENOUS.
TXRCF	BASIC FED CORP PROFITS TAX RATE, EXOGENOUS, CREATED BY CEA.
UN	UNEMPLOYMENT RATE, TOTAL, 16 YRS AND OLDER, %, IDENTITY.
W	US TOTAL, WAGE AND SALARY DISBURSEMENTS, $MCUR, TABLE 5, "PERSONAL INCOME BY MAJOR SOURCES AND TOTAL LABOR INCOME BY TYPE AND INDUSTRY, US, STATES, AND COUNTIES," REGIONAL MEASUREMENT DIVISION, BEA.
Wr	WAGE AND SALARY DISBURSEMENTS, $MCUR, REGION R, TABLE 5, "PERSONAL INCOME BY MAJOR SOURCES AND TOTAL LABOR INCOME BY TYPE AND INDUSTRY, US, STATES, AND COUNTIES," REGIONAL MEASUREMENT DIVISION, BEA.
WR	US AVERAGE, WAGE RATE, IDENTITY.
WRr	WAGE RATE, $TCUR, REGION R, IDENTITY.
XIPM	INDEX OF INDUSTRIAL PRODUCTION, MANUFACTURING, 67 = 100, FEDERAL RESERVE G.12.3 RELEASE.
YPr	PROPRIETORS INCOME, $MCUR, REGION R, TABLE 5, "PERSONAL INCOME BY MAJOR SOURCES AND TOTAL LABOR INCOME BY TYPE AND INDUSTRY, US, STATES, AND COUNTIES," REGIONAL MEASUREMENT DIVISION, BEA.
YPTr	PROPERTY INCOME, $MCUR, REGION R, TABLE 5, "PERSONAL INCOME BY MAJOR SOURCES AND TOTAL LABOR INCOME BY TYPE AND INDUSTRY, US, STATES, AND COUNTIES," REGIONAL MEASUREMENT DIVISION, BEA.
ZE	DEPRECIATION FACTOR, EQUIPMENT, IDENTITY.
ZS	DEPRECIATION FACTOR, STRUCTURES, IDENTITY.

APPENDIX A.4 CONSTRUCTION OF THE REGIONAL DATA SERIES

Because regional data is not available on a consistent 1973 SMSA definition, the series used in this model are built up from disaggregated county or individual bank data. This data is either annual, as in the case of income and employment, or semi-annual, as in the case of the deposit and loan data. Most series were interpolated to quarterly using the Bureau of the Census polynomial interpolation algorithm, which allows users to specify a quarterly indicator series providing an interpolation pattern. Figure A.4.1, following this page, lists the quarterly series which are used for interpolating each annual series.

In the following subsections, we discuss this data in more detail.

A.4.1 Employment Data

Monthly employment data is available for states and all but 47 metropolitan areas, through 1979, from the Employment and Earnings Program of the BLS. This data is provided by BLS on a consistent SMSA definition, and the definition used is the most recent one. Because this data was not complete, and because the USDA preferred the April 1973 metropolitan area definition, this data is not used.

A second data source for monthly employment data is the Covered Employment Program of the BLS. This is county data, available through 1978 at a two-digit level of detail. This data was not used in this study because of significant disclosure problems. As of the time of this study, BLS has been unable to aggregate this data to Census Regions by metropolitan-non-metropolitan separation, which would remove the disclosure problem.

The data chosen is unpublished BEA employment data, obtained by USDA. Here, both the disclosure and SMSA definition problems have been eliminated. This is annual county data at a two-digit SIC level, which USDA aggregated and provided for this study. All series were converted to quarterly using monthly BLS "Employment and Earnings" data as indicator series.

FIGURE A.4.1

QUARTERLY REGIONAL DATA USED FOR INTERPOLATION OF ANNUAL SERIES

Series To be Interpolated	Quarterly Indicator Series
Annual BEA Employment by County	BLS "Employment and Earnings," July 1980, SMSA Definitions
Annual BEA Income by County	BEA State Income
Semiannual FHLBB Statement of Condition Data for Savings and Loans	Linear Interpolation
Semiannual FDIC Statement of Condition Data for Commercial Banks and Mutual Savings Banks	Linear Interpolation
Annual Bureau of Census Housing Start Data Regions	Bureau of Census Housing Start Datat for Census

A.4.2 Income Data

State income data are quarterly, but county and metropolitan area data are annual. Income does not show the rapid cyclical variation which is characteristic of employment, and, as is well known, individuals make most of their consumption and savings decisions based on income expectations rather than current wage and salary income. Therefore, the interpolation accuracy is not as critical here as it is with employment.

Chase Econometrics has had excellent experience with its metropolitan area models in using state income series as the indicator series. We have also done this with the metropolitan data in this case, and constructed the non-metropolitan series as the difference between the metro and state totals.

A.4.3 Loan and Deposit Data

The thrift institution data consist of two parts:

(1) Savings and loan association statements of condition from the FHLBB.

(2) Mutual savings bank statements of condition from the FDIC.

The mortgage and deposit series were expanded from semi-annual to quarterly using linear interpolation. We also have quarterly savings and loan data on a varying SMSA definition if degrees of freedom problems arise.

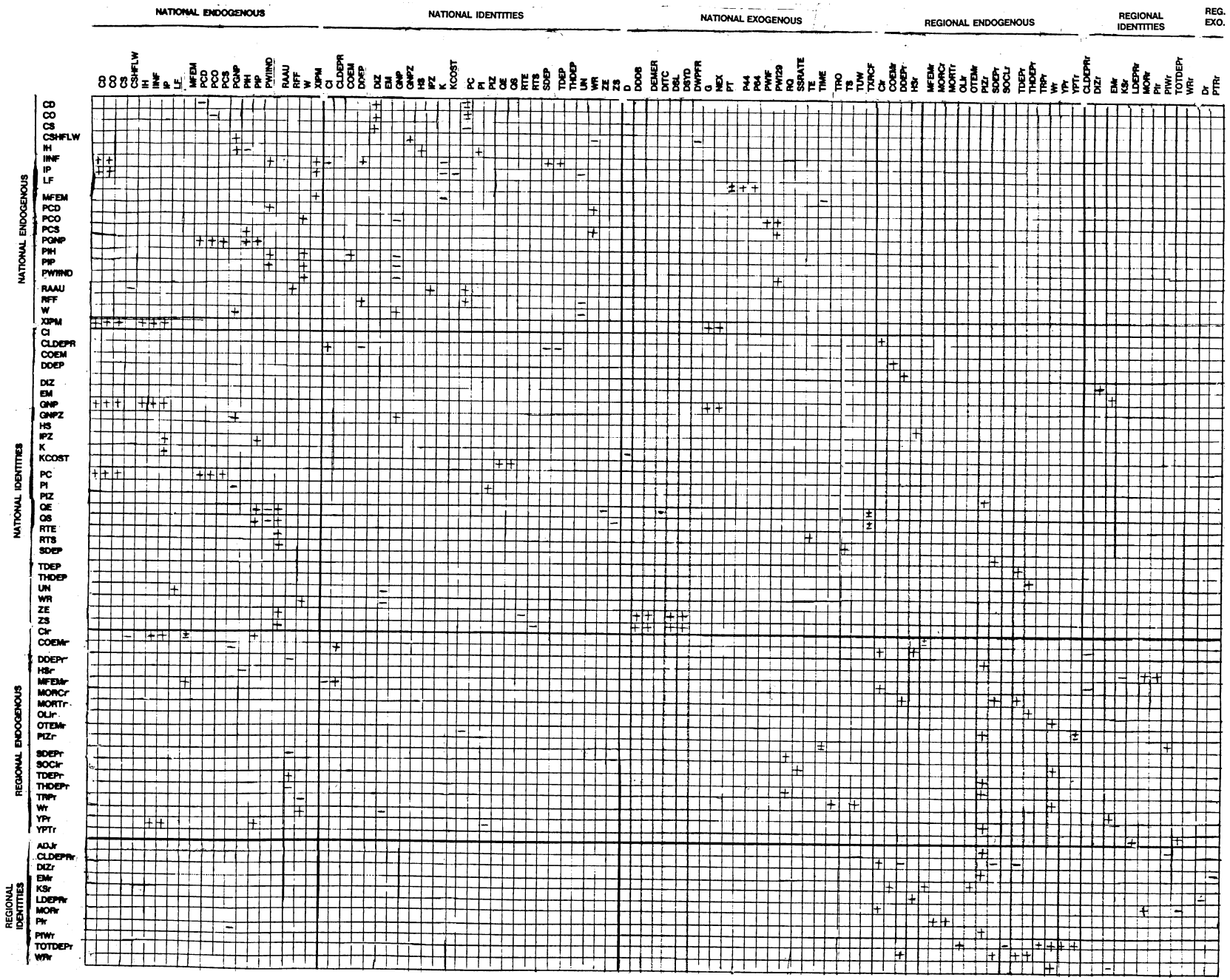
As with the thrift institution data, the commercial bank data is semi-annual statement of condition data. The source is the FDIC commercial bank statements of condition by individual bank. Aggregation to metro-nonmetro regions is based on the county of the bank or of the main office where branching occurs. Again, we use linear interpolation to fill in the missing quarters.

A.4.4 Housing Starts

The housing starts were developed from two series of Census Bureau housing data. The first is quarterly housing starts by region, with no breakdown between metropolitan and non-metropolitan area starts. The second is annual housing starts by region for metropolitan areas. The metropolitan starts were converted to quarterly by polynomial interpolation using the quarterly starts for the region as the indicator series. These new metropolitan series were then subtracted from the total starts to give the non-metropolitan housing starts.

APPENDIX A.5 MATRIX OF VARIABLES IN THE MODEL

APPENDIX A.5
MATRIX OF VARIABLES IN THE MODEL



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