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AN ECONOMETRIC MODEL OF NEW YORK CITY

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by

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Abstract

AN ECONOMETRIC MODEL OF NEW YORK CITY

by

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This dissertation, apparently the first attempt to develop a small-scale macroeconometric model for New York City, focuses on the construction, estimation, and testing of such a model. It will be useful to planners, industrialists, and fiscal managers for understanding the structure of the local economy and studying the growth and decline of the city. By its ability to measure in a simple way the impacts of changes in GNP and policy variables on local economic and fiscal variables, the model can serve as a useful tool in decision-making procedures. Further, used as a forecasting model, it can predict the magnitude of local economic and fiscal variables.

The development of the model was accomplished in four stages: (1) construction of gross city product data by industry and government; (2) identification and classification of industries into export-market-, mixed-market-, and local-market-oriented depending upon the type of market(s) they primarily serve; (3) specification of the equations in the model using relevant variables; and (4) estimation of the model.

The model divides the economy into two sectors, the private economy sector and the local government sector. For the private sector,

equations are specified for output, employment, and money wages for each of five groups of major industries. The model is primarily demand-oriented. The output of each group of industries is dependent on the relevant demand variable(s), national or local, as the case may be. In addition, employment in each major industry group depends on output by the respective industry group and the ratio of cost of capital to cost of labor.

The local government sector contains two tax base equations and an expenditure equation. Both tax bases are related to the personal income of the city's residents. The local government operating expenditure is postulated to be positively related to both availability of funding and the demand for public services. The major linkage between the two sectors (private and local government) is provided by gross city product identity and the use of personal income (PY) as a predetermined variable in the equations for both private and local government sectors.

Because of the special characteristics of New York City's economy, this model differs considerably from earlier small-scale models of other regions in the nation. The differences can be summarized as follows: (1) grouping of the city's industries and their classification; (2) treatment of the local government sector; and (3) specification of the equations. However, in its broad features, this model resembles earlier models.

The "goodness" of the model is tested by conducting an ex post simulation. Judging by the results, the model seems to have an overall good fit in a simulation context.

For instance, MAPE statistics show that it is able to track the historical data series closely. The results of an ex post forecast of important local variables suggest that the model is able to forecast reasonably well over a short period.

A multiplier simulation and two policy simulations are performed with the model. A significant finding of the multiplier simulation is that the impact elasticity of gross city product with respect to gross national product is low (0.53). But this is comparable to results obtained for Mississippi state and the Los Angeles SMSA. The policy simulations consider changes in intergovernmental aid and real estate tax rate.

Some suggestions for future improvement of the model are presented in the last chapter.

ACKNOWLEDGMENTS

I express my sincere gratitude to my supervisory committee and other economists who deepened my understanding of the problems involved in the conception, testing, and presentation of an econometric model for New York City.

My thanks go also to the members of my family for their constant moral support, encouragement, and sacrifice, over many years, that made this study possible.

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INTRODUCTION

In the 1960s, New York City experienced a modest growth period characterized by a gradual transformation of the city's export base from manufacturing to services. During this period, the city lost 121,000 manufacturing jobs while it gained 252,100 jobs in finance, insurance and real estate, and service industries, and 138,000 jobs in the public sector.[1]

The period 1970-75 saw a drastic local economic decline partly as a result of two national recessions and partly due to continuing changes in the city's export base. The city lost 469,000 jobs during this time.[2] Between March 1970 and November 1971, the city's employment decreased by 2.7 percent while national employment declined by only 1.4 percent. In the next national trough, between September 1974 and June 1975, the number of jobs in the city declined by 4.5 percent as opposed to 3 percent nationally.[3]

Owing to job losses and changes in the demographic characteristics,[4] the city faced a gradual erosion of economic and tax bases which

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[1]U.S. Department of Labor, Bureau of Labor Statistics, Employment in States and Areas, 1939-75.

[2]Ibid.

[3]U.S. Department of Labor, Bureau of Labor Statistics, Regional Labor Statistics Bulletin No. 40, January 1976, Table 3.

[4]Demographic changes here refer to the out-migration of middle-class people and the in-migration of poorer people which led to an increase of those in need of public services and to a decrease of those capable of financing such services.

culminated in the fiscal crisis of 1975. At the time of the crisis, the city's total outstanding short- and long-term debt was close to $12 billion.[5] Because the city was unable to pay its short-term debts, the investors lost confidence in the city's notes and bonds. Consequently, the private capital market was closed to it. The closure of the capital market meant not only cutbacks in capital expenditures, but also cutbacks in operating expenses for essential services.

The macroeconometric model of New York City presented in this paper has been constructed with a view toward gaining a better understanding and identification of the local economic and fiscal problems. It will contribute to the knowledge of the structure of the local economy and will be helpful in the analysis of local economic growth and decline. Such a model should also be useful in forecasting local economic and fiscal variables. It should aid in evaluating the impact of changes in national economic variables on the city's economy and the effects of policy scenarios. Its advantages over larger models lie precisely in its smallness and simplicity.

In the present study, the first chapter describes the city's socioeconomic changes and fiscal conditions during the period 1960-75. The results of the application of shift and shares analysis to the changes in employment are discussed. Some light is also shed on demographic and fiscal trends. The second chapter reviews several regional econometric models. The third chapter introduces the New York City model and discusses its characteristics. The fourth chapter deals with the

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[5]The City of New York, Comptroller, Annual Report, 1974-75.

theoretical properties of the model and examines the estimated equations. The fifth chapter presents an analysis of four multiplier and policy simulations, and makes forecasts based on the model. The sixth chapter provides the conclusions of the study and suggests directions for future research.

CHAPTER I

AN OVERVIEW OF SOCIOECONOMIC AND FISCAL CONDITIONS OF NEW YORK CITY (1960-75)

In the 1960s, the city's employment underwent a moderate growth; in the 1970s, it faced a drastic decline as a result of erosion of its employment base. An application of the shift and shares framework suggests that this decline was primarily due to loss of competitiveness. While in the sixties the city's population was relatively stable, the population declined in the seventies. The state of local finances also had been discouraging for some time. The local government expenditures outpaced the local government revenues over the years, although an increase in intergovernmental aid and borrowing made possible the financing of the rising government expenditures.

Employment Trend

In the moderate growth period of the sixties, the private economy showed symptoms of decline due specifically to a fall in manufacturing employment. However, simultaneous growth of the public sector apparently offset the decline, and the real scenario of the local economy was not visible until all the major industries demonstrated similar symptoms upon the onset of two national recessions in the seventies.[1]

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[1]See Appendix B, Tables 10, 12, 14, 16, 18, and 20.

In order to analyze changes in employment with respect to major industries locally, the shift and shares framework is applied and three components of the change in employment are separated for the period between 1960 and 1975. The first component is the national share, which refers to the change in employment an industry would have experienced if the employment had changed at the same rate that the total national employment in all the industries changed.

The second component of the change in employment is called the industrial mix component. Such employment change in a particular industry would have been observed if employment had a differential growth rate analogous to that of the same industry nationwide. The differential growth rate is defined here as the difference between the average rate of growth of employment for all industries nationally and the rate of growth for that particular national industry.

The third component is called the competitive component. It reflects a change in employment which a particular industry would have had as a result of a change in competitive position.[2]

The computations based on the shift and shares framework show that the national components of the change in employment have positive signs. The competitive components have negative signs. The industrial mix components for manufacturing, construction and transportation and utilities have negative signs. The findings suggest that the loss of employment by the major industries can be primarily attributed to gradual erosion of competitive advantages[3] so long enjoyed by the city.

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[2]See Appendix A.

[3]References to the city's competitive position in corporate activities are found in the literature. The Temporary Commission on

However, the shift and shares framework does not tell us why this erosion occurs.

The loss of employment in the city during this period obviously resulted in a fall in the city's share of national employment by industry.[4] Concurrently, there was a change in the industrial mix in the city. Manufacturing, transportation and utilities, and construction lost their relative importance as measured by their percentage share of employment. But the service sector gained. Similar changes in the industrial mix were also observed in the nation.[5]

Demographic Changes

The strength of a local economic base depends on such demographic characteristics as age, sex, and education. In the moderate growth period from 1960 through 1970, the total number of people in the city remained relatively stable. But the population underwent drastic changes in terms of ethnic make-up and income characteristics. These changes led to an increase in the proportion of people who needed more public services and a decrease in the proportion of people who were capable of

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City Finances discusses high energy cost, labor cost, cost of living, and taxes in the city. See The City of New York, The Temporary Commission on City Finances, Economic and Demographic Trends in New York: The Outlook for the Future, May 1977, p. 43. Terry Clark (Chicago), in his study of fifty cities in the United States, found that New York City has the highest per capita taxes. See The Temporary Commission on City Finances, Final Report, June 1976, p. 300. Wolfgang Quante discusses the pull and push factors underlying the locational decision of corporations. His discussions focus on the competitive disadvantages faced by the corporations locally. See Wolfgang Quante, Exodus of Corporate Headquarters (New York: Praeger, 1976), pp. 81-129.

[4]See Appendix B, Tables 9, 11, 13, 15, 17, and 19.

[5]See Appendix B, Table 8.

financing them.[6] In this period, a net migration of the white population by -14.4 percent and of the nonwhite population by 58.2 percent led to an increase in the percentage of nonwhites and Hispanics in the population.[7]

The total population declined after 1970. This decline was probably reinforced by the depressed level of economic activities in the period from 1970 through 1975. In this period the city's aggregate population shrank by 4.2 percent and net migration mounted to -6.2 percent.[8]

A decline in population is likely to have an impact on the city's economy. In discussing the New York City model we will have an opportunity to observe the importance of population size in relation to the local economy.

Local Finances

The gradual erosion of the tax bases due to job loss, and the extensive nature of the city's services (a significant portion of which are mandatory) had largely contributed to a growing gap between local government revenues and local government expenditures over the years.

Local Government Revenues

The revenues of the City of New York comprise locally raised revenues, intergovernmental aid and short- and long-term debts. The

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[6]U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population and Housing, New York SMSA, PHC (1) 145, Parts 1 and 2.

[7]U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population and Housing, General Demographic Trends for the Metropolitan Areas, Final Report, New York, 1971, PHC (2)-34, Table 4.

[8]U.S. Department of Commerce, Bureau of the Census, Current Population Estimates, Series p-25, No. 709, September 1977, Table 1.

locally raised revenues fall into two categories--tax revenues and non-tax revenues. The principal sources of tax revenues are the real estate tax, the general sales tax, and taxes on personal and business income. These taxes contributed roughly 76.8 percent of the locally raised revenues in the 1975-76 fiscal year.[9]

Local Taxes

The real estate tax is the largest single source of the city's revenues. But there is a limit to the amount that can be raised from this tax, a limit set by the New York State Constitution. Accordingly, the amount to be raised should not exceed 2.5 percent of the average full valuation of taxable real estate.[10] However, there is also a provision that the city can impose a debt service levy without limit to pay the principal and interest on debts.

The legal base of the real estate tax is the assessed value of taxable real estate, which is different from the full value. For some time the real estate tax base had been increasing at a declining rate. In fact, absolute decline in the base is observed in the years subsequent to the period under study.[11]

The second major source of revenues for the local government is the general sales tax. This tax is imposed on most items of retail sales. The legal base of the tax is, therefore, closely related to retail sales.

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[9]The City of New York, Comptroller, Annual Report, 1975-76.

[10]Thelma E. Smith, Guide to the Municipal Government (New York: Meilen Press Inc., 1973), p. 72.

[11]The City of New York, Comptroller, Annual Reports, various issues.

In 1967, for the first time, a personal income tax was levied on residents and a commuter tax was imposed on non-residents. The commuters pay taxes to the city on their earnings in the city. In addition, taxes are imposed on income from business. Business taxes include a general corporation tax, and financial and transportation corporation taxes. Unincorporated business, commercial rent, and occupancy taxes are other business taxes. The importance of income-based taxes as sources of the local government revenues increased gradually. In fact, total revenues from business, personal, and commuter taxes exceeded revenues from the sales taxes.[12]

Intergovernmental Aid

Intergovernmental aid refers to transfers from federal and state governments to local governments. Intergovernmental aid from the federal government is classified here in three categories, either as general purpose grants, block grants, or conditional grants. The city is free to spend general purpose aid at its discretion. The formulae for allocation of general purpose grants are based on three factors: per capita income, population, and local tax efforts. Like federal transfers, state government transfers are either general purpose or categorical, and allocated by formulas.

The City of New York had been depending increasingly on intergovernmental aid during the period of the study, and the amount of such aid increased as the city's federal and the state government sponsored programs expanded.[13]

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[12]Ibid.

[13]Ibid.

Borrowing

The City of New York is authorized by law to issue notes and bonds. Between 1960 and 1975, it borrowed at an increasing rate to finance its operating and capital expenditures. Consequently, debt servicing expenditures comprised a significant portion of total operating expenditures.[14]

Operating Expenses

Over the years in question, the operating expenses of the local government grew at a higher rate than the tax revenues. This resulted in a broadening gap between revenues and expenditures. Consequently, the city had to resort to short-term and long-term borrowing. The rise in operating expenses was reflected in higher per capita local government expenditures that amount to $1,716 in 1976, second only to those of Washington, D.C.[15] As a result, the city had no alternative but to curtail essential services so vital for its economic and social health.

In this chapter, we have been concerned with employment, population, and fiscal aspects of the economy important to an understanding of the New York City model as developed in Chapters 3, 4, and 5.

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[14]Ibid.

[15]The City of New York, Temporary Commission on City Finances, A Historical and Comparative Analysis of Expenditures in the City of New York, Eighth Interim Report, October 1976, Tables 1, 8, and 22. U.S. Department of Commerce, Bureau of the Census, The City Government Finances, 1975-76, pp. 86, 88.

CHAPTER II

AN INTRODUCTION TO REGIONAL ECONOMETRIC MODELS

This chapter introduces regional macroeconometric models and discusses the important differences between national and regional models of this type. The problems of regional modeling stemming from a paucity of data are also discussed. In addition, a number of such models are reviewed.

In recent years, macroeconometric regional models have been gaining importance due primarily to their flexibility, which facilitates analysis of problems of urban growth and decline. Econometric models are not restricted to a priori theories and can, therefore, be developed through trial and error (i.e., they permit experimentation). This flexibility is not inherent in economic base models and input-output models.[1]

Differences between National and Regional Models

Differences between national models and regional models may be summarized as follows:

1. It is possible to construct sophisticated national models around the Keynesian expenditures identity because of the availability

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[1]Norman J. Glickman, Econometric Analysis of Regional Systems (New York: Academic Press, 1977), p. 38.

of a plethora of data. On the other hand, owing to a paucity of data, most regional models are simple and built around a gross product identity (sum of output of all sectors).

2. Data pertaining to gross national product for different sectors are easily available for use in the national models. By contrast, data relating to gross city product are not available and must be constructed either by the value added method or by the procedure described by Kendrick and Jaycox.[2]

3. The use of quarterly data makes it possible to construct dynamic national models. However, these quarterly data are not available for most regional variables. Consequently, most regional macroeconometric models are constructed with annual data. It is difficult to establish meaningful and logical lag relationships with annual data. Thus, regional models are highly static.

4. Furthermore, the paucity of data necessitates modifications of theories to build regional models. For instance, because of inadequate data for supply variables, most such models establish only demand relationships. For the same reasons, the use of proxy variables is very common.

Approach to Regional Models

In the United States, regional econometric models are constructed as a satellite system to the national models which already exist; they do not include interdependence of regional and national systems.[3]

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[2]J. W. Kendrick and C. M. Jaycox, "The Concept and Estimation of Gross State Product," Southern Economic Journal 32 (October 1965): 153-68.

[3]Lawrence R. Klein and Norman J. Glickman, "Econometric Model Building at Regional Level," Regional Science and Urban Economics 7 (March 1977): 4-5.

Statistical Problems

The major statistical problem which arises in constructing and estimating a regional model is the problem of specification. Owing to a general paucity of regional accounts, relevant variables are sometimes omitted from the models, resulting in specification errors and biased estimates of true parameters.[4]

Methods of Estimation

A number of estimation methods are generally used by regional economists. They include Ordinary Least Squares, Two-Stage Least Squares and others.[5] In most cases the parameters are stable with respect to the different estimation techniques.

A Review of Regional Macroeconometric Models in the Literature

Development of the Philadelphia Model

Contributions of the Philadelphia model to the development of the art of regional model building at a sub-national level are many. The model was developed in several stages beginning with a 26-equation model for the sample period from 1949 to 1966, and was later expanded to more than 200 equations. The model (1971) deals with three sectors: (1) manufacturing, (2) wholesale and retail trade, and services, and (3) other activities. Sector 1 was an export-oriented sector, while Sectors 2 and

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[4]Glickman, Econometric Analysis, p. 63.

[5]Ibid., p. 39.

3 were considered as local-market-oriented sectors. For each of these sectors, the equations were specified for output, employment, and average annual money wages. In addition, a small government block specifies the local government revenues and local government expenditures.

Because the model was based upon the economic base hypothesis, the export sector was tied to national economic variables. The output in the local-market-oriented sectors was considered to be a function of local spending represented by personal income. While employment was dependent on output, average annual wage was related to average annual national wage and to local labor market conditions. In addition, equations were estimated for labor force, which varied positively with employment opportunities and for population, which was dependent on the natural growth of population and labor force.

The model was estimated by Ordinary Least Squares (OLS) and Two-Stage Least Squares (TSLS), and both methods yielded similar results. To evaluate the sample period performance of the model, Mean Absolute Percentage Errors (MAPE) were calculated. The MAPE statistics show reasonably good predictive power for the model. Simulations and forecasting experiments performed with the model had satisfactory results.

The Philadelphia regional model as of 1977 went further in sectoral disaggregation. It incorporates 19 industrial sectors, and includes equations for both output and employment. Equations for wages, prices, income, the government sector, population, banking, retail sales, etc., were estimated. Simulations over the sample period indicated a reasonably good performance of the model in replicating the historical

data series. Policy simulations and forecasting experiments were also successful.[6]

Because the general structure of this model proved effective, a number of analogous models were subsequently constructed. These also yielded satisfactory results.

The Los Angeles Model

The Los Angeles model was based on the general structure of the Philadelphia model. This model, which covered a sample period from 1959 to 1970, consisted of 29 equations.

The model was founded on economic base theory in that manufacturing was export-oriented while other industrial sectors were local-market-oriented. The output of the export sector was determined by export demand, a function of GNP, and the output of the local sector by local spending. The employment depended on the output of the respective sector, which reflected the demand for workers. In addition, the model specified equations for average money wages by sector and for personal income. In the small local government sector, the revenues were shown to be dependent on personal income and the tax rate, and the expenditures were related to the tax revenues.

As regards methods of estimation, both OLS and TSLS were used to estimate the model and the results obtained from applying both methods were comparable.

The sensitivity of the Los Angeles economy to external shocks (i.e., changes in exogenous variables) was tested by the model in terms

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[6]Ibid., pp. 75-190.

of multipliers. They were stated to have characteristics compatible with regional multipliers in the literature.[7]

In sum, the model offers strong evidence of successful applicability of the general structure of the Philadelphia model (1971) to the Los Angeles SMSA, and warrants the status of a prototype for modeling with regard to small areas in the country.

The Model of Mississippi State

The Mississippi model, consisting of 39 behavioral equations, was estimated over the sample period from 1953 to 1970. The general structure of the model was analogous to the Philadelphia model.

The model postulated that the output of the export sector depended on the national market and competitiveness of production resulting from comparative advantages of the Mississippi economy. On the other hand, the output of the domestic-market-oriented sectors was related to regional demand as measured by three variables: disposable income, gross state product, and population. Labor demand relationships were estimated by employment equations specified on the basis of a CES production function. As for wage equations, the manufacturing wage rate was determined by the national manufacturing wage rate. Wage rates in other sectors were related to the manufacturing wage rate. In addition, the state unemployment rate entered the wage equations as a proxy for local labor market conditions. The model contained five tax equations. Since tax

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[7] O. P. Hall and J. A. Licari, "Building Small Region Econometric Models: An Extension of Glickman's Structure to Los Angeles," Journal of Regional Science 14 (December 1974): 337-53.

bases were not easy to estimate, appropriate proxies were substituted for tax bases in the tax equations. Effective tax rates and tax collections for the previous year entered the tax sub-model as explanatory variables.

In addition to OLS, Iterated Instrumental Variables (IIV) were used to estimate the model. However, OLS estimates were considered better and were used in forecasting. The model was simulated and the simulation error statistics were found to be low. The model tracked the growth of the important variables over the sample period well. The multiplier calculated with the model indicated cyclically less sensitiveness of the economy at the regional level. Forecasts with the model corresponded closely to the predictions made by the Wharton Quarterly Econometric Model.[8]

In conclusion, a review of these regional models reveals that the art of modeling is in the process of development and very few ideas from established microeconomic theories have so far been incorporated into these models.

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[8]F. Gerard Adams, Carl Garland Brooking, and Norman J. Glickman, "On the Specification and Simulation of a Regional Econometric Model: A Model of Mississippi," The Review of Economics and Statistics (August 1975): 286-98.

CHAPTER III

AN INTRODUCTION TO THE NEW YORK CITY MODEL

This chapter presents a macroeconometric model for New York City, one which can be used for studying the effects of exogenous shocks on the local economy and for forecasting local economic and fiscal variables. Analogous to other regional models, this is primarily a demand-oriented model dealing with a private economy sector and a local government sector. The private economy sector is made up of export-market-oriented, mixed-market-oriented, and local-market-oriented industries. The model contains 47 equations, including identities. Several simulations and a forecasting experiment are performed with the model.

The Purposes of the Model

The purposes of the model are as follows: First, to develop a broad framework for a basic accounting identity for the city. This will entail estimation of gross city product by industry and by government sector. Second, to provide data pertaining to employment and wages by industry, to demography, labor force, major tax bases, and local government expenditures. This will be useful to planners, industrialists, and fiscal managers for understanding the structure of the local economy and finances, and for studying the growth and decline of the city.

Third, to use the estimated results for predicting local economic and fiscal variables. Thus, the model will serve as an effective tool in decision-making procedures.

Fourth, to study the impact of external shocks on the local economy in terms of a multiplier and other effects resulting from exogenous changes. This involves simulating the model to examine the effects of a change in GNP, intergovernmental aid, and real estate tax rate.

Nature of the Model

Like other macroeconometric regional models, the structure of the New York City model is determined by its application and by the availability of data.

The enumerated purposes require that the model be specified for both private and public sectors. Other requirements are: First, identification of export-market-, mixed-market-, and local-market-oriented industries in order to determine what influence the national economic growth has on the city's economy and the impact of an exogenous shock on the latter.

Second, disaggregation of industries of particular importance to the city in order to understand the pattern of local industrial development. Accordingly, the model comprises equations for private and public sectors and specifies equations for export-market-, mixed-market-, and local-market-oriented industries.[1]

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[1]See Appendix D.

Data Constraints

Owing to data constraints, the structure of the model is modified in several ways. First, an income-expenditure approach cannot be adopted because social accounts are not kept fully at the local level. Data pertaining to investment, expenditures, corporate profit, and exports and imports at the city level are not available. Therefore, the model is constructed utilizing the "output" approach (adding output by sector), with the general structure of the Philadelphia model as guide.[2]

Second, modification of the theoretical structure of the model owing to the paucity of data is reflected in the specification of the equations. Data considerations require that the model be constructed principally as demand-oriented. Thus, the private economy sector consists of a set of "demand for output" and "demand for employment" equations by industry. Relevant data pertaining to supply variables are not available to construct complete models for output or employment determination. The output of the export-market-oriented industries is related to GNP, a suitable proxy for national final demand for the sectoral output. The output of the mixed-market-oriented industries is dependent on

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[2]Although other types of regional models, for example, economic base and input-output models can be used for forecasting and for analysis of the impact of exogenous shocks, they have limitations. The economic base models present conceptual and technical problems regarding proper identification of sectors and stability of the basic/service ratio. See C. M. Tiebout, the Community Economic Base Study (New York: Committee for Economic Development, 1962). Despite its superiority over the economic base model, the input-output model has limitations stemming from the assumption of fixed coefficients. See W. H. Miernyk, Elements of Input-Output Analysis, cited in Carl Garland Brooking, "A Farm-Oriented Econometric Model of the State of Mississippi" (Ph.D. dissertation, University of Pennsylvania, 1974), p. 2.

the proxy for national final demand and a local variable used as a proxy for local demand--e.g., population. The output of the local-market-oriented sectors depends on personal income of residents of the city or on gross city product or some other local variables. Employment equations reflect the demand for labor by industry. The labor force equation is the only supply equation in the model.

Due to various inadequacies in the appropriate data, there are a number of statistical problems in estimating the equations. First, at the local level, time-series data are not easily available. Hence, the maximum number of explanatory variables in an individual equation does not exceed three. In terms of theory, the exclusion of a relevant variable (or variables) from an equation may give rise to specification error.

Static Nature

The model is static because lagged variables are not used to construct the equations. This assumes that the use of annual data may not enable the model to establish theoretically good lag relationships. As stated earlier, quarterly data for only a few variables at the local level are available.

Approach to the Model

As with most other regional macroeconometric models, the present model adopts a top-down approach. According to this approach, the influence of the national variables on the local variables is taken into account and no allowance is made for feedback from local variables to national variables.

Method of Estimation

The model is log-linear and is estimated by OLS. It is worth noting here that a review of earlier models indicates that OLS, TSLS, and other methods used to estimate similar systems of equations yielded comparable results.

In a number of equations in the model, it is found that there is serial correlation of the disturbances when tested by the Durbin-Watson statistic. This is to be expected because the model is based on time series data. If serial correlation is detected, the Hildreth-Lu procedure is one of the commonly used methods of eliminating it. Accordingly, most of the equations with serially correlated disturbances are corrected using the Hildreth-Lu procedure. These corrections are necessary for obtaining efficient estimated coefficients.[3]

Statistical Evaluation of the Model

The equations of the model are evaluated by the measure of goodness of fit such as R^2 and a significance test such as the t-test. In addition, the performance of the model is tested by conducting a historical simulation (i.e., a simulation from 1968 through 1975) and then examining how closely the simulated value of each endogenous variable tracks the historical data series. One quantitative measure of the deviation of the simulated variable from the corresponding data series in percentage terms is called Root Mean Square Percent Error (RMS percent error). RMS percent simulation error is computed for each of the

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[3]R. S. Pindyck and D. L. Rubinfeld, Econometric Models and Economic Forecasts (New York: McGraw-Hill, 1976), p. 112.

endogenous variables in the model. The error is defined as follows:

$$\text{RMS percent error} = \sqrt{\frac{1}{T}\sum_{t=1}^{T}\left(\frac{Y_t^s - Y_t^a}{Y_t^a}\right)^2} \cdot 100$$

Y^s = simulated value of Y_t

Y^a = actual value of Y_t

T = number of periods in the simulation.[4]

Another such measure of simulation error is called Mean Absolute Percent Error (MAPE). MAPE is also computed for each of the endogenous variables in the model. This is done because MAPE statistics for some other regional models are available for comparison.

$$\text{MAPE} = \frac{\sum_{j=1}^{N} \left| Y_{ij}^p - Y_{ij}^a \right| / Y_{ij}^a}{N} \cdot 100$$

Y_{ij}^p = i^{th} endogenous variable predicted by the model solution.

Y_{ij}^a = the actual value of the i^{th} endogenous variable.

N = number of periods in the simulation.[5]

Simulations

Several simulations are performed to study the sensitivities of the local economy to changes in gross national product and to changes in

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[4]Ibid., pp. 314-20.

[5]Glickman, Econometric Analysis of Regional Systems, p. 68.

policy variables. In addition, the model is used to forecast local variables for the period between 1976 and 1978.

An Overview of the Model

The model is constructed for the five boroughs of New York City. It is built around the gross product identity and consists of 47 equations, including identities. The sample covers the period between 1960 and 1975. To facilitate the understanding of the model, descriptions of the dependent and explanatory variables, and the equations are given.

Gross product identity is written as:

$$GCP = QM + QC + QF + QTU + QWRS + QFSLG$$

where

GCP = gross city product

QM = output, manufacturing

QC = output, construction

QF = output, finance, insurance, and real estate

QTU = output, transportation, and utilities

QWRS = output, wholesale and retail trade, and services

QFSLG = output, federal, state, and local governments

Private Sector

The model consists of equations for two principal sectors, namely, private and local government. The private sector consists of five major industries classified into three categories according to the market(s) they serve.[6] Finance, insurance, and real estate constitute the

[6]See Appendix D.

export-market-oriented sector as its output depends primarily upon national demand represented by gross national product.[7] The three industries--construction, transportation and utilities, wholesale and retail trade and services--are components of the local-market-oriented sector. The output of these industries depends on local demand represented by gross city product or personal income or some other variables. Manufacturing is treated as a mixed-market-oriented sector serving both local and national markets. The local demand, represented by population, and the national demand, represented by GNP, determine manufacturing output.

The model consists of equations for output, employment, and average wage rate by the aforementioned major industry. In addition, a number of equations for subsectors which belong to these major industries are specified. These subsectors are considered either export-market-oriented or mixed-market-oriented depending on the type of market(s) they are assumed to serve.[8]

Local Government Sector

In the local government sector, the equations are specified for local government expenditures and the real estate tax and sales tax bases. In addition, equations are specified for personal income tax collections

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[7]Although, strictly speaking, the real estate sector is a local one, I have not treated it as such. The U.S. Department of Commerce considers finance, insurance, and real estate as one major industry group. Therefore, data for the industry group are lumpy. Lumpiness of data could affect the results.

[8]The assumptions upon which subsectors are classified as either export-market-oriented or mixed-market-oriented are discussed in Appendix D.

and government output. Although the private economy and local government sectors are not fully integrated, the two sectors are linked by gross product identity and by the use of personal income of residents (PY) as an explanatory variable in the equations for private and local government sectors.

Finally, the model contains a labor force equation, an unemployment rate equation, and a number of identities. The identities close the model.

An Overview of the Model Equations

Dependent Variables	Explanatory Variables
Output, manufacturing in New York City in current dollars (QM).	Gross national product in current dollars (GNP), population of New York City (POP).
Output, construction in New York City in constant dollars (QCC).	Number of new residential units completed in New York City (NRHC), new manufacturing investment in New York City in constant dollars (NMI), construction cost index for New York City (CC).
NRHC.	Mortgage interest rate charged by the City Bank of New York (MIR), personal income of residents of New York City in current dollars (PY).
Output, finance, insurance, and real estate sector in New York City in current dollars (QF).	GNP.
Output, transportation and utilities in New York City in current dollars (QTU).	Gross City Product in current dollars (GCP).
Output, wholesale and retail trade, and services in New York City in current dollars (QWRS).	PY.

Dependent Variables	Explanatory Variables
Employment, manufacturing in New York City (EM).	Output, manufacturing in New York City in constant dollars (QMC), Ratio of rate on AAA Corporate Bonds to Average money wage rate in manufacturing in New York City (R/MAWMN).
Employment, Construction in New York City (EC).	Output, construction in constant dollars (QCC), Ratio of rate on AAA Corporate Bonds to Average money wage rate in construction in New York City (R/MAWCN).
Employment, finance, insurance, and real estate in New York City (EF).	Output, finance, insurance, and real estate in New York City in constant dollars (QFC), Ratio of rate on AAA Corporate Bonds to Average money wage rate in finance, insurance, and real estate in New York City (R/MAWFN).
Employment, transportation and utilities in New York City (ETU).	Output, transportation and utilities in New York City in constant dollars (QTUC), Ratio of rate on AAA Corporate Bonds to Average money wage rate in transportation and utilities in New York City (R/MAWTUN).
Employment, wholesale and retail trade, and services in New York City (EWRS).	Output, wholesale and retail trade, and services in New York City in constant dollars (QWRSC), Rate on AAA Corporate Bonds (R), Average money wage rate in wholesale and retail trade, and services in New York City (MAWWRSN).
Employment, apparel production in New York City (E23).	Employment, apparel production in the rest of the nation (E23R), POP.
Employment, printing and publishing in New York City (E27).	Employment, printing and publishing in the rest of the nation (E27R), POP.
Employment, leather production in New York City (E31).	Employment, leather production in the rest of the nation (E31R), POP.
Employment, air transportation in New York City (E45).	Employment, air transportation in the rest of the nation (E45R).

Dependent Variables	Explanatory Variables
Employment, communications in New York City (E48).	Employment, communications in the rest of the nation (E48R).
Employment, banking in New York City (E60).	Employment, banking in the rest of the nation (E60R), POP, Domestic bank deposits (BD).
Employment, security and commodity brokers, and services in New York City (E62).	Dollar value of securities sold in the New York Stock Exchange (SD).
Employment, legal services in New York City (E81).	Employment, legal services in the rest of the nation (E81R).
MAWMN.	Average money wage rate in manufacturing in the nation (MAWMUS), Adjusted New York City unemployment rate (UNRA).
MAWCN.	Average money wage rate in construction in the nation (MAWCUS), UNRA.
MAWFN.	Average money wage rate in finance, insurance, and real estate in the nation (MAWFUS), New York City unemployment rate (UNR).
MAWTUN.	Average money wage rate in transportation and utilities in the nation (MAWTUUS), UNRA.
MAWWRSN.	Average money wage rate in wholesale and retail trade, and services in the nation, UNRA.
Assessed Value of Real Estate in current dollars (AVRE).	PY
Retail sales in current dollars (RTS).	PY
Personal Income Tax collections in current dollars (PITC).	Personal income of residents of New York City minus transfer payments in current dollars (PYMT).
Local Government expenditures in current dollars (LGEXP).	Locally raised revenues in current dollars (LGREV), Intergovernmental aid (INTGA), per capita income of New York City residents (PCI).

Dependent Variables	Explanatory Variables
Output, Federal, State, and Local Governments (QFSLG).	LGEXP.
PY.	GCP.
Labor force (LF).	UNR.
UNR.	Unemployment rate in U.S. cities (UNRUS).

Identities

GCP = QM + QC + QF + QTU + QWRS + QFSLG

QMC = QM/CPI

QCC = QC/CPI

QFC = QF/CPI

QTUC = QTU/CPI

QWRSC = QWRS/CPI

where CPI = Consumer Price Index for New York and New Jersey area

TEMP = EM + EC + EF + ETU + EWRS + LGEMP + FSEMP

where TEMP = Total City Employment
LGEMP = Local Government Employment
FSEMP = Federal and State Government Employment

EMR = Residual employment, manufacturing

where EMR = EM - (E23 + E27 + E31)

EFR = Residual employment, finance, insurance, and real estate

where EFR = EF - (E60 + E62)

ETUR = Residual employment, transportation and utilities

where ETUR = ETU - (E45 + E48)

EGOV = LGEMP + FSEMP

LGREV = RETC + STC + PITC + REVRES

where RETC = Real estate tax collections
STC = General sales tax collections
PITC = Personal income and commuter tax collections
REVRES = Residual locally raised revenues

RETC = RETR*AVRE

where RETR = Effective real estate tax rate (RETC/AVRE)

STC = STR*RTS

where STR = Effective sales tax rate (STC/RTS)

Exogenous Variables

Label		Description
BD	=	Bank deposits (domestic) in New York City
CPI	=	Consumer price index for New York and New Jersey area
CC	=	Construction cost index for New York City
E23R	=	Employment in apparel production in the rest of the nation
E27R	=	Employment in printing and publishing in the rest of the nation
E31R	=	Employment in leather production in the rest of the nation
E45R	=	Employment in air transportation in the rest of the nation
E48R	=	Employment in communications in the rest of the nation
E60R	=	Employment in banking in the rest of the nation
E81R	=	Employment in legal services in the rest of the nation
EGOV	=	Employment in government
INTGA	=	Intergovernmental aid
GNP	=	Gross national product
MIR	=	Mortgage interest rate
MAWMUS	=	Average money wage rate in manufacturing in the nation

Label		Description
MAWCUS	=	Average money wage rate in construction in the nation
MAWFUS	=	Average money wage rate in finance, insurance, and real estate in the nation
MAWTUUS	=	Average money wage rate in transportation and utilities in the nation
MAWWRSUS	=	Average money wage rate in wholesale and retail trade, and services in the nation
NMI	=	New manufacturing investment in constant dollars in New York City
POP	=	Population of New York City
PCI	=	Per capita income of residents of New York City
PYMT	=	Personal income of residents of New York City minus transfer payments
R	=	Rate on AAA corporate bonds
REVRES	=	Locally raised residual revenues
RETR	=	Real estate tax rate (effective)
STR	=	Sales tax rate (effective)
SD	=	Dollar value of securities sold in the New York Stock Exchange
UNRUS	=	Unemployment rate in U.S. cities

Sectors

Private Sector

A. Output

1. Manufacturing
2. Construction
3. New residential housing units completed
4. Finance, Insurance, and Real Estate

5. Transportation and utilities

6. Wholesale and Retail Trade, and Services

B. Employment

1. Manufacturing

a. Total

b. Apparel

c. Printing and Publishing

d. Leather production

e. Residual Employment[9]

2. Construction

a. Total

3. Finance, Insurance, and Real Estate

a. Total

b. Banking

c. Security and commodity brokers, and Services

d. Residual Employment

4. Transportation and Utilities

a. Total

b. Air Transportation

c. Communications

d. Residual Employment

5. Wholesale and Retail Trade, and Services

a. Total

b. Legal Services

c. Residual Employment

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[9]Equations are not estimated for residual employment.

C. Wages

1. Manufacturing
2. Construction
3. Finance, Insurance, and Real Estate
4. Transportation and Utilities
5. Wholesale and Retail Trade, and Services

Local Government Sector

A. Real Estate Tax Base

B. Sales Tax Base

C. Personal Income Tax Collections

D. Local Government Expenditures

E. Government Output

Other

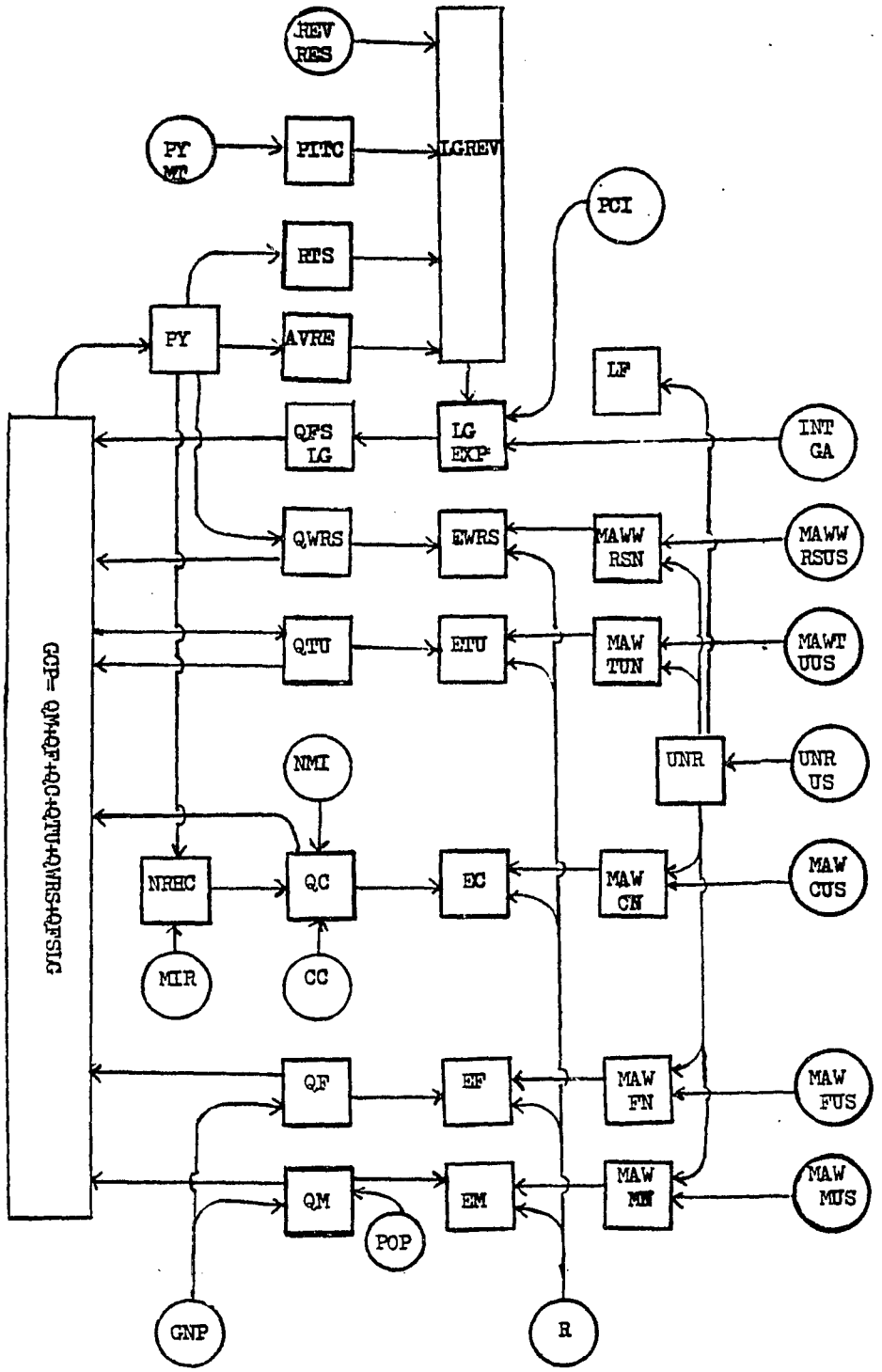
A. Personal Income of New York City Residents

B. Labor Force

C. Unemployment Rate

CHART 1

A LOGIC DIAGRAM OF THE NEW YORK CITY MODEL



Circles indicate exogenous and policy variables.

Variables in the Diagram

Label		Description
AVRE	=	Assessed value of taxable real estate
CC	=	Construction cost index for New York City
EC	=	Employment, construction
EF	=	Employment, finance, insurance, and real estate
EM	=	Employment, manufacturing
ETU	=	Employment, transportation and utilities
EWRS	=	Employment, wholesale and retail trade, and services
GCP	=	Gross city product
GNP	=	Gross national product
INTGA	=	Intergovernmental aid
LGEXP	=	Local government's operating expenditures
LF	=	Labor force
LGREV	=	Locally raised revenues
MAWCN	=	Average money wage rate in construction, New York City
MAWFN	=	Average money wage rate in finance, insurance, and real estate, New York City
MAWMN	=	Average money wage rate in manufacturing, New York City
MAWTUN	=	Average money wage rate in transportation and utilities, New York City
MAWWRSN	=	Average money wage rate in wholesale, and retail trade, and services, New York City
MAWCUS	=	Average money wage rate in construction in the nation
MAWFUS	=	Average money wage rate in finance, insurance, and real estate in the nation
MAWMUS	=	Average money wage rate in manufacturing in the nation

Label		Description
MAWTUUS	=	Average money wage rate in transportation and utilities in the nation
MAWWRSUS	=	Average money wage rate in wholesale and retail trade, and services in the nation
MIR	=	Mortgage interest rate charged by the City Bank
NRHC	=	New residential housing units completed
NMI	=	New manufacturing investment
POP	=	Population of New York City
PY	=	Personal income of the residents of New York City
PYMT	=	Personal income minus transfer payments
PITC	=	Personal income tax collections
PCI	=	Per capita income of the city's residents
QC	=	Output, construction
QF	=	Output, finance, insurance, and real estate
QM	=	Output, manufacturing
QTU	=	Output, transportation and utilities
QWRS	=	Output, wholesale, retail trade, and services
QFSLG	=	Output, federal, state, and local governments
R	=	AAA corporate bond rate
RTS	=	Retail sales
REVRES	=	Revenues, residual
UNR	=	Unemployment rate, New York City
UNRUS	=	Unemployment rate, U.S. cities.

CHAPTER IV

THE MODEL: SPECIFICATION, RESULTS, AND DISCUSSION

The theoretical basis and the statistical interpretation of the equations, along with the estimated results, are presented in this chapter. As stated earlier, the model deals with private and local government sectors. Each sector is now considered, in turn, to develop the exact specification of the equations for that sector. (For an overview of the model, the reader is referred to Chapter 3, p. 24).

Private Sector

Output Equations

Output equations show that output is determined by demand alone. In specifying the output equations, it is postulated that there are always excess capacities in industries.

Supply responds to demand without any constraint. Furthermore, the textbook definition that demand is related to prices could not be adhered to. Nor is any distinction made between consumption and investment goods.[1]

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[1]Data pertaining to output prices are not available. Likewise, data for investment goods are not easily available. The U.S. Department of Commerce publishes data for investment in manufacturing annually. For other major industries, similar data are not published annually by the U.S. Department of Commerce. Thus, data constraints preclude the use of output prices and investment goods as variables in the model.

Manufacturing

Manufacturing output is related to a measure of external demand represented by gross national product and to a measure of local demand represented by population. The output is positively related to both explanatory variables.[2] The estimated equation is expressed as:

$$\ln QM = -18.4878 + 2.8577 \ln POP + 0.3081 \ln GNP$$
$$(-2.79)^* \qquad (3.94)^* \qquad (9.74)^*$$
$$R^2 = 0.863 \qquad DW = 1.89 \qquad SER = 0.0374$$

QM = Output, manufacturing

POP = Population, New York City

GNP = Gross national product

Note: The figures in the parentheses represent t values; an asterisk indicates that the t value is statistically significant at 5 percent or less. R^2 is the coefficient of multiple determination, adjusted for the number of degrees of freedom. DW represents the Durbin-Watson statistic. SER is the standard error of the estimate. RHO is shown for those equations estimated by the Hildreth-Lu procedure.

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[2] I regressed QM on GNP and personal income of the city's residents (representing a measure of local demand for manufacturing output). The estimated coefficients did not have the theoretically expected signs. The Philadelphia model is also a demand-oriented model using population in more than one equation for manufacturing and nonmanufacturing sectors. See Glickman, Econometric Analysis of Regional Systems, pp. 78-84. The model of the State of Mississippi also uses population as an explanatory variable in the output equation for finance, insurance, and real estate. See Brooking, "A Farm-Oriented Econometric Model of the State of Mississippi," p. 19. However, in the literature, no theoretical justification is given explicitly for the use of population as an explanatory variable in the output equations.

The local demand represented by POP has been found to have a large effect on QM. By contrast, the effect of GNP on QM is not large. If we assume that POP will remain constant, QM would increase in response to a growth of GNP. The responsiveness of QM to a variation in GNP would increase if the industry gradually obtains a larger share of the national market. This depends on various factors including increased competitiveness of the industry.

Construction

The output of the industry is related to some measures of local demand. These measures are: new manufacturing investment, new residential units completed, and construction cost index. The growth of new manufacturing investment, raising the demand for manufacturing space, also increases the demand for construction activities. The number of residential units completed indicates a demand for construction activities. Therefore, the model postulates that these two variables are positively related to industry's output. The construction cost index is used as a proxy for the output price. The estimated equation is expressed in the following form:

$$\ln QCC = 4.7604 + 0.0634 \ln NRHC + 0.1904 \ln NMI + 0.2132 \ln CC$$

$$\qquad\qquad (5.53)^* \qquad (1.24) \qquad\quad (1.83)^* \qquad (2.11)^*$$

$$R^2 = 0.425 \qquad DW = 1.66 \qquad SER = 0.0573$$

QCC = Output in constant dollars, construction

NRHC = New residential housing units completed

NMI = New manufacturing investment in constant dollars

CC = Construction cost index

The coefficient of NRHC is small and statistically insignificant. Although data show that the number of new residential units completed annually were considerably lower in the seventies than in the early and mid-sixties, no clear trend in NRHC over the years is observable. The low elasticity of QCC with respect to NMI suggests that an increase in NMI does not lead to a substantial increase in construction activities. CC has the unexpected sign.[3]

New Residential Units Completed

The model specifies equations for new residential units completed based on the premise that the effective demand for housing is dependent on personal income of the city's residents and mortgage interest rate.[4]

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[3]An explanation for this perverse sign may be given as follows: QCC includes private and public residential construction activities. As for private construction, the available evidence suggests that the demand for housing services is price-elastic. Muth finds that the price-elasticity of housing demand is about -1 when real income is held constant. See Richard F. Muth, "Urban Residential Land Use and Housing Market," in Issues in Urban Economics, ed. Harvey S. Parloff and Wingo Lowden Jr. (Baltimore: Johns Hopkins Press, 1968), p. 286. No studies regarding the price elasticity of non-residential construction activities can be cited here in support of the perverse sign. Nevertheless, the demand for non-residential construction activities (i.e., commercial, industrial, and public construction) can be assumed to be a function of a myriad of variables including cost of space, which should be affected by cost of construction. Public construction activities, both residential and non-residential, are largely dependent on intergovernmental aid, the local government's budgetary conditions, and projects and programs of the Port Authority.

[4]People make housing decisions on the basis of their expected income over their life cycle. Therefore, permanent income, rather than current income, probably would be a more appropriate variable. However, no measure of permanent income was available. Therefore, current income is used in the model. See Dick Netzer, Economics and Urban Problems (New York: Basic Books Inc., 1970), pp. 104-105.

The latter represents cost and availability of construction funds.[5] The estimated equation is in the following form:

$$\ln NRHC = 7.0561 + 0.0822 \ln PY - 2.4353 \ln MIR$$
$$(7.48)^* \qquad (0.76) \qquad (-5.31)^*$$
$$R^2 = 0.694 \qquad DW = 0.84 \qquad SER = 0.2506$$

NRHC = New residential housing units completed

PY = Personal income of New York City's residents

MIR = Mortgage interest rate

NRHC varies positively with PY and negatively with MIR. The coefficient of PY is statistically insignificant, as one might expect in view of the fact that most of the city's residents are renters. Moreover, a mere rise in PY does not provide adequate incentive to invest in new houses in the city. Substantial population loss, building abandonments, deterioration of housing stocks--all these have contributed to an unfavorable residential climate (i.e., one that discourages housing investment). MIR is found to have significant effect on NRHC. It is thus evident that an appropriate interest rate policy is an effective tool for promoting housing demand in the city.

Finance, Insurance, and Real Estate

The demand for the services of this industry responds positively to an increase in the national demand for loans, investment, trading in securities and insurance. In short, the output of the industry responds

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[5]Harry W. Richardson, Urban Economics (Hinsdale, Ill.: Dryden Press, 1978), p. 256.

to a variation in national economic activities. Since such activities are dependent on the level of GNP, a positive relationship is established between the output and GNP. The equation is estimated as

$$\ln QF = 4.6706 + 0.7681 \ln GNP$$
$$(7.10)^* \qquad (8.05)^*$$
$$R^2 = 0.966 \qquad SER = 0.0513 \qquad RHO = 0.599$$

QF = Output, finance, insurance, and real estate

Note: RHO is the coefficient of auto-correlation.

QF increases at a slower rate than GNP. This suggests that growth of QF would increase if the industry secures continuously a larger share of the national market than what it has at present. One way to achieve this goal is to increase its competitiveness vis-a-vis the nation.

Transportation and Utilities

The volume of goods and services exchanged depends on economic activities in the city and the exchange of goods and services entails movement of goods and people. The latter is facilitated by transportation services. Likewise, the demand for utilities varies with a variation in construction and other economic activities. Since the level of economic activities in the city is dependent on gross city product, the latter is considered as a measure of demand for the services of the industry. The output equation is estimated in the following form:

$$\ln QTU = -3.5159 + 1.114 \ln GCP$$
$$\qquad\qquad (-9.16)^* \qquad (31.95)^*$$
$$R^2 = 0.986 \qquad DW = 2.22 \qquad SER = 0.0346$$

QTU = Output, transportation and utilities

The coefficient of GCP is tested and found to be significantly greater than 1. Therefore, QTU grows at a faster rate than the rate of growth of GNP.

Wholesale and Retail Trade, and Services

The combined wholesale and retail trade, and services is a local-market-oriented sector. Therefore, output changes in response to a change in the local demand. Personal income of the city's residents (PY) is considered as a measure of the local demand. The estimated output equation is in the following form:

$$\ln QWRS = -0.0486 + 0.9564 \ln PY$$
$$\qquad\qquad (-0.59) \qquad (121.05)^*$$
$$R^2 = 0.999 \qquad SER = 0.0079 \qquad RHO = -0.018$$

QWRS = Output, wholesale and retail trade, and services

The extremely good fit of the equation and the very high t value of the coefficient of PY suggest that personal income is a good measure of the local demand. Disposable income would have been a better measure. However, data for disposable income for the city's residents are not available.

Employment Equations: Major Industries

There are 13 employment equations in the model, five of them for five major industries. These five employment equations are specified according to the same postulates. The relationships represent demand for labor by industry. Since the demand for labor is derived from the demand for final goods and services, the former varies positively in response to a variation in the latter. Further, it is assumed that labor and capital are substitutable and that the extent of substitutability depends on their relative cost. The variable representing relative cost is the ratio of a proxy for the cost of capital to the cost of labor. This variable is assumed to have a positive relationship with demand for labor. The rationale behind this assumption is that an increase in the ratio implies a fall in the relative cost of labor, resulting in substitution of labor for capital. Conversely, a decrease in the ratio indicates a rise in the relative cost of labor and causes a substitution of capital for labor. The supply side of employment determination is not considered. The estimated employment equations are as follows:

Manufacturing

$$\ln EM = -2.4291 + 1.0146 \ln QMC + 0.0238 \ln R/MAWMN$$

$$(-2.04)^* \qquad (15.41)^* \qquad (0.23)$$

$$R^2 = 0.969 \qquad SER = 0.0294 \qquad RHO = -0.1$$

EM = Employment, manufacturing

QMC = Output in constant dollars, manufacturing

MAWMN = Average money wage rate, manufacturing

R = AAA corporate bond rate, proxy for cost of capital

Construction

$$\ln EC = -0.42007 + 0.8189 \ln QCC + 0.1265 \ln R/MAWCN$$

$$(-0.32) \qquad (5.15)^* \qquad (0.97)$$

$$R^2 = 0.769 \qquad SER = 0.0463 \qquad RHO = 0.5$$

EC = Employment, construction

QCC = Output in constant dollars, construction

MAWCN = Average money wage rate, construction

Finance, Insurance, and Real Estate

$$\ln EF = 4.3999 + 0.2498 \ln QFC + 0.1086 \ln R/MAWFN$$

$$(3.15)^* \qquad (1.85)^* \qquad (1.03)$$

$$R^2 = 0.775 \qquad SER = 0.0272 \qquad RHO = 0.799$$

EF = Employment, finance, insurance, and real estate

QFC = Output in constant dollars, finance, insurance, and real estate

MAWFN = Average money wage rate, finance, insurance, and real estate

Transportation and Utilities

$$\ln ETU = -53.4608 + 0.7447 \ln QTUC + 0.1195 \ln R/MAWTUN$$

$$(-4.42)^* \qquad (4.87)^* \qquad (3.76)^*$$

$$R^2 = 0.948 \qquad SER = 0.0147 \qquad RHO = 0.999$$

ETU = Employment, transportation, and utilities

QTUC = Output in constant dollars, transportation, and utilities

MAWTUN = Average money wage rate, transportation, and utilities

Wholesale and Retail Trade, and Services

$$\ln EWRS = 4.6448 + 0.1591 \ln R + 0.3743 \ln QWRSC - 0.1508 \ln MAWWRSN$$

$$(8.57)^* \qquad (4.01)^* \qquad (4.23)^* \qquad (-6.47)^*$$

$$R^2 = 0.863 \qquad DW = 1.54 \qquad SER = 0.0347$$

EWRS = Employment, wholesale and retail trade, and services

QWRSC = Output in constant dollars, wholesale and retail trade, and services

MAWWRSN = Average money wage rate, wholesale and retail trade, and services

The magnitudes of the estimated coefficients of QMC, QCC and QTUC indicate that an output expansion policy is an effective tool for employment expansion. This also explains the simultaneous decline in output and employment in the recessions of the seventies. On the other hand, no plausible explanation can be given for the very small coefficient of QFC in the EF equation other than the technological advancement in the industry requiring substitution of capital for labor. The small coefficient of QWRSC in the EWRS equation can be explained similarly.[6]

The estimated coefficients of the EM, EC, and EF equations have the theoretically expected signs. However, insofar as the estimated coefficients of the bond rate/wage rate ratios in the EM, EC, and EF equations are statistically insignificant, they do not provide enough evidence of substitutability of labor for capital and vice versa in these industries. Perhaps the entrepreneurs are guided primarily by considerations of technological factors and secondarily by relative costs of the inputs. In the ETU equation the coefficient of R/MAWTUN

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[6]The ramifications of technological changes have not been considered in the present study.

has the theoretically expected sign. Although the coefficient is statistically significant, its numerical value is small. The EWRS equation is specified somewhat differently but the results appear to satisfy theoretical expectations. In addition, the coefficients are statistically highly significant. This suggests that when the bond rate (R) and the wage rate are considered separately, the effects of relative costs of labor and capital on employment are more apparent. It is worth noting here that at first the EWRS equation--specified in the same manner as the other four equations--was estimated but the results were neither theoretically nor statistically good. Therefore, the equation is re-specified in this manner.

Employment Equations: Subsectors

The model specifies employment equations for eight subsectors which are parts of four major industry groups. Employment in each of these subsectors accounts for a large percentage of employment in the parallel national industry. According to their importance in the nation in terms of employment, these industries are considered either mixed-market-oriented or export-market-oriented. This categorization is based on the assumption that the production levels of these industries are high enough to enable them to sell their product in the national market and local market simultaneously. Among the eight industries, apparel production, printing and publishing, and leather production (i.e., manufacturing group); security and commodity brokers, and services, and banking (i.e., finance, insurance, and real estate group) are considered mixed-market-oriented, serving both local and national markets. Air transportation and communications (i.e., transportation and utilities group),

and legal services (i.e., services group) are considered export-market-oriented, serving primarily the export market.

Apparel Production, Printing and Publishing, and Leather Production

The employment equations for the above three industries are specified similarly. Employment in each of these industries is tied to local and national demand. The local population is taken as a proxy for local demand while employment in the respective industries in the rest of the nation is assumed to be a good proxy for export demand. The underlying premise is that output and employment are positively related. The choice of variables representing the export demand for the output of the subsectors locally must be made on the same logical basis. National output of the respective subsectors would have been a better measure of export demand. But continuous time-series data for the output of most of the subsectors are not published. Thus, owing to difficulties in obtaining the relevant data, employment in the rest of the nation (in the respective industries) is used as a suitable proxy for export demand. The estimated equations for the above three subsectors establish the following relationships:

Apparel Production

$$\ln E23 = -122.64 + 2.7971 \ln POP + 0.4041 \ln E23R$$
$$(-6.63)^* \qquad (2.79)^* \qquad (3.45)^*$$
$$R^2 = 0.976 \qquad SER = 0.0274 \qquad RHO = 0.999$$

Printing and Publishing

$$\ln E27 = -103.938 + 1.5804 \ln POP + 0.9807 \ln E27R$$
$$(-5.41)^* \qquad (2.13)^* \qquad (3.29)^*$$
$$R^2 = 0.969 \qquad SER = 0.0195 \qquad RHO = 0.999$$

Leather Production

$$\ln E31 = -36.7648 + 3.2233 \ln POP + 1.9525 \ln E31R$$

$$(-5.99)^* \qquad (4.38)^* \qquad (17.70)^*$$

$$R^2 = 0.985 \qquad DW = 1.42 \qquad SER = 0.03$$

E23 = Employment, apparel production

E23R = Employment, apparel production in the rest of the nation

E27 = Employment, printing and publishing

E27R = Employment, printing and publishing in the rest of the nation

E31 = Employment, leather production

E31R = Employment, leather production in the rest of the nation

The signs of the estimated coefficients and their statistical significance support the premise that employment depends on local and export demand. The coefficients of POP in the E23 and E31 equations are greater than the same in the E27 equation. This indicates that E23 and E31 are more sensitive to a change in the local demand. Apparently, part of the explanation for the decline in E23, E27, and E31 is found in the decline in the city's population between 1970 and 1975. The coefficient of E23R being far below one indicates that responsiveness of E23 to a change in the external demand is not great. On the other hand, the coefficients of E27R and E31R suggest that E27 and E31 are significantly influenced by export demand.

The city's population has been on the decline for some time. Therefore, the conclusion emerges that an increase in employment in these industries has to depend on an increase in export demand in the future.

Banking

Employment in banking is related to both local and national demand. The estimated equation is written in the following form:

$$\ln E60 = -16.2733 + 1.5364 \ln E60R - 0.4547 \ln BD + 1.7506 \ln POP$$
$$(-1.68) \qquad (4.93)^* \qquad (-2.19)^* \qquad (1.67)$$
$$R^2 = 0.958 \qquad DW = 1.36 \qquad SER = 0.0323$$

E60 = Employment, banking

E60R = Employment, banking in the rest of the nation

BD = Dollar value of bank deposits (domestic), New York City

It is assumed that the demand for output and employment are positively related. Accordingly, a rise in the demand for banking services nationwide leads to a rise in E60R. In other words, E60R represents national demand for banking services. Theoretically, a rise in E60R leads in turn to a rise in E60.

One would expect that an increase in bank deposits, raising the demand for banking services in terms of loans and investment, would increase employment in the industry. But the coefficient of BD has the opposite sign. This suggests that the replacement of some categories of bank employees has been taking place, as a result of automation and computerization of the industry. The elasticity of E60 with respect to population, here used as the proxy for local demand for the banking services, is high. Because the population of the city has been declining, this finding leads one to conclude that the industry must depend increasingly on export demand for its growth.

Security and Commodity Brokers, and Services Industry

It is postulated that the demand for the services of the above industry depends both on local and export demand, represented by SD. The estimated equation is as follows:

$$\ln E62 = 1.9992 + 0.1977 \ln SD$$
$$(1.23) \qquad (1.45)$$
$$R^2 = 0.794 \qquad SER = 0.1012 \qquad RHO = 0.799$$

E62 = Employment, security and commodity brokers, and services

SD = Dollar value of securities sold in the New York Stock Exchange

As SD increases, more activities take place in the securities industry, reflecting an increased demand for employment. However, we have not considered the effects of automation and computerization on employment, both of which may account for the low coefficient of SD and its statistical insignificance.

Air Transportation and Communications

Both air transportation and communications are here considered as export-market-oriented industries. Therefore, the export demand is the crucial variable which leads to a change in employment in these industries. The estimated equations are expressed in the following form:

Air Transportation

$$\ln E45 = -71.7178 + 0.8861 \ln E45R$$
$$(-2.49)^* \qquad (6.20)^*$$
$$R^2 = 0.949 \qquad SER = 0.028 \qquad RHO = 0.999$$

E45 = Employment, air transportation

E45R = Employment, air transportation in the rest of the nation

Communications

$$\ln E48 = -54.0287 + 1.2159 \ln E48R$$
$$(-1.68) \qquad (3.47)^*$$
$$R^2 = 0.846 \qquad SER = 0.0353 \qquad RHO = 0.999$$

E48 = Employment, communications

E48R = Employment, communications in the rest of the nation

The export demand for the services of air transportation and communications is represented by E45R and E48R respectively, assuming the demand for output and employment to be positively related. Similarly, the export demand is assumed to be positively related to E45 and E48. Thus, increases in E45R and E48R lead to increases in E45 and E48 respectively. The estimated coefficients indicate that the export demand has a significant effect on E45 and E48.

Legal Services

The legal services industry is considered an export-market-oriented sector. The employment equation for legal services is expressed in the following form:

$$\ln E81 = 0.8485 + 0.4795 \ln E81R$$
$$(2.32)^* \qquad (6.8)^*$$
$$R^2 = 0.763 \qquad DW = 1.45 \qquad SER = 0.0692$$

E81 = Employment, legal services

E81R = Employment, legal services in the rest of the nation

E81R is considered to be the proxy for the export demand for legal services. Thus, on the assumption that the demand for output and employment are positively related, a positive relationship is established between E81 and E81R. The estimated coefficient of E81R indicates that the export demand does not have considerable effect on E81.

Money Wage Equations

Average money wage rates equations for five major industries are specified in the same manner. It is postulated that a rise in the national wage rate relative to the local wage rate by industry causes a net out-migration of labor and a reduction in labor supply locally. Consequently, the local wage rate increases. In contrast, a decline in the national wage rate has the opposite effect. The above reasoning, however, is based on the assumption that complete information about wages in various markets are available.

(The classical economists assume that complete information about wages in various markets are available. Therefore, when higher wages are paid in other regions, laborers tend to migrate to those areas. This occurs until labor supply in a specific industry in the low-wage region drops, raising the wage rate to the level prevailing in the high-wage areas. Theoretically speaking, such migration continues as long as the difference between the local wage and the wage prevailing in the other regions exceeds migration cost. But in the real world the wage rates do not approach such equalization.[7])

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[7]Walter Isard, Introduction to Regional Science (Englewood Cliffs, N.J.: Prentice-Hall, 1975), pp. 174-77.

The average money wage rate for each industry is related to the local unemployment rate in each of the money wage equations. A rise in the local unemployment rate ceteris paribus, indicates a rise in the labor supply relative to demand. This prompts the employers to offer lower money wages. On the other hand, when the unemployment rate declines, the labor supply decreases in relation to demand, and wages increase. The estimated money wage equations are:

Manufacturing

$$\ln MAWMN = -1.6014 + 1.1751 \ln MAWMUS + 0.0295 \ln UNRA$$
$$(-5.76)^* \qquad (34.78)^* \qquad (1.31)$$
$$R^2 = 0.995 \qquad DW = 2.76 \qquad SER = 0.0196$$

MAWMUS = Average money wage rate in manufacturing in the nation

UNRA = Adjusted unemployment rate

Note: In order to increase the number of observations, two unemployment series are combined to construct the UNRA series. The two unemployment series are computed using two different methods. For example, the method used by the U.S. Department of Labor to compute the unemployment rate before 1968 differs from the one the Department has been applying since then.

Construction

$$\ln MAWCN = -0.1971 + 1.0451 \ln MAWCUS + 0.048 \ln UNRA$$
$$(-0.19) \qquad (8.2)^* \qquad (0.51)$$
$$R^2 = 0.913 \qquad DW = 2.15 \qquad SER = 0.0818$$

MAWCUS = Average money wage rate in construction in the nation

Finance, Insurance, and Real Estate

$$\ln MAWFN = 2.3408 + 0.7889 \ln MAWFUS - 0.1017 \ln UNR$$

(0.82) (2.43)* (-1.23)

$R^2 = 0.941$ SER = 0.0334 RHO = 0.699

MAWFUS = Average money wage rate in finance, insurance, and real estate in the nation

UNR = Unemployment rate

Transportation and Utilities

$$\ln MAWTUN = 0.3693 + 0.9609 \ln MAWTUUS + 0.0652 \ln UNRA$$

(0.33) (7.12)* (0.65)

$R^2 = 0.888$ DW = 2.13 SER = 0.0879

MAWTUUS = Average money wage rate in transportation and utilities in the nation

Wholesale and Retail Trade, and Services

$$\ln MAWWRSN = -1.2975 + 1.1947 \ln MAWWRSUS - 0.0296 \ln UNRA$$

(-2.64)* (19.05)* (-0.73)

$R^2 = 0.982$ DW = 1.87 SER = 0.034

MAWWRSUS = Average money wage rate in wholesale and retail trade, and services in the nation

The coefficients of MAWMUS, MAWCUS, MAWFUS, MAWTUUS and MAWWRSUS are statistically significant. They also suggest that national wage rates have considerable effect on the local wage rates. This finding corroborates the similar findings from studies using both the Philadelphia (1971) and Los Angeles models. But since the equations in these

models are not in logarithmic form, the numerical values of the coefficients are not to be compared with those of the present model.

The estimated coefficients of unemployment rate are statistically insignificant. Thus, the effects of unemployment rate on average money wage rates are not clear. This may be due to the fact that overall rate of unemployment in the city is not a good proxy for sectoral unemployment rate (or labor market conditions).

(The Los Angeles model constructed by Hall and Licari contains two money wage equations with unemployment rate as an explanatory variable. The authors have found the variable statistically insignificant in both equations.[8] In estimating the Philadelphia model, Glickman finds unemployment rate statistically insignificant in one money wage equation. Commenting on this result, Glickman mentions in a footnote that he tested various formulations of Phillip's Hypothesis and found them insignificant.[9])

Local Government Sector

The model specifies equations for the local government sector, focusing chiefly on the major tax bases and the aggregate level of local government expenditures. The sector contains four stochastic equations in addition to one government output equation (i.e., output generated in local, state, and federal governments within the administrative boundary of the city).

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[8]Hall and Licari, "Building Small Region Econometric Models," p. 342.

[9]N. J. Glickman, "An Econometric Model of the Philadelphia Region," Journal of Regional Science 11(1) (April 1971): 18.

The Real Estate Tax

The real estate tax revenues are computed by multiplying the tax base by the tax rate. That is:

$R = B.r$

R = the revenues collected from the tax

B = the legal base of the tax

r = exogenously determined policy variable

Thus, once the tax base is determined, it is easy to compute R.

The legal base of the real estate tax is the assessed value of real estate (AVRE). The model estimates an equation for AVRE. The reasoning underlying the estimated relationship runs as follows: One of the determinants of AVRE is the market value of real estate (i.e., the economic base of the tax). The market value increases as the capitalized stream of income from real estate increases. Furthermore, the capitalized stream of income from real estate and personal income of the city's residents are assumed to be positively related. Therefore, it is postulated that AVRE and PY are positively related.[10] The estimated AVRE equation is:

$$\ln AVRE = 4.6232 + 0.5521 \ln PY$$
$$(19.11)^* \quad (23.8)^*$$
$$R^2 = 0.976 \qquad DW = 0.42 \qquad SER = 0.224$$

The results show that the growth rate of AVRE is far less than that of PY. This is partly explained by the fact that there is a lag

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[10] Thus, the chain of relationships is: AVRE depends on market value; market value depends on capitalized stream of income; and the capitalized stream of income depends on personal income (PY).

between the growth rates of assessed value and market value due to current assessment practices. Since the market value is assumed to be positively related to PY, AVRE grows with a lag in response to the growth of PY.[11] On the other hand, increasing building abandonment, decreasing housing stock, and deteriorating living environment in the city are often cited as having had an adverse effect on assessed value of real estate in the city. However, the influence of these variables is not considered here.

General Sales Tax

As in the case of real estate tax revenues, revenues from the general sales tax are computed by multiplying the legal base of the tax by its rate which is an exogenously determined policy variable. Dollar value of retail sales, excluding food and drugs, is closely related to the legal base of the tax. It is here used as a proxy for the legal base. Thus the model estimates the retail sales equation as follows:

$$\ln RTS = 2.5462 + 0.6261 \ln PY$$
$$(8.04)^* \quad (20.57)^*$$
$$R^2 = 0.968 \qquad DW = 1.01 \qquad SER = 0.0294$$

RTS = Retail sales or the proxy for the tax base

It is postulated that RTS is dependent on PY.[12] In some instances local shoppers make purchases outside the city in an effort to circumvent

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[11] Werner Z. Hirsch, The Economics of State and Local Government (New York: McGraw-Hill, 1970), p. 79.

[12] Disposable income could not be used as the explanatory variable in the equation because the relevant data are not available. If RTS was

the sales tax. In this equation, however, the estimated coefficient of PY does not reflect such purchases. In the Philadelphia model, RTS is related to disposable income and the coefficient is statistically highly significant.[13] But the coefficients are not comparable for reasons indicated previously.

Personal Income Tax

The city personal income tax refers to commuter earnings tax and the tax on residents' income. Non-residents are taxed on wages and salaries and on earnings from self-employment in the city.[14] The residents are taxed on city-adjusted gross income.[15] Since it is difficult to compute the tax base, the personal income of the city's residents minus transfer payments is considered the proxy for the tax base. Further, due to multiple rates of the tax, it is not simple to relate the total tax collections to the base and the rates precisely. Therefore, the estimated equation relates total income tax collections to the base.

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regressed on disposable income instead of PY, the estimated coefficient could have been greater. This is because the rate of growth of disposable income is slower than personal income due to the progressive system of taxation.

[13]Glickman, Econometric Analysis, p. 128.

[14]Personal income tax collections from non-residents accounted for approximately 10 percent of total city personal income tax collections in fiscal year 1975-76. Source: The City of New York, Office of Management and Budget.

[15]The city adjusted gross income means federal adjusted gross income with certain modifications.

The equation is in the following form:

$$\ln PITC = -35.007 + 3.8834 \ln PYMT$$
$$(-3.86)^* \qquad (4.5)^*$$
$$R^2 = 0.681 \qquad DW = 1.95 \qquad SER = 0.315$$

PYMT = Personal income of the city's residents minus transfer payments

PITC = Personal income tax collections

The high estimated coefficient of PYMT is an indication of the local government's increased reliance on income-based tax. This will make the revenue policy more flexible. The revenues from this tax increase in times of prosperity since the income tax base is highly sensitive to a change in local economic conditions.

Local Government Expenditures

The goals of local government expenditures are the changing of the allocation of resources and the redistribution of income. The allocation function of the local government is primarily financed by local resources, whereas the distribution function is mainly financed by transfers from higher levels of government (i.e., intergovernmental aid).[16] Thus, locally raised revenues and intergovernmental aid are resource constraints of the local government.

It will be helpful at this point to refer to earlier econometric studies--those relating to variations in state and local government

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[16]Richard A. Musgrave and Peggy B. Musgrave, Public Finance in Theory and Practice (New York: McGraw-Hill, 1976), pp. 613-37.

expenditures. In these studies, per capita income, population density, degree of urbanization and per capita federal grants have been used as explanatory variables. The study undertaken by Roy W. Bahl and Robert J. Saunders reveals that the changes in per capita federal grants to states was the only factor which significantly affected changes in per capita state and local spending.[17]

In specifying the local government expenditures equation, however, the resource constraints of the local government (locally raised revenues and intergovernmental aid) are considered explanatory variables.

Furthermore, the local government provides certain goods to the consumers through budgetary process (this refers to the allocation function). The publicly provided goods are called social goods or public goods. On the one extreme is the polar case of pure social goods. They possess two major characteristics: (1) non-rivalry in consumption, and (2) non-excludability. A good is called non-rival in consumption if its consumption by one person does not reduce consumption benefits derived by other consumers. A good is called non-excludable if it cannot be denied to people who are unwilling to pay the price for its consumption. Again, there are certain social goods which are excludable but it is very costly to apply the exclusion principle. These two characteristics usually lead to zero pricing of social goods and the latter are provided through 100 percent budget finance. In actual fact, most social goods are not pure social goods. They are examples of mixed goods which combine characteristics of both social and private goods (i.e., the

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[17]Roy W. Bahl, "Determinants of Changes in State and Local Government Expenditures," National Tax Journal (May 1965): 51-52.

consumption of these goods gives rise to both private benefits and externalities). The local government must formulate a general tax-subsidy scheme to provide these social goods. There is another kind of social goods which is called merit goods. In providing merit goods, however, preferences are imposed on certain classes of consumers.[18]

In specifying the local government expenditures equation, it is assumed that the local government spends more on the provision of social goods as the per capita income of the residents of the city increases. The underlying assumption is that these goods are superior goods and the demand for them increases as per capita income increases. The equation is estimated as:

$$\ln LGEXP = -2.6646 + 0.6053 \ln LGREV + 0.1853 \ln INTGA + 0.5901 \ln PCI$$
$$(-3.72)^* \qquad (8.61)^* \qquad (5.73)^* \qquad (3.68)^*$$

$$R^2 = 0.999 \qquad DW = 0.86 \qquad SER = 0.0129$$

LGEXP = Local government expenditures

LGREV = Locally raised revenues

INTGA = Intergovernmental aid

PCI = Per capita income of the residents of New York City

This is a good equation. All the coefficients have the expected signs and they are statistically highly significant. The coefficient of

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[18]Richard A. Musgrave, "Provision of Social Goods," in Public Economics, ed. J. Margolis and H. Guitton (New York: St. Martin's Press, Macmillan, 1969), pp. 124-43.

INTGA is small. INTGA includes both categorical and general purpose aid. An increase in the latter does not necessarily lead to an increase in LGEXP by the same amount. The local government has the option for substituting general purpose aid for locally raised revenues in the financing of its functions. To the extent this is done, an increase in INTGA does not lead to an increase in LGEXP. The small coefficient of PCI is expected. Part of the explanation is that welfare and medicaid expenditures are included in LGEXP; and the expenditures for welfare and medicaid usually increase with the growth of population of low-income category, irrespective of the level of PCI.

Government Output

An equation is specified for the federal, state and local government output generated in the city. An expansion of federal and state programs at the local government level leads to an increase in local government expenditures. Such an increase, in turn, promotes federal and state government activities. Therefore, it is assumed that the federal and state government output is positively related to local government expenditures. The local government output depends on the latter. Therefore, the estimated government output equation establishes the following relationship:

$$\ln QFSLG = 1.8619 + 0.7604 \ln LGEXP$$
$$(14.43)^* \qquad (50.51)^*$$
$$R^2 = 0.995 \qquad DW = 1.71 \qquad SER = 0.0301$$

QFSLG = Output, federal, state, and local governments

QFSLG grows at a slower rate than LGEXP. This is quite logical. LGEXP does not cause an increase in QFSLG to the extent its growth reflects growth in transfer payments.

Other Equations

Personal Income

The personal income equation establishes a positive relationship between personal income of the residents and gross city product.

$$\ln PY = -1.1292 + 1.0468 \ln GCP$$
$$(-5.37)^* \qquad (54.87)^*$$
$$R^2 = 0.995 \qquad DW = 1.29 \qquad SER = 0.0191$$

Labor Force

As mentioned earlier, the labor force equation is the only supply equation in the model. It is postulated that the supply of labor is affected by in-migration and out-migration of labor force and its participation rate. Although the literature on labor force migration suggests that a great many factors affect in-migration and out-migration, we will here be concentrating on economic conditions. Accordingly, it is assumed that the local unemployment rate represents local economic conditions which affect both in-migration and out-migration. When the local unemployment rate increases, in-migration of labor decreases and its out-migration increases.

(Edward Miller attempts to relate out-migration to unemployment rate. In his study, Miller finds unemployment rate statistically

significant in explaining out-migration in some equations.[19] Lowry establishes a statistically significant relationship between unemployment rate and in-migration.[20])

The labor force participation rate is likely to decline in periods of unemployment because those unemployed who are searching for jobs become discouraged and drop out of the labor force (discouraged worker effect). On the other hand, the participation rate among certain female categories increases when the unemployment rate increases (additional worker effect). However, it is assumed here that for the entire labor force, the discouraged worker effect predominates. This means that a rise in unemployment leads to an overall decline in the participation rate and hence a reduction in the labor force. This is an additional reason for the expected negative relationship between the labor force and the unemployment rate.

(Michael L. Wachter finds in his study that the discouraged worker effect is observed especially during chronically high unemployment. This is likely to be true for New York City during the major part of the sample period used for the labor force equation. However, he finds that for the female 45-54 and 65+ age categories, the additional worker effect predominates over the discouraged worker effect.[21])

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[19]Edward Miller, "Is Out-Migration Affected by Economic Conditions?" Southern Economic Journal 39 (January 1973): 401.

[20]Ibid.

[21]Michael L. Wachter, "Labor Supply Model for Secondary Workers," The Review of Economics and Statistics 54 (May 1972): 148-49.

The estimated equation is:

$$\ln LF = 8.1626 - 0.0499 \ln UNR$$
$$(268.0)^* \quad (-3.12)^*$$
$$R^2 = 0.492 \qquad DW = 1.13 \qquad SER = 0.0206$$

LF = Labor force

The coefficient of UNR has the theoretically expected sign. It is expected to reflect the discouraged worker effect, added worker effect and the effects of in-migration and out-migration attributed to changes in the local unemployment rate.

Local Unemployment Rate

The local unemployment rate is related to the national unemployment rate. The chain of responses of the local unemployment rate to a variation in the national unemployment rate can be expressed as follows: A rise in the latter causes a decline in the national demand for output of the city's export-market-oriented and mixed-market-oriented industries. This, in turn, leads to a fall in employment and a rise in local unemployment rate. Consequently, employment in the local-market-oriented industries declines. The estimated unemployment rate equation is specified as:

$$\ln UNR = -0.5693 + 1.4221 \ln UNRUS$$
$$(-2.91)^* \quad (12.55)^*$$
$$R^2 = 0.946 \qquad DW = 2.26 \qquad SER = 0.099$$

UNRUS = Unemployment rate, U.S. Cities

It appears that the national unemployment rate has significant effects on the local labor market situations. This can be primarily attributed to the labor intensive character of some of the industries locally.

In the following chapter, the estimated equations are used to simulate the model.

CHAPTER V

SIMULATIONS AND FORECASTS

This chapter presents the results of simulations and forecasting experiments. A number of simulations have been performed to test the model statistically, to study the impact of a change in GNP on the local economic and fiscal variables, and to study the effects of a change in policy variables. In addition, a short-run forecast has been made with the model. The results of simulations and forecasts suggest that this is a useful model.

Historical Simulation

The model is statistically tested as a complete system through a simulation process. The individual equations are assembled to form a complete model for this purpose.[1] A simulation is then performed in order to evaluate the model's ability to replicate historical data series for the period from 1968 through 1975, since the time-series data for all the variables are available.[2]

The results of simulation demonstrate that 78 percent of all the variables have 5 percent or less Mean Absolute Percent Error (see

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[1]See Pindyck and Rubinfeld, Econometric Models and Economic Forecasts, pp. 309-10.

[2]This is a historical simulation which is used in evaluating the model's ability to forecast.

Table 1).[3] The error statistics indicate that in general the model has replicated historical data series well. Graphs 1 through 7 depict the actual and model generated values for selected endogenous variables. It may be noted that since the model deals mainly with the nominal values of the variables, neither the observed values nor the model generated values (those obtained from historical simulation) depict the turns in the business cycles. Nonetheless, Graph 5 demonstrates that both observed and simulated values of the total city employment drastically declined during the simulation period.

Root Mean Square Percent Error is another measure of the deviation of the simulated variable from its actual time path. RMS percent error statistics for all the endogenous variables are presented in Table 1.

Multiplier Simulation[4]

A multiplier simulation has been performed to study the impact of a change in gross national product on the city's economy. The impact is

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[3]MAPE statistics for the present model and those of a number of regional models are compared here. The Philadelphia model (1971) has 5 percent or less MAPE for 57 percent of the variables. See Glickman, "An Econometric Model of the Philadelphia Region," p. 25. MAPE for 79 percent of the selected variables for the Los Angeles Model are 5 percent or less. See Hall and Licari, "Building Small Region Econometric Models," p. 344. The North East Corridor Model (for the central region) has 5 percent or less MAPE for 73 percent of the variables. See Robert Crow, "A Nationally Linked Regional Econometric Model," Journal of Regional Science 13(2) (August 1973): 200. The Philadelphia model as of 1977 has less than 5 percent MAPE for 82 percent of the variables. See Glickman, Econometric Analysis of Regional Systems, p. 143.

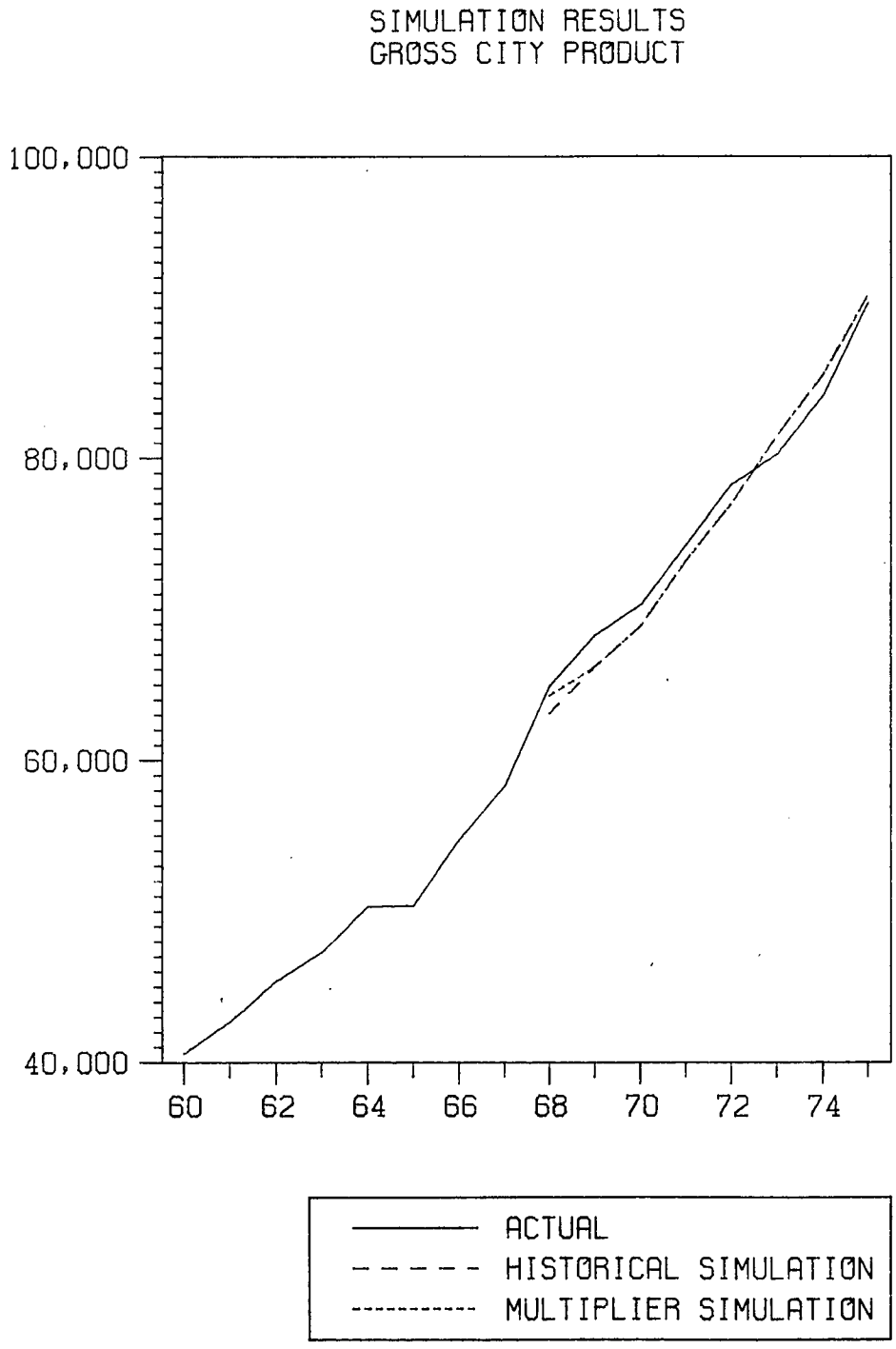
[4]For impact multiplier, see Henri Theil, Principles of Econometrics (New York: John Wiley, 1971), pp. 465-68.

TABLE 1

MEAN ABSOLUTE PERCENT ERROR AND ROOT MEAN SQUARE PERCENT ERROR STATISTICS FOR ENDOGENOUS VARIABLES

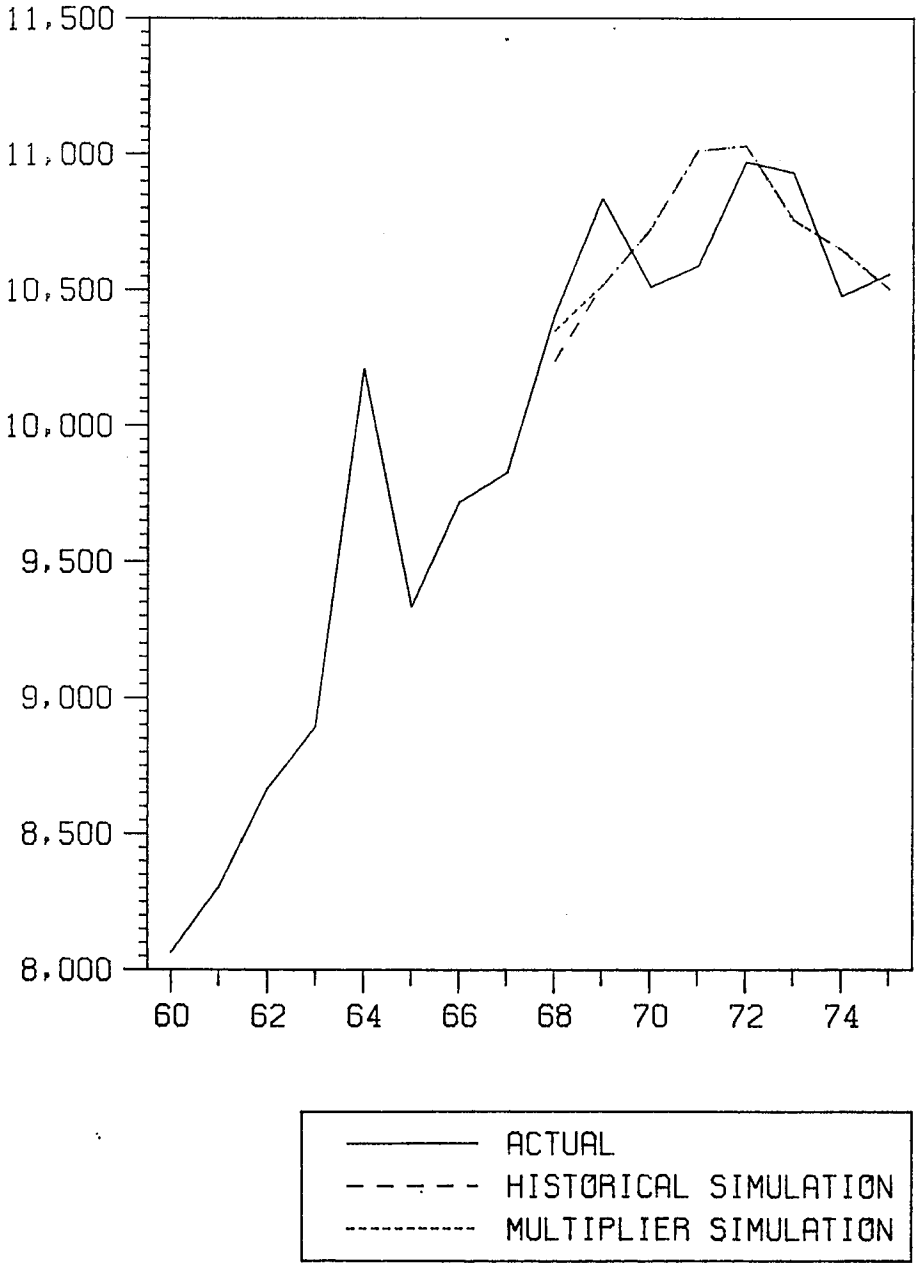
Variables	Mean Absolute Percent Error	Root Mean Square Percent Error
QM	1.86	2.16
QF	6.13	6.44
QC	9.38	13.52
QTU	1.78	2.18
QWRS	1.20	1.40
GCP	1.88	2.05
NRHC	24.77	29.42
EM	2.36	3.19
EC	6.38	11.71
EF	4.48	5.39
ETU	1.86	2.22
EWRS	0.77	0.82
EMR	3.37	4.95
EFR	3.29	4.24
ETUR	5.04	5.51
EWRSR	0.87	0.90
E23	2.43	2.62
E27	2.69	3.10
E31	1.80	2.27
E60	2.31	2.64
E62	14.70	17.10
E45	2.89	3.29
E48	3.42	4.12
E81	2.40	2.52
MAWMN	1.86	2.06
MAWCN	5.93	7.99
MAWFN	3.36	4.12
MAWTUN	6.40	9.25
MAWWRSN	2.17	3.64
AVRE	0.53	0.68
RETC	0.53	0.68
RTS	1.53	1.94
STC	1.53	1.94
PITC	24.29	31.41
LGEXP	1.44	1.98
LGREV	2.07	2.83
QFSLG	2.83	3.09
PY	0.77	1.40
LF	1.45	1.93
UNR	9.34	9.77
TEMP	0.95	1.07

GRAPH No. 1


SIMULATION RESULTS
GROSS CITY PRODUCT
100,000
80,000
60,000
40,000
60
62
64
66
68
70
72
74
ACTUAL
HISTORICAL SIMULATION
MULTIPLIER SIMULATION

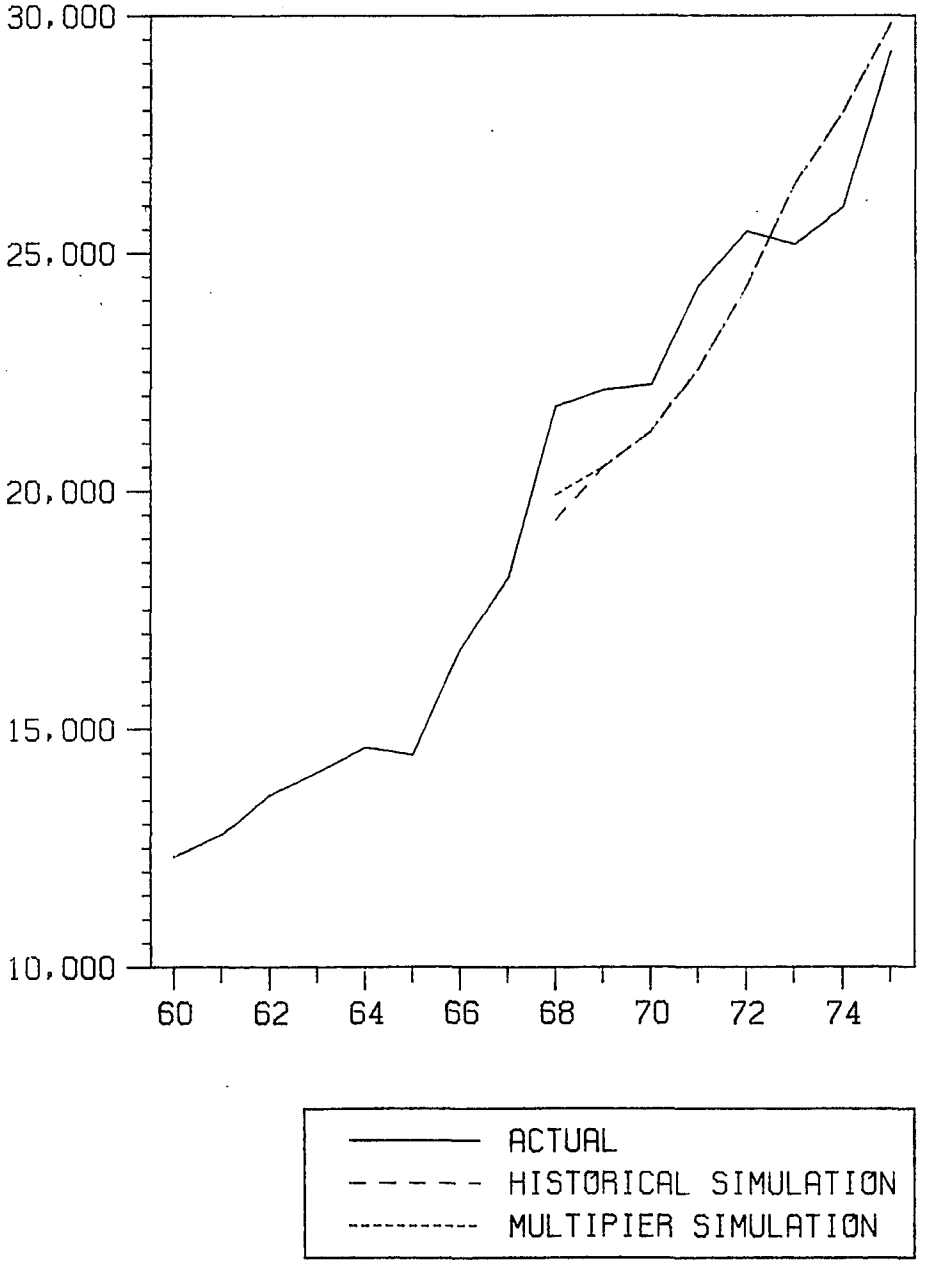
GRAPH No. 2

SIMULATION RESULTS
MANUFACTURING OUTPUT



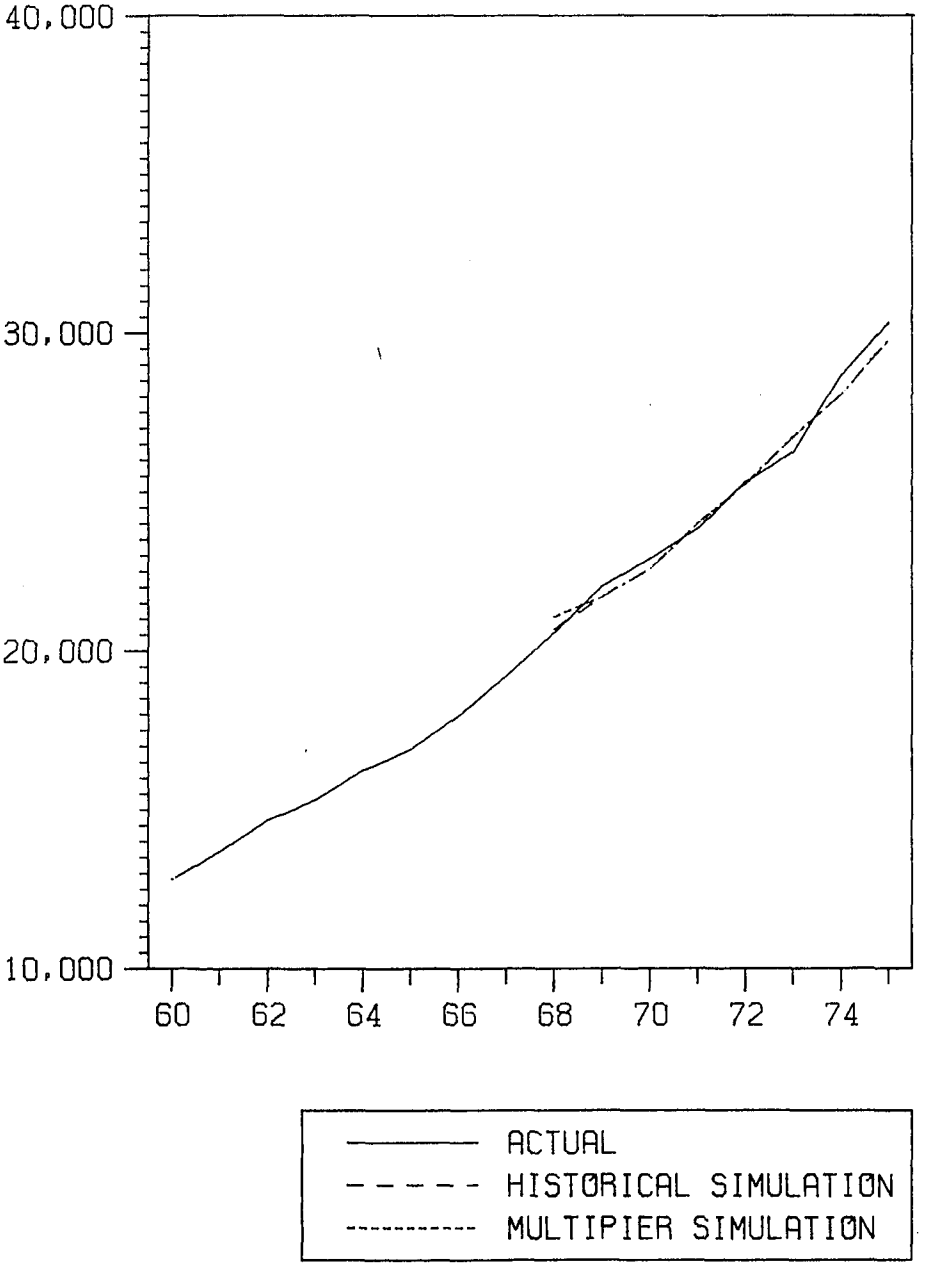
GRAPH No. 3

SIMULATION RESULTS
FINANCE, INSURANCE AND REAL ESTATE OUTPUT



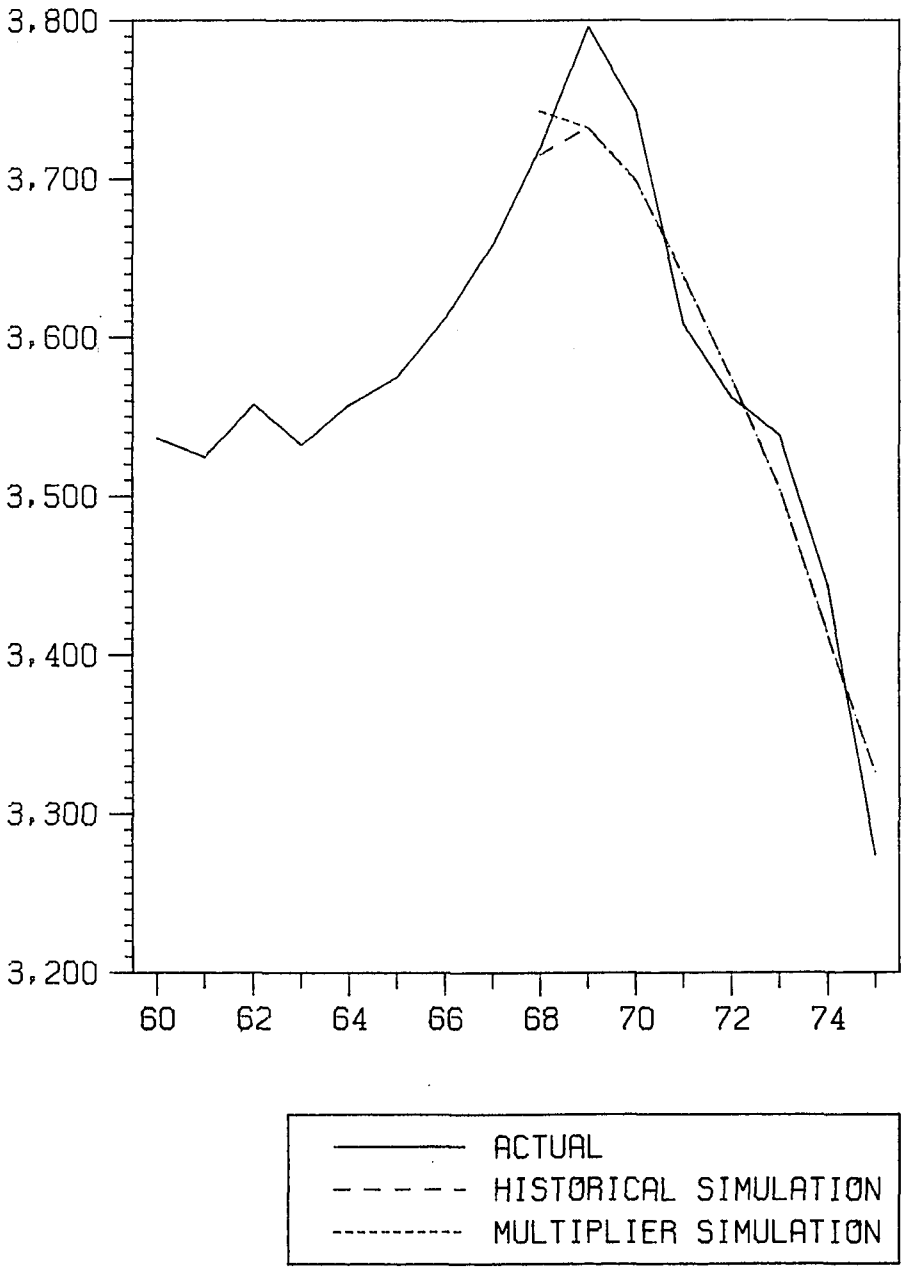
GRAPH No. 4

SIMULATION RESULTS
WHOLESALE AND RETAIL TRADE AND SERVICES OUTPUT



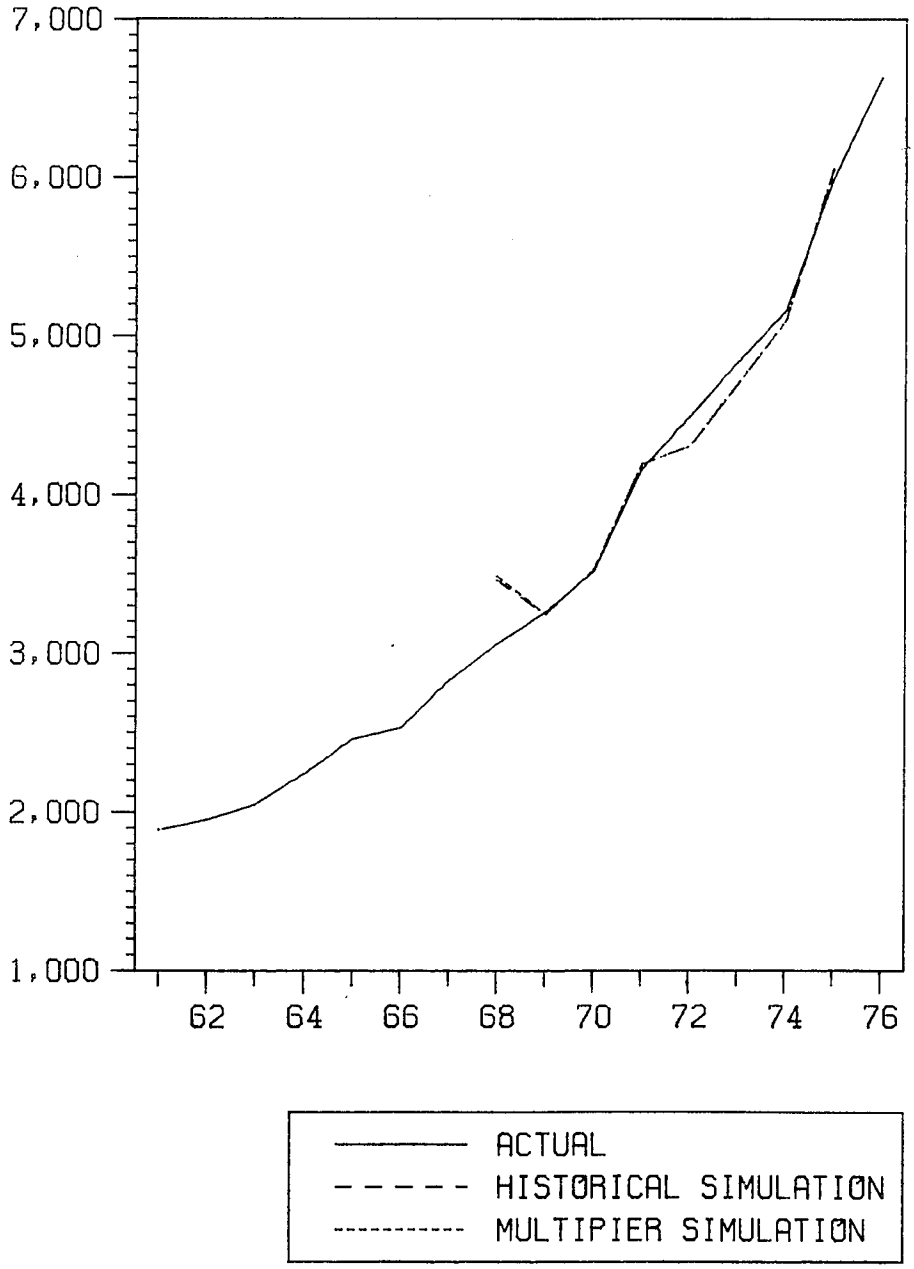
GRAPH No. 5

SIMULATION RESULTS
TOTAL CITY EMPLOYMENT



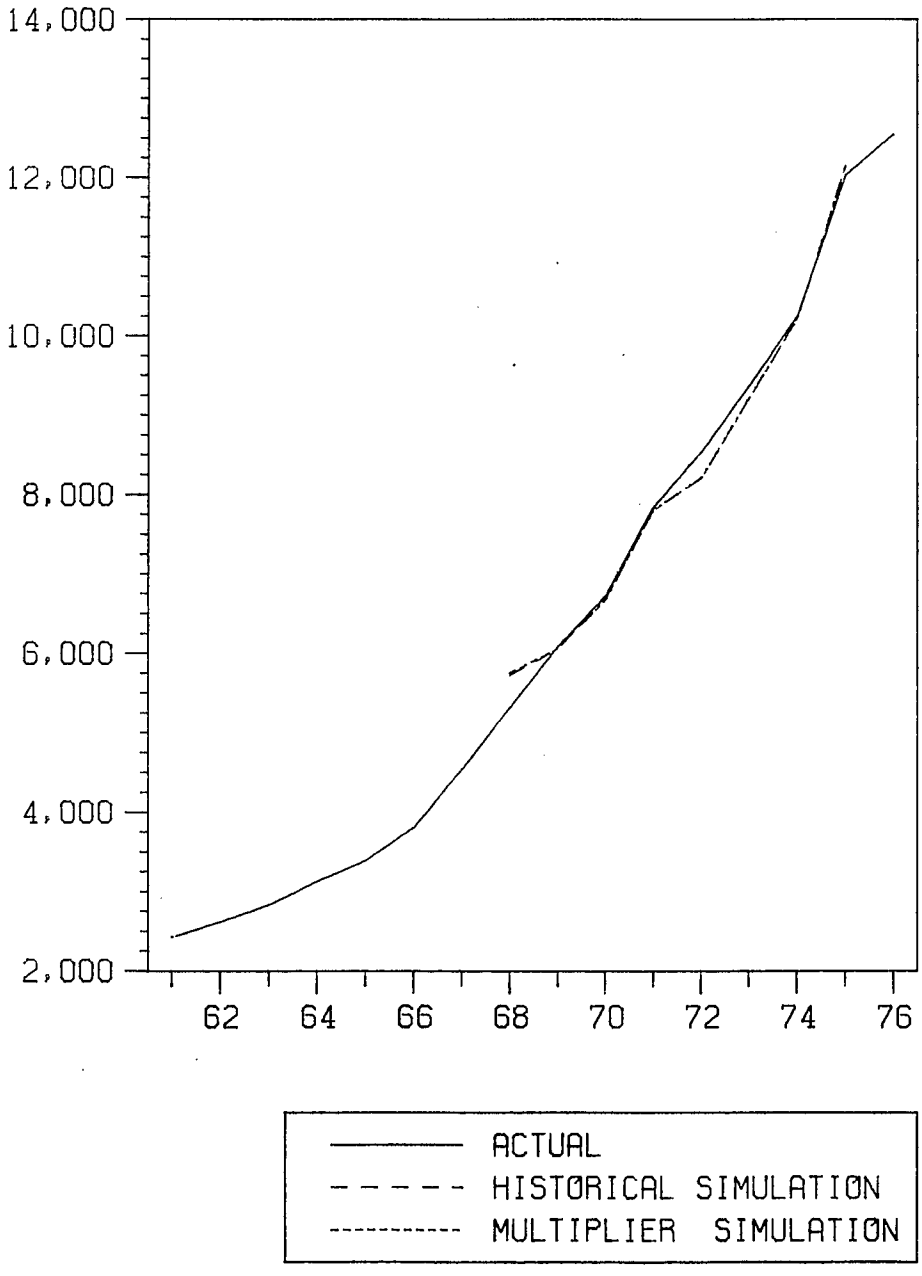
GRAPH No. 6

SIMULATION RESULTS
LOCAL GOVERNMENT REVENUE



GRAPH No. 7

SIMULATION RESULTS
LOCAL GOVERNMENT EXPENDITURES



here measured in terms of elasticity. This is one way of studying the linkage between the local and national economies. The simulation results shown in Table 2 suggest that the local economy is less volatile with regard to cyclical changes than the national economy. For instance, a 1 percent reduction in gross national product has a negative impact of only 0.53 percent on gross city product. This result compares favorably with the impact elasticity studies of the Mississippi state economy and the economy of the Los Angeles SMSA. A 1 percent reduction in gross national product had a negative impact of 0.45 percent on Mississippi gross state product.[5] Similarly, a 1 percent increase in gross national product had a positive impact of 0.55 percent on Los Angeles gross product.[6]

The low volatility of the city's economy in response to a change in gross national product is presumably due to the nature of manufacturing in the city. The city's manufacturing output (QM) consists predominantly of non-durables and is, therefore, less volatile with regard to a change in GNP than other major industries. On the other hand, sensitivity of the output of the combined finance, insurance, and real estate sector (QF) to a change in GNP is greater than that of gross city product to the same change. The impact elasticity of the output of transportation and utilities is close to that of gross city product with respect to GNP. That of services, and wholesale and retail trade, is similarly close.

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[5]See Adams, Brookings, and Glickman, "On the Specification and Simulation of a Regional Econometric Model: A Model of Mississippi," p. 291.

[6]Hall and Licari, "Building Small Region Econometric Models," p. 349.

TABLE 2

IMPACT ELASTICITIES*: EFFECTS OF 1 PERCENT INCREASE OF GNP ON SELECTED LOCAL VARIABLES (BASE = 1968)

Variables	Percent Increase
Gross city product	0.53
Personal income of the city's residents	0.55
Output, manufacturing	0.30
Output, finance, insurance, and real estate	0.76
Output, transportation, and utilities	0.59
Output, wholesale and retail trade, and services	0.53
Assessed value of real estate	0.30
Real estate tax collections	0.30
Retail sales, sales tax base	0.35
General sales tax collections	0.35
Local government revenues**	0.20
Local government expenditures	0.12
Output, federal, state, and local governments	0.09
Total employment	0.21

* Impact elasticity is defined as the first period percentage change in an endogenous variable due to a 1 percent change in a specific exogenous variable.

** Refer to locally raised revenues.

The GNP impact is felt lightly on the local government sector. The low impact elasticity of local government revenues (locally raised revenues) is due to the nature of their relationship with gross city product as established by the model. The low impact elasticities of the local government sector as compared to those of major private industrial sectors are confirmed also by the results obtained by the Los Angeles model (1974).

In conclusion, the above discussions on impact elasticities suggest that the national recessions of the seventies contributed partially to the downturn of the local economy. However, it should be remembered that other causes for the downturn that are more fundamental and long-range include gradual loss of competitiveness of the industries locally and decreasing attractiveness of the city as a place to live, as mentioned earlier.

Policy Simulations

Intergovernmental Aid

Intergovernmental aid influences the local economy through its effects on the local government expenditures (LGEXP). A decrease in intergovernmental aid reduces LGEXP. A reduction in LGEXP in turn reduces government output (QFSLG) and gross city product (GCP). Thus, all the local economic variables which are related to GCP are affected adversely by a decrease in intergovernmental aid (see Table 3).

The decline in the city's population in the period between 1970 and 1975 discussed in Chapter 1 will probably continue. Since the number of people who reside in the city is one of the criteria for determination

TABLE 3

SIMULATION RESULTS: A DECREASE IN INTERGOVERNMENTAL AID BY 1 PERCENT (ELASTICITIES)

Variables	Percent Change
Gross city product	-0.017
Personal income of the city's residents	-0.017
Output, transportation, and utilities	-0.017
Output, wholesale and retail trade, and services	-0.015
Assessed value of real estate	-0.009
Real estate tax collections	-0.009
Retail sales, general sales tax base	-0.010
General sales tax collections	-0.009
Locally raised revenues	-0.006
Local government expenditures	-0.177
Output, federal, state, and local governments	-0.134
Total employment	-0.004

of fdedral and state aid, it is expected that the amount of intergovernmental aid to the local government will tend to decline in the future as well.

Real Estate Tax

As mentioned earlier, the revenues from the real estate tax depend on the tax rate and the tax base (the assessed value of real estate). The effects of a change in the tax rate on the assessed value is controversial.[7] However, if we assume that a reduction in the tax rate leads to an increase in the capitalized stream of income from the taxed real estate, assessed value will increase as a result of such a tax reduction in the long run.

The immediate effects of a tax rate reduction are quite to the contrary. Those of a 1 percent reduction in the effective tax rate (from 1968 level) on selected variables are shown in Table 4. As expected, a 1 percent reduction in the tax rate leads to a 1 percent decrease in real estate tax collections (RETC) and a 0.5 percent reduction in locally raised revenues (LGREV). Furthermore, in response to a fall in locally raised revenues, local government expenditures (LGEXP) decline by 0.3 percent (far less than 1 percent), causing 0.027 percent

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[7] On the one hand, a fall in the real estate tax rate leads to a rise in the capitalized stream of income from real estate and, therefore, in assessed value. On the other hand, a fall in the real estate tax rate leads to a fall in real estate tax collections and reduces local government revenues. Further, a reduction in local government revenues causes a shrinkage in local government services. Since the value of local services is usually capitalized in the market value of real estate, a cutback in local government services leads to a decline in the capitalized stream of income and assessed value. This is more likely to happen if the local services are site-oriented. See Hirsch, The Economics of State and Local Government, pp. 96-97.

TABLE 4

SIMULATION RESULTS: A DECREASE IN THE REAL ESTATE TAX RATE BY 1 PERCENT (ELASTICITIES)

Variable	Percent Change
Gross city product	-0.027
Personal income of the city's residents	-0.029
Output, transportation, and utilities	-0.029
Output, wholesale and retail trade, and services	-0.024
Assessed value of real estate	-0.014
Real estate tax collections	-1.000
Retail sales, general sales tax base	-0.016
General sales tax collections	-0.011
Locally raised revenues	-0.507
Local government expenditures	-0.308
Output, federal, state, and local governments	-0.235
Total employment	-0.005

decline in gross city product. Thus, all other variables which are influenced by GCP are also affected in the same way.

Forecasts for New York City Economy

We will now consider a forecasting experiment which has been performed with the model. For forecasting purposes, the actual values of GNP, national unemployment rates, mortgage interest rates, and AAA corporate bond rates are used. For some exogenous variables, a linear trend is assumed to hold good, and the rest of the exogenous variables are assumed to remain unchanged at the 1975 level.

The actual values and the predicted values of selected endogenous variables are given in Table 5. The actual values and the predicted values of endogenous variables are close except for a few variables that are affected directly by a change in the local government policies. The disparity between the actual and the predicted local government operating expenditures is probably the result of a structural shift in the expenditures brought about by the expenditure-reduction policies of the local government in 1977 and 1978. The decline in the growth rate of assessed value in recent years was partly due to the removal of some properties--i.e., a significant portion of publicly assisted properties--from the tax rolls. This largely explains disparities between the actual and predicted values in forecast years. The discrepancies in the actual and predicted government output are to be expected since the policies geared to cutting back expenditures were pursued by the local government; this, in fact, depressed the level of government output. However, the closeness of the predicted and actual values for most of the important variables suggests that the model can well serve as a short-run forecasting tool for the post-sample period and perhaps beyond.

TABLE 5*

ACTUAL AND FORECAST VALUES FOR SELECTED ENDOGENOUS VARIABLES FOR 1976, 1977, AND 1978

Variables	1976		1977		1978		Maximum Percent Error
	Actual	Forecast	Actual	Forecast	Actual	Forecast	
Gross city product (in billions of dollars)[a]	95.0	97.7	101.0	105.2	N.A.	113.0	4.1
Personal income of the city's residents (in billions of dollars)[b]	53.0	54.1	55.6	58.4	N.A.	63.0	5.0
Output, manufacturing (in billions of dollars)[a]	11.4	10.8	12.1	11.2	N.A.	11.6	7.4
Output, finance, insurance, and real estate (in billions of dollars)[a]	31.1	32.4	33.7	35.2	N.A.	38.4	4.4
Output, wholesale and retail trade, and services (in billions of dollars)[a]	31.7	32.0	33.2	34.5	N.A.	37.3	3.9
Assessed value of real estate (in billions of dollars)[c]	39.6	41.8	38.8	43.6	38.6	45.6	18.1
Retail sales,** sales tax base (in billions of dollars)[b]	11.4	11.7	12.2	12.3	12.6	12.9	2.3
General sales tax collections (in millions of dollars)[c]	825.0	847.3	867.8	889.5	931.2	935.6	2.7
Local government expenditures (in billions of dollars)[c]	12.4	13.4	13.6	14.8	13.6	16.4	19.7
Output, federal, state, and local governments (in billions of dollars)[a]	7.4	8.9	7.8	9.6	N.A.	10.3	23.0
Total employment by place of work (in thousands)[d]	3247	3202	3182	3132	3283	3109	5.3
Total labor force (in thousands)[d]	3113	3122	3052	3142	3033	3177	4.7

* Data pertaining to the actual values of the variables are obtained as follows:

a. Data constructed by the author on the basis of the procedure used by Kendrick and Jaycox from the U.S. Department of Commerce data.

b. The U.S. Department of Commerce.

c. The City of New York, Comptroller, Annual Reports.

d. The U.S. Department of Labor.

** Excludes food and drugs.

CHAPTER VI

CONCLUSIONS

Summary

The study focuses on the construction, estimation, and testing of a prediction model for New York City. In addition, the model has been simulated (1) to study the impact of a change in gross national product on the local economy and (2) to study the effects of changes in two policy variables, intergovernmental aid, and real estate tax rate. Finally, the model is used to forecast the local economy.

The model contains equations relating to the private-economy and the local-government sectors. The two sectors are interdependent. The estimated results demonstrate that the export-market-oriented sector is primarily affected by national variables, while the mixed-market-oriented sector is influenced by both local and national variables. The output in the local-market-oriented sector is mainly dependent on local variables. The linkage between the local and the national economies is established through the export-market- and mixed-market-oriented sectors. Employment mainly depends on output. Furthermore, the model has postulated that output and employment in a number of industries are dependent on population, a proxy for demand. Assuming that the declining trend in population observed in the period from 1970 through 1975 continues, the demand for output and employment of these industries will decline.[1]

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[1]The U.S. Department of Commerce, Bureau of the Census, has reported a decline in the city's population in the years after 1975. The trend does not appear to be the same in all the boroughs of New York City.

The results of historical simulation show that the model has performed well in replicating corresponding historical data series. Mean Absolute Percent Error statistics (which are used as measures of statistical significance) for the endogenous variables of this model are either comparable to or better than those found in the literature for other similar models, with the exception of the model for the Philadelphia region as of 1977.[2]

The impact elasticity of New York City gross product with respect to a change in gross national product is 0.53. Although the numerical value of the impact is comparable to those obtained by some other regional models, the impact is not great. This suggests that the growth of gross national product will contribute to the growth of local economy only to a limited extent.

Further, the study reveals that a reduction in intergovernmental aid causes a reduction in the local government's operating expenditures. This, in turn, leads to a decline in gross city product and in the magnitudes of other fiscal and economic variables. Since one of the criteria for determining the amount of intergovernmental aid is the number of people living in the city, the decline in the city's population would lead to a decrease in the amount of intergovernmental aid. Such effects can be offset if the intergovernmental aid formulae are modified.

Table 4 on real estate tax shows that a decrease in the real estate tax rate has a primary impact on real estate tax collections,

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[2]The Philadelphia model as of 1977 has less than 5 percent MAPE for 82 percent of the variables. See Glickman, Econometric Analysis of Regional Systems, p. 143.

locally raised revenues, local government expenditures, and gross city product in declining order. The impact of a decrease in the real estate tax on the other economic variables analyzed in the model is of a much smaller order. It should be remembered that only the immediate impact is indicated. It may well be that in the long-run, elasticities for the variables would be quite different. This, however, cannot be shown in the analytics of the present model.

Finally, ex post forecasting experiment with the model demonstrates its predictive accuracy for endogenous variables in the post-sample period. This suggests that the model can serve as a good forecasting tool.

Contributions of the Model to Regional Econometric Model Building

Regional macroeconometric model building is a relatively new area. The present model is the first small-scale macroeconometric model for New York City built broadly on the basis of the earliest version of the Philadelphia model. Nevertheless, this model is far from a replica of any other earlier regional model. The model's structure was developed after many tests made to obtain equations responsive to theoretical and statistical considerations.

A model of this kind is probably of more use to an individual researcher or a policy maker than a large-scale model would be, when it comes to understanding the structure of the city's economy or performing policy simulations and forecasting. We all know that econometric models have the advantage that they may be developed and modified through experience with a view to improving the results. Therefore, this model

offers scope for further research into the local economic problems vis-a-vis the nation as well as for various policy options and forecasting experiments.

Because the U.S. Department of Commerce does not provide data pertaining to gross product for New York City, we constructed such data (by industry and government) for the purpose of building the model. These data would certainly be valuable inputs for further research in the development of ideas relating to construction of basic statistics for the city's economy.

The classification of the city's industries as export-market-oriented, mixed-market-oriented and local-market-oriented is made after a study has been done.[3] This classification would be helpful in understanding the nature of local economic issues.

Finally, the present model deals with more disaggregated industrial sectors than those dealt with by most other small-scale econometric models for other regions. Obviously, more disaggregation sheds additional light on the behavior of the local economic variables.

Some Suggestions for Future Research

As noted earlier, data constraints limit the sophistication of this model as compared to national models. However, with increasing availability of regional data, the art of regional macroeconometric model building will develop and the regional models will no longer continue to be relatively simple. Data problems aside, a few suggestions for future

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[3]See Appendix D.

research in the field are given here. An attempt should be made to include in the model appropriate variable(s) representing competitiveness of the industries locally. The importance of competitiveness to the city's economy is evident in the analysis of employment changes applying the shift and shares framework mentioned in Chapter 1. Also, attention must be paid, in constructing such a model, to the productivity levels of the labor force and the local industries. An inclusion of an investment equation, upon availability of data, would render the model more dynamic and might improve the estimated results. The model would also assume a more dynamic character with the use of quarterly data. Further, more disaggregation of the various sectors might contribute toward a better performance of the model. Finally, the local government sector must be more disaggregated. More detailed treatment of the government sectors in the model could serve as a useful tool to policy-makers.

As for estimation procedure, other methods, namely, Two-Stage Least Squares--Principal Components and Iterated Instrumental Variables (IIV), might be applied, and results compared with each other and with the results obtained by Ordinary Least Squares as used in estimating the equations in the present model.

APPENDIX A

SHIFT AND SHARES ANALYSIS AND NEW YORK CITY'S EMPLOYMENT CHANGES

In order to describe the changes in employment in the city during the period from 1960 to 1975 by industrial sector, the shift and shares analysis/framework is used here. The basis of the shift and shares framework is expressed by the following identity:

$$\Delta R_i^* = R_i\,[(US^*/US) - 1] + R_i\,[(US_i^*/US_i) - (US^*/US)] + R_i\,[(R_i^*/R_i) - (US_i^*/US_i)]$$

where:

ΔR_i^* = Change in regional employment in the i th industry at the end of the period

R_i = Regional employment in the i th industry at the beginning of the period

R_i^* = Regional employment in the i th industry at the end of the period

US = Total national employment at the beginning of the period

US_i = Total national employment in the i th industry at the beginning of the period

US* = Total national employment at the end of the period

US_i^* = Total national employment in the i th industry at the end of the period

The three terms on the right hand side of the above identity are, respectively, national share, industrial mix, and competitive components--

the three components of employment changes. The first, national share component, accounts for the change in employment the particular industry would have experienced if employment had changed at the same rate as the total national employment in all industries. The industrial mix component equals the change in employment which the industry at the regional level would have experienced due to the difference in the rate of the growth of the industry nationally from the national average of all industries. Industrial mix component is computed on the basis of the assumption that employment in a particular regional industry grows as if at the same differential rate as the employment in the corresponding national industry. The last component, viz., the competitive component, accounts for the change in employment that can be attributed primarily to the comparative advantage that the region enjoys in terms of production and marketing of a specific good or goods.[1] In other words, the last component measures the growth differential resulting from interregional differences which have had impact on the attractiveness of the region for the location of the particular industry. It may be noted that it is the magnitude and the sign of the components that are important.

The changes in employment in the six major industries are partitioned into three components applying the shift and shares framework as follows:

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[1]Werner Z. Hirsch, Urban Economic Analysis (New York: McGraw Hill, 1973), pp. 223-26.

Industry	Period: 1960 to 1975
Manufacturing:	-419,000 = 396,000 - 309,000 - 506,000
Construction:	-47,000 = 52,000 - 27,000 - 72,000
Finance, insurance, & real estate:	36,000 = 162,000 + 63,000 - 189,000
Transportation & utilities:	-50,000 = 133,000 - 94,000 - 89,000
Wholesale & retail trade:	-109,000 = 315,000 + 41,000 - 465,000
Services:	163,000 = 254,000 + 283,000 - 374,000

The computations shown above indicate that the last components of the change in employment for all the six industries have negative signs. The last components being the competitive components suggest loss of competitive advantages by the city over the years.

APPENDIX B

TABLES 6 THROUGH 20

TABLE 6

CHANGE IN THE SHARE OF EMPLOYMENT IN NON-FARM PRIVATE AND PUBLIC SECTORS IN NEW YORK CITY IN SELECTED YEARS BY PERCENT

Year	Non-Farm Private Sector	Public Sector	Total
1960	88.5	11.5	100
1969	85.6	14.4	100
1975	82.5	17.5	100

NOTE: Tables 6 and 7 are based on data reported, U.S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings in States and Areas, 1939-75, 1977. The choice of the years for presentation of employment data in Tables 6-20 is based on the following considerations: the period between 1960-69 was a moderate growth period and New York City experienced a peak level of employment in 1969. Between 1969 and 1975 there were two national recessions and employment in the city dipped drastically.

TABLE 7

CHANGE IN EMPLOYMENT IN PRIVATE AND PUBLIC SECTORS IN NEW YORK CITY IN SELECTED PERIODS BY PERCENT

	Private Sector		Public Sector	
Year	Total	Annual	Total	Annual
1960-69	3.8	0.4	34.0	3.3
1969-75	-16.8	-2.6	4.6	0.8

TABLE 8

CHANGE IN THE DISTRIBUTION OF EMPLOYMENT BY INDUSTRIAL SECTOR IN SELECTED YEARS BY PERCENT

Year	Manufac-turing	Finance	Construction	Transpor-tation	Wholesale & Retail Trade	Services	Govern-ment	Total
				U.S.A.				
1960	31.4	5.0	5.4	7.5	21.3	13.9	15.6	100.1
1969	28.9	5.1	5.0	6.4	21.1	16.1	17.5	100.1
1975	24.1	5.5	4.5	5.9	22.2	18.4	19.4	100.0
				New York City				
1960	26.8	10.9	3.5	9.0	21.0	17.2	11.5	99.9
1969	21.7	12.3	2.8	8.5	19.7	20.5	14.4	99.9
1975	16.1	12.9	2.4	8.2	19.4	23.5	17.5	100.0

NOTE: Tables 8-20 are based on data reported, U.S. Department of Labor, Bureau of Labor Statistics (1) Employment and Earnings, United States, 1909-74; (2) Employment and Earnings in States and Areas, 1939-75, 1977; (3) Employment and Earnings, January 1978.

TABLE 9

NEW YORK CITY'S SHARE OF NATIONAL EMPLOYMENT IN SELECTED YEARS BY PERCENT: MANUFACTURING

Year	Manufacturing
1960	5.6
1969	4.1
1975	2.9

TABLE 10

CHANGE IN EMPLOYMENT IN NEW YORK CITY AND THE U.S.A. IN SELECTED PERIODS BY PERCENT: MANUFACTURING

	New York City		U.S.A.	
Year	Total	Annual	Total	Annual
1960-69	-12.8	-1.3	20.1	2.1
1969-75	-36.1	-5.3	-9.2	-1.5

TABLE 11

NEW YORK CITY'S SHARE OF NATIONAL EMPLOYMENT IN SELECTED YEARS BY PERCENT: CONSTRUCTION

Year	Construction
1960	4.3
1969	3.0
1975	2.3

TABLE 12

CHANGE IN EMPLOYMENT IN NEW YORK CITY AND THE U.S.A. IN SELECTED PERIODS BY PERCENT: CONSTRUCTION

	New York City		U.S.A.	
Year	Total	Annual	Total	Annual
1960-69	-16.6	-1.7	22.2	2.3
1969-75	-25.4	-3.8	-1.9	-0.3

TABLE 13

NEW YORK CITY'S SHARE OF NATIONAL EMPLOYMENT IN SELECTED YEARS BY PERCENT: FINANCE, INSURANCE, AND REAL ESTATE

Year	Finance, Insurance, and Real Estate
1960	14.5
1969	13.1
1975	10.0

TABLE 14

CHANGE IN EMPLOYMENT IN NEW YORK CITY AND THE U.S.A. IN SELECTED PERIODS BY PERCENT: FINANCE, INSURANCE, AND REAL ESTATE

	New York City		U.S.A.	
Year	Total	Annual	Total	Annual
1960-69	20.6	2.1	33.5	3.3
1969-75	-9.3	-1.5	18.6	2.9

TABLE 15

NEW YORK CITY'S SHARE OF NATIONAL EMPLOYMENT IN SELECTED YEARS BY PERCENT: TRANSPORTATION AND UTILITIES

Year	Transportation and Utilities
1960	7.9
1969	7.3
1975	6.0

TABLE 16

CHANGE IN EMPLOYMENT IN NEW YORK CITY AND THE U.S.A. IN SELECTED PERIODS BY PERCENT: TRANSPORTATION AND UTILITIES

	New York City		U.S.A.	
Year	Total	Annual	Total	Annual
1960-69	1.8	0.2	10.8	1.2
1969-75	-17.1	-2.7	1.4	0.3

TABLE 17

NEW YORK CITY'S SHARE OF NATIONAL EMPLOYMENT IN SELECTED YEARS BY PERCENT: WHOLESALE AND RETAIL TRADE

Year	Wholesale and Retail Trade
1960	6.5
1969	5.1
1975	3.7

TABLE 18

CHANGE IN EMPLOYMENT IN NEW YORK CITY AND THE U.S.A. IN SELECTED PERIODS BY PERCENT: WHOLESALE AND RETAIL TRADE

	New York City		U.S.A.	
Year	Total	Annual	Total	Annual
1960-69	0.6	0.06	29.1	2.9
1969-75	-15.1	-2.4	15.3	2.4

TABLE 19

NEW YORK CITY'S SHARE OF NATIONAL EMPLOYMENT IN SELECTED YEARS BY PERCENT: SERVICES

Year	Services
1960	8.2
1969	6.9
1975	5.5

TABLE 20

CHANGE IN EMPLOYMENT IN NEW YORK CITY AND THE U.S.A. IN SELECTED PERIODS BY PERCENT: SERVICES

	New York City		U.S.A.	
Year	Total	Annual	Total	Annual
1960-69	28.4	2.8	51.3	4.7
1969-75	-1.2	-0.2	24.6	3.7

APPENDIX C

DATA CONSTRUCTION AND SOURCES

Data Contruction

Due to a paucity of regional data, the economist faces problems in building regional models. An additional problem is the lack of time-series data for consecutive years. Consequently, regional model builders must construct data pertaining to the basic economic variables. Therefore, we have constructed some basic statistics for New York City.

Unlike gross national product, data for gross city product is not available. Therefore, the method similar to the one discussed by Kendrick and Jaycox is used here to construct output data.[1] In order to estimate gross city product using available data, it is assumed that the structure within each non-farm industry group in the city is similar to that of the corresponding industry group in the nation. The procedure involves several computational steps:

First, the proportional relationship is established between gross national product and national aggregate wage bill by industry group and public sector. The proportions thus computed are assumed to be identical to the corresponding proportions for the city. Six major industry groups are considered.

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[1] Kendrick and Jaycox, "The Concept and Estimation of Gross State Product," pp. 153-68.

Second, the proportional relationship is established between total non-farm labor and proprietors income for New York City and non-farm labor and proprietors income by each of the six major industry groups and public sector. Data pertaining to labor and proprietors income are published by the U.S. Department of Commerce.

Third, the aggregate wage bill for New York City is allocated among the six major industry groups and the public sector using the proportion of labor and proprietors income accruing to each group.

Fourth, gross city product by each of the six industry groups and public sector is computed using the proportion between gross national product and aggregate wage bill by industry group and public sector. The sum of gross city product by industry group and public sector will add up to gross city product.

The above approach to the estimation of gross regional product is called the "output approach." The value added method is another variant of "output approach." Data related to value added in manufacturing only for New York City is published annually. Therefore, the value added method could not be applied to compute gross city product. It may be recalled that export and import and sector-wise investment and consumption expenditures data for the city are not available. Nor are meaningful profit data readily obtainable. Therefore, the expenditures or income approach has not been adopted to estimate gross product for the city.

Data Sources

The U.S. Department of Commerce: Gross national product; personal income of the city's residents; money wage rate by industry group, new manufacturing investment in the city; retail sales; personal income of the city's residents minus transfer payments; population of the city.

The U.S. Department of Labor: Employment by industry, labor force, and consumer price-index.

The City of New York, Comptroller, Various annual reports: locally raised revenues; intergovernmental aid; local government operating expenditures; assessed value of real estate (taxable only); real estate tax collections; general sales tax collections and personal income and commuter earnings tax collections.

The Federal Reserve Bulletin (Washington, D.C.), Various issues: Rates of return on AAA corporate bonds.

The City Bank: Mortgage interest rate.

The Clearing House of New York City: Domestic bank deposits of the city's banks.

Securities and Exchange Commissions, Various annual reports: Dollar value of securities sold in the New York Stock Exchange.

McGraw-Hill Information Systems Company, Dodge building cost index for U.S. and Canadian cities: construction cost index.

The City of New York, Department of City Planning: New housing units completed.

APPENDIX D

CLASSIFICATION OF INDUSTRIES AS EXPORT-MARKET-, MIXED-MARKET-, AND LOCAL-MARKET-ORIENTED SECTORS

The proper specification of the equations contained in the New York City model requires that the industries be classified as export-market-, mixed-market-, and local-market-oriented sectors. This is not an easy task due to a paucity of data.

However, an attempt has been made here to classify the industries locally into three groups as mentioned above. The procedure used for this purpose is based on the principles applied by Richard Knight to classify export and local industries.[1] It involved three steps: an estimation of gross city product by industry, an estimation of requirements of the local economy by industry, and the determination of local exports and imports by subtracting the requirements from gross city product by industry. It is assumed that total requirements are equal to gross city product, and there is no net flow of funds into or out of the city. The requirements for the city's six major industries are determined as follows:

First, proportions for the six corresponding national industries are computed relating gross national product by industry to total gross domestic national product. Gross city product is then allocated to the six industries locally on the basis of the proportions thus obtained.

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[1] Richard Knight, Employment Expansion and Metropolitan Trade (New York: Praeger Publishers, 1973), pp. 14-25.

The products so allocated represent requirements by industry.

Net exporting and importing industries are then identified in the following manner:

Let GCPN be gross city product and TON be the total outlay of the local residents. N refers to New York City. By assumption, GCPN = TON. Let NRJ = GAJ (TON); TJ = NRJ - GCPJ, where NRJ = New York City requirements for industry J, GAJ = Gross national domestic product coefficient for industry J, TJ = Trade balance in industry J, GCPJ = Gross city product for industry J. A positive TJ is attributed to imports and a negative TJ is attributed to exports.

There are some differences between the procedure discussed above and the one used by Richard Knight. While Knight estimates production by industry for metropolitan areas using national index of value added, we have used the procedure discussed by Kendrick and Jaycox for estimating gross city product. Instead of using gross national domestic product coefficient as used here, Knight uses national income coefficients in estimating requirements by industry.

The results obtained through the application of the above procedure demonstrate that New York City's financial sector is a net exporter accounting for 44 percent and 46 percent of output as exports in 1960 and 1975 respectively. In these years, 42 percent and 58 percent of requirements of manufacturing could be attributed to imports. In 1975 the output of services exceeded requirements by 14 percent. On the other hand, the output of transportation and utilities, construction, and wholesale and retail trade falls short of the requirements of the respective sectors.

Thus, in the New York City model considered in the present study, finance, insurance, and real estate (i.e., financial sector) are treated as export-market-oriented industry. Construction, transportation, and utilities, and the combined services, wholesale and retail trade industries, are local-market-oriented. But manufacturing is considered as mixed-market-oriented, serving both national and local market. It is quite logical to assume that the city's large manufacturing sector produces goods for national market as well. At the same time, imported manufacturing goods are needed for the large and diversified local consumer market.

Lastly, a number of industries which belong to the six major industries considered here are also classified as export-market- and mixed-market-oriented sectors somewhat arbitrarily. The export-market-oriented industries are: air transportation, communications, and legal services. Mixed-market-oriented industries are: Apparel production, printing and publishing, and leather production; banking, security and commodity brokers, and services. All of these industries have one common characteristic in that they account for a large percentage of employment in the corresponding national industries.

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