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AN ECONOMETRIC MODEL OF OKLAHOMA TAX REVENUES: AN ANALYSIS OF STATIC AND DYNAMIC IMPLICATIONS OF TAX POLICY SIMULATION.

THE UNIVERSITY OF OKLAHOMA, PH.D., 1978

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GRADUATE COLLEGE

AN ECONOMETRIC MODEL OF OKLAHOMA TAX REVENUES: AN ANALYSIS OF STATIC AND DYNAMIC IMPLICATIONS OF TAX POLICY SIMULATION

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

by

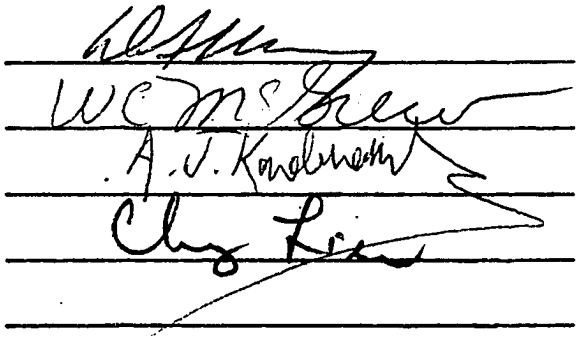
KWANGOK KIM

Norman, Oklahoma

1978

AN ECONOMETRIC MODEL OF OKLAHOMA TAX REVENUES:
AN ANALYSIS OF STATIC AND DYNAMIC IMPLICATIONS
OF TAX POLICY SIMULATION

APPROVED BY



DISSERTATION COMMITTEE

ACKNOWLEDGEMENT

I am sincerely thankful to Dr. Chong K. Liew, Professor of Economics, for his directing my research and to Dr. Donald A. Murry, Chairman of the Committee and Director of the Center for Economic and Management Research, and to Mr. Neil J. Dikeman, Jr., Assistant Director of the Center for Economic and Management Research for their valuable comments and for allowing me to have the computer time so essential to my research.

I am also grateful to the other members of the Dissertation committee; Dr. David A. Huettner, Dr. W. C. McGrew, and A. J. Kondonassis for their valuable comments and suggestions.

I am also grateful to Dr. Steve Robinson, Dean of the School of Business, William Carey College who provided assistance and convenience in every possible way, and to my loving wife, Yongsoon, I express special gratitude for her encouragement and moral support. I am deeply indebted to my son, Dennis, and my daughter, Christina, during the completion of my dissertation.

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AN ECONOMETRIC MODEL OF OKLAHOMA TAX REVENUES: AN ANALYSIS OF STATIC AND DYNAMIC IMPLICATIONS OF TAX POLICY SIMULATION

CHAPTER I

INTRODUCTION

Purpose

The primary purpose of this study is to investigate the ability of the Oklahoma state tax structure to generate adequate tax revenues since most states are faced with a problem of revenue inadequacy relative to state expenditure demands. The concept of adequacy of state tax is that the state tax system must produce sufficient revenues to meet needs while tax revenues grow fast enough to meet the expanding expenditures of the state government.

An additional objective of this study is to measure the effect of alternative tax policies on the state's economy.

Method

The methodology of this study is to use a computer simulation to analyze the economic impact of alternative

tax policies on the state economy. To accomplish this, an econometric model of the Oklahoma tax revenue system is constructed with seventeen simultaneous log linear equations and three definitional relations. This system of equations is to be solved by two-stage least squares estimation techniques. Following this, the estimated equations are then to be incorporated with Evans and Klein's simulation model for alternative tax policy simulation.

The computer simulation is to be conducted by varying either, or both, the estimated coefficients of the equations and the values of the predetermined variables of the equations.

To evaluate the forecasting performance, the forecasting performance of this model is to be compared with that of Box-Jenkins Model.

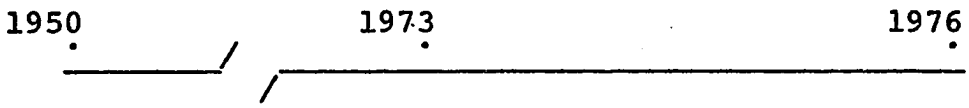
The data obtained and used in this model are in current values rather than in real values and cover the period 1950-1973. The signs and magnitudes of the estimated coefficients of the equations estimated by two stage least squares techniques turned out to be unacceptable when the data are transformed into the real value terms.

Scope

Two types of computer simulation are to be conducted--static simulation and dynamic simulation. Static simulation is achieved by changing one or more estimated coefficients of the equations with actual lagged endogenous

variables and actual exogenous variables. The impact of static simulation lasts for only a one year period. Dynamic simulation is achieved by changing one or more estimated coefficients to generate simulated values with simulated lagged endogenous variables and actual exogenous variables. Then all the actual values of the following year are replaced by the simulated values which will be used to generate the simulated values for the subsequent periods.

Forecasting and simulation to be performed in this study are as follows:



Ex Post period	Ex Ante period
(1) Ex Post forecast	(3) Ex Ante forecast
a). Static forecast $Y = y(Y_{-1}, X, \hat{\Theta})$	
b). Dynamic forecast $Y = y(\hat{Y}_{-1}, X, \hat{\Theta})$	a). Dynamic forecast $Y = y(\hat{Y}_{-1}, X, \hat{\Theta})$
(2) Ex Post simulation	
a). Static simulation $\Delta Y = y(Y_{-1}, X, \Delta\hat{\Theta})$	
b). Dynamic simulation $\Delta Y = y(\hat{Y}_{-1}, X, \Delta\hat{\Theta})$	

where

Y = endogenous variables,

X = predetermined variables,

$\hat{\theta}$ = estimated coefficients,

$\hat{Y}$ = replaced endogenous variables by predicted values.

To clarify the terms to be used, ex post period covers sample period of 1950 to 1973 and ex ante period covers the following three year period.

Limitations

The model is formulated to forecast only the state tax revenues while excluding state expenditures.

In formulating an econometric model of an economic system, the choice of variables to be included in the model depends upon the availability of data. A problem of insufficient data leads to an alternative choice of variables. Such an alternative choice of variables may lead to misspecification of the equations. As a result, the availability of data is the main criterion in this study for reducing the institutional equations to the six tax equations: individual income tax, corporate income tax, general sales tax, motor fuel tax, vehicles and vehicle operator's tax, and death and gift tax. Gross production tax (severance) is added later in the study. Total state tax revenues are to be allocated to gross production tax on the basis of allocation method by the actual percentage of gross production tax to the total tax.

Organization of the Study

In order to place the study in proper perspective, Chapter II presents a brief survey of the literature concerning an outline of Oklahoma tax structure and estimation of elasticities.

Chapter III presents the econometric model of selective state taxes which forecasts, simulates the alternative tax policies, and also explains interrelationships between tax variables with some other economic variables. This chapter also discusses the reliability of the model.

Chapter IV offers simulation of alternative tax policies and comparison of ex ante forecasting performance with that of the Box-Jenkins model.

Chapter V presents the summary and the conclusions of this study.

CHAPTER II

SURVEY OF THE LITERATURE

In surveying the literature the following elements will be considered: (1) outline of Oklahoma tax structure and (2) estimation of elasticities.

Outline of Oklahoma Tax Structure

The United States tax system is based on three major types of taxes--income, expenditure and property or wealth.[1]

Income Taxes

Individuals and businesses are subject to federal, state and sometimes local income taxes on their income. Forty-four states levy income tax on individuals and businesses.[2] Generally state tax rate structures are less progressive than that of the federal income tax.

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[1]Roger A. Freeman, The Growth of American Government: A Morphology of the Welfare State (Stanford, Calif.: Hoover Institution Press, 1975): 81-83; John F. Due, Government Finance: Economics of the Public Sector, 4th ed. (Homewood, Illinois: Irwin, 1968): 104-144.

[2]U.S. Department of Commerce, Bureau of the Census, State Government Finances in 1976 (Washington, D.C.: Government Printing Office), p. 11.

The social security tax which is another type of income taxation is levied on the earned income of individuals and businesses. The federal government mainly relies on income taxation for its tax revenues. However, state government dependency on income taxation for their tax revenue keeps increasing.[1]

Expenditure Taxes

When individuals spend what remains of their incomes after they pay income taxes, they face expenditure taxes on their spendings. These expenditure taxes take the form of federal excise taxes on certain items such as gasoline, automobiles, cigarettes and alcoholic beverages and state and local sales taxes which are composed of general sales taxes and selective sales taxes.[2]

A general sales tax is a flat rate that is applied to the total amount of retail sales. This general sales tax has been adopted by forty-five state governments. All states utilize one or more selective sales taxes such as gasoline, cigarettes, alcoholic beverages, automobile vehicles and some other items.[3] Selective sales taxes are flat rates that are applied to the quantity purchased rather than the total value of the sales. Most state

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[1] Ibid.

[2] Ibid., pp. 19-26.

[3] Ibid.

governments rely on the general and selective sales taxation.[1] Some local governments use these general and selective sales taxes for their tax revenues.

Property or Wealth Taxes

There are two types of property or wealth taxation. The first type is taxes that are levied on real and personal property by local governmental units. The second type is federal and state taxes imposed on accumulated wealth at death such as federal estate tax, state estate, and state inheritance taxes.[2] A gift tax is a form of wealth tax which is imposed by federal and state governments on the donors in making gifts. The main source of local government revenues is coming from property taxation.

Other Taxes

Besides the above mentioned three major types of taxation, there is gross production tax (severance) which grows fast and becomes important in oil producing states such as Texas, Louisiana and Oklahoma. And state governments generally levy taxes on the rights and privileges granted corporations to do business within the state, right to operate motor vehicles within the state, right to use public roads and also the privileges of hunting and

---

[1] Ibid.

[2] Ibid.

fishing.[1]

The taxes levied by Oklahoma state government are classified as follows:[2]

1. Individual income tax
2. Corporate income tax
3. General sales tax
4. Selective sales tax
   a). Motor vehicle fuels
   b). Alcoholic beverages
   c). Tobacco products
   d). Insurance companies
   e). Public utilities
   f). Others
5. Licenses and privileges
   a). Motor vehicles
   b). Motor vehicle operators
   c). Corporations in general
   d). Alcoholic beverages
   e). Fishing and hunting
   f). Occupation and business
   g). Amusement
   h). Others
6. Gross production (Severance)
7. Death and gift taxes

---

[1] Ibid.

[2] Ibid., p. 11.

According to the Oklahoma statutes, the income tax is levied annually upon the net income of individuals, corporations, estates and trusts.

> Every resident individual is subject to the income tax levied upon the net income derived from wages, salaries, commissions, professional or occupational earnings or other compensation regardless of where such income is earned. A non-resident is also subject to the income tax upon the portion of the total income earned within the state. A corporation is also subject to the income tax upon its net income.[1]

The rate structure of the state individual income tax is less progressive than that of the federal income tax. The marginal income tax rate is ranging from 1/2 percent to 6 percent. There are three tax rate schedules: (1) for single individuals and married individuals filing separately, (2) for heads of households and (3) for married individuals filing jointly.[2]

A corporation income tax is levied upon the Oklahoma taxable income of the corporation doing business within the state or deriving income from sources within the state. For the multi-state corporation which operates in more than one state, the states use apportionment formulas to determine what portion of the corporation's total income each state government will impose tax upon. The three factor formula is used to obtain the average percentage to apply to the total income of a multi-state

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[1]Oklahoma, Oklahoma Statutes Annotated, Title 68, Article 23 (St. Paul, Minnesota: West Publishing Co., 1966): 2-126.

[2]Ibid., pp. 22-23.

corporation to determine the Oklahoma tax base upon which the flat 4 percent of the tax rate is applied. The three factor formula is:[1]

$$\frac{\text{in-state investment}}{\text{total investment}} + \frac{\text{in-state cost}}{\text{total costs}} + \frac{\text{in-state sales}}{\text{total sales}} = \text{tax base}$$

The general sales tax is the tax imposed upon the gross proceeds or gross receipts of the retail sales. The tax base is defined as retail sales of tangible personal property plus certain selective services such as haircuts, laundry, and hotel and motel occupancy. The general sales tax is computed as a constant percentage of the retail sales value. The sales tax in effect in Oklahoma is based on the Laws 1941.[2] There have been several sales tax changes since enactment of the original law in 1933. Most of the changes in the general sales tax law have consisted of extension in the number of items to which the tax levy is applicable.

There are some items exempted from the general sales taxation such as raw farm products, gasoline, motor fuel, motor vehicles, cigarettes, 3.2 percent beer, goods for resale, feed, sales to or by churches and governments,

---

[1]Lecture note of Dr. Jack Robinson, late Professor of Economics; David Fellman and Kenyon E. Poole, The Cost of American Governments: Facts, Trends, Myths (New York: Dodd, Mead & Co., 1967): 37-71.

[2]Oklahoma, Statutes, Article 13, pp. 338-374.

and raw materials to be used in manufacturing.[1]

A use tax is levied on tangible personal property purchased or brought into the state from the outside which is used or consumed within the state.[2] This use tax is intended to protect local businesses and also to protect state tax revenues derived from sales taxes. Since the flat 2 percent is applied to the total retail sales, the general sales tax is regressive in effect.

In addition to the general sales and use taxes, there are certain taxes levied upon specific commodities on a per-unit basis. This tax is called the selective sales tax.

A few examples of the selective sales tax are the motor fuel tax, motor vehicle and vehicle operators taxes, alcoholic beverage tax, and fishing and hunting taxes. The current motor fuel tax rate is 6.58 cents per gallon of the motor fuel sold in Oklahoma and the motor vehicle tax is 2 percent of the value of the vehicle of which ownership is transferred and registered in Oklahoma.[3]

Death taxes consist of two major forms, an estate tax and an inheritance tax. The estate tax is a tax levied upon the transfer of the net estate of property, whether

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[1]Ibid., pp. 351-359.

[2]Oklahoma Tax Commission, A Brief Outline of the Oklahoma Revenue System (Oklahoma City, Oklahoma, 1973), p. 2.

[3]Oklahoma, Statutes, Article 21, pp. 434-436.

real, personal, or mixed, and whether tangible or intangible property whereas the inheritance tax is a tax levied upon the shares of the estate transferred to the beneficiaries. There used to be a single tax rate structure ranging from one percent on the first 10,000 dollars to ten percent on the excess of ten million dollars of the net estate with the aggregate exemptions of 15,000 dollars to parents, children or descendants.[1]

By Laws 1973 which became effective as of July 1, 1974, major changes in the estate tax structures are that two different tax rate structures exist--one for the net estate transferring to the parents, children, spouse, and children of the husband or wife and any lineal descendants of the deceased, ranging from one percent to ten percent. The other tax rate structure applies to transfers of the net estate to other than the above mentioned persons, ranging from two percent on the first 10,000 dollars of the net estate to 15 percent on the excess of one million dollars with new aggregate exemptions of 60,000 dollars.[2]

In addition, the state levies a tax upon the transfer of property by gift. Any gift made to a spouse during the year, and the first 3,000 dollars to each donee are exempted from the gift tax. Gift tax structures are the

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[1]Oklahoma, Statutes, Article 8, pp. 208-230, and Cumulative Pocket Part, pp. 29-39.

[2]Ibid.

same as that of estate tax.[1]

There is a fast growing tax called gross production tax in Oklahoma. The gross production tax is a tax levied on the gross value of the production of minerals, oil, and gas. Tax rate structures used to be as follows until amendment by Laws in 1971: (a) five percent rate on the gross value of the production of petroleum, (b) five percent rate on the gross value of the production of natural gas and (c) a rate of 3/4 of one percent on the gross value of other minerals. The net tax rate on the gross value of the production of petroleum and natural gas is 7 percent.[2]

While the property tax is the principal revenue source and yields most of the tax revenue for the local governments, there is no single tax that predominates for the tax revenue of the state governments. However, general sales and selective sales taxes plus the state income taxes account for approximately three-fourths of the tax revenues of the state government.[3]

The states follow diverse taxing policies.[4] Some

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[1]Oklahoma, Statutes, Article 9, pp. 256-259.

[2]Oklahoma, Statutes, Article 10, pp. 269-272 and Cumulative Annual Pocket Part, p. 47.

[3]Oklahoma Tax Commission, Annual Report, Fiscal Year 1973 (Oklahoma City, Oklahoma, 1974):5-7.

[4]James A. Maxwell and J. Richard Aronson, Financing State and Local Governments, 3rd ed. (Washington, D.C.: The Brookings Institution, 1977):92-106; James O'Connor, The Fiscal Crisis of the State (New York: St. Martin's Press, 1973):17-18; Ira Sharkansky, Spending in the American States (Chicago: Rand McNally & Co., 1968):

states utilize only general sales tax along with the selective sales taxes while others utilize only income taxes. In 1976 states which did not impose the individual income were Washington, Florida, Nevada, Wyoming, South Dakota and Texas while the following five states, Alaska, Delaware, Montana, New Hampshire and Oregon, did not have the general sales tax. Corporate income tax was not levied in Washington, Nevada, Wyoming and Texas.[1] Thirty-one states utilize gross production tax which is growing fast and is becoming important in some states such as Texas, Louisiana, and Oklahoma. However, Oklahoma does not use property tax while 44 states have property tax as their tax revenue source.

The comparative percentage of selective taxes of the total tax revenues between all U.S. states' average and Oklahoma for 1950, 1960, 1970, 1973 and 1976 is given below in Table 1.

Oklahoma tax revenue from the individual income tax has been growing from 4.39 percent in 1950 to 20.10 percent in 1976 while the U.S. state average increased from 8.10 percent to 24.03 percent over the same period. In Oklahoma the tax revenue from the selective sales tax has been decreasing from 36.93 percent in 1950 to 26.45 percent in 1976 while the license tax revenue has not been

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[1]U.S. Department of Commerce, Government Finances, p. 11.

TABLE 1

Percentage of Selective Taxes of the Total Tax Revenues
Of All U.S. States' Average and Oklahoma
For Selective Years
(Percent)

	1950		1960		1970		1973		1976	
Tax	All	Ok.	All	Ok.	All	Ok.	All	Ok.	All	Ok.
General Sales	18.68	21.05	23.85	20.40	29.56	18.69	29.08	18.11	30.62	18.18
Total Selective Sales	33.56	36.93	34.42	37.98	27.26	36.53	25.46	34.05	22.47	26.45
License	13.46	14.52	13.84	16.81	9.62	16.10	8.45	14.30	7.73	12.17
Individual Income	8.10	4.39	12.25	6.09	19.15	10.06	22.90	15.20	24.03	20.10
Corporation Income	6.55	4.76	6.54	4.42	7.79	5.47	7.97	5.13	8.15	5.34
Death and Gift	4.67	1.84	2.33	2.32	2.08	2.88	2.10	2.53	1.70	2.30
Property	3.48	--	3.37	--	2.28	--	1.93	--	2.37	--
Severance	2.36	12.45	2.33	11.97	1.43	10.07	1.25	10.34	2.27	15.13
Others	9.14	4.07	1.07	0.01	0.83	0.20	0.86	0.34	0.66	0.33

Source: U.S. Department of Commerce, Bureau of the Census, State Government Finances in 1950, 1960, 1970, 1973, 1976 (Washington, D.C.: Government Printing Office).

changed from 1950 to 1976. Oklahoma gross production tax has been growing from 12.45 percent in 1950 to 15.13 percent in 1976. Over 50 percent of the total tax revenue of Oklahoma is generated from the combination of the general sales tax, selective sales taxes, and license tax.

Estimation of Elasticities

Most previous studies have utilized the following approaches for analyzing various taxes. One approach is to estimate tax receipts directly as a function of personal income.[1] A second approach is to construct the tax base by income brackets and apply different effective tax rates to the estimated basis of income.[2] Estimation of elasticities of state tax revenues provides a basis for determining the tax yield as a function of income and the appropriate elasticity coefficients.[3]

Income Elasticity of Individual Income Tax

The role of state individual income taxes as a source of revenue has changed. It has been the fast growing major source of tax revenue. There are various factors

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[1]Selma J. Mushkin and Gabrielle C. Lupo, "Project '70: Projecting the State-Local Sector," The Review of Economics and Statistics 49 (May 1967):237-240; Harold M. Groves and Robert L. Bish, Financing Government, 7th ed. (New York: Holt, Rinehart & Winston, Inc., 1973):342-346.

[2]Ibid.

[3]Ibid.

for the recent upsurge of interest in the individual income tax as a source of revenues. The first factor is the lack of responsiveness of revenues to economic growth and inflation. The second is the reluctance to rely mainly on sales taxes. The third factor is the successful record of a few states in developing the individual income tax as a revenue producer.[1]

Several studies have been made recently which attempt to estimate the income elasticity of yield for state individual income taxes. Dick Netzer[2] estimated the income elasticity of the state income tax for all states combined. He estimated that the tax liability rises about 1.7 percent for each 1.0 percent increase in taxable income.

James A. Papke[3] estimated that the income elasticity of state individual income taxes is about 1.5 based on experience in the state of Indiana. Another estimate of income elasticity was made by H. M. Groves and C. Harry Kahn for the state of Wisconsin for the sample period from 1936 to 1950. They estimated the income elasticity by

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[1]Robert E. Berney, Tax Structure Variations in the State of Washington (Pullman, Washington: Washington State University, 1970):85-89.

[2]Dick Netzer, "Financial Needs and Resources Over the Next Decade: State and Local Governments," Public Finances: Needs, Sources, and Utilization (Princeton: National Bureau of Economic Research, 1961):36-38.

[3]James A. Papke, "Research and State Tax Reform," National Tax Association Proceedings (1963), p. 366.

regressing tax collections on income, using logarithms of both variables. Their estimated elasticity was 1.75 for the same period.[1]

The relationship between growth in the number of taxable incomes and individual income tax yields for Wisconsin for the period of 1933 to 1951 was investigated by Lee Sotow.[2] His conclusion was that a given percentage increase in state income can result in at least double that percentage increase in income tax yields.

Groves and Kahn[3] pioneered in studying the responsiveness of state tax revenue to income growth by defining the elasticity of tax revenue with respect to income. Income elasticity (E) is defined as:

$$E = \frac{\Delta T/T}{\Delta Y/Y}$$ where T is tax revenue and Y is personal income

Their elasticity estimates were calculated using a logarithmic estimating function as:

$$\log T = \log a + e \log Y$$ where the regression coefficient, e, is the income elasticity estimate.

---

[1]H. M. Groves and C. Harry Kahn, "Stability of State and Local Tax Yields," American Economic Review 42 (March 1952), p. 87.

[2]Lee Soltow, "The Historic Rise in the Number of Taxpayers in a State with Constant Tax Law," National Tax Journal 8 (December 1955), p. 381.

[3]Groves and Kahn, "Tax Yields," pp. 86-102.

Based on the income elasticity estimates, they grouped the various types of taxes into three classes according to their degree of revenue stability. The first class is taxes whose yield in tax revenue is very stable such as licenses, property taxes and poll taxes of which income elasticity is substantially less than unity. The second class is taxes whose yield varies roughly in proportion to changes in income such as general sales tax, of which the income elasticity is close to unity. The last class is taxes which are highly sensitive to changes in income whose yield varies more than in proportion to changes in income. Examples for this last class are individual income and corporation income taxes whose income elasticity coefficient is above 1.5. The reasons for the high sensitivity of yield to changes in income are that the tax base for income taxes varies more than in proportion to income and/or the average tax rate rises as income rises due to a progressive rate schedule. Their underlying assumptions are that the tax revenue is independent of all other tax revenues, and also the income elasticity of the tax is constant over the time period.

There are several studies which attempt to estimate the income elasticity of taxes by modifying the Groves-Kahn model. W. T. Wilford[1] added the tax rate as an independent

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[1]Walton Terry Wilford, "State Tax Stability Criteria and the Revenue Income Elasticity Coefficients-Reconsidered," National Tax Journal 17 (September 1965):304-312.

variable in the Groves-Kahn model such as:

$$\log T = \log a + e \log Y + f \log R$$

where R is tax rate variable and f is its coefficient. R. A. Zubrow[1] suggested the addition of the tax base as an independent variable such as

$$\log T = \log a + e \log Y + f \log R + g \log B$$

where B is the tax base variable and g is its coefficient. Neil M. Singer[2] used dummy variables for any changes in the tax bases and the tax rates in estimating the elasticities. Therefore, his model has the form of

$$\log T = a + e \log Y + c D$$

where T is tax revenue, Y is personal income, and D is dummy variables.

In estimating the income elasticities for each state, Harris[3] applied sets of effective rates to size distributions of adjusted gross income. The effective tax

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[1]R. A. Zubrow, "Recent Trends Toward Uniformity in State Personal Income Taxation," National Tax Journal 18 (March 1966):86-94.

[2]Neil M. Singer, "The Use of Dummy Variables in Estimating the Income-Elasticity of State Income Tax Revenues," National Tax Journal 21 (June 1968):200-204.

[3]Robert Harris, Income and Sales Taxes: The 1970 Outlook for States and Localities (Chicago: Council of State Governments, January 1966):4-13.

rates were computed using standard deductions for single taxpayers and married couples with two children. A series of tax liabilities for each state were yielded by applying the average effective tax rates to the size distributions of adjusted gross income. Then the resulting tax series was regressed with respect to the personal income.

$$\log T = a + b \log X$$

where T is tax yield series and X is personal income, and b is income elasticities. The estimated elasticities for state individual income taxes were used in projecting the state tax revenues to 1970 based on the projected personal income.

Income Elasticity of General Sales Tax

The income elasticity with respect to general sales tax has been estimated by several authors. Dick Netzer[1] has estimated the elasticity for the general sales tax at 0.9 for the post-war period. Also Otto Eckstein[2] has estimated an elasticity at 1.0 for general sales tax in his 1959 study of trends of public expenditures. The equation they used is as follows:

$$\log T = a + b \log X$$

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[1]Netzer, "Financial Needs."

[2]Otto Eckstein, Trends in Public Expenditures in the Next Decade (Washington, D.C.: Committee for Economic Development, April 1959):5-15.

David Davies[1] has estimated the income elasticity of general sales taxes for most states at about 1.0 for the period of 1933 to 1959. He measured the elasticity of personal income for the general sales taxes by including the lagged general sales tax revenue in the model and by solving for b in

$$\log T_t = \log a + b \log T_{t-k} + \log U_t \quad (t = 1, 2, \ldots m)$$

where T_t is a state's tax revenue for the $_t$th year, k is a lag, and U_t is error terms. In his estimation of elasticity he made an assumption that the sales tax has a positive functional relationship with personal income. If estimated elasticity is less than one ($b < 1$), then on the average the percentage change in revenue is less than the percentage change in income. Therefore, stable tax requires that the elasticity is less than one but larger than zero ($0 < b < 1$). Friedlaender, Swanson and Due[2] estimated elasticity using the following equation:

$$\log RS_i = b_1 \log Y_i + b_2 \log N_i + b_3 \log R_i + \log U_i$$

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[1]David G. Davies, "The Sensitivity of Consumption Taxes to Fluctuations in Income," National Tax Journal 15 (September 1962):282-285.

[2]Ann F. Friedlaender, Gerald J. Swanson and John E. Due, "Estimating Sales Tax Revenue Changes in Response to Changes in Personal Income and Sales Tax Rates," National Tax Journal 26 (March 1973), p. 107.

where Y is per capita income, R is sales tax rate, N is population, RS is sales tax, and U is error terms.

Legler and Shapiro[1] developed a more general model of estimating income elasticity by eliminating the assumption of independency of one state tax with another. By their analysis, Legler and Shapiro have attempted to analyze the state's entire tax system rather than each tax individually. Their major assumption is that sales taxes change relative prices in the economy. The changes in sales tax rates will distort the relative prices and thus the changes in relative prices will affect work-leisure and consumption choices. Therefore, these relative price distortions will affect total state revenue from taxation. Other assumptions which they made in their study are that first, there are only two types of taxes--income taxes and consumption taxes, secondly, both taxed and untaxed consumption goods have perfect elasticity of supply schedules, and thirdly, state personal income and growth are independent of the tax yields.

Since there are only income taxes and consumption taxes, total state tax revenues (R) are expressed by the following equation:

$$R = r_1 Y + r_2 C_t$$

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[1]John B. Legler and Perry Shapiro, "The Responsiveness of State Tax Revenue to Economic Growth," National Tax Journal 21 (March 1968):46-56.

where r_1 is income tax rate, r_2 is sales tax rate, Y is state income and C_t is gross sales. Then the elasticities of tax revenues are estimated by the equation of

$$\frac{\dot{R}}{R} = e_1 \frac{\dot{Y}}{Y} + e_2 \frac{\dot{N}}{N} + e_3 \frac{\dot{r}_1}{r_1} + e_4 \frac{\dot{r}_2}{r_2} + e_5 \frac{\dot{P}}{P}$$

where e_i is the coefficients of elasticities, Y is per capita income, N is population, P is sales price, r_1 is the income tax rate and r_2 is the sales tax rate.

Because of unavailability of data on the relative prices of taxed goods and untaxed goods, they assumed that the relative prices remained unchanged, and a single proxy for the income tax rate was used rather than rates for every income bracket.

There is a difficulty in estimating the responsiveness of state tax revenue to the changes in income due to the frequent changes in state tax structures. One method of eliminating these changes in tax statutes is through the use of dummy variables in the regressional equation.[1]

In summary, the various studies which attempt to estimate the income elasticities with respect to income taxes and general sales taxes are surveyed. Most of the relevant estimations of income elasticities have been made for each tax independently, and personal income has been adopted as an independent variable in the estimating equation for both income taxes and general sales taxes.

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[1]Singer, "Dummy Variables."

Therefore, the ability of the tax structure to generate revenues can be discussed using income elasticity. The income elasticity of a tax is one criterion of the adequacy of the tax. The elasticity of tax revenues with respect to income is a measure which indicates whether the rate of growth of revenues from a tax can be expected to exceed, equal, or fall short of the rate of growth in income. The income elasticity of a tax structure indicates the relative shares of economic growth going to the public sector versus the private sector of the state economy.

Most of the previous studies estimating income elasticities are using a single equation in which a personal income variable is the only exogenous variable. However, a personal income variable is also dependent upon some other economic variables. In evaluating the previous studies, there is a lack of interrelationships among the economic variables which require simultaneous equations in the econometric model building.

Friedlaender, Swanson and Due, and Legler and Shapiro introduced a sales tax rate variable into their separate equations in estimating income elasticities. However, the general sales tax rate stays the same as two percent in Oklahoma. Therefore, it is not applicable in regression analysis even though inclusion of sales tax rate is theoretically sound in explaining general sales tax. It is not practical in empirical study.

In most of the previous studies, it is assumed that income tax yield fluctuation results from personal income change alone. But there are some other factors affecting tax yields such as tax rate and rate structures, real per capita income, output, price level, spending patterns, population, tax base definitions, and also other taxes.[1]

In most of the previous studies, it is assumed that the yield of one tax is not affected by the yield of any other tax. Therefore, the responsiveness of a tax to growth in income is examined independently of other taxes.

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[1]William V. Williams, Robert M. Anderson, David O. Froehle and Kaye L. Lamb, "The Stability, Growth and Stabilizing Influence of State Taxes," National Tax Journal 26 (June 1973):268-269.

CHAPTER III

MODEL

The primary purpose of this research is to attempt to provide a reliable econometric model which forecasts the selective state tax revenues of individual income tax, corporation tax, general sales tax, motor fuel tax, vehicles and operators tax, death and gift tax and gross production tax and simulates alternative tax policies.

Regression Analysis

The Oklahoma tax revenue model is a system of seventeen simultaneous log linear stochastic equations and three definitional relations. In this model a two-stage regression method is used to estimate the coefficients of the variables of the model. The main objective of using the two-stage least squares techniques is the existence of the simultaneous equation bias.[1] The source of the bias is that there are jointly determined endogenous variables in the system of equations. The estimation procedures are based on the following assumptions:

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[1] H. Theil, Economic Forecasts and Policy, 2nd ed. (Amsterdam: North-Holland, 1961):335-348.

(1) The expected values of the disturbance terms are equal to zero. $E(U) = 0$.

(2) The disturbance terms are not correlated with one another and they have the same variance, σ^2.

$$E(UU') = \sigma^2 I_n$$

(3) The matrix X is a set of fixed numbers and they are not subject to random variation.

(4) The matrix X has $k < n$ linearly independent columns.[1]

The general form of the ith structural equation is:

$$\gamma_{i1} Y_{1t} + \gamma_{i2} Y_{2t} + \ldots + \gamma_{ip} Y_{pt} + \beta_{i1} X_{1t} + \beta_{i2} X_{2t} + \ldots + \beta_{iq} X_{qt} + \varepsilon_{it} = 0$$

where Y_i is the ith endogenous variable ($i = 1, \ldots, p$)

X_i is the ith predetermined variable ($i = 1, \ldots, q$)

γ_{ij} is the jth coefficient of endogenous variable in ith equation

β_{ij} is the jth coefficient of predetermined variable in ith equation.

Consider the following model:

$$\underset{(n,p)}{Y}\ \underset{(p,p)}{\Gamma} + \underset{(n,q)}{X}\ \underset{(q,p)}{\beta} + \underset{(n,p)}{E} = 0 \qquad (1)$$

where Y is the matrix of n observations on the p jointly dependent variables

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[1] William C. Merrill and Karl A. Fox, Introduction to Economic Statistics (New York: John Wiley & Sons, 1970): 515-565.

X is the matrix of n observations on the q predetermined variables

Ɛ is the matrix of random errors

Γ and β are the unknown structural paramters to be estimated.

Following Zellner and Theil,[1] the individual structural equation after the normalization can be expressed as the following:

$$y_j = Z_j \delta_j + \varepsilon_j \qquad (j = 1, \ldots, p) \qquad (2)$$

where

$$Z_j = (Y_j, X_j) \text{ and } \delta_j = \begin{bmatrix} \gamma_j \\ \beta_j \end{bmatrix}$$

In this notation,

y_j is a vector of observations on the jth column of Y

Y_j is a matrix of observations on the jointly dependent variables included in the equation (other than the normalized one)

X_j is a matrix of observations on the included predetermined variables

ε_j is the jth column of Ɛ

Vector $(\gamma_j . \beta_j)$ is the structural coefficients of the included jointly dependent variables and the included predetermined variables, respectively.

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[1]Arnold Zellner and H. Theil, "Three-Stage Least Squares: Simultaneous Estimation of Simultaneous Equations," Econometrica 30 (January 1962):54-63.

By making equation (2) in the stack form,

$$y = Z\delta + \varepsilon$$

where

$$y = \begin{bmatrix} y_1 \\ \vdots \\ y_p \end{bmatrix}, \quad Z = \begin{bmatrix} Z_1 & & 0 \\ & \ddots & \\ 0 & & Z_p \end{bmatrix}, \quad \delta = \begin{bmatrix} \delta_1 \\ \vdots \\ \delta_p \end{bmatrix}, \quad \varepsilon = \begin{bmatrix} \varepsilon_1 \\ \vdots \\ \varepsilon_p \end{bmatrix}$$

We derive the two-stage least-squares estimators by multiplying X' to equation (2),

$$X'y_j = X'Z_j\delta_j + X'\varepsilon_j \tag{3}$$

the two-stage least-squares estimator is:

$$d_j = [Z_j'X(X'X)^{-1} X'Z_j]^{-1} Z_j'X (X'X)^{-1} X'y_j$$

or it can be expressed in the following stacked form:

$$d = [Z'\bar{X} (\bar{X}'\bar{X})^{-1} \bar{X}'Z]^{-1} Z'\bar{X} (\bar{X}'\bar{X})^{-1} \bar{X}'y$$

where

$$\bar{X} = \begin{bmatrix} X & & 0 \\ & \ddots & \\ 0 & & X \end{bmatrix}$$

The two-stage least-squares estimation method by using instrumental variables is essentially the weighted least-squares estimator of equation (3).

The two-stage least-squares estimator is asymptotically unbiased and a consistent estimator of δ.[1]

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[1] Ibid.

To prove the above statement, we made the following assumptions:

(1) X is a stochastic matrix, distributed independently of Φ

(2) X has rank q with probability one

(3) $E\ (n^{-1}\ X'X) = \Sigma_{x'x}$

(4) $\text{plim}\ n^{-1}\ X'X = \Sigma_{x'x}$

(5) $E\ (\varepsilon) = 0$

(6) $V\ (\varepsilon) = \Sigma \otimes I$ where Σ is a positive definite matrix and $\otimes$ is a Kronecker cross.

(7) $\text{plim}\ n^{-1}\ \Phi'\Phi = \Sigma$

(8) $\text{plim}\ n^{-1}\ X\Phi = 0$

(9) $n^{-1/2}\ (I \otimes X')$ is asymptotically normal and consistent estimator $(0, \Sigma \otimes \Sigma_{x'x})$

The following are evident:

$$\text{plim}\ d_j = \delta_j + \text{plim}\ [(Z_j'X\ (X'X)^{-1}\ X'Z_j)^{-1}\ Z_j'X\ (X'X)^{-1}\ X'\varepsilon_j]$$

$$= \delta_j + \text{plim}\ [(n^{-1}\ Z_j'X\ (n^{-1}\ X'X)^{-1}\ n^{-1}\ X'Z_j)^{-1}\ n^{-1}\ Z_j'X\ (n^{-1}\ X'X)^{-1} n^{-1}\ X'\varepsilon_j]$$

$$= \delta_j$$

since

$$\text{plim}\ n^{-1}\ Z_j'X = \Sigma_{z'x}$$

$$\text{plim}\ (n^{-1}\ X'X)^{-1} = \Sigma_{x'x}$$

and $$\text{plim}\ (n^{-1}\ X'\varepsilon_j) = 0.$$

Therefore, the two-stage least-squares estimator d_j

is asymptotically consistent estimator.

Next we prove that the two-stage least-squares estimator d_j is an asymptotically unbiased estimator of δ_j.

$$E(d_j) = \delta_j + [Z_j'X\ (X'X)^{-1}\ X'Z_j]^{-1}\ Z_j'X\ (X'X)^{-1}\ X'E(\varepsilon_j)$$

$$= \delta_j$$

since

$$E\ (\varepsilon_j) = 0.$$

Discussion of Equations

The model consists of twenty independent equations, seventeen of which are stochastic and three of which are relational. There are six institutional equations which describe the various types of tax revenues such as state individual income tax, corporate income tax, general sales tax, motor fuel tax, vehicles and vehicle operators tax, and death and gift tax. The remaining eleven stochastic equations delineate the economic variables in order to explain the tax equations. Gross production tax is estimated on the basis of allocation method. To eliminate the impact due to population variations, some variables are divided by populations. There are twenty endogenous variables and eight exogenous variables including constant terms. Data are collected for the sample period of 1950 to 1973 for this model. In collecting the data most of the tax revenues are tabulated based on the fiscal year ending

June 30 while some other variables are based on a calendar year. Therefore, there is an inconsistency in data collections. The list of data sources is given in Table 2. All the unknown coefficients are estimated by the two-stage least squares method.[1] The complete list of variatbles in the model is presented in Table 3 and the estimates of the stochastic equations and definitional equations are presented in Table 4.

This model is not considered to be the perfect model in respect to forecasting and explaining the interrelationships between tax variables and economic variables since there might be a specification bias due to the limitations of available data in this study. Also, it is necessary to point out that several different specifications have been tried in this model on a trial and error basis to find out the right specifications for the model.

Individual Income Tax Equation

$$\log (IT/P) = -10.47 + 0.4484 \log(PR/WS) + 1.851 \log(PY/P) - 1.252 \log(EXRT) + 0.1613D \quad (1)$$

The per capita state individual income tax (IT/P) variable is explained in this equation. Per capita state individual income tax depends upon per capita personal

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[1] C. K. Liew and D. K. Kahng, The Computerized Econometric Analysis (Norman, Oklahoma: Center for Economic and Management Research, University of Oklahoma).

TABLE 2

Data Sources

Variable	Source
RS*, WS*, PR*	Center for Economic and Management Research, Statistical Abstract of Oklahoma, 1974, Norman, Oklahoma: Center for Economic and Management Research.
VR	State of Oklahoma, Oklahoma Tax Commission, Report of the Motor Vehicle Division of Oklahoma Tax Commission, 1974, Oklahoma City, Oklahoma: Oklahoma Tax Commission, and U.S. Department of Commerce, Bureau of the Census, Statistical Abstract of U.S., U.S. Government Printing Office, Washington, D.C.
BI	U.S. Department of Commerce, Bureau of the Census, Business Conditions Digest, U.S. Government Printing Office, Washington, D.C.
IT, CIT, GST, MFT, VOT, DGT, P, UT, OPT, OT, GPT, OKTT	U.S. Department of Commerce, Bureau of the Census, State Government Finances, 1950-1976, U.S. Government Printing Office, Washington, D.C.
PY	U.S. Department of Commerce, Bureau of the Census, Survey of Current Business, 1950-1973, U.S. Government Printing Office, Washington, D.C.
FC*	U.S. Department of Transportation, Federal Highway Administration, Highway Statistics, 1950-1975, U.S. Government Printing Office, Washington, D.C.
PYP	Oklahoma permanent income is estimated based on Oklahoma personal income.
HS*, P21Ø, P65Ø, GPI	U.S. Department of Commerce, Bureau of the Census, Statistical Abstract of U.S., 1950-1976, U.S. Government Printing Office, Washington, D.C.

TABLE 2 (Continued)

Variable	Source
DTHR	Oklahoma State Department of Health, Public Health Statistics Division, Oklahoma Health Statistics, 1950-1976.
EXRT*	U.S. Department of Treasury, Internal Revenue Service, Statistics of Income: Individual Income Tax Returns, U.S. Government Printing Office, Washington, D.C.

*For ex ante forecasting purposes, the values of these variables of 1974, 1975 and 1976 have been estimated.

TABLE 3

List of Variables

Name	Description
1. IT	: Oklahoma Individual Income Tax (Million dollars)
2. CIT	: Oklahoma Corporation Income Tax (Million dollars)
3. GST	: Oklahoma General Sales Tax (Million dollars)
4. MFT	: Oklahoma Motor Vehicle Fuels Tax (Million dollars)
5. VOT	: Oklahoma Vehicle & Vehicle Operator Tax (Million dollars)
6. DGT	: Oklahoma Death & Gift Tax (Million dollars)
7. RS	: Oklahoma Retail Sales (Million dollars)
8. FC	: Oklahoma Motor Fuel Consumption (Million gallons)
9. VR	: Number of Oklahoma Vehicles Registered (Million)
10. DTHR	: Oklahoma Death Rate per 1,000 Persons
11. P	: Oklahoma Population (Million)
12. PY	: Oklahoma Personal Income (Million dollars)
13. P21Ø	: Oklahoma Population over 21 Years Old (Million)
14. P65Ø	: Oklahoma Population over 65 Years Old (Million)
15. WS	: Oklahoma Wages & Salaries (Million dollars)
16. EXRT	: Number of Personal Exemptions per Tax Return (Unit)
17. HS	: Number of Oklahoma Households (Million)
18. PR*	: Oklahoma Profit Income (Million dollars)
19. OKTT	: Oklahoma Total Tax (Million dollars)
20. PYP	: Oklahoma Permanent Income (Million dollars)
21. OT	: Oklahoma Other Tax (Million dollars)
22. UT	: U.S. Average Per Capita State Tax (Dollars)
23. BI	: U.S. Business Index (A composite index of twelve leading business indexes (811) from Business Condition Digest)
24. GPT	: U.S. Gasoline Price Index
25. D	: Dummy for Change of Individual Income Tax in 1971
26. T	: Time
27. OPT	: Per Capita Oklahoma State Tax (OPT = OKTT/P) (Dollars)
28. GPT**	: Gross Production Tax (Million dollars)

*PY - WS = PR is used as proxy for Oklahoma state profit income.

**Gross production tax is simulated on the basis of allocation method.

TABLE 4

Two-Stage Least Squares Estimates of the Seventeen Stochastic Equations[1]

Equations	R^2	D.F.
1. $\log(IT/P) = -10.47 + 0.4484 \log(PR/WS) + 1.851 \log(PY/P)$		
$(2.127)\ (0.2226)\ (0.06575)$		
$-1.252 \log(EXRT) + 0.1613\ D$	0.9935	18
$(1.688)\ (0.06395)$		
2. $\log(CIT/P) = -8.279 + 0.2282 \log(BI) + 1.273 \log(RS/P)$	0.8989	20
$(1.15)\ (0.6705)\ (0.3179)$		
3. $\log(GST/P) = -3.62 + 0.6346 \log(RS/P) + 0.3334 \log(RS/P)_{-1}$	0.9927	20
$(0.1494)\ (0.1975)\ (0.2083)$		
4. $\log(MFT/P) = 0.3639 + 0.4338 \log(FC/P) + 0.01921\ T$	0.9818	20
$(1.695)\ (0.2981)\ (0.00898)$		
5. $\log(VOT/P) = 3.44 + 1.178 \log(VR/P) + 0.01266\ T$	0.9921	20
$(0.4094)\ (0.4383)\ (0.01179)$		

TABLE 4 (Continued)

Equations	R^2	D.F.
6. $\log(DGT/P) = -6.169 + 1.853 \log(DTHR) + 0.3169 \log(PYP/P)$ $(3.895) \quad (1.374) \qquad (0.3374)$ $+ 0.6494 \log(DGT/P)_{-1}$ (0.2184)	0.9648	19
7. $\log(RS/P) = 0.7904 + 0.8351 \log(PYP/P)$ $(0.1394) \quad (0.0183)$	0.99	21
8. $\log(FC/P) = 0.03162 + 0.3731 \log(PYP/P) + 0.7426 \log(GPI)$ $(0.6118) \quad (0.1042) \qquad (0.2999)$	0.9729	20
9. $\log(VR/P) = 0.3595 + 0.7685 \log(P21Ø/P) + 0.9244 \log(VR/P)_{-1}$ $(0.2245) \quad (0.5073) \qquad (0.0491)$	0.9938	20
10. $\log(DTHR) = 2.75 + 0.2565 \log(P) + 0.3146 \log(P65Ø/P)$ $(0.6649) \quad (0.234) \qquad (0.2098)$	0.7743	20

TABLE 4 (Continued)

Equations	R^2	D.F.
11. $\log(P) = 0.7692 - 0.5858 \log(OPT/UT) + 0.008506\ T$ $\quad (0.02186)\ \ (0.05491) \qquad\qquad (0.001406)$	0.9836	20
12. $\log(PY/P) = -0.4603 + 0.3448 \log(PY/P)_{-1} + 0.7657 \log(RS/P)$ $\quad (0.6241)\ \ (0.1612) \qquad\qquad (0.1624)$ $+ 0.002379\ T$ $\quad (0.004321)$	0.9963	19
13. $\log(P21Ø) = -0.687 + 1.226 \log(P)$ $\quad (0.01192)\ \ (0.1373)$	0.9974	21
14. $\log(P65Ø) = -3.157 + 2.065 \log(P)$ $\quad (0.06875)\ \ (0.07917)$	0.9701	21
15. $\log(WS/P) = -0.04608 + 0.9893 \log(RS/P) + 0.01199\ T$ $\quad (0.9185)\ \ (0.1378) \qquad\qquad (0.005659)$	0.9909	20

TABLE 4 (Continued)

Equations	R^2	D.F.
16. $\log(EXRT) = 0.3129 + 0.6497 \log(P/HS)$ $(0.1763)\ (0.1551)$	0.4827	21
17. $\log(HS) = -1.392 + 1.295 \log(P)$ $(0.03354)\ (0.03862)$	0.9816	21

Definitional Relations

1. $PY = WS + PR$
2. $OKTT = IT + CIT + MFT + GST + VOT + DGT + OT$
3. $PYP = (0.4)\ PY + (1 - 0.4 + 0.02)\ PYP_{-1}$ or $PYP = 0.4\ (1 - 0.4 + 0.02)^{i} PY_{-1}$*

[1]The standard errors of the coefficients are given in parentheses. R^2 denotes the coefficients of determination based on instrumental variables.

*Milton Friedman, A Theory of the Consumption Function (Princeton, N.J.: Princeton University Press for National Bureau of Economic Research, 1950):143-144.

income, income distribution, and average number of personal exemptions per tax return.[1]

The ratio of non-wage and salary income to wage and salary income (PR/WS)[2] is used as an indicator of the effect of income distribution on the tax revenues. It implies that the higher the ratio is, the more taxpayers there are in the higher income brackets. The personal exemption effects on the tax revenues are explained by the average personal exemptions per tax return. The assumption is that the average personal exemptions are almost the same as the number on the federal income tax returns. Dummy variable (D) reflects the present Oklahoma state individual income tax structure which has been effective since 1971.

The estimated elasticity of the per capita state personal income tax with respect to per capita individual income is approximately 1.85, which is elastic. The income distribution variable (PR/WS) is inelastic (0.448) but the

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[1]Neil M. Singer, "Estimating State Income Tax Revenues: A New Approach," The Review of Economics and Statistics 52 (November 1970):427-428.

[2]Klein used this ratio of profit income to wages and salaries variable as an indicator of distribution of income in his well-knwon Model I in P. J. M. Van Den Bogaard and H. Theil, "Macrodynamic Policy-Making: An Equivalence Concept to the Economy of the United States, 1933-1936," Metroeconomica 2 (1959):149-167.

Since data for state profit income are not available, non-wage and salaried income is used as a proxy for state profit income under the assumption that governmental transfer payment represents the fixed proportion of total personal income.

personal exemption variable (EXRT) is elastic (-1.252) with respect to the individual income tax.

The state individual income tax is more sensitive to personal income and personal exemptions than to income distribution. Income elasticity coefficients measure the percentage change in the given tax revenue relative to a percentage change in state personal income or some other variables. The elasticities are estimated using a linear regression model of the following form:

$$\log T = \log a + b \log Y$$

where T is the tax, Y is personal income, log a is a constant and b is the elasticity coefficient. Since the above equation can be rewritten by

$$T = a\, Y^{b}$$

then the elasticity of T with respect to Y is

$$\frac{Y}{T}\,\frac{d\,T}{d\,Y} = \frac{Y}{aT^{b}} \cdot a\, b\, T^{b-1} = b$$

Therefore, elasticity is equal to

$$\frac{d \log T}{d \log Y} = b.$$[1]

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[1]Teh Wei Hu, Econometrics (Baltimore: University Park Press, 1973), p. 62.

Corporate Income Tax Equation

$$\log(CIT/P) = -8.279 + 0.2282 \log(BI) + 1.273 \log(RS/P) \quad (2)$$

The per capita state corporate income tax (CIT/P) variable is explained by state and national business conditions. State business conditions are explained by state retail sales while national business conditions are explained by a U.S. business index. Outside business cycle is explained by business index and inside business cycle is explained by per capita retail sales since state business activities are subject to changes in national economy along with state economy. The elasticity of per capita state corporate income tax with respect to state retail sales is elastic while that with respect to U.S. business conditions is inelastic. When per capita state retail sales increases by 10 percent, the income tax revenue from corporations will increase by approximately 12.73 percent.

General Sales Tax Equation

$$\log(GST/P) = -3.62 + 0.6346 \log(RS/P) + 0.3334 \log(RS/P)_{-1} \quad (3)$$

The per capita general sales tax (GST/P) variable is explained by current and lagged state retail sales since the total amount of retail sales within the state is subject to the general sales tax. The elasticities of per capita general sales tax are inelastic with respect to the current and lagged retail sales. A 1.0 percent increase in per capita retail sales results in 0.635 percent increase in per

capita general sales tax revenue.

Motor Fuel Tax Equation

$$\log(MFT/P) = 0.3639 + 0.4338 \log(FC/P) + 0.01921\ T \qquad (4)$$

The per capita motor fuel consumption (gasoline) (FC/P) variable and time (T) variables are employed to explain the per capita motor fuel tax (MFT/P). Time (T) variable is included in this equation since it reflects a change in consumer taste on motor fuel consumptions. When per capita fuel consumption increases by one percent, motor fuel tax revenue will increase by 0.4338 percent. Therefore, motor fuel tax is inelastic with respect to the motor fuel consumption.

Vehicles and Operators Tax Equation

$$\log(VOT/P) = 3.44 + 1.178 \log(VR/P) + 0.01266\ T \qquad (5)$$

The per capita vehicles and vehicle operators tax (VOT/P) variable is described by the number of the vehicle registration (VR), population (P) and time (T) variables. As the number of registered vehicles increases, tax revenue from this source will also increase. A 1.0 percent increase in the per capita vehicle registration results in 1.85 percent increase in the vehicles and operators tax revenues.

Death and Gift Tax Equation

$$\log(DGT/P) = -6.169 + 1.853 \log(DTHR) + 0.3169 \log(PYP/P)$$

$$+ 0.6494 \log(DGT/P)_{-1} \qquad (6)$$

The per capita state death and gift tax (DGT/P) variable is explained by the state death rate (DTHR), per capita permanent income (PYP/P), and lagged death and gift tax. Per capita permanent income is included in this equation as an indicator of the accumulated wealth within the state which is subject to the state estate tax. The elasticity of death and gift taxes with respect to the state death rate is elastic whereas that with respect to per capita permanent income is inelastic.

Retail Sales Equation

$$\log(RS/P) = 0.7904 + 0.8351 \log(PYP/P) \qquad (7)$$

The per capita permanent income (PYP/P) variable is employed to explain per capita state retail sales (RS/P) since the household consumption expenditure is better explained by permanent income.[1] A 1.0 percent increase in per capita permanent income will result in a 0.835 percent increase in per capita retail sales.

Fuel Consumption Equation

$$\log(FC/P) = 0.03162 + 0.3731 \log(PYP/P) + 0.7426 \log(GPI) \qquad (8)$$

The per capita motor fuel consumption (FC/P) variable is explained by per capita permanent income (PYP/P) and

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[1] T. M. Brown, "Habit Persistence and Lags in Consumer Behavior," Econometrica 20 (July 1952):355-371.

by a U.S. gasoline price index (GPI). A 1.0 percent change in per capita permanent income results in a 0.373 percent change in fuel consumption and a 0.7426 percent change by one percent change in gasoline price index.

Vehicle Registration Equation

$$\log(VR/P) = 0.3595 + 0.7685 \log(P21Ø/P) + 0.9244 \log(VR/P)_{-1} \quad (9)$$

The per capita vehicle registration variable is explained by the ratio of persons 21 years old and over to total population $(P21Ø/P)$[1] and the lagged vehicle registration. The ratio of 21 years old and over to the total population variable is employed in the equation under as assumption that most of the automobiles are driven by the age group of 21 years old and older people. A 1.0 percent increase in this age group results in an approximately 0.77 percent increase in the number of vehicle registrations.

Death Rate Equation

$$\log(DTHR) = 2.75 + 0.2565 \log(P) + 0.3146 \log(P65Ø/P) \quad (10)$$

The state death rate (DTHR) variable is explained by the size of the population and the ratio of 65 years old and over to total population. When the total population increases by 1.0 percent, the state death rate increases by

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[1]A variable of population 18 years old and over is more appropriate than P21Ø, but there are no data available for that variable.

approximately 0.26 percent. When the ratio of old population relative to total population increases by one percent, state death rates increase by approximately 0.31 percent.

Population Equation

$$\log(P) = 0.7692 - 0.05858 \log(OPT/UT) + 0.008506\ T \qquad (11)$$

In measuring the impact of population migration on state taxation, the state population variable is explained by the state tax burden variable (OPT/UT) and time variable (T). To explain the state tax burden variable, the ratio of Oklahoma per capita state tax to U.S. average per capita state tax is employed and a time variable is used to indicate the natural growth of Oklahoma population. When the Oklahoma state tax burden increases by 1.0 percent, there is an out-migration of the state population by approximately 0.058 percent. However, without the state tax burden, the state's population grows at the rate of 0.85 percent annually.

In this study, the effect of tax burdens on population migration is being examined, assuming that other factors remain the same even though there are various factors affecting migration of population, such as higher earnings, employment opportunities, crime rates, climate, pollution levels, medical facilities, etc.

In making a brief review of the previous studies concerning location choice, Bloom[1] found no significant

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[1]C. C. Bloom, State and Local Tax Differentials (Iowa City: Bureau of Business Research, State University of Iowa, 1955):30-57.

correlations between growth in manufacturing employment and state-local tax burdens.

Strasma[1] indicated that higher business tax burdens do not have any measurable effects on rate of growth, and Greenhut[2] indicated that tax incentives are a relatively unimportant secondary factor of location. Campbell[3] found in his survey that approximately 14 percent of the business firms moving out of New York City for the years 1947 through 1955 indicated taxation to be the major reason.

Personal Income Equation

$$\log(PY/P) = -0.4603 + 0.3448 \log(PY/P)_{-1} + 0.7657 \log(RS/P) + 0.002379\ T \qquad (12)$$

The per capita state personal income variable is explained by the lagged state personal income, per capita state retail sales and the time variables. Per capita retail sales is employed as an indicator of state business conditions. As state business condition improves, state personal income increases. This relationship is such that a 1.0 percent increase in per capita retail sales results in approximately a 0.77 percent increase in per capita

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[1] J. D. Strasma, State and Local Taxation of Industry (Boston: Federal Reserve Bank of Boston, 1959), p. 14.

[2] M. L. Greenhut, Plant Location in Theory and Practice (Chapel Hill: University of North Carolina Press, 1955), p. 139.

[3] A. K. Campbell, "Tax and Industrial Location in the New York Metropolitan Region," National Tax Journal 11 (September 1958), p. 198.

state personal income.

Population Over 21 Years Old Equation

$$\log(P21\emptyset) = -0.687 + 1.226 \log(P) \quad (13)$$

The population size of 21 years old and over variable is explained by the age distribution of total population. When the total population increases by 1.0 percent, the size of 21 years old and over in the population increases slightly more than one percent.

Population Over 65 Years Old Equation

$$\log(P65\emptyset) = -3.157 + 2.065 \log(P) \quad (14)$$

The population size of 65 years old and over variable is explained by the age distribution of total population. A 1.0 percent increase in total population results in slightly more than a 2.0 percent increase in the 65 years old and older age group.

Wages and Salaries Equation

$$\log(WS/P) = -0.04608 + 0.9893 \log(RS/P) + 0.01199\ T \quad (15)$$

The per capita wages and salaries income variable is described by the state business conditions, technical progress and industrial structures. Retail sales is used to explain the state's business condition, and a time variable is used to indicate technical progress. A 1.0 percent increase in per capita retail sales results in approximately a 1.0 percent increase in per capita wage and salary income.

Personal Exemption Equation

$$\log(EXRT) = 0.3129 + 0.6497 \log(P/HS) \quad (16)$$

The average size of families variable is employed to explain the average personal exemption per tax return. The ratio of population to the number of households is used as an indicator for average family size. A 1.0 percent increase in average family size results in approximately a 0.65 percent increase in average personal exemption.

Number of Household Equation

$$\log(HS) = -1.392 + 1.295 \log(P) \quad (17)$$

The number of the households variable is explained by the population size. When population increases by 1.0 percent, the number of households increases by approximately 1.39 percent.

Reliability of the Model

In evaluating the reliability of the model, the coefficients of determination, sum of squared residuals, F-values for the equations and t-values for every variable in the model are to be considered. They are presented in Table 5. R^2, which is the ratio of the explained sum of squares to the total sum of squares, is called the coefficient of determination. The coefficient of determination measures the closeness of fit of the regression plane to the acutal observations. The sum of squared residuals serve

TABLE 5

Measures of Reliability of the Equations

Equation	Sum of Squared Residuals[1]	Mean Square[2]	Standard Error of Regression[3]	R^2[4]	F-value[5]	D.F.[6]
1	0.067374	0.003743	0.6118	0.9935	687.83	18
2	0.3606	0.01803	0.13428	0.8989	88.91	20
3	0.01123	0.0005615	0.023696	0.9927	1359.86	20
4	0.019956	0.0009987	0.031588	0.9818	539.45	20
5	0.015828	0.0007914	0.028132	0.9921	1256.20	20
6	0.24548	0.01292	0.11367	0.9648	173.59	19
7	0.01709	0.0008137	0.028525	0.99	2079.00	21
8	0.02662	0.001331	0.036583	0.9729	359.00	20
9	0.004542	0.0002271	0.015070	0.9938	1602.90	20
10	0.010544	0.0005272	0.02296	0.7743	34.31	20
11	0.001679	0.0000839	0.009161	0.9836	599.76	20
12	0.009762	0.0005138	0.022667	0.9963	1705.70	19
13	0.000403	0.0000192	0.004384	0.9974	8056.54	21

TABLE 5 (Continued)

Equation	Sum of Squared Residuals[1]	Mean Square[2]	Standard Error of Regression[3]	R^2[4]	F-value[5]	D.F.[6]
14	0.013423	0.0006392	0.025282	0.9701	681.35	21
15	0.0254	0.00127	0.035637	0.9909	1088.90	20
16	0.00555	0.0002643	0.016257	0.4827	19.60	21
17	0.003194	0.0001521	0.012333	0.9816	1120.29	21

[1] Σe^2

[2] $\Sigma e^2/(n-k)$

[3] $\sqrt{\Sigma e^2/(n-k)}$

[4] $1 - \Sigma e^2/\Sigma(Y-\bar{Y})^2$

[5] $\frac{R^2/(k-1)}{(1-R^2)/(n-k)}$

[6] Degree of freedom

the same objective as the coefficient of determination. The standard error of regression measures the variability of the conditional distribution of the endogenous variables for fixed values of predetermined variables. F-value and t-value are used for significance tests of the coefficient parameters. For a goodness of fit test for the regression as a whole, the F test is used.[1]

Eight equations, (1), (3), (5), (7), (9), (12), (13), and (15), have very high coefficients of determination (R^2) while equations (16) and (10) have relatively low coefficients of determination. Specification errors are suspected as being the reason for the relatively low coefficients of determination. Equation (16) which has the lowest coefficient of determination (48.27 percent) produces a sum of squared residuals of 0.0055503 while equation (2) has the largest sum of squared residuals of 0.3606. For equation (16) a low F value of 19.60 suggests there is misspecification in this equation. In all the other sixteen equations high values of F lead to a rejection of the null hypothesis that the regression relationships are not significant. All seventeen equations have relatively low standard errors of regression.

Judging reliability of the model on the basis of coefficients of determination, sum of squared residuals,

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[1]Merrill and Fox, Statistics.

mean squares, standard error of regression, F test and t test, lead the investigator to accept the overall reliability of the model.

Comparison of Elasticities with Other Studies

Most of the previous studies estimated the various tax elasticities with respect to the state personal income while this research study attempts to estimate tax elasticities with respect to other economic variables such as state retail sales, motor fuel consumption, vehicle registration and permanent income. Therefore, direct comparison of elasticities with that of other studies is impossible except for income elasticity with respect to personal income. However, the above economic variables are used as a measure of responsiveness to changes in the state's economy. Indirect comparisons will be considered in this section.

Dick Netzer[1] estimated that the income tax elasticity[2] for all states combined in 1961 was 1.7 and Groves and Kahn[3] estimated the income tax elasticity for Wisconsin at 1.75. Robert Harris[4] estimated the income tax elasticity

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[1]Netzer, "Financial Needs."

[2]The term "income tax elasticity" refers to the responsiveness of the income tax revenue to changes in per capita personal income.

[3]Groves and Kahn, "Tax Yields."

[4]Harris, 1970 Outlook.

at 1.8 for Oklahoma, and Ray and Soltow's[1] estimate for Oklahoma using data for 1951 to 1970 is 1.685. Singer's estimations of income tax elasticities ranged from 1.36 to 2.35 for different states.[2]

Dick Netzer's estimation of general sales tax elasticity with respect to per capita personal income is 0.9 for all states combined.[3] In contrast, the state of Oklahoma's individual income tax elasticity with respect to per capita personal income is estimated by this research project at 1.85. In this study, additional elasticities estimated were: corporate income tax elasticity with respect to per capita retail sales (1.273) and general sales tax elasticity with respect to per capita retail sales (0.635) which are relatively low in comparison to other studies. Complete comparisons of elasticities are presented in Table 6.

State-by-state variations in income elasticity of tax revenues are due to the following facts: (1) the tax base is not the same, (2) the tax is generally calculated in accordance with the pattern established by federal tax law, but each state has special provisions for inclusions and exclusions, (3) deductions from gross income varies

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[1]Cadwell Ray and Allen Soltow, "Oklahoma Tax and Expenditure Elasticity," Oklahoma Business Bulletin 41 (January 1973), p. 18.

[2]Singer, "Dummy Variables."

[3]Netzer, "Financial Needs."

TABLE 6

Elasticities of Selective Taxes

Author	State	Individual Income Tax	Corporate Income Tax	General Sales Tax
Dick Netzer	All states	1.7		0.9
James A. Papke	Indiana	1.5		
Groves & Kahn	Wisconson	1.75		
Harris	Oklahoma	1.8	1.0-1.5	1.0
Lee Soltow	Wisconsin	2.0		
Berney & Frerichs[1]	Washington	1.53		0.94
Wasylenko[2]	New York	1.464		
David Davies	Oklahoma			0.823
Ray & Soltow	Oklahoma	1.685		0.873
Singer	Arkansas	2.07		
	Delaware	1.54		
	Iowa	2.35		
	Minnesota	1.74		
	Wisconsin	1.36		
Norman & Russell	Hawaii	1.80		
Kim		1.85	1.273	0.635

[1]Robert E. Berney and Bernard H. Frerichs, "Income Elasticities for State Tax Revenues: Techniques of Estimation and Their Usefulness for Forecasting," Public Finance Quarterly 1 (October 1973), p. 413.

[2]Michael Wasylenko, "Estimating the Elasticity of State Personal Income Taxes," National Tax Journal 28 (March 1975), p. 142.

among the states, (4) tax rate structures are not the same, and (5) there are differences in the income distribution among the states.[1]

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[1]Harris, 1970 Outlook, pp. 6-7.

CHAPTER IV

TAX POLICY SIMULATION

Econometric Simulation

The twenty endogenous variables of the econometric model of state tax revenue were solved simultaneously on the basis of parameter estimates and the value of the predetermined variables for each observation. The process is as follows: Let F_i (y, y_{-1}, X) be the i^{th} stochastic equation where $i = 1 \ldots 20$ and let y be the vector of the endogenous variables, let y_{-1} be the vector of the lagged endogenous variables and let X be the vector of the exogenous variables. To simplify, let $Z' = (y_{-1}', X')$ be the vector of predetermined variables, then

$$F_i(y;\ Z) = e_i \tag{1}$$

The estimated residual e_i is fixed at its expected zero value and the functions are approximated linearly as follows:

$$F_i(y;\ Z) \cong F_i(y^*;\ Z_t) + \frac{\partial F_i^*}{\partial y}\ (y - y^*) = 0 \tag{2}$$

y^* are initial values of the endogenous variables and the values of Z_t are the actual values given at the time t for

the predetermined variables.[1] The system of simultaneous linear equations can be rewritten as:

$$F^* + \nabla F^*(y - y^*) = 0 \tag{3}$$

where $F^* = (F^*_1 \ . \ . \ . \ F^*_{20})'$ and

$$F_i^* = F_i(y^*; Z)$$

$$\nabla F^* = \left(\frac{\partial F_1^*}{\partial y} , \ . \ . \ . \ \frac{\partial F^*_{20}}{\partial y}\right)'$$

and

$$\frac{\partial F^*_i}{\partial y} = \left.\frac{\partial F_i}{\partial y}\right|_{y = y^*}$$

By rearranging expression of (2)

$$\hat{y} = y^* - (\nabla F^*)^{-1} F^* \tag{4}$$

or

$$\begin{bmatrix} \hat{y}_1 \\ \vdots \\ \hat{y}_{20} \end{bmatrix} = \begin{bmatrix} y^*_1 \\ \vdots \\ y^*_{20} \end{bmatrix} - \begin{bmatrix} \\ \nabla F^* \\ \\ \end{bmatrix}^{-1} \begin{bmatrix} F^*_1 \\ \vdots \\ F^*_{20} \end{bmatrix}$$

The lagged values of y are used as an initial approximation of Y* for the calculation. The first round estimate, $\hat{y}$, are considered as the predicted value of y.[2]

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[1] M. K. Evans and L. R. Klein, Wharton Economic Forecasting Model, 2nd ed. (Philadelphia: University of Pennsylvania, Economic Research Unit, 1968):40-50.

[2] Ibid.

Forecasting Performance of the Model

One of the most important roles of the Oklahoma tax revenue model is forecasting the future tax receipts and other economic variables of the state, and simulating alternative tax policies. The forecasting and simulating ability of the model is evaluated by its ex post performance.[1] If the model forecasts well during the sample period of 1952 to 1973, it is expected to forecast well for the future period if there is no major structural change in the Oklahoma economy. Likewise, if the model simulates very well during the sample period, it is expected to simulate well for the various changes in the tax structure and in other economic conditions for the future.[2] With these points in mind, we now turn to the forecasting and simulation results of the model.

Given the model $\hat{y} = y^* - (\nabla F^*)^{-1} F^*$ the predicted values of endogenous variables of the model are obtained by solving simultaneously the estimated equations that contain

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[1]Chong K. Liew and Dae K. Kahng, "The Oklahoma Econometric Model I," Oklahoma Business Bulletin 39 (July 1971): 7-13; and Owen P. Hall and Joseph A. Licari, "Building Small Region Econometric Models: Extension of Glickman's Structure to Los Angeles," Journal of Regional Science 14 (December 1974):341-344.

[2]Morris Norman and R. Robert Russell, "A Personal Income Tax Simulation Model; with an Application to the State of Hawaii," National Tax Journal 23 (December 1970): 429-33; J. Alec McLaren, "An Income Tax Simulation Model for the State of Minnesota," National Tax Journal 26 (March 1973):71-76; and John C. Hambor, Morris R. Norman and R. Robert Russell, "A Tax Revenue Forecasting Model for the State of Hawaii," Public Finance Quarterly 2 (October 1974): 433-447.

the actual values of predetermined variables for each period.

Computational steps for static forecasting:

Step 1 Setting up ∇F^* matrix using actual values of initial observation (1951) where ∇F^* matrix is $\frac{\partial F_i}{\partial y}\Big|_{y = y^*}$ and the estimated coefficients.

Step 2 Inverting ∇F^* matrix to $(\nabla F^*)^{-1}$

Step 3 Computing estimated residuals F_i^* using actual values of initial observation (1951) and estimated coefficients

Step 4 Multiplying estimated residuals to inverse of (∇F^*) and we denote XF_i as the product, i.e., $(\nabla F^*)^{-1} \cdot F_i^* = XF_i$

Step 5 Predicted values of the following years are calculated by subtracting XF_i from actual values of initial observation.

Step 6 Computing absolute percentage prediction error by

$$\left|\frac{\text{actual values - predicted values}}{\text{actual values}}\right|$$

The actual values are compared with the predicted values and then the average absolute percentage forecasting errors of twenty endogenous variables for the sample period of 1952 to 1973 are calculated. The average absolute percentage forecasting errors are computed by

$$\frac{1}{n}\sum_{t=1}^{n}\left|\frac{Y_{it} - \bar{Y}_i}{Y_{it}}\right|$$

where Y_i is actual values, $\bar{Y}_i$ is predicted values and n is number of observations.

In dynamic forecasting, the above procedure is repeated with simulated values of lagged endogenous variables

rather than actual values. The actual values of predetermined variables are used in solving predicted values and then the predicted values are substituted for the lagged variables for the next year's solution.[1] In this model, the predicted values of 1952 are computed by using the actual values of 1951. Therefore, from 1953 the predicted values are obtained by solving simultaneously the estimated equations using the simulated values rather than actual values.

The average absolute percentage dynamic forecasting error is computed by $\left|\frac{\text{predicted - simulated}}{\text{predicted}}\right|$. The average absolute percentage errors of ex post static forecasting and ex post dynamic forecasting are presented in Table 7.

Actual, ex post static forecasts, and ex post dynamic forecast values of each endogenous variable of the period from 1952 to 1973 are attached in Appendix A. The total average absolute percentage static forecasting error is found to be 4.10 percent while the total average absolute percentage dynamic forecasting error is 4.31 percent. The average abosolute percentage error for the state individual income tax is highest (10.24 percent) in the static forecasting while the average absolute percentage dynamic forecasting error for the state corporation income tax is highest (11.71 percent) in the dynamic forecasting. The

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[1] Guy H. Orcutt, "Simulation of Economic Systems," American Economic Review 50 (December 1960):893-903.

TABLE 7

Average Absolute Percentage Ex Post
Forecasting Error
1952-1973

Variable	Ex Post Static Forecasting (Percent)	Ex Post Dynamic Forecasting (Percent)
1. IT	10.24	8.68
2. CIT	9.02	11.71
3. GST	3.64	2.08
4. MFT	1.53	4.15
5. VOT	3.34	4.80
6. DGT	9.85	9.63
7. RS	4.14	3.04
8. RC	3.28	2.70
9. VR	3.02	1.50
10. DTHR	1.82	5.30
11. P	0.62	1.46
12. PY	4.89	2.74
13. P21Ø	1.09	3.20
14. P65Ø	1.15	0.90
15. WS	4.54	2.34
16. EXRT	1.52	5.35
17. HS	0.52	0.52
18. PR	7.88	5.02
19. OKTT	4.65	6.52
20. PYP	4.27	1.55
21. GPT	5.07	7.36
TOTAL AVERAGE	4.10	4.31

household variable has the lowest average absolute percentage static forecasting error of 0.52 percent and also the lowest average absolute percentage dynamic forecasting error of 0.52 percent. The general sales tax variable has an average absolute percentage static forecasting error of 3.64 percent and a dynamic forecasting of 2.08 percent. Among the tax variables of individual income tax, corporate income tax, general sales tax, motor fuel tax, vehicles and operators tax, and death and gift tax, the motor fuel tax has the lowest static forecasting error of 1.53 percent while the general sales tax has the lowest dynamic forecasting error of 2.08 percent. Motor fuel tax has a dynamic forecasting error of 4.15 percent which is the second lowest in dynamic forecasting among the tax variables chosen in the study. The average absolute percentage static forecasting error of vehicles and operators tax and dynamic forecasting error of the same tax are 3.34 percent and 4.80 percent respectively. The average absolute percentage static forecasting error and the dynamic forecasting error of Oklahoma state total tax are 4.65 percent and 6.52 percent respectively. For the population variable, the static forecasting error is 0.62 percent while the dynamic forecasting error is 1.46 percent. For the retail sales (state) variable, the static forecasting error is 4.14 percent and the dynamic forecasting error is 3.04 percent. While the total average absolute percentage static forecasting error is

4.10 percent, the individual static forecasting error ranges from 10.24 percent of state individual income tax to 0.52 percent of the household. And when total average absolute percentage dynamic forecasting error is 4.31 percent, the individual dynamic forecasting error ranges from 11.71 percent of state corporate income tax to 0.52 percent of the household variable.

Ex Ante Forecasting Performance Compared with Box-Jenkins

We compare the forecasting performance of our econometric model with that of Box-Jenkins model. Ibrahim and Otsuki indicated that Box-Jenkins model outperforms the econometric models in short-term forecasting.[1] They chose the forecast for one period ahead in comparison.

Box-Jenkins model is one of the popular tools to forecast for the time series analysis. It is based on the assumption that there is some pattern existing in what has been in the past. The existing pattern can be extrapolated into the future in order to obtain a forecast.[2] Box-Jenkins postulate an autoregressive integrated moving average (ARIMA) model as an alternative to econometric models in forecasting.

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[1] I. B. Ibrahim and T. Otsuki, "Forecasting GNP Components Using the Method of Box and Jenkins," Southern Economic Journal 42 (January 1976):461-467.

[2] G. E. P. Box and G. M. Jenkins, Time-Series Analysis: Forecasting and Control (San Francisco: Holden Day, 1970):53-84.

On the other hand, multiple regression analysis assumes that there is the alternative form of pattern which consists of a relationship between variables.

Therefore, a basic principle of Box-Jenkins model is based on the assumption that a time series can be explained by previous values of its own series and/or previous error terms.[1]

Box-Jenkins model is an integration of autoregressive model (AR) and moving average model (MA).

The basic equation of Box-Jenkins model, ARIMA(p,d,q), is given as follows:[2]

$$y_t = \phi_1 y_{t-1} + \ldots + \phi_p y_{t-p} + \delta + e_t - \theta_1 e_{t-1} - \ldots - \theta_q e_{t-q}$$

where

y_t is time series variables

e_t is error terms, i.e., $e_t = y_t - \hat{y}_t$ where $\hat{y}_t$ is predicted value

δ is constant term

ϕ and θ are unknown parameters to be estimated.

However, the basic equation of autoregressive model (AR) is as follows:

$$y_t = \phi_1 y_{t-1} + \phi_2 y_{t-2} + \ldots + \phi_p y_{t-p} + \delta + e_t$$

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[1] Ibid.

[2] Robert S. Pindyck and Daniel L. Rubinfeld, Econometric Models and Economic Forecasts (New York: McGraw-Hill, 1976):421-512.

The main assumption of AR model is that the time series is stationary which means that the mean of time series must be invariant with time, i.e., $E(y_t) = E(y_{t-1}) = \ldots = E(y_{t-p}) = u$ where u is mean.[1]

The basic equation of MA model is as follows:

$$y_t = u + e_t - \theta_1 e_{t-1} - \theta_2 e_{t-2} - \ldots - \theta_q e_{t-q}$$

In this MA model the random error terms are assumed to be generated by a "white noise" process. Each error term is assumed to be a normal random variable with zero mean, variance σ^2 and covariance $E(e_t, e_{t-k}) = 0$ for $k \neq 0$, i.e., $E(e_t) = 0$, $E(e_t^2) = \sigma_e^2$ and $E(e_t, e_{t-k}) = 0$ for $k \neq 0$.[2]

When time series is non-stationary, non-stationary series can be transformed into stationary series by differencing the series.

Suppose $w_t = \Delta^d y_t$ where w_t is differenced time series by d degree.

Then $\Delta y_t = y_t - y_{t-1}$

$$\Delta^2 y_t = \Delta y_t - \Delta y_{t-1}$$

Therefore, Box-Jenkins model is denoted as ARIMA(p,d,q).[3]

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[1]Ibid.

[2]Ibid.

[3]Ibid.

Basic procedures of ARIMA(p,d,q) model:

Step 1 postulate general class of model

Step 2 Identify tentative model
Identification of specific ARIMA(p,d,q) model can be done by examining the autocorrelation and partial autocorrelation coefficients. However, it is possible that selected model will not be mixed AR and MA model. Selected model could be either ARIMA, ARI or MAI.

Step 3 Estimation of the parameters
Once the model is selected, the next step is to estimate the parameters of the model. The estimation of the parameters is made by the maximum likelihood estimation method.

Step 4 Diagnostic checking
In evaluating adequacy of the selected model, diagnostic checking can be made in two ways--one way is to examine the residual differences. If the residual differences are white noise which means randomness, the selected model is considered as adequate in forecasting. The other way is called Box-Pierce Test which is comparing computed X^2 with the table values. When computed X^2 values are smaller than table values at certain probability level, it is accepted that the selected model is adequate.[1]

Step 5 If the selected model is not adequate, repeat Steps 2, 3, and 4.

The selected models are given in Table 8, ex ante forecasting error for 1974, 1975 and 1976 of our econometric model in comparison with that of the Box-Jenkins model, and ex ante forecasts of both models compared with actual values of twenty-one variables[2] are given in Table 9 and Appendix B, respectively.

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[1]G. E. P. Box and D. A. Pierce, "Distribution of Residual Autoregressive-Integrated Moving-Average Time-Series Models," Journal of the American Statistical Association 65 (December 1970):1509-1526.

[2]Oklahoma Gross Production Tax (Severance) has been added in this study later since this tax revenue grows faster and becomes important in state tax revenues.

TABLE 8

Selected Box-Jenkins ARIMA(p,d,q) Models[1]

Equations	Selected Form	χ^2	D.F.
1. $IT_t = 0.07692 + 0.977072\ IT_{t-1}$ $(0.01226)\ (0.04401)$	ARI(1,0,0)	6.7	10
2. $CIT_t = 0.111856 + 0.960047\ CIT_{t-1}$ $(0.02649)\ (0.07545)$	ARI(1,0,0)	14.7	10
3. $\Delta GST_t = 0.072122 - 0.361476\ \Delta GST_{t-1} + 0.686427\ e_{t-1} + e_t$ $(0.4632)\ (0.3377)\ (0.02618)$	ARIMA(1,1,1)	6.1	9
4. $\Delta MFT_t = 0.084967 - 0.85741\ \Delta MFT_{t-1} + 0.609104\ e_{t-1} + e_t$ $(0.2055)\ (0.3291)\ (0.01162)$	ARIMA(1,1,1)	7.5	9
5. $\Delta VOT_t = 0.058161 - 0.028238\ \Delta VOT_{t-1}$ $(0.2234)\ (0.01342)$	ARI(1,1,0)	6.8	10
6. $DGT_t = 0.042618 + 0.978978\ DGT_{t-1}$ $(0.0149)\ (0.03248)$	ARI(1,0,0)	10.2	10

TABLE 8 (Continued)

	Equations	Selected Form	χ^2	D.F.
7.	$RS_t = 1.731372 + 0.909312\ RS_{t-1} + 1.07502\ e_{t-1}$ (0.03991) (0.24) (0.2576) $+ 0.834194\ e_{t-2} - 0.006493\ e_{t-3} + e_t$ (0.2122) (0.3245)	ARIMA(1,0,3)	8.8	7
8.	$FC_t = 0.690881 + 0.902652\ FC_{t-1}$ (0.02312) (0.1656)	ARI(1,0,0)	8.1	10
9.	$VR_t = 0.075592 - 0.998413\ VR_{t-1} + 0.927216\ e_{t-1} + e_t$ (0.00466) (0.08417) (0.004771)	ARIMA(1,1,1)	2.6	9
10.	$DTHR_t = 0.575165 + 0.745971\ DTHR_{t-1}$ (0.09598) (0.2176)	ARI(1,0,0)	13.7	10
11.	$P_t = 0.051744 + 0.940843\ P_{t-1}$ (0.01771) (0.01583)	ARI(1,0,0)	9.2	10

TABLE 8 (Continued)

	Equations	Selected Form	χ^2	D.F.
12.	$PY_t = 1.01452 + 0.883326\ PY_{t-1} + 2.11922\ e_{t-1}$ (0.07793) (0.03948) (0.06237) $+ 1.88899\ e_{t-2} + 0.737439\ e_{t-3} + e_t$ (0.05425) (0.6731)	ARIMA(1,0,3)	12.3	7
13.	$P21\emptyset_t = 0.009049 + 0.977571\ P21\emptyset_{t-1}$ (0.01232) (0.005459)	ARI(1,0,0)	5.0	10
14.	$P65\emptyset_t = 0.005968 + 1.00324\ P65\emptyset_{t-1}$ (0.001095) (0.003288)	ARI(1,0,0)	6.8	10
15.	$WS_t = 0.644774 + 0.920117\ WS_{t-1}$ (0.02657) (0.2166)	ARI(1,0,0)	4.3	10
16.	$EXRT_t = 1.051089$ (0.004647)	ARIMA(0,0,0)	8.9	11

TABLE 8 (Continued)

Equations	Selected Form	χ^2	D.F.
17. $HS_t = 0.0085 + 1.02098\ HS_{t-1}$ $(0.0008154)\ (0.0007479)$	ARI(1,0,0)	5.9	10
18. $PR_t = 0.559147 + 0.927556\ PR_{t-1}$ $(0.01996)\ (0.1562)$	ARI(1,0,0)	14.7	10
19. $\Delta OKTT_t = 0.060638 + 0.024419\ \Delta OKTT_{t-1}$ $(0.2236)\ (0.01578)$	ARI(1,1,0)	6.7	10
20. $\Delta PYP_t = 0.005927 + 0.923925\ \Delta PYP_{t-1}$ $(0.1008)\ (0.007545)$	ARI(1,1,0)	6.4	10
21. $\Delta GPT_t = 0.0984787 - 0.532748\ \Delta GPT_{t-1} + 0.879273\ e_{t-1} + e_t$ $(0.2138)\ (0.06685)\ (0.04012)$	ARIMA(1,1,1)	1.7	9

[1]The standard errors of the coefficients are given in parenthesis. χ^2 is chi-squares.

TABLE 9

Ex Ante Forecasting Error
Of Our Econometric Model
(Percentage)

Variables	1974	1975	1976	Average
1. IT	9.85	9.10	20.65	13.20
2. CIT	9.58	8.32	20.81	12.90
3. GST	9.36	6.42	16.11	10.63
4. MFT	8.09	8.36	7.67	8.04
5. VOT	6.77	4.02	8.95	6.58
6. DGT	13.72	3.13	15.83	10.89
7. RS	6.63	2.03	2.33	3.66
8. FC	42.43	20.83	22.64	28.63
9. VR	0.10	0.24	1.19	0.51
10. DTHR	15.88	1.86	13.00	10.25
11. P	1.51	0.77	2.46	1.58
12. PY	6.59	0.16	4.28	3.67
13. P21Ø	4.00	1.32	5.37	3.56
14. P65Ø	0.00	1.50	0.59	0.70
15. WS	1.94	2.33	5.69	3.32
16. EXRT	4.35	4.15	4.51	4.34
17. HS	6.40	0.10	21.18	9.23
18. PR	13.92	3.26	1.96	6.38
19. OKTT	13.03	3.02	16.16	10.74
20. PYP	1.55	2.04	2.54	2.04
21. GPT	2.15	3.05	16.17	7.12
TOTAL AVERAGE	8.47	4.10	10.00	7.52

TABLE 9 (Continued)

Ex Ante Forecasting Error
Of Box-Jenkins Model
(Percentage)

Variables	1974	1975	1976	Average
1. IT	14.93	38.34	51.11	34.79
2. CIT	15.72	22.71	40.73	26.39
3. GST	11.95	22.82	30.34	21.70
4. MFT	2.62	1.85	7.49	3.99
5. VOT	7.92	12.16	17.83	12.64
6. DGT	23.25	31.53	28.09	27.62
7. RS	0.03	8.75	26.90	11.89
8. FC	1.40	12.26	32.43	15.36
9. VR	1.18	2.46	4.03	2.56
10. DTHR	20.49	3.38	43.67	22.51
11. P	5.61	9.37	14.53	9.84
12. PY	6.98	4.55	26.34	12.62
13. P21Ø	4.23	6.67	10.69	7.20
14. P65Ø	0.00	0.30	0.88	0.39
15. WS	11.64	24.32	39.40	25.12
16. EXRT	62.50	62.44	62.41	62.45
17. HS	3.78	1.56	15.63	6.99
18. PR	13.67	14.66	30.81	19.71
19. OKTT	10.96	21.65	30.76	21.12
20. PYP	2.06	2.63	0.79	1.83
21. GPT	38.40	23.44	34.76	32.20
TOTAL AVERAGE	12.35	15.61	26.17	18.04

In comparing the ex ante forecasting performance of our econometric model with that of the Box-Jenkins model, our model out-performs the Box-Jenkins model over a three-year period even though it is known that the Box-Jenkins model out-performs the econometric models in short-run forecasting.[1] The total average of forecasting error of our model is 7.52 percent while the forecasting error of the Box-Jenkins model is 18.04 percent. The vehicle registration variable (VR) has the lowest forecasting error (0.51 percent) in our model while the population over 65 years old variable (P65Ø) has the lowest forecasting error (0.39 percent) in the Box-Jenkins model. The highest forecasting error (28.63 percent) of our model comes from the fuel consumption variable (FC) while the highest forecasting error (62.45 percent) of the Box-Jenkins model is a result of the average personal exemption per tax return variable (EXRT). In selecting an ARIMA model for the EXRT variable, the acceptable model was not found, which is the main reason for the high forecasting error.

The interesting point is that the Box-Jenkins model performs better in one-year-ahead forecasting than in two- or three-years-ahead forecasting, while better forecasting of our model is obtained from two-years-ahead forecasting.

In summary, the Box-Jenkins model does not necessarily out-perform the alternative econometric models in

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[1] Ibrahim and Otsuki, "Box-Jenkins."

short-run forecasting. The Box-Jenkins model performs better for one-year-ahead forecasting than two-years-ahead and three-years-ahead forecasting.

Economic Impact Analysis

If state tax structures are changed, it would most likely change the parameter values of the tax equations. Since the model uses double log equations, the parameter values represent the elasticities. For example, if the state individual income tax rate structure is raised, then the income parameter value of personal income would increase. If the state general sales tax rate is raised from its present level of 2 percent, then the parameter value of retail sales variable would be expected to increase. Therefore, various state tax reforms could be introduced into the model by changing the parameter values of the model.

The model has the feature of simulating both the static and dynamic economic impact implications of state tax reforms in the state's economy. By the static analysis, the economic impact of any change in a parameter value is restricted to a one year period. The static economic impact is measured by solving the system of equations with actual predetermined variables period by period with and without the changes in parameter values.[1] The static economic impact lasts only for a period of one year, since

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[1]Ray C. Fair, A Model of Macroeconomic Activity (Cambridge: Ballinger, 1974):103-118.

actual lagged endogenous variables are employed as the predetermined variables. The percentage changes of the static and dynamic impact of tax reforms are given in Tables 10 and 11 respectively. The simulated results of a tax reform are presented in Appendices C and D. The impacts of increases only in the parameter values are included in Appendices C and D.

Static and Short-Run Simulation

Change in State Individual Income Tax Rate Structure and/or Income Tax Base. One of the ways to raise the tax revenue from state individual income tax is either through increasing tax rates, increasing the tax base,[1] or some combination of both methods. If the state individual income tax rate structures or the tax base increases, then the parameter values of individual income variables will increase. As an example, if the parameter value for the personal income variable is increased by 5 percent, the model predicts total state tax revenues will increase by an average of 4.92 percent. This same increase of 5 percent in the parameter value of the personal income variable results in the highest increase of an average 70.40 percent in the

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[1]The tax base is defined as the particular item upon which taxes are levied. Most commonly used bases are income, consumption, and wealth, in David N. Hyman, The Economics of Governmental Activity (New York: Holt, Rinehart & Winston, Inc., 1973):147-154; Richard E. Wagner, The Public Economy (Chicago: Markham Publishing Co., 1973): 153-155; Gary Fromm and Paul Taubman, Public Economic Theory and Policy (New York: Macmillan Co., 1973):53-60.

TABLE 10

Static Impact of Tax Reform
(Annual Average of 1952-1973)
(Percent)

Description	Variables									
(1) 5 percent increase in parameter[1]	IT	CIT	GST	MFT	VOT	DGT	OKTT	FC	VR	DTHR
(PY/P) in Eq. 1	70.40	-0.05	-0.18	-0.26	-0.37	-0.57	4.92	-0.21	-0.36	-0.18
(PR/WS) in Eq. 1	-1.00	0.00	0.00	0.00	0.01	0.01	-0.07	0.00	0.01	0.00
(EXRT) in Eq. 1	-6.56	0.01	0.02	0.02	0.03	0.05	-0.45	0.02	0.03	0.02
(RS/P) in Eq. 2	-0.06	45.24	-0.08	-0.11	-0.15	-0.24	2.09	-0.09	-0.15	-0.08
(RS/P) in Eq. 3	-0.13	-0.04	22.11	-0.23	-0.32	-0.50	4.33	-0.19	-0.32	-0.16
(FC/P) in Eq. 4	-0.08	-0.03	-0.10	12.91	-0.20	-0.31	2.65	-0.12	-0.19	-0.10
(VR/P) in Eq. 5	0.01	0.01	0.02	0.02	-3.56	0.05	-0.47	0.02	0.03	0.02
(PYP/P) in Eq. 6	-0.01	0.00	-0.01	-0.01	-0.02	11.94	0.28	-0.01	-0.02	-0.01
(2) 5 percent increase in UT of (OPT/UT) in Eq. 11	0.14	0.05	0.17	0.25	0.35	0.54	0.16	0.20	0.34	0.17
(3) Average percent share of tax revenue	8.83	4.90	19.44	19.47	13.05	2.59	100			

TABLE 10 (Continued)

Description	Variables									
(1) 5 percent increase in parameter[1]	RS	P	PY	P21Ø	P65Ø	WS	EXRT	HS	PR	PYP
(PY/P) in Eq. 1	-0.01	-0.31	-0.15	-0.38	-0.63	-0.11	0.06	-0.40	-0.22	-0.07
(PR/WS) in Eq. 1	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.00
(EXRT) in Eq. 1	0.01	0.03	0.01	0.03	0.06	0.01	-0.01	0.04	0.02	0.06
(RS/P) in Eq. 2	-0.04	-0.13	-0.06	-0.16	-0.27	-0.04	0.03	-0.17	-0.09	-0.03
(RS/P) in Eq. 3	-0.09	-0.27	-0.13	-0.33	-0.55	-0.09	0.05	-0.35	-0.20	-0.06
(FC/P) in Eq. 4	-0.06	-0.17	-0.08	-0.20	-0.34	-0.06	0.03	-0.21	-0.12	-0.03
(VR/P) in Eq. 5	0.01	0.03	0.01	0.04	0.06	0.01	0.01	0.04	0.02	0.06
(PYP/P) in Eq. 6	-0.01	-0.02	-0.01	-0.02	-0.04	-0.01	0.00	-0.02	-0.01	0.00
(2) 5 percent increase in UT of (OPT/UT) in Eq. 11	0.10	0.29	0.14	0.36	0.60	0.10	-0.06	0.38	0.21	0.06

[1]A 5 percent decrease will change the sign.

TABLE 11

Dynamic Impact of Tax Reform
(Annual Average of 1952-1953)
(Percent)

Description	Variables									
(1) a 5 percent increase in parameter of	IT	CIT	GST	MFT	VOT	DGT	OKTT	FC	VF	DTHR
(PY/P) in Eq. 1	52.28	1.47	0.83	-0.05	-0.07	0.73	4.01	0.24	-0.06	-0.14
(PR/WS) in Eq. 1	1.38	1.51	0.94	0.14	0.23	1.22	0.42	0.40	0.22	-0.02
(EXRT) in Eq. 1	-1.52	1.52	0.95	0.15	0.25	1.25	0.22	0.41	0.24	-0.01
(RS/P) in Eq. 2	1.90	30.26	0.90	0.07	0.11	1.03	1.79	0.34	0.11	-0.07
(RS/P) in Eq. 3	1.88	1.48	13.69	0.01	0.02	0.87	2.94	0.29	0.02	-0.11
(FC/P) in Eq. 4	1.90	1.49	0.89	7.38	0.10	1.01	1.94	0.33	0.10	-0.07
(VR/P) in Eq. 5	1.93	1.52	0.95	0.15	-1.55	1.25	0.22	0.41	0.24	-0.01
(PYP/P) in Eq. 6	1.92	1.51	0.93	0.13	0.21	11.13	0.69	0.39	0.20	-0.03
(2) A change in per capita U.S. average state tax (UT) in Eq. 11										
5 percent increase	1.95	1.54	1.01	0.27	0.42	1.55	0.54	0.50	0.41	0.07
50 percent increase	2.18	1.77	1.51	1.20	1.88	4.01	1.11	1.27	1.80	0.68

TABLE 11 (Continued)

Description	Variables									
(1) A 5 percent increase in parameter of	RS	P	PY	P21Ø	P65Ø	WS	EXRT	HS	PR	PYP
(PY/P) in Eq. 1	0.86	-0.25	0.44	-0.30	-0.52	0.82	0.04	-0.32	-0.12	1.05
(PR/WS) in Eq. 1	0.95	-0.04	0.54	-0.03	-0.07	0.91	0.00	-0.04	-0.01	1.10
(EXRT) in Eq. 1	0.95	-0.02	0.54	-0.02	-0.05	0.91	0.00	-0.03	-0.01	1.11
(RS/P) in Eq. 2	0.91	-0.12	0.50	-0.14	-0.25	0.87	0.02	-0.15	-0.06	1.08
(RS/P) in Eq. 3	0.89	-0.19	0.47	-0.22	-0.40	0.85	0.03	-0.24	-0.09	1.06
(FC/P) in Eq. 4	0.91	-0.13	0.50	-0.15	-0.27	0.87	0.02	-0.17	-0.06	1.08
(VR/P) in Eq. 5	0.95	-0.02	0.54	-0.02	-0.05	0.91	0.00	-0.03	-0.01	1.11
(PYP/P) in Eq. 6	0.94	-0.05	0.53	-0.05	-0.11	0.90	0.01	-0.07	-0.02	1.10
(2) A change in per capita U.S. average state tax (UT) in Eq. 11										
5 percent increase	1.00	0.10	0.60	0.14	0.22	0.96	-0.02	0.14	0.05	1.14
50 percent increase	1.41	1.15	1.04	1.43	2.41	1.37	-0.22	1.50	0.55	1.41

TABLE 11 (Continued)

Description	Variables									
(1) A 5 percent decrease in parameter of	IT	CIT	GST	MFT	VOT	DGT	OKTT	FC	VR	DTHR
(PY/P) in Eq. 1	-34.41	1.54	1.03	0.28	0.44	1.57	-2.05	0.51	0.43	0.08
(PR/WS) in Eq. 1	2.47	1.51	0.94	0.14	0.22	1.21	0.50	0.40	0.21	-0.02
(EXRT) in Eq. 1	5.52	1.51	0.93	0.13	0.20	1.18	0.70	0.39	0.20	-0.03
(RS/P) in Eq. 2	1.95	-23.16	0.98	0.20	0.33	1.38	-0.69	0.45	0.31	0.03
(RS/P) in Eq. 3	1.96	1.54	-10.41	0.26	0.42	1.53	-1.75	0.50	0.40	0.07
(FC/P) in Eq. 4	1.95	1.53	0.99	-6.59	0.35	1.41	-0.92	0.46	0.33	0.03
(VR/P) in Eq. 5	1.92	1.51	0.93	0.13	2.04	1.18	0.70	0.39	0.20	-0.03
(PYP/P) in Eq. 6	1.92	1.51	0.95	0.15	0.24	-7.32	0.26	0.41	0.23	-0.01
(2) A change in per capita U.S. average state tax (UT) in Eq. 11										
5 percent decrease	1.89	1.48	0.87	0.01	0.02	0.87	0.38	0.29	0.02	-0.11
50 percent decrease	1.49	1.07	0.04	-1.63	-2.49	-3.28	-0.64	-1.07	-2.38	-1.19

TABLE 11 (Continued)

Description	Variables									
(1) A 5 percent decrease in parameter of	RS	P	PY	P21Ø	P65Ø	WS	EXRT	HS	PR	PYP
(PY/P) in Eq. 1	1.01	0.12	0.61	0.17	0.25	0.97	-0.03	0.16	0.08	1.14
(PR/WS) in Eq. 1	0.95	-0.04	0.53	-0.04	-0.08	0.90	0.00	-0.05	-0.01	1.10
(EXRT) in Eq. 1	0.94	-0.05	0.53	-0.05	-0.11	0.90	0.01	-0.07	-0.02	1.10
(RS/P) in Eq. 2	0.97	0.04	0.57	0.06	0.07	0.93	-0.01	0.05	0.03	1.12
(RS/P) in Eq. 3	1.00	0.10	0.60	0.14	0.21	0.96	-0.02	0.14	0.07	1.14
(FC/P) in Eq. 4	0.98	0.05	0.57	0.07	0.10	0.94	-0.01	0.07	0.03	1.12
(VR/P) in Eq. 5	0.94	-0.05	0.53	-0.05	-0.11	0.90	-0.01	-0.07	-0.02	1.10
(PYP/P) in Eq. 6	0.95	-0.03	0.54	-0.02	-0.05	0.91	0.00	-0.03	-0.01	1.11
(2) A change in per capita U.S. average state tax (UT) in Eq. 11										
5 percent decrease	0.89	-0.19	0.47	-0.22	-0.39	0.85	0.03	-0.24	-0.08	1.06
50 percent decrease	0.16	-2.01	-0.32	-2.45	-4.10	0.11	0.39	-2.59	-0.94	0.57

variable, state individual income tax while this change results in the slight decrease of less than 1.0 percent of all the other tax revenue variables. If the parameter value of the personal income variable had been increased by 5 percent, the individual income tax revenue would have been $26.82 million while the actual tax collections were $16.78 million in 1960, and in 1973 it would have been $155.0 million while the actual collections were $105.1 million. Therefore, as the individual income tax rate structures or income tax base or combinations of both increase, the tax revenue from the individual income tax and the total tax revenue will increase.

Changes in the number of personal exemption or the amount of personal exemption. When the number of personal exemptions and/or the dollar amount of personal exemption increase, the tax revenue from the state individual income tax will decrease. The exemption effect is negative on the tax revenue. When the parameter value of personal exemption per tax return is increased by 5 percent, the state tax revenue from the individual income tax is decreased by an average of 6.56 percent, and the total state tax revenue shows a slight decrease of less than 1 percent with almost no change in all the other revenue variables. If there had been a 5 percent increase in the parameter value of the personal exemption per tax return, then the model predicts that the individual income tax revenue would have been

$15.38 million in 1960 and $74.20 million in 1973 while the actual tax revenues were $16.78 million and $105.1 million for 1960 and 1973 respectively.

Change in the ratio of profit income to wages and salaries income. The ratio of profit income to wages and salaries income is employed to attempt to explain the effects of changes in the income distribution on the income tax revenue. The 5 percent increase in the parameter value of the ratio of profit income to wages and salaries results in an average of 1 percent decrease in state individual income tax revenue and almost no change in total tax revenue. The simulated value is $16.24 million in 1960 and $79.50 million in 1973, while the actual ones are $16.78 million and $105.1 million for 1960 and 1973 respectively.

The profit and wages and salaries ratio is introduced as the indicator of the effects of income distribution changes between non-wage earners and wage earners on the income tax revenue. The increase in the number of non-wage earners in relation to the number of wage earners has a negative effect on income tax revenues due to the fact that non-wage earners include welfare recipients and also private pension recipients who are not subject to the income tax.

In conclusion, changes in individual income tax rate structures or changes in the income tax base, or any combination of both, is more effective in the state individual income tax reform than by comparing any changes in the

number of personal exemptions or the amount of personal exemptions.

Change in corporate income tax rate and/or income tax base. If there is any increase in the state corporate income tax rate or the corporate income tax base or any combination of the two, this increase will result in an increase in the parameter value of the state retail sales variable since this parameter represents the state corporate income tax elasticity with respect to corporate income. In addition, the state retail sales variable is used in the equation as the indicator of corporate income.

The 5 percent increase in the parameter of the retail sales variable results in an average of 45.24 percent increase in corporate income tax revenues. This leads to approximately a 2 percent rise in the state total tax revenue, with a slight decrease in all other variables.

Change in general sales tax rate. Usually the total amount of retail sales is subject to the state general sales tax. Therefore, the state retail sales variable is employed in this general sales tax equation. If there is any increase in the general sales tax rate, then the parameter values of the state retail sales variable will increase. When the parameter value is increased by 5 percent the state tax revenue from the general sales tax is increased by an average of 22.11 percent and the state total tax revenue increases by an average of 4.33 percent accompanied by a

slight decrease in all other variables. In terms of dollar amounts, the general sales tax revenue would have been $67.28 million and $136.9 million for 1960 and 1973 respectively while the actual revenues were $56.20 million and $125.1 million respectively.

Change in motor fuel tax rate. Any increase in the motor fuel tax rate will result in an increase in the parameter value of the fuel consumption variable. The 5 percent increase in the value of the fuel consumption variable parameter results in an average of 2.65 percent increase in total tax revenues with an average of 12.91 percent increase in motor fuel tax revenues. In addition there is almost no change in all the other variables.

Change in motor vehicle and vehicle operator's tax rate. If the motor vehicle and vehicle operator's tax rate is raised, the parameter value of the number of per capita vehicles registered will be increased since this number is employed in the equation to explain the motor vehicles and operator's taxes. The 5 percent increase in the parameter value of the number of per capita vehicle registration variable results in an average of 3.56 percent decrease in the tax revenue from the motor vehicle and operator's tax and results in less than a 1 percent decrease in the state total tax revenue with no change in all the other variables.

The tax revenue decrease would be explained by the fact that the number of per capita vehicle registrations

will decline when motor vehicle and operator's tax rates increase. In terms of dollar amounts, the 5 percent increase in the parameter value of number of per capita vehicle registration variable results in $34.47 million and $72.88 million for 1960 and 1973 respectively while the actual dollar values were $38.45 million and $77.37 million respectively.

Change in death and gift tax rate. For the death and gift tax equation, per capita permanent income is used as an indicator of wealth since wealth is subject to death and gift taxes. Like the changes in other tax rates discussed above, the increase in the death and gift tax rate will make the parameter value of the per capita permanent income variable increase. When there is a 5 percent increase in the parameter value, there are averages of 11.94 percent and 0.28 percent increase in death and gift tax revenue and state total tax revenue respectively. All other variables remain almost unchanged. Therefore, if there had been 5 percent increase in the parameter of per capita permanent income, the tax revenue from death and gift tax would have been $6.28 million and $21.04 million in 1960 and 1973 respectively comparing with the actual tax revenues of $6.40 million and $17.49 million respectively.

Change in the relative state tax burden relative to the U.S. state average tax burden. The ratio of the per capita state tax to the per capita U.S. average state tax is

used in the population equation as an indicator of the effects of the relative tax burden on the migration of the U.S. population. It is hypothesized that state population depends upon time and the relative tax burden. Suppose that other states increase their tax burden by increasing the tax rate while the Oklahoma state tax structure remains unchanged, then the tax burden variable will decrease and there will be more population migration into Oklahoma. This hypothesis is based on the belief that a relatively low tax burden will attract business and population into Oklahoma. In order to trace the impact of the relative tax burden on population migration, per capita U.S. average state tax is raised by an average 5 percent, which has the effect of lowering the Oklahoma state tax burden relatively. The resultant relative lowering of the Oklahoma state tax burden increases the state total tax revenue by only 0.16 percent while the largest impact of such a relatively lower tax burden comes from an increase in the death and gift taxes (0.54 percent) followed by increases in the vehicle and vehicle operator's tax (0.35 percent) and motor fuel tax (0.25 percent).

In conclusion, the relative lowering of the state tax burden does not appear to be an effective means of attracting business and population in-migration into the state.[1]

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[1]John F. Due, "Studies of State-Local Tax Influences on Location of Industry," National Tax Journal 14 (June

Dynamic and Long-Run Simulation

Given the model $\hat{y} = y^* - (\nabla F^*)^{-1} \cdot F^*$ the simulated values of endogenous variables are obtained by solving simultaneously the system of equations with the simulated lagged endogenous variables instead of actual ones.

Computational steps for dynamic simulation:

Step 1 Set up ∇F^* matrix $\frac{\partial F_i}{\partial y}$ using 1951 values and estimated coefficients with a change in it.

Step 2 Invert ∇F^* matrix to $(\nabla F^*)^{-1}$.

Step 3 Compute estimated residuals by using 1951 variables and changed coefficients and we denote the residuals SF^*_i.

Step 4 Multiply the estimated residuals (SF^*_i) to the inverted ∇F^* matrix $(\nabla F^*)^{-1}$ and we denote XXF_i as the product, i.e., $(\nabla F^*)^{-1} SF^*_i = XXF_i$.

Step 5 Compute the simulated value of 1952 by subtracting XXF_i from actual values of 1951.

Step 6 Replace the lagged variables by simulated values.

Step 7 Transform the values of replaced variables to log values.

Step 8 Set up ∇F^* matrix using the replaced variables (simulated values) and changed coefficients.

Step 9 Compute estimated residuals (SF_i^*) using simulated and changed coefficients.

1961):163-173; Richard J. Cebula and Richard K. Vedder, "A Note on Migration, Economic Opportunity, and the Quality of Life," Journal of Regional Science 13 (August 1973):205-211; Cicely Blanco, "The determinants of Interstate Population Movements," Journal of Regional Science 5 (Summer 1963):77-84.

Step 10 Invert ∇F^* matrix to $(\nabla F^*)^{-1}$.

Step 11 Multiply estimated residuals (SF^*_i) to inverted ∇F^* matrix to compute XXF_i.

Step 12 Compute simulated values by subtracting XXF_i from simulated values.

Step 13 Compute percent change between predicted and simulated by $\left|\frac{\text{predicted - simulated}}{\text{predicted}}\right|$

Since all the endogenous variables are replaced by the simulated values, the impact of an initial shock will be spread over subsequent periods. This shock effect has definite and important dynamic implications. For example, if the general sales tax rate is raised it would change the magnitudes of all twenty endogenous variables. For the t + 1 period's calculation, the changed endogenous variables enter the equations of the model as lagged variables. Therefore, the impact of the initial change in any of the policy variables can accumulate over the subsequent period.

The practical importance of the dynamic implications are to be found in the subsequent changes in personal income. If the income tax rate is increased, the income tax revenues will consequently increase. The increased income tax rate and tax revenues implies that a higher tax burden will induce an out-migration of the state's population. Such a reduced population will change the state individual income variable, the tax variables as well as other variables. As a result, the changed population and personal income will affect the subsequent year's tax revenues since

they are used as lagged variables in the model.

In the dynamic impact analysis, the economic impact of an initial shock will spread over the following years by using simulated lagged endogenous variables rather than actual ones for the solution of the model.[1]

If the individual income tax rate or the tax base or some combination of both is raised, this will result in an increase in the parameter value of the per capita personal income variable. To evaluate the dynamic impact of the various tax reforms the following simulation was carried out.

Change in the individual income tax rate structure and/or income tax base. When a 5 percent increase in the parameter value of the per capita personal income variable for the year 1952 is introduced as an initial shock, it results in an average 52.28 percent increase in the state individual tax revenues with an average 4.01 percent increase in the state total tax revenues. This results in a slight increase in the other tax revenues of the corporate income tax, the general sales tax, and the death and gift tax by an average of 1.47 percent, 0.83 percent and 0.73 percent respectively while the motor fuel tax revenues and vehicle and vehicle operator's tax revenues show a slight decrease of 0.05 percent and 0.07 percent respectively.

All other non-tax variables are affected by the 5

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[1]Fair, Model.

percent increase in the parameter value of per capita personal income. The population migration variable changes by an average of 0.25 percent while personal income increases by an average of 0.44 percent.

A 5 percent decrease in the parameter value of the per capita personal income variable results in an average decrease of 34.41 percent in state individual income tax revenues and an average decrease of 2.05 percent in state total tax revenues while other tax revenues are increased. The magnitude of tax revenue increases are: corporate income tax revenues are increased by an average of 1.54 percent, general sales tax revenues increase by an average of 1.03 percent, motor fuel tax revenues increase by an average of 0.28 percent, and vehicle and vehicle operator's tax revenues and death and gift tax revenues are increased by an average of 0.44 and 1.57 percent respectively.

Among the variables other than tax variables, the state population is increased by an average of 0.12 percent and personal income is increased by an average of 0.61 percent. All other variables are changed even less.

Changes in the parameter value of the ratio of profit income to wages and salaries income. A 5 percent increase in the parameter value of the ratio of profit income to wages and salaries income results in an increase in the revenues from various taxes. The tax revenues from the state individual income tax increase by an average of 1.38

percent, from corporate income tax increases by an average of 1.51 percent, from general sales tax increases by an average of 0.94 percent, from motor fuel tax increases by an average of 0.14 percent, from vehicle and operators tax increases by an average of 0.23 percent and from death and gift tax increases by an average of 1.22 percent. This 5 percent increase results in a 0.04 percent decrease in the state's population while personal income increases by an average of 0.54 percent.

A 5 percent decrease in the parameter value of the ratio variable of profit to wages and salaries results in increases in all tax revenues.

The state individual income tax revenues increase by an average of 2.47 percent, corporate income tax revenues increase by an average of 1.51 percent, general sales tax revenues increase by an average of 0.94 percent, motor fuel tax revenues, vehicle and vehicle operator's tax revenues and death and gift tax revenues increase by 0.14 percent, 0.22 percent and 1.21 percent respectively, and state total tax revenues increase by 0.50 percent. The impact of 5 percent increase in the ratio of profit income to wages and salaries on state population and personal income are almost the same as the effect of 5 percent decrease in the ratio parameter. The population decreases by an average of 0.04 percent and personal income increases by an average of 0.53 percent.

In summary of a 5 percent increase and decrease in the ratio of profit income to wages and salaries income, the impact is virtually the same on the state total tax revenues and other tax revenues except for the impact on state individual income tax revenues noted above. This ratio is introduced in the equation as an indication of the income distribution effect.

Changes in the parameter of personal exemption per tax return. When the parameter value of personal exemption per tax return variable is increased by 5 percent, the tax revenues from the state individual income tax decrease by an average of 1.52 percent, from the corporate income tax it increases by the same percent (1.52), and state total tax revenues are increased by an average of 0.22 percent. The 5 percent increase results in general sales tax revenues increasing by 0.95 percent, motor fuel tax revenue increasing by 0.15 percent, vehicle and vehicle operators tax revenues and death and gift tax revenues increasing by 0.25 percent and 1.25 percent respectively. The population has almost no change (0.02 percent decrease) and personal income increases by 0.54 percent.

When the parameter value of the personal exemption variable is decreased by 5 percent, the state individual income tax revenue increases by an average of 5.52 percent while total state tax revenues increase by only an average of 0.70 percent. The largest increase is in state individual income taxes and is followed by corporate income taxes

which increase by an average of 1.51 percent. General sales tax revenues increase by an average of 0.93 percent, motor fuel tax revenues increase by an average of 0.13 percent, vehicle and vehicle operator's tax increase by an average of 0.20 and death and gift tax revenues increase by an average of 1.18 percent. Population decreases by an average of 0.05 percent and personal income increases by an average of 0.53 percent.

Change in the general sales tax rate. Since any change in the general sales tax rate will affect the parameter value of per capita retail sales, the parameter value is increased and decreased by 5 percent to evaluate the economic impact of a change in the general sales tax rate.

A 5 percent increase in the parameter value of the per capita retail sales variable results in an average of 13.69 percent increase in tax revenues from the general sales tax while the state total tax revenue is increased by an average of 2.94 percent. Individual income tax revenues increase by an average of 1.88 percent, corporate income taxes increase by an average of 1.48 percent, and death and gift tax revenues increase by an average of 0.87 percent while there are almost no changes in revenues from the motor fuel tax and vehicle and vehicle operator's tax. Population decreases by an average of 0.19 percent while the personal income increases by an average of 0.47 percent.

A 5 percent decrease in the parameter value of the

per capita retail sales variable results in a 10.41 percent decrease in general sales tax revenues while the state total tax revenues decrease by an average of 1.75 percent. However, the revenues from individual income taxes increase by an average of 1.96 percent followed by an average of 1.54 percent increase in corporate income tax revenues. Then motor fuel tax revenues increase by an average of 0.26 percent, vehicle and vehicle operator's tax revenues increase by an average of 0.42 percent and death and gift tax revenues increase by an average of 1.53 percent. This 5 percent increase in the parameter value of the retail sales variable results in a 0.10 percent increase in population and a 0.60 increase in personal income.

Change in the corporate income tax rate and/or in the income tax base. A 5 percent increase in the parameter value of retail sales variable in the corporate income tax equation results in an average of 30.26 percent increase in the tax revenues from the corporate income tax while the state total tax revenues increase by an average of 1.79 percent and general sales tax revenues increase by an average of 0.90 percent. Motor fuel tax revenues stay almost the same (0.07 percent increase), and vehicle and vehicle operator's tax revenues increase by an average of 0.11 percent and 1.03 percent respectively. Population decreases by an average of 0.12 percent and personal income increases by an average of 0.50 percent.

A 5 percent decrease in the parameter value results in an average of 23.16 percent decrease in the tax revenues from the corporate income tax while the state total income tax revenues decrease by an average of 0.69 percent. An average of 23.16 percent decrease in corporate income tax revenues is counterbalanced by increases in the other tax revenues. The individual income tax revenues increase by an average of 1.95 percent, followed by an average of 1.38 percent increase in death and gift tax revenues. Also, general sales tax revenues increase by 0.98 percent and motor fuel tax revenues and vehicle and vehicle operator's revenues increase by an average of 0.20 percent and 0.33 percent respectively. This 5 percent decrease in the parameter value has no effect on the population migration variable while personal income increases by an average of 0.57 percent.

Change in motor fuel tax rate. When the parameter value of motor fuel consumption is increased by 5 percent, the tax revenues from the motor fuel tax increase by an average of 7.38 percent while total state tax revenues increase by an average of 1.94 percent. This 5 percent increase in the parameter value results in an average of 1.90 percent increase in the individual income tax revenues, and corporate income tax revenues also increase by an average of 1.49 percent. General sales tax revenues increase by an average of 0.89 percent, vehicle and vehicle operator's

taxes increase by an average of 0.10 percent and death and gift tax revenues increase by an average of 1.01 percent. Population is decreased by an average of 0.13 percent and personal income increases by an average of 0.50 percent.

A 5 percent decrease in the parameter value of the fuel consumption variable results in an average of 6.59 percent decrease in the tax revenues from the motor fuel tax while state total tax revenues are reduced by an average of 0.92 percent. However, other tax revenues are increased. Individual income tax revenues are increased by an average of 1.95 percent followed by an increase in corporate income tax revenues of an average 1.53 percent. The general sales tax revenues also increase by an average amount of 0.99 percent, while vehicle and vehicle operator's tax revenues increase by an average of 0.35 percent and death and gift tax revenues increase by an average of 1.41 percent. The state's population increases slightly (0.05 percent) and personal income increases by an average of 0.57 percent.

Change in the motor vehicle and vehicle operator's tax rate. A 5 percent increase in the value of the parameter of average per capita vehicle registration results in an average 1.55 percent decrease in tax revenues from vehicle and vehicle operator's taxes while state total tax revenues increase by an average of 0.22 percent. This 5 percent increase in the parameter results also in an average of 1.93 percent increase in individual income tax revenues, an

average of 1.52 percent increase in corporate income tax revenues, an average of 0.95 percent increase in general sales tax revenues, an average of 0.15 percent increase in motor fuel tax revenues and an average 1.25 percent increase in death and gift tax revenues. There is no change in population while personal income increases by an average of 0.54 percent.

A 5 percent decrease of the parameter value results in an average of 2.04 percent increase in vehicle and vehicle operator's tax revenues. State total tax revenues increase by an average of 0.70 percent. Individual income tax revenues increase by an average of 1.92 percent, corporate income tax revenues increase by an average of 1.51 percent, general sales tax revenues increase by an average of 0.93 percent, motor fuel tax revenues increase by an average of 0.13 percent and death and gift tax revenues increase by an average of 1.18 percent. Population decreases by an average of 0.05 percent and personal income increases by an average of 0.53 percent.

Change in death and gift tax rate. In order to evaluate any change in the death and gift tax rate, a 5 percent increase and decrease is introduced in the parameter value of the per capita permanent income variable. A 5 percent increase in the parameter value results in an average 11.13 percent increase in death and gift tax revenues as the state total tax revenues increase by an average of 0.69 percent.

This 5 percent increase results in an average of 1.92 percent increase in the individual income tax revenues, an average of 1.51 percent increase in the corporate income tax revenues, an average of 0.93 percent increase in the general sales tax revenues, an average of 0.13 percent increase in the motor fuel tax revenues and an average 0.21 percent increase in the vehicle and vehicle operator's tax revenues. Population decreases by an average of 0.05 percent and personal income increases by an average of 0.53 percent.

A 5 percent decrease in the parameter value for per capita permanent income results in an average 7.32 percent decrease in the death and gift tax revenues while total state tax revenues increase by an average of 0.26 percent. This results from the decrease of an average of 7.32 percent in death and gift tax which counterbalances the increases of an average of 1.92 percent from individual income tax, 0.95 percent average increase in the general sales tax, average of 0.15 percent increase in the motor fuel tax, and average of 0.24 percent increase from the vehicle and vehicle operator's tax. Population decreases by an average of 0.03 percent and personal income increases by an average of 0.54 percent.

Change in the relative tax burden of Oklahoma to the U.S. state average tax burden. The relative tax burden variable as compared with other states is employed in the

equation as an indicator of the impact of the relative tax burden on the population migration and on the attraction of business into the state.[1]

In evaluating the relative tax burden, the per capita U.S. average state tax is changed. First it is changed by 5 percent and then by 50 percent in order to evaluate the impact on the state economy.

A 5 percent increase in per capita U.S. average state tax (UT) results in an average of 0.10 percent increase in population and an average 0.60 percent increase in personal income. This 5 percent increase results in an average of 0.54 percent increase in the state total tax revenues. The highest impact occurs on the state individual income tax followed by the corporation income tax.

A 50 percent increase in the per capita U.S. average state tax results in an average of 1.15 percent increase in population and an increase of 1.04 percent increase in personal income with an average of 1.11 percent increase in state total tax revenues. The tax revenues from the state individual income tax increases by an average of 2.18 percent; the smallest increase coming from the motor fuel tax (average of 1.20 percent).

By decreasing per capita U.S. average state tax (UT) by 5 percent and 50 percent, population decreases by an average of 0.19 percent and 2.01 percent respectively.

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[1]Due, "Tax Influence on Location."

Personal income increases by an average of 0.47 percent for the 5 percent decrease in UT and decreases by an average of 0.32 percent for the 50 percent decrease in UT.

State total tax revenues increase by an average of 0.38 percent and decrease by an average of 0.64 percent for the 50 percent decrease in UT.

Tax revenues and population migration are insensitive to the change in UT. The relative tax burden appears not to be a significant factor for population migration and attracting business into the state.[1]

In summary, the simulation model was discussed, and ex post forecasting performance of this econometric model was evaluated and ex ante forecasting performance of this model was compared with that of Box-Jenkins model. This model out-performed Box-Jenkins model in short-run forecasting. Ex post static and dynamic simulations of various alternative tax policies as measures of effective means of raising tax revenues were discussed. Changing income tax and general sales tax structures appeared to be effective means of raising the total tax revenue based on the results of this study.

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[1]Raymond J. Struyk, "An Analysis of Tax Structure, Public Service Levels, and Regional Economic Growth," Journal of Regional Science 7 (Winter 1967):175-182; William V. Williams, "A Measure of the Impact of State and Local Taxes on Industry Location," Journal of Regional Science 7 (Summer 1967):49-57.

CHAPTER V

SUMMARY AND CONCLUSIONS

This study provides an econometric model which forecasts the selective state tax revenues of individual income tax, corporate income tax, general sales tax, motor fuel tax, vehicles and operators tax, death and gift tax, and gross production tax, and simulates the alternative tax policies. The ex post sample period forecasting and simulation experiments indicate that the model is capable of accurately explaining interrelationships of the selective state taxes with some of the state economic variables, such as population, retail sales, fuel consumption, vehicle registration, state personal income, wages and salaries, the number of persons in the household, profit income, permanent income, and average personal exemption per tax return.

At the outset, a brief reveiw of Oklahoma tax structure was presented in the classification of individual income tax, corporate income tax, general sales tax, selective sales tax, license tax, death and gift tax, and gross production tax.

There have been structural changes in individual

income tax since 1971 when the marginal income tax rate changed to the present rate schedule, ranging from one half percent to 6 percent. There are three different rate schedules for (1) single individuals and married filing separately, (2) for heads of households and (3) for married filing jointly.

The corporate income tax rate is a flat four percent on the taxable income. For multi-state corporations, there is an apportionment formula for allocating the total income of such firms to the various states which levy income tax on it.

The general sales tax is a tax levied on the gross amount of retail sales with some exempted items. The current general sales tax rate is a flat two percent.

The selective sales tax is a tax levied on the specific commodities on a per-unit basis. The tax rates vary with the specific items.

The death and gift tax is a tax levied on the transfer of property to the descendants, and a gift tax is a tax levied on the transfer of the property by gift. In recent years, there have been some changes in these taxes. The separate tax rate schedule is added to the property transferred to other than the specified individuals such as parents, children, spouse, children of spouse, and any lineal descendants, and in the death tax, the aggregate exemption has been increased from 15,000 dollars to 60,000 dollars.

The gross production tax is a tax levied on the gross value of the production of minerals, oil, and gas in the state. This gross production tax is one of the fastest growing taxes, along with the income tax, and is becoming an important revenue source in recent years. Tax rate schedules have been changed in 1974, from five percent to seven percent, for oil and natural gas production.

The literature concerning forecasting and simulating state tax revenues was briefly reviewed in order to establish some perspective on the approaches analyzing the state taxes. One approach is to estimate income elasticities of the various taxes which provide a basis for determining the tax yield. Another approach is to construct the tax base by income brackets and apply effective tax rates to the estimated tax basis.

The most generally used and relatively simple approach is that of estimating elasticities. In estimating elasticities of various taxes, most previous studies estimated elasticities of taxes with respect to personal income only under the assumption that tax yield is affected by only personal income and is not affected by other taxes, thus treating personal income as the only exogenous variable. Some studies attempted to include the effective tax rates and relative price in the equations.

Therefore, most of the tax variables are explained by a single equation in most previous studies even though

tax variables are interrelated with other economic variables. In previous studies, only in the individual income tax was there any attempt to simulate.

In this study, the econometric model of log linear simultaneous equation was attempted to build to explain the interrelationships between various taxes and the various economic variables, and attempted to forecast the various tax revenues, and simulate the alternative tax policies.

In specifying equations, the tax institutional euqations are limited to individual income tax, corporate income tax, general sales tax, motor fuel tax, vehicles and operator's tax, and death and gift tax. Gross production tax is estimated on the basis of allocation method. The limitations of data availability is the main reason for restricting the institutional equations to the six equations. Data are collected on the sample period of 1950 to 1973, and the two-stage least-squares estimation technique is used in estimating the structural parameters.

To evaluate the forecasting performance of the econometric model, this model is compared with the Box-Jenkins model, and then is compared with the actual values for the ex ante period of 1974, 1975, and 1976.

This model performs better than the Box-Jenkins model in ex ante forecasting, and ex post forecasting has smaller error than ex ante forecasting.

In simulation of alternative tax policies changing

the income tax and general sales tax are the most effective means to raise the total state tax revenues in Oklahoma, and tax burden is not the major consideration for migration of population. The model suggests that lowering the state tax burden in order to attract population and business into the state is not an effective means.

In consideration of further developments of the model, the state tax revenue model can be improved by developing a forecasting model of state expenditures. The predictive accuracy of the model can be strengthened by the use of other estimation techniques or by changes in the specification of some of the equations. Furthermore, a more comprehensive tax forecasting model can be developed by increasing the number of tax equations, a quite formidable task.

Simulation is a powerful tool in many investigations. Simulation can be a useful guide for alternative policy measures to be adopted. Economic consequences of a policy change by changing a value of the variables and the parameters of the model can be simulated, and these simulation results can be utilized in arriving at the policy decision.

However, there are three major limitations of linearity, assumed knowledge of predetermined variables, and treatment of the disturbance terms in building an econometric model.[1] With the built-in linear functions in the

[1]M. Dutta, Econometric Methods (Cincinnati: South-Western, 1975):298-365.

model, the time path of a variable generated can hardly be expected to show the ups and downs of actual observations.[1] The second limitation is due to lack of knowledge of the predetermined variables of the model. The third limitation is due to the fact that each stochastic equation contains the disturbance term. Even if the specification of the equation is based on sound prior theory of economics, there are some aribtrary elements since the parameters of the model are estimated from given sample.[2]

This model is not the perfect one due to the probable specification bias since there is a lack of regional data, and there have been some changes in the tax structures.

However, by this study, it has been attempted to make a modest contribution to the stock of knowledge concerning constructing the regional econometric model for the various taxes and simulate the various alternative tax policies which could be used as the basis for decision-making.

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[1] Ibid.

[2] Ibid.

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APPENDIX A

Ex Post Static Forecasting
And Ex Post Dynamic Forecasting
With No Parameter Change

Actual, Ex Post Static Forecasting and Ex Post Dynamic Forecasting With No Change In Parameter 1972-1973

IT

Year	Actual	Static	Dynamic
	(Unit=$million)		
1952	$9.969	$6.738	$6.738
1953	5.173	8.228	10.82
1954	9.404	9.874	9.150
1955	10.43	10.88	11.84
1956	12.12	11.26	10.90
1957	12.57	12.12	14.59
1958	13.49	13.21	12.60
1959	14.96	14.60	16.45
1960	16.78	16.37	16.56
1961	17.88	17.42	19.46
1962	19.13	19.18	19.58
1963	19.02	19.91	22.34
1964	21.78	21.33	21.03
1965	26.48	22.99	26.60
1966	30.34	25.63	29.04
1967	32.44	29.54	34.56
1968	41.36	34.27	36.00
1969	47.80	38.37	49.31
1970	50.53	46.05	50.37
1971	63.65	53.35	60.15
1972	97.72	73.20	83.88
1973	105.1	80.52	107.9

CIT

Year	Actual	Static	Dynamic
	(Unit=$million)		
1952	8.852	7.763	7.763
1953	8.536	8.188	9.262
1954	7.844	8.928	8.658
1955	8.150	9.599	9.437
1956	9.797	9.940	9.357
1957	10.45	10.48	11.46
1958	10.84	10.95	10.68
1959	11.28	11.88	12.57
1960	12.17	12.53	12.01
1961	14.68	13.19	14.07
1962	14.57	14.09	15.50
1963	20.67	14.74	14.90
1964	16.86	14.85	22.39
1965	17.09	16.53	21.64
1966	22.32	17.57	22.72
1967	21.50	18.49	19.62
1968	24.22	20.59	23.79
1969	22.13	22.22	24.58
1970	27.48	24.00	23.48
1971	25.21	26.53	32.17
1972	28.03	29.30	25.14
1973	35.43	32.26	36.62

GST

Year	Actual (Unit=$million)	Static	Dynamic
1952	41.000	38.32	38.32
1953	43.30	40.53	42.78
1954	43.50	43.21	45.21
1955	46.25	45.57	45.85
1956	49.16	47.07	49.08
1957	49.75	48.80	50.87
1958	50.66	50.54	51.57
1959	54.84	52.56	53.97
1960	56.20	55.13	58.24
1961	58.19	57.28	58.41
1962	60.36	59.71	62.07
1963	62.85	61.65	63.68
1964	66.42	63.87	66.46
1965	69.22	66.26	70.19
1966	74.10	70.81	73.60
1967	75.74	74.88	78.41
1968	79.54	79.03	80.58
1969	87.00	83.06	86.66
1970	93.84	90.78	96.72
1971	101.2	97.29	98.64
1972	113.2	102.2	111.1
1973	125.1	109.8	119.5

MFT

Year	Actual	Static	Dynamic
	(Unit=$million)		
1952	42.51	41.56	41.56
1953	44.80	43.96	44.87
1954	46.56	46.18	46.40
1955	47.90	48.01	48.54
1956	51.57	50.11	49.85
1957	52.78	52.71	54.77
1958	57.12	54.41	52.90
1959	56.34	56.58	61.02
1960	58.56	59.10	54.87
1961	59.90	61.06	64.89
1962	62.63	63.31	58.88
1963	65.28	65.40	69.36
1964	67.50	67.61	64.18
1965	70.48	70.92	74.53
1966	74.55	73.96	70.68
1967	77.89	77.80	82.00
1968	80.74	81.33	77.99
1969	86.22	85.61	88.00
1970	90.89	89.63	87.88
1971	96.67	93.79	97.55
1972	102.9	98.02	98.11
1973	109.3	105.0	110.6

VOT

Year	Actual	Static	Dynamic
	(Unit=$million)		
1952	23.69	22.56	22.56
1953	25.25	24.71	25.22
1954	27.03	26.13	27.09
1955	29.12	28.53	29.38
1956	32.66	30.16	30.74
1957	33.41	32.77	35.53
1958	34.59	33.65	32.47
1959	36.17	34.51	37.58
1960	38.45	35.95	35.63
1961	39.50	38.33	42.15
1962	41.27	40.22	38.79
1963	43.37	42.13	45.61
1964	46.09	44.76	43.75
1965	48.23	47.69	51.10
1966	51.54	49.97	48.58
1967	53.44	53.14	57.32
1968	57.47	56.21	53.86
1969	61.71	59.03	63.86
1970	65.70	63.07	62.58
1971	68.08	66.15	70.89
1972	73.28	69.92	68.96
1973	77.37	74.33	80.18

DGT

Year	Actual (Unit=$million)	Static	Dynamic
1952	3.211	2.690	2.690
1953	3.002	3.475	3.585
1954	3.342	3.535	3.278
1955	3.354	3.581	3.890
1956	3.987	3.889	3.743
1957	4.068	4.053	4.619
1958	5.049	4.590	4.488
1959	5.188	4.779	5.725
1960	6.398	5.671	5.606
1961	7.140	5.937	7.122
1962	7.288	6.991	7.495
1963	7.112	7.645	7.843
1964	9.555	7.908	7.631
1965	9.809	7.913	10.47
1966	12.90	9.991	9.999
1967	13.32	10.30	13.78
1968	12.99	13.05	13.21
1969	14.58	13.81	13.86
1970	14.46	14.20	15.59
1971	16.72	15.94	15.88
1972	18.73	16.51	18.35
1973	17.49	18.63	20.49

RS

Year	Actual (Unit=$million)	Static	Dynamic
1952	1948.000	1796.000	1796.000
1953	2025.000	1888.000	2035.000
1954	2100.000	2032.000	2100.000
1955	2176.000	2138.000	2235.000
1956	2251.000	2201.000	2237.000
1957	2326.000	2285.000	2407.000
1958	2402.000	2387.000	2428.000
1959	2501.000	2505.000	2579.000
1960	2602.000	2639.000	2675.000
1961	2702.000	2746.000	2804.000
1962	2800.000	2874.000	2898.000
1963	2901.000	2966.000	3031.000
1964	3246.000	3076.000	3114.000
1965	3406.000	3200.000	3499.000
1966	3535.000	3353.000	3453.000
1967	3649.000	3564.000	3833.000
1968	4110.000	3806.000	3828.000
1969	4389.000	4047.000	4563.000
1970	4406.000	4361.000	4452.000
1971	4921.000	4671.000	4895.000
1972	5405.000	5036.000	5364.000
1973	6072.000	5347.000	5732.000

FC

Year	Actual (Unit=Million Gallons)	Static	Dynamic
1952	805.700	783.900	783.900
1953	825.7	841.4	861.4
1954	841.1	889.6	969.9
1955	940.2	921.1	911.9
1956	968.8	965.8	1010.0
1957	969.8	1018.0	999.3
1958	1035.0	1033.0	1026.0
1959	1141.0	1072.0	1098.0
1960	1190.0	1126.0	1188.0
1961	1183.0	1142.0	1168.0
1962	1228.0	1177.0	1214.0
1963	1246.0	1198.0	1241.0
1964	1273.0	1221.0	1254.0
1965	1347.0	1286.0	1332.0
1966	1419.0	1340.0	1387.0
1967	1447.0	1418.0	1482.0
1968	1526.0	1483.0	1482.0
1969	1597.0	1572.0	1652.0
1970	1694.0	1646.0	1633.0
1971	1762.0	1719.0	1820.0
1972	1837.0	1800.0	1790.0
1973	1921.0	1987.0	2077.0

VR

Year	Actual	Static	Dynamic
	(Unit=Vehicles in Millions)		
1952	0.892	0.834	0.834
1953	0.929	0.894	0.933
1954	0.963	0.929	0.954
1955	1.026	0.991	1.027
1956	1.052	1.029	1.053
1957	1.072	1.093	1.119
1958	1.090	1.109	1.088
1959	1.143	1.121	1.152
1960	1.184	1.151	1.171
1961	1.222	1.204	1.247
1962	1.275	1.243	1.249
1963	1.333	1.280	1.337
1964	1.380	1.336	1.362
1965	1.438	1.397	1.446
1966	1.495	1.441	1.467
1967	1.542	1.503	1.567
1968	1.610	1.563	1.573
1969	1.650	1.615	1.686
1970	1.714	1.691	1.692
1971	1.808	1.746	1.806
1972	1.887	1.813	1.854
1973	1.985	1.892	1.963

DTHR

Year	Actual	Static	Dynamic
	(Unit=per a thousand persons)		
1952	8.900	9.124	9.124
1953	8.998	9.178	8.958
1954	9.198	9.219	9.254
1955	8.998	9.267	9.201
1956	9.300	9.310	9.104
1957	9.602	9.387	9.569
1958	9.699	9.445	9.470
1959	9.699	9.485	9.706
1960	9.796	9.528	9.511
1961	9.699	9.594	9.869
1962	9.796	9.646	9.464
1963	9.796	9.692	10.01
1964	9.796	9.754	9.528
1965	9.602	9.821	10.07
1966	10.10	9.864	9.386
1967	10.00	9.936	10.63
1968	10.20	9.995	9.338
1969	10.10	10.07	10.89
1970	10.30	10.14	9.312
1971	9.602	10.22	11.15
1972	10.30	10.24	8.659
1973	10.10	10.32	11.80

P

Year	Actual (Unit=millions)	Static	Dynamic
1952	2.183	2.154	2.154
1953	2.141	2.176	2.206
1954	2.157	2.195	2.127
1955	2.186	2.210	2.237
1956	2.239	2.231	2.178
1957	2.273	2.261	2.317
1958	2.271	2.285	2.238
1959	2.301	2.302	2.330
1960	2.328	2.320	2.286
1961	2.353	2.347	2.383
1962	2.378	2.366	2.333
1963	2.403	2.387	2.425
1964	2.428	2.412	2.386
1965	2.453	2.440	2.476
1966	2.478	2.460	2.432
1967	2.510	2.490	2.529
1968	2.525	2.514	2.490
1969	2.542	2.548	2.575
1970	2.559	2.574	2.536
1971	2.610	2.607	2.625
1972	2.633	2.628	2.606
1973	2.663	2.653	2.671

PY

Year	Actual (Unit=$million)	Static	Dynamic
1952	3087.000	2682.000	2682.000
1953	3201.0	2924.0	3266.0
1954	3193.	3219.	3267.
1955	3390.	3403.	3460.
1956	3591.	3509.	3567.
1957	3744.	3651.	3872.
1958	4037.	3845.	3912.
1959	4194.	4130.	4361.
1960	4390.	4410.	4386.
1961	4598.	4583.	4767.
1962	4737.	4871.	4853.
1963	4937.	4971.	5154.
1964	5280.	5196.	5274.
1965	5711.	5434.	5755.
1966	6195.	5769.	6066.
1967	6751.	6254.	6705.
1968	7322.	6819.	7148.
1969	7928.	7239.	7907.
1970	8696.	7983.	8430.
1971	9239.	8687.	9431.
1972	10100.	9487.	9837.
1973	11560.	10090.	10990.

P21Ø

Year	Actual	Static	Dynamic
	(Unit=in millions)		
1952	1.320	1.290	1.290
1953	1.273	1.305	1.337
1954	1.281	1.319	1.253
1955	1.305	1.330	1.354
1956	1.353	1.346	1.294
1957	1.380	1.368	1.421
1958	1.372	1.386	1.341
1959	1.395	1.398	1.425
1960	1.416	1.411	1.378
1961	1.410	1.431	1.465
1962	1.454	1.422	1.389
1963	1.473	1.462	1.520
1964	1.492	1.481	1.429
1965	1.511	1.502	1.558
1966	1.530	1.516	1.465
1967	1.554	1.539	1.598
1968	1.564	1.557	1.509
1969	1.575	1.583	1.631
1970	1.586	1.604	1.543
1971	1.627	1.630	1.666
1972	1.650	1.644	1.600
1973	1.680	1.664	1.706

P65Ø

Year	Actual	Static	Dynamic
	(Unit=in millions)		
1952	0.204	0.208	0.208
1953	0.209	0.212	0.209
1954	0.214	0.216	0.215
1955	0.220	0.219	0.217
1956	0.225	0.223	0.226
1957	0.231	0.229	0.228
1958	0.237	0.234	0.237
1959	0.243	0.238	0.237
1960	0.249	0.242	0.247
1961	0.253	0.248	0.249
1962	0.256	0.252	0.255
1963	0.260	0.257	0.256
1964	0.264	0.262	0.265
1965	0.268	0.269	0.266
1966	0.272	0.273	0.274
1967	0.278	0.280	0.277
1968	0.283	0.285	0.286
1969	0.288	0.293	0.289
1970	0.300	0.300	0.297
1971	0.314	0.308	0.309
1972	0.317	0.313	0.316
1973	0.321	0.319	0.318

WS

Year	Actual (Unit=$million)	Static	Dynamic
1952	1755.000	1635.000	1635.000
1953	1861.0	1739.0	1852.0
1954	1962.0	1891.0	1970.0
1955	2104.0	2014.0	2095.0
1956	2260.0	2097.0	2196.0
1957	2323.0	2204.0	2374.0
1958	2387.0	2329.0	2396.0
1959	2521.0	2473.0	2560.0
1960	2597.0	2637.0	2708.0
1961	2701.0	2772.0	2795.0
1962	2883.0	2932.0	2965.0
1963	2986.0	3067.0	3149.0
1964	3192.0	3215.0	3228.0
1965	3390.0	3383.0	3521.0
1966	3719.0	3586.0	3654.0
1967	4057.0	3857.0	4117.0
1968	4459.0	4172.0	4328.0
1969	4872.0	4488.0	4881.0
1970	5323.0	4890.0	5164.0
1971	5646.0	5307.0	5770.0
1972	6171.0	5777.0	6004.0
1973	6815.0	6205.0	6745.0

EXRT

Year	Actual	Static	Dynamic
	(Unit=Number of exemption per return)		
1952	2.977	2.916	2.916
1953	2.806	2.909	2.971
1954	2.881	2.903	2.741
1955	2.818	2.900	3.038
1956	2.855	2.895	2.674
1957	2.904	2.889	3.063
1958	2.934	2.883	3.720
1959	2.919	2.880	3.090
1960	2.899	2.875	2.697
1961	2.934	2.869	3.066
1962	2.842	2.864	2.726
1963	2.916	2.860	2.974
1964	2.928	2.853	2.794
1965	2.819	2.847	2.982
1966	2.864	2.843	2.678
1967	2.870	2.839	3.019
1968	2.809	2.832	2.677
1969	2.816	2.823	2.954
1970	2.862	2.817	2.678
1971	2.772	2.812	2.992
1972	2.701	2.807	2.582
1973	2.800	2.801	2.914

HS

Year	Actual (Unit=in millions)	Static	Dynamic
1952	0.677	0.672	0.672
1953	0.684	0.681	0.687
1954	0.691	0.688	0.685
1955	0.689	0.695	0.700
1956	0.705	0.703	0.700
1957	0.713	0.715	0.718
1958	0.720	0.725	0.718
1959	0.727	0.732	0.732
1960	0.735	0.739	0.733
1961	0.746	0.750	0.750
1962	0.757	0.759	0.753
1963	0.768	0.766	0.768
1964	0.779	0.778	0.775
1965	0.791	0.789	0.791
1966	0.803	0.797	0.796
1967	0.814	0.809	0.815
1968	0.826	0.820	0.818
1969	0.839	0.834	0.840
1970	0.851	0.846	0.843
1971	0.864	0.860	0.866
1972	0.876	0.868	0.864
1973	0.889	0.879	0.888

PR

Year	Actual (Unit=$million)	Static	Dynamic
1952	1332.000	1047.000	1047.000
1953	1340.0	1186.0	1413.0
1954	1231.0	1327.0	1297.0
1955	1286.0	1390.0	1365.0
1956	1331.0	1411.0	1371.0
1957	1421.0	1447.0	1498.0
1958	1650.0	1516.0	1516.0
1959	1673.0	1657.0	1801.0
1960	1793.0	1774.0	1679.0
1961	1897.0	1811.0	1972.0
1962	1854.0	1939.0	1887.0
1963	1951.0	1904.0	2005.0
1964	2088.0	1981.0	2046.0
1965	2321.0	2051.0	2234.0
1966	2476.0	2183.0	2411.0
1967	2694.0	2397.0	2587.0
1968	2863.0	2648.0	2820.0
1969	3056.0	2750.0	3025.0
1970	3373.0	3092.0	3266.0
1971	3593.0	3380.0	3661.0
1972	3931.0	3710.0	3832.0
1973	4743.0	3885.0	4244.0

OKTT

Year	Actual (Unit=$million)	Static	Dynamic
1952	187.800	174.500	174.500
1953	196.200	187.900	199.200
1954	203.600	200.000	201.300
1955	210.400	212.100	219.300
1956	229.600	217.700	213.700
1957	235.700	231.300	252.500
1958	246.500	240.000	229.400
1959	256.300	249.600	272.100
1960	275.400	262.300	253.300
1961	285.100	280.000	309.400
1962	307.900	291.400	274.700
1963	321.900	314.100	356.600
1964	332.300	323.900	299.800
1965	357.600	336.300	278.200
1966	388.700	364.200	353.500
1967	401.000	387.100	432.700
1968	427.500	411.200	391.800
1969	472.600	433.300	483.200
1970	502.100	480.800	486.800
1971	540.900	512.300	543.500
1972	649.400	558.500	576.100
1973	691.200	636.000	735.700

PYP

Year	Actual (Unit=$million)	Static	Dynamic
1952	2826.000	2632.000	2632.000
1953	3004.0	2789.0	2970.0
1954	3109.0	3040.0	3208.0
1955	3251.0	3224.0	3304.0
1956	3418.0	3331.0	3450.0
1957	3581.0	3476.0	3646.0
1958	3795.0	3657.0	3812.0
1959	3987.0	3872.0	4041.0
1960	4183.0	4117.0	4273.0
1961	4388.0	4305.0	4465.0
1962	4567.0	4542.0	4700.0
1963	4756.0	4709.0	4889.0
1964	5008.0	4910.0	5095.0
1965	5332.0	5122.0	5371.0
1966	5725.0	5413.0	5735.0
1967	6188.0	5808.0	6176.0
1968	6701.0	6277.0	6682.0
1969	7259.0	6732.0	7255.0
1970	7909.0	7348.0	7866.0
1971	8525.0	7975.0	8586.0
1972	9246.0	8698.0	9274.0
1973	10270.0	9322.0	10010.0

GPT

Year	Actual (Unit=$million)	Static	Dynamic
1952	26.03	24.20	24.20
1953	27.38	26.23	27.81
1954	31.11	30.56	30.76
1955	29.00	29.23	30.22
1956	32.12	30.46	29.90
1957	34.01	33.38	36.44
1958	34.11	33.22	31.75
1959	33.75	32.87	35.84
1960	32.97	31.40	30.32
1961	33.97	33.35	36.85
1962	34.46	32.61	30.74
1963	35.63	34.77	39.90
1964	37.96	37.02	34.27
1965	38.48	36.19	29.93
1966	39.92	37.40	36.30
1967	45.46	43.90	49.07
1968	45.86	44.12	42.04
1969	48.22	44.20	49.29
1970	50.54	48.42	49.02
1971	51.28	48.57	51.52
1972	73.34	63.06	65.04
1973	96.98	79.31	91.74

APPENDIX B

Ex Ante Forecasts of Our Econometric Model And Box-Jenkins Model

Ex Ante Forecasts of Our Econometric Model
And Box-Jenkins Model
1974

Variable	Actual	Kim	Box-Jenkins
IT	120.80	108.90	102.77
CIT	40.39	36.48	34.13
GST	144.30	130.80	127.06
MFT	111.20	120.20	108.29
VOT	83.96	78.28	77.31
DGT	22.37	19.30	17.17
RS	6050.00	6451.00	6052.00
FC	1711.00	2437.00	1735.00
VR	2.041	2.039	2.017
DTHR	10.20	8.58	8.11
P	2.709	2.668	2.557
PY	11560.00	12320.00	12367.00
P21Ø	1.724	1.655	1.651
P65Ø	0.328	0.328	0.328
WS	7097.00	7235.00	6271.00
EXRT	2.803	2.681	1.051
HS	0.952	0.891	0.916
PR	4461.00	5082.00	4400.00
OKTT	777.50	676.20	692.28
PYP	10990.00	11160.00	11216.00
GPT	71.46	69.92	99.11

Ex Ante Forecasts of Our Econometric Model
And Box-Jenkins Model
1975

Variable	Actual	Kim	Box-Jenkins
IT	162.70	147.90	100.49
CIT	42.53	46.07	32.87
GST	163.50	153.00	126.42
MFT	111.30	120.60	109.24
VOT	88.08	91.62	77.37
DGT	24.61	25.38	16.85
RS	6455.00	6324.00	5890.00
FC	1786.00	2158.00	1567.00
VR	2.113	2.108	2.061
DTHR	10.00	11.86	6.62
P	2.712	2.733	2.458
PY	12410.00	12430.00	11845.00
P21Ø	1.739	1.762	1.623
P65Ø	0.334	0.329	0.335
WS	7626.00	7804.00	5771.00
EXRT	2.798	2.914	1.051
HS	0.959	0.958	0.944
PR	4783.00	4627.00	4082.00
OKTT	883.70	910.40	692.37
PYP	11780.00	12020.00	12090.00
GPT	128.10	130.00	98.07

Ex Ante Forecasts of Our Econometric Model
And Box-Jenkins Model
1976

Variable	Actual	Kim	Box-Jenkins
IT	201.00	159.50	98.26
CIT	53.43	42.31	31.67
GST	181.90	152.60	126.72
MFT	117.30	126.30	108.51
VOT	94.23	85.80	77.43
DGT	23.00	26.64	16.54
RS	7326.00	7155.00	5355.00
FC	2094.00	2568.00	1415.00
VR	2.181	2.155	2.093
DTHR	9.80	8.53	5.52
P	2.677	2.698	2.364
PY	14240.00	13630.00	10489.00
P21Ø	1.787	1.691	1.596
P65Ø	0.339	0.341	0.342
WS	8764.00	8265.00	5311.00
EXRT	2.796	2.670	1.051
HS	1.152	0.908	0.972
PR	5473.00	5366.00	3787.00
OKTT	1000.00	838.40	692.43
PYP	13000.00	12670.00	12898.00
GPT	151.32	126.85	98.72

APPENDIX C

Static Simulation Results

Of Parameter Increase

IT (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	9.696	12.53	6.653	6.148	6.733
1953	9.173	14.71	8.147	7.577	8.223
1954	9.409	16.07	9.801	9.258	9.869
1955	10.43	17.29	10.80	10.25	10.87
1956	12.12	18.38	11.17	10.56	11.25
1957	12.57	20.43	12.00	11.31	12.11
1958	13.49	21.87	13.09	12.37	13.20
1959	14.96	23.96	14.48	13.70	14.59
1960	16.78	26.82	16.24	15.38	16.36
1961	17.88	29.19	17.26	16.30	17.41
1962	19.13	31.80	19.01	18.00	19.17
1963	19.02	33.46	19.71	18.65	19.90
1964	21.78	34.87	21.12	20.07	21.31
1965	26.48	38.56	22.75	21.56	22.98
1966	30.34	44.68	25.33	23.89	25.61
1967	32.44	51.54	29.22	27.55	29.51
1968	41.36	57.99	33.94	32.14	34.24
1969	47.80	68.84	37.91	35.67	38.33
1970	50.53	81.63	45.56	42.94	46.02
1971	63.65	91.29	52.84	50.07	53.31
1972	97.72	121.5	72.57	69.07	73.16
1973	105.1	155.0	79.50	74.20	80.46

IT (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	5% Increase in UT of OPT/UT Eq.11
1952	6.726	6.731	6.739	6.737	6.750
1953	8.216	8.220	8.230	8.228	8.242
1954	9.862	9.866	9.876	9.873	9.886
1955	10.87	10.87	10.88	10.88	10.89
1956	11.24	11.25	11.26	11.26	11.27
1957	12.10	12.11	12.12	12.12	12.13
1958	13.19	13.20	13.21	13.21	13.23
1959	14.58	14.59	14.60	14.60	14.62
1960	16.35	16.36	16.37	16.37	16.39
1961	17.40	17.40	17.42	17.42	17.44
1962	19.16	19.17	19.18	19.18	19.20
1963	19.89	19.90	19.91	19.91	19.94
1964	21.30	21.31	21.33	21.33	21.35
1965	22.96	22.98	23.00	22.99	23.02
1966	25.60	25.61	25.63	25.63	25.67
1967	29.50	29.51	29.54	29.53	29.58
1968	34.22	34.24	34.27	34.26	34.31
1969	38.31	38.33	38.37	38.36	38.42
1970	45.99	46.02	46.06	46.05	46.12
1971	53.28	53.31	53.35	53.34	53.42
1972	73.11	73.15	73.20	73.19	73.29
1973	80.40	80.46	80.53	80.51	80.66

CIT (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	8.852	7.760	7.763	7.763	11.33
1953	8.536	8.184	8.188	8.188	12.02
1954	7.844	8.925	8.928	8.928	12.66
1955	8.150	9.596	9.599	9.599	13.05
1956	9.797	9.938	9.940	9.941	13.54
1957	10.45	10.48	10.48	10.48	14.82
1958	10.84	10.95	10.95	10.95	15.60
1959	11.28	11.87	11.88	11.88	16.73
1960	12.17	12.53	12.53	12.53	17.61
1961	14.68	13.18	13.18	13.19	18.69
1962	14.57	14.09	14.09	14.09	20.76
1963	20.67	14.74	14.74	14.74	21.39
1964	16.86	14.84	14.85	14.85	24.31
1965	17.09	16.52	16.53	16.53	24.28
1966	22.32	17.56	17.57	17.57	25.46
1967	21.50	18.48	18.49	18.50	28.87
1968	24.22	20.57	20.59	20.59	30.66
1969	22.13	22.20	22.22	22.22	33.64
1970	27.48	23.98	24.00	24.00	34.53
1971	25.21	26.51	26.53	26.53	39.70
1972	28.03	29.28	29.31	29.31	41.50
1973	35.43	32.22	32.26	32.26	45.90

CIT (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	RC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	5% Increase in UT of OPT/UT Eq.11
1952	7.759	7.761	7.764	7.763	7.767
1953	8.183	8.185	8.188	8.187	8.192
1954	8.924	8.925	8.028	8.928	8.932
1955	9.595	9.597	9.599	9.599	9.602
1956	9.937	9.938	9.941	9.940	9.944
1957	10.47	10.48	10.48	10.48	10.48
1958	10.94	10.95	10.95	10.95	10.95
1959	11.87	11.87	11.88	11.88	11.88
1960	12.53	12.53	12.53	12.53	12.54
1961	13.18	13.18	13.19	13.19	13.19
1962	14.09	14.09	14.09	14.09	14.10
1963	14.74	14.74	14.74	14.74	14.75
1964	14.84	14.85	14.85	14.85	14.85
1965	16.52	16.53	16.53	16.53	16.54
1966	17.56	17.56	17.57	17.57	17.57
1967	18.48	18.49	18.50	18.49	18.51
1968	20.58	20.58	20.59	20.59	20.60
1969	22.21	22.21	22.22	22.22	22.23
1970	23.99	23.99	24.00	24.00	24.01
1971	26.51	26.52	26.53	26.53	26.54
1972	29.29	29.30	29.31	29.30	29.32
1973	32.24	32.25	32.26	32.25	32.27

GST (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	41.00	38.28	38.33	38.33	38.30
1953	43.30	40.48	40.53	40.54	40.50
1954	43.50	43.16	43.21	43.22	43.18
1955	46.25	45.52	45.57	45.57	45.54
1956	49.16	47.02	47.07	47.08	47.05
1957	49.75	48.73	48.80	48.80	48.76
1958	50.66	50.47	50.54	50.54	50.50
1959	54.84	52.49	52.56	52.56	52.52
1960	56.20	55.05	55.13	55.14	55.09
1961	58.19	57.20	57.28	57.29	57.24
1962	60.36	59.62	59.71	59.72	59.66
1963	62.85	61.56	61.65	61.66	61.61
1964	66.42	63.78	63.87	63.88	63.80
1965	69.22	66.16	66.26	66.27	66.21
1966	74.10	70.68	70.82	70.83	70.76
1967	75.74	74.74	74.89	74.90	74.81
1968	79.54	78.87	79.03	79.05	78.96
1969	87.00	82.86	83.06	83.08	82.98
1970	93.84	90.55	90.78	90.80	90.71
1971	101.2	97.04	97.29	97.31	97.20
1972	113.2	101.9	102.2	102.2	102.1
1973	125.1	109.3	109.8	109.8	109.7

GST (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	RC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	5% Increase in UT of OPT/UT Eq.11
1952	46.55	38.29	38.33	38.32	38.39
1953	49.26	40.49	40.54	40.53	40.60
1954	52.52	43.17	43.22	43.21	43.29
1955	54.98	45.52	45.57	45.56	45.64
1956	57.11	47.03	47.08	47.07	47.15
1957	59.50	48.75	48.81	48.79	48.88
1958	61.42	50.48	50.55	50.53	50.62
1959	63.71	52.50	52.57	52.55	52.64
1960	67.28	55.07	55.14	55.12	55.22
1961	69.78	57.22	57.29	57.27	57.37
1962	63.17	59.65	59.72	59.70	59.81
1963	75.20	61.59	61.66	61.65	61.76
1964	78.03	63.81	63.88	63.86	63.98
1965	81.27	66.20	66.27	66.25	66.37
1966	86.55	70.75	70.82	70.81	70.93
1967	91.84	74.81	74.89	74.87	75.01
1968	96.50	78.96	79.04	79.02	79.16
1969	101.5	82.99	83.07	83.05	83.20
1970	111.2	90.70	90.79	90.77	90.93
1971	119.4	97.21	97.30	97.28	97.45
1972	126.3	102.1	102.2	102.2	102.4
1973	136.9	109.7	109.8	109.7	109.9

MFT (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	42.51	41.50	41.56	41.57	41.52
1953	44.80	43.88	43.96	43.96	43.91
1954	46.56	46.11	46.19	46.19	46.14
1955	47.90	47.93	48.01	48.02	47.97
1956	51.57	50.03	50.11	50.12	50.07
1957	52.78	52.62	52.71	52.72	52.66
1958	57.12	54.31	54.41	54.42	54.36
1959	56.34	56.47	56.59	56.60	56.53
1960	58.56	58.98	59.10	59.11	59.04
1961	59.90	60.93	61.06	61.07	61.00
1962	62.63	63.17	63.31	63.32	63.24
1963	65.28	65.26	65.41	65.42	65.33
1964	67.50	67.47	67.61	67.63	67.51
1965	70.48	70.75	70.92	70.93	70.83
1966	74.55	73.77	73.97	73.98	73.88
1967	77.89	77.58	77.81	77.82	77.70
1968	80.74	81.09	81.34	81.35	81.23
1969	86.22	85.30	85.61	85.63	85.49
1970	90.89	89.29	89.64	89.66	89.53
1971	96.67	93.42	93.79	93.82	93.66
1972	102.9	97.57	98.03	98.06	97.91
1973	109.3	104.4	105.0	105.0	104.9

MFT (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	5% Increase in UT of OPT/UT Eq.11
1952	41.47	46.59	41.58	41.56	41.67
1953	43.85	49.39	43.97	43.95	44.07
1954	46.07	51.96	46.20	46.18	46.30
1955	47.90	54.04	48.03	48.01	48.13
1956	49.99	56.35	50.13	50.11	50.24
1957	52.59	59.47	52/73	52.71	52.85
1958	54.28	61.33	54.43	54.41	54.55
1959	56.45	64.11	56.60	56.58	56.73
1960	58.96	66.57	59.11	59.09	59.24
1961	60.92	68.84	61.08	61.05	61.21
1962	63.17	71.29	63.33	63.30	63.46
1963	65.26	73.77	65.42	65.39	65.56
1964	67.46	76.34	67.63	67.60	67.78
1965	70.76	80.00	70.93	70.90	71.09
1966	73.80	83.50	73.98	73.95	74.14
1967	77.63	87.96	77.82	77.79	78.00
1968	81.15	92.01	81.35	81.32	81.53
1969	85.42	96.75	85.62	95.59	85.81
1970	89.43	101.6	89.65	89.61	89.85
1971	93.57	106.5	93.80	93.77	94.02
1972	97.79	111.6	98.03	98.00	98.27
1973	104.8	119.6	105.0	105.0	105.2

VOT (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	23.69	22.50	22.56	22.56	22.52
1953	25.25	24.65	24.71	24.71	24.67
1954	27.03	26.07	26.13	26.14	26.10
1955	29.12	28.47	28.53	28.54	28.50
1956	32.66	30.09	30.16	30.17	30.12
1957	33.41	32.69	32.78	32.78	32.73
1958	34.59	33.57	33.66	33.66	33.61
1959	36.17	34.42	34.51	34.52	34.46
1960	38.45	35.85	35.96	35.96	35.90
1961	39.50	38.21	38.33	38.34	38.28
1962	41.27	40.10	40.23	40.24	40.16
1963	43.37	41.99	42.13	42.14	42.06
1964	46.09	44.62	44.76	44.77	44.66
1965	48.23	47.53	47.69	47.70	47.61
1966	51.54	49.79	49.98	49.99	49.90
1967	53.44	52.92	53.14	53.16	53.04
1968	57.47	55.98	56.21	56.23	56.11
1969	61.71	58.74	59.04	59.06	58.92
1970	65.70	62.73	63.07	63.10	62.97
1971	68.08	65.79	66.16	66.19	66.03
1972	73.28	69.48	69.93	69.96	69.81
1973	77.37	73.72	74.34	74.39	74.22

VOT (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	5% Increase in UT of OPT/UT Eq.11
1952	22.48	22.51	21.32	22.55	22.64
1953	24.63	24.66	23.48	24.70	24.79
1954	26.04	26.08	24.86	26.13	26.22
1955	28.44	28.47	27.26	28.53	28.63
1956	30.06	30.10	28.84	30.16	30.26
1957	32.66	32.70	31.39	32.77	32.89
1958	33.54	33.58	32.24	33.65	33.77
1959	34.40	34.43	33.06	34.50	34.63
1960	35.83	35.88	34.47	35.95	36.08
1961	38.21	38.25	36.83	38.33	38.47
1962	40.09	40.14	38.74	40.22	40.36
1963	41.99	42.04	40.62	42.12	42.27
1964	44.62	44.67	43.26	44.75	44.91
1965	47.53	47.59	46.18	47.67	47.85
1966	49.82	49.88	48.46	49.96	50.14
1967	52.97	53.04	51.62	53.12	53.32
1968	56.04	56.11	54.73	56.19	56.40
1969	58.85	58.92	57.50	59.02	59.24
1970	62.87	62.95	61.55	63.05	63.28
1971	65.94	66.03	64.61	66.14	66.38
1972	69.70	69.80	68.45	69.90	70.16
1973	74.11	74.21	72.88	74.31	74.59

DGT (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	3.211	2.678	2.690	2.691	2.682
1953	3.002	3.463	3.475	3.476	3.468
1954	3.342	3.524	3.535	3.536	3.528
1955	3.354	3.570	3.581	3.583	3.575
1956	3.987	3.877	3.889	3.890	3.883
1957	4.068	4.037	4.053	4.054	4.045
1958	5.049	4.574	4.590	4.592	4.581
1959	5.188	4.757	4.779	4.781	4.768
1960	6.398	5.648	5.671	5.673	5.660
1961	7.140	5.906	5.937	5.939	5.922
1962	7.288	6.955	6.991	6.994	6.972
1963	7.112	7.609	7.645	7.648	7.627
1964	9.555	7.874	7.908	7.911	7.885
1965	9.809	7.863	7.913	7.917	7.888
1966	12.90	9.933	9.992	9.996	9.967
1967	13.32	10.22	10.30	10.31	10.26
1968	12.99	12.97	13.05	13.06	13.02
1969	14.58	13.70	13.81	13.81	13.77
1970	14.46	14.08	14.21	14.21	14.17
1971	16.72	15.82	15.94	15.95	15.90
1972	18.73	16.34	16.51	16.53	16.47
1973	17.49	18.39	18.64	18.65	18.59

DGT (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	5% Increase in UT of OPT/UT Eq.11
1952	2.672	2.679	2.692	3.058	2.708
1953	3.458	3.405	3.477	3.837	3.492
1954	3.519	3.535	3.537	3.877	3.551
1955	3.564	3.570	3.584	3.965	3.599
1956	3.871	3.878	3.891	4.276	3.907
1957	4.032	4.040	4.056	4.514	4.075
1958	4.569	4.577	4.593	5.064	4.612
1959	4.753	4.761	4.782	5.370	4.806
1960	5.644	5.654	5.675	6.283	5.699
1961	5.904	5.916	5.941	6.694	5.971
1962	6.954	6.968	6.995	7.841	7.029
1963	7.609	7.622	7.649	8.516	7.684
1964	7.873	7.886	7.911	8.762	7.947
1965	7.864	7.883	7.917	9.064	7.965
1966	9.943	9.962	9.996	11.18	10.04
1967	9.920	9.926	10.31	11.88	10.37
1968	12.99	9.985	13.06	14.69	13.13
1969	13.74	13.77	13.81	15.42	13.88
1970	14.13	14.16	14.21	16.03	14.28
1971	15.87	15.90	15.94	17.77	16.02
1972	16.43	16.46	16.52	18.64	16.60
1973	18.55	18.59	18.64	21.04	18.73

RS (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	1948.	1794.	1796.	1796.	1795.
1953	2025.	1887.	1888.	1888.	1887.
1954	2100.	2031.	2032.	2032.	2031.
1955	2176.	2136.	2138.	2138.	2137.
1956	2251.	2200.	2201.	2201.	2201.
1957	2326.	2283.	2285.	2285.	2284.
1958	2402.	2385.	2387.	2387.	2386.
1959	2501.	2504.	2505.	2506.	2504.
1960	2602.	2637.	2639.	2639.	2638.
1961	2702.	2744.	2746.	2746.	2745.
1962	2800.	2872.	2874.	2874.	2873.
1963	2901.	2963.	2966.	2966.	2965.
1964	3246.	3074.	3076.	3076.	3074.
1965	2406.	3196.	3200.	3200.	3198.
1966	3535.	3349.	3353.	3353.	3351.
1967	3649.	3559.	3564.	3564.	3562.
1968	4110.	3801.	3806.	3806.	3804.
1969	4389.	4041.	4047.	4048.	4045.
1970	4406.	4354.	4361.	4362.	4359.
1971	4921.	4664.	4672.	4672.	4669.
1972	5405.	5027.	5036.	5037.	5034.
1973	6072.	5334.	5347.	5348.	5345.

RS (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	5% Increase in UT of OPT/UT Eq.11
1952	1794.	1794.	1796.	1796.	1798.
1953	1886.	1887.	1888.	1888.	1890.
1954	2030.	2031.	2032.	2032.	2034.
1955	2136.	2137.	2138.	2138.	2140.
1956	2199.	2200.	2202.	2201.	2203.
1957	2283.	2284.	2285.	2285.	2287.
1958	2385.	2386.	2387.	2387.	2389.
1959	2503.	2504.	2506.	2505.	2508.
1960	2637.	2638.	2639.	2639.	2642.
1961	2744.	2744.	2746.	2746.	2749.
1962	2872.	2873.	2874.	2874.	2877.
1963	2963.	2964.	2966.	2966.	2969.
1964	3073.	3074.	3076.	3096.	3079.
1965	3197.	3198.	3200.	3199.	3203.
1966	3350.	3351.	3353.	3353.	3356.
1967	3560.	3562.	3564.	3563.	3567.
1968	3802.	3804.	3806.	3805.	3809.
1969	4044.	4045.	4048.	4047.	4052.
1970	4357.	4359.	4362.	4361.	4366.
1971	4667.	4669.	4672.	4671.	4676.
1972	5032.	5034.	5037.	5036.	5041.
1973	5342.	5345.	5347.	5347.	5353.

FC (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	805.7	782.9	783.9	784.0	783.3
1953	825.7	840.2	841.4	841.5	840.7
1954	841.1	888.5	889.6	889.7	889.0
1955	940.2	920.0	921.1	921.2	920.5
1956	968.8	964.5	965.8	966.0	965.1
1957	969.8	1017.	1018.	1018.	1017.
1958	1035.	1031.	1033.	1033.	1032.
1959	1141.	1070.	1072.	1072.	1071.
1960	1190.	1124.	1126.	1126.	1125.
1961	1183.	1140.	1142.	1142.	1141.
1962	1228.	1175.	1177.	1178.	1176.
1963	1246.	1196.	1198.	1199.	1197.
1964	1273.	1218.	1221.	1221.	1219.
1965	1347.	1283.	1286.	1286.	1284.
1966	1419.	1337.	1341.	1341.	1339.
1967	1447.	1414.	1418.	1418.	1416.
1968	1526.	1480.	1483.	1484.	1482.
1969	1597.	1567.	1572.	1573.	1570.
1970	1694.	1641.	1646.	1646.	1644.
1971	1762.	1713.	1719.	1719.	1717.
1972	1837.	1793.	1800.	1800.	1798.
1973	1921.	1978.	1987.	1987.	1985.

FC (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	5% Increase in UT of OPT/UT Eq.11
1952	782.4	783.0	784.2	783.9	785.5
1953	839.8	840.4	841.6	841.3	843.1
1954	888.0	888.6	889.9	889.6	891.4
1955	919.4	920.0	921.3	921.0	922.8
1956	963.9	964.6	966.1	965.7	967.8
1957	1016.	1017.	1018.	1018.	1020.
1958	1031.	1032.	1033.	1033.	1035.
1959	1070.	1070.	1072.	1072.	1074.
1960	1123.	1124.	1126.	1125.	1128.
1961	1140.	1141.	1142.	1142.	1144.
1962	1175.	1176.	1178.	1177.	1180.
1963	1196.	1197.	1199.	1198.	1201.
1964	1218.	1219.	1221.	1220.	1223.
1965	1283.	1284.	1286.	1285.	1288.
1966	1338.	1339.	1341.	1340.	1343.
1967	1415.	1416.	1418.	1418.	1421.
1968	1481.	1482.	1484.	1483.	1486.
1969	1569.	1570.	1572.	1572.	1575.
1970	1643.	1644.	1646.	1645.	1649.
1971	1715.	1717.	1719.	1718.	1722.
1972	1796.	1798.	1800.	1799.	1803.
1973	1983.	1985.	1987.	1986.	1990.

VR (Million)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	0.892	0.832	0.834	0.835	0.833
1953	0.929	0.892	0.894	0.894	0.893
1954	0.963	0.927	0.929	0.929	0.928
1955	1.026	0.989	0.991	0.991	0.990
1956	1.052	1.026	1.029	1.029	1.027
1957	1.072	1.090	1.093	1.093	1.092
1958	1.090	1.106	1.109	1.109	1.108
1959	1.143	1.118	1.121	1.122	1.120
1960	1.884	1.148	1.151	1.152	1.150
1961	1.222	1.200	1.204	1.204	1.202
1962	1.275	1.239	1.243	1.243	1.241
1963	1.333	1.276	1.280	1.280	1.278
1964	1.380	1.332	1.336	1.336	1.333
1965	1.438	1.392	1.397	1.397	1.394
1966	1.495	1.435	1.441	1.441	1.438
1967	1.542	1.497	1.503	1.504	1.500
1968	1.610	1.556	1.563	1.563	1.560
1969	1.650	1.606	1.615	1.615	1.612
1970	1.714	1.682	1.691	1.691	1.688
1971	1.808	1.737	1.746	1.747	1.743
1972	1.887	1.801	1.813	1.814	1.810
1973	1.985	1.876	1.892	1.893	1.889

VR (Million)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	5% Increase in UT of OPT/UT Eq.11
1952	0.831	0.833	0.835	0.834	0.837
1953	0.891	0.892	0.895	0.894	0.897
1954	0.926	0.927	0.930	0.929	0.932
1955	0.988	0.989	0.991	0.991	0.994
1956	1.025	1.026	1.029	1.028	1.032
1957	1.090	1.091	1.093	1.093	1.097
1958	1.106	1.107	1.110	1.109	1.113
1959	1.118	1.119	1.122	1.121	1.125
1960	1.147	1.149	1.152	1.151	1.155
1961	1.200	1.201	1.204	1.203	1.208
1962	1.239	1.240	1.243	1.243	1.247
1963	1.276	1.278	1.281	1.280	1.284
1964	1.331	1.333	1.336	1.335	1.340
1965	1.392	1.394	1.397	1.396	1.401
1966	1.436	1.438	1.441	1.440	1.446
1967	1.499	1.500	1.504	1.503	1.508
1968	1.558	1.560	1.563	1.562	1.568
1969	1.610	1.612	1.615	1.614	1.620
1970	1.686	1.688	1.691	1.690	1.696
1971	1.740	1.743	1.746	1.745	1.750
1972	1.807	1.819	1.813	1.812	1.819
1973	1.886	1.889	1.892	1.891	1.898

DTHR (per 1,000 persons)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	8.900	9.113	9.124	9.125	9.117
1953	8.998	9.167	9.178	9.179	9.171
1954	9.198	9.209	9.219	9.220	9.213
1955	8.998	9.257	9.268	9.269	9.262
1956	9.300	9.299	9.310	9.311	9.304
1957	9.602	9.375	9.387	9.388	9.380
1958	9.699	9.433	9.445	9.446	9.439
1959	9.699	9.472	9.485	9.486	9.478
1960	9.796	9.514	9.528	9.529	9.521
1961	9.699	9.579	9.594	9.596	9.587
1962	9.796	9.631	9.646	9.648	9.638
1963	9.796	9.676	9.692	9.693	9.684
1964	9.796	9.739	9.754	9.755	9.744
1965	9.602	9.804	9.821	9.822	9.813
1966	10.10	9.845	9.864	9.865	9.856
1967	10.00	9.915	9.936	9.938	9.926
1968	10.20	9.974	9.995	9.997	9.986
1969	10.10	10.04	10.07	10.07	10.06
1970	10.30	10.11	10.14	10.14	10.13
1971	9.60	10.19	10.22	10.22	10.21
1972	10.30	10.20	10.24	10.24	10.23
1973	10.10	10.28	10.32	10.32	10.31

DTHR (per 1,000 persons)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	5% Increase in UT of OPT/UT Eq.11
1952	9.109	9.114	9.126	9.123	9.139
1953	9.163	9.168	9.180	9.177	9.193
1954	9.204	9.209	9.221	9.218	9.235
1955	9.252	9.258	9.270	9.267	9.283
1956	9.294	9.300	9.312	9.309	9.325
1957	0.371	9.377	9.389	9.386	9.403
1958	0.429	9.435	9.447	9.445	9.462
1959	9.469	9.474	9.487	9.484	9.501
1960	9.511	9.518	9.530	9.527	9.545
1961	9.578	9.584	9.596	9.593	9.611
1962	9.630	9.636	9.648	9.645	9.663
1963	9.676	9.682	9.694	9.691	9.709
1964	9.738	9.744	9.756	9.753	9.771
1965	9.805	9.811	9.822	9.820	9.838
1966	9.848	9.854	9.865	9.862	9.880
1967	9.920	9.926	9.937	9.934	9.954
1968	9.979	9.975	9.996	9.993	10.01
1969	10.05	10.06	10.07	10.07	10.09
1970	10.12	10.13	10.14	10.14	10.16
1971	10.20	10.21	10.22	10.22	10.23
1972	10.22	10.23	10.24	10.23	10.25
1973	10.30	10.31	10.32	10.32	10.34

P (Million)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	2.183	2.150	2.154	2.155	2.152
1953	2.141	2.171	2.176	2.176	2.173
1954	2.157	2.191	2.195	2.195	2.192
1955	2.186	2.206	2.210	2.210	2.208
1956	2.239	2.227	2.231	2.232	2.229
1957	2.273	2.256	2.261	2.261	2.258
1958	2.271	2.280	2.285	2.286	2.283
1959	2.301	2.297	2.302	2.302	2.299
1960	2.328	2.314	2.302	2.320	2.317
1961	2.353	2.341	2.347	2.347	2.344
1962	2.378	2.360	2.367	2.367	2.363
1963	2.403	2.381	2.387	2.388	2.384
1964	2.428	2.405	2.412	2.412	2.407
1965	2.453	2.434	2.440	2.441	2.437
1966	2.478	2.453	2.461	2.461	2.457
1967	2.510	2.483	2.490	2.491	2.486
1968	2.525	2.505	2.515	2.515	2.511
1969	2.542	2.537	2.548	2.549	2.544
1970	2.559	2.563	2.575	2.575	2.571
1971	2.610	2.595	2.607	2.608	2.603
1972	2.633	2.614	2.629	2.630	2.625
1973	2.663	2.635	2.654	2.655	2.656

P (Million)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	5% Increase in UT of OPT/UT Eq.11
1952	2.418	2.150	2.155	2.154	2.161
1953	2.170	2.172	2.177	2.176	2.182
1954	2.189	2.191	2.196	2.195	2.201
1955	2.204	2.206	2.211	2.210	2.216
1956	2.225	2.227	2.232	2.231	2.238
1957	2.254	2.257	2.261	2.260	2.267
1958	2.279	2.281	2.286	2.285	2.292
1959	2.296	2.298	2.303	2.301	2.308
1960	2.313	2.315	2.320	2.319	2.326
1961	2.340	2.343	2.347	2.346	2.353
1962	2.360	2.362	2.367	2.366	2.373
1963	2.381	2.383	2.388	2.387	2.394
1964	2.405	2.408	2.412	2.411	2.419
1965	2.434	2.436	2.441	2.440	2.448
1966	2.454	2.457	2.461	2.460	2.468
1967	2.484	2.486	2.491	2.490	2.498
1968	2.508	2.510	2.515	2.514	2.522
1969	2.541	2.544	2.548	2.547	2.555
1970	2.568	2.571	2.575	2.574	2.582
1971	2.600	2.603	2.608	2.607	2.615
1972	2.621	2.624	2.629	2.628	2.636
1973	2.647	2.650	2.654	2.653	2.661

PY (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	3087.	2679.	2682.	2682.	2680.
1953	3201.	2921.	2924.	2925.	2923.
1954	3193.	3216.	3219.	3219.	3217.
1955	3390.	3400.	3403.	3404.	3402.
1956	3591.	3506.	3509.	3509.	3507.
1957	3744.	3647.	3651.	3651.	3649.
1958	4037.	3841.	3845.	3845.	3843.
1959	4194.	4125.	4130.	4130.	4128.
1960	4390.	4405.	4410.	4411.	4408.
1961	4598.	4578.	4583.	4584.	4581.
1962	4737.	4865.	4871.	4872.	4868.
1963	4937.	4965.	4971.	4972.	4968.
1964	5280.	5190.	5196.	5197.	5192.
1965	5711.	5427.	5434.	5435.	5431.
1966	6185.	5760.	5769.	5770.	5765.
1967	6751.	6244.	6254.	6255.	6249.
1968	7322.	6807.	6819.	6820.	6814.
1969	7928.	7223.	7239.	7240.	7233.
1970	8696.	7965.	7983.	7984.	7977.
1971	9239.	8667.	8687.	8689.	8680.
1972	10100.	9462.	9488.	9489.	9481.
1973	11560.	11060.	10090.	10090.	10080.

PY (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	5% Increase in UT of OPT/UT Eq.11
1952	2678.	2680.	2683.	2682.	2686.
1953	2920.	2922.	2925.	2924.	2929.
1954	3214.	3216.	3219.	3218.	3223.
1955	3399.	3401.	3404.	3403.	3408.
1956	3504.	3506.	3510.	3509.	3514.
1957	3646.	3648.	3651.	3651.	3656.
1958	3840.	3841.	3945.	3844.	3850.
1959	4124.	4126.	4131.	4130.	4136.
1960	4404.	4407.	4411.	4410.	4416.
1961	4577.	4580.	4584.	4583.	4590.
1962	4865.	4867.	4872.	4871.	4878.
1963	4965.	4967.	4972.	4971.	4978.
1964	5190.	5192.	5197.	5196.	5203.
1965	5427.	5430.	5435.	5434.	5442.
1966	5761.	5764.	5770.	5768.	5777.
1967	6246.	6249.	6255.	6254.	6263.
1968	6810.	6814.	6820.	6818.	6829.
1969	7229.	7233.	7239.	7238.	7249.
1970	7972.	7976.	7983.	7982.	7994.
1971	8675.	8680.	8688.	8686.	8700.
1972	9475.	9480.	9488.	9486.	9501.
1973	10080.	10080.	10090.	10090.	10110.

P21Ø (Million)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	1.320	1.286	1.290	1.290	1.288
1953	1.273	1.301	1.305	1.305	1.303
1954	1.281	1.316	1.319	1.319	1.317
1955	1.305	1.327	1.330	1.330	1.328
1956	1.353	1.342	1.346	1.346	1.344
1957	1.380	1.364	1.368	1.368	1.366
1958	1.372	1.382	1.386	1.386	1.384
1959	1.395	1.394	1.398	1.398	1.396
1960	1.416	1.406	1.411	1.411	1.409
1961	1.410	1.427	1.431	1.432	1.429
1962	1.454	1.417	1.422	1.422	1.420
1963	1.473	1.457	1.462	1.462	1.460
1964	1.492	1.477	1.481	1.482	1.478
1965	1.511	1.497	1.502	1.502	1.499
1966	1.530	1.510	1.516	1.517	1.514
1967	1.554	1.533	1.539	1.540	1.536
1968	1.564	1.550	1.557	1.558	1.554
1969	1.575	1.575	1.583	1.584	1.580
1970	1.586	1.595	1.604	1.605	1.602
1971	1.627	1.621	1.630	1.630	1.627
1972	1.650	1.633	1.644	1.645	1.641
1973	1.680	1.649	1.664	1.665	1.661

P21Ø (Million)

Year	Static Simulation Results of 5 Percent Increase in Parameter of RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	5% Increase in UT of OPT/UT Eq.11
1952	1.285	1.287	1.290	1.289	1.294
1953	1.300	1.302	1.305	1.305	1.310
1954	1.314	1.316	1.319	1.318	1.323
1955	1.325	1.327	1.330	1.329	1.334
1956	1.341	1.343	1.346	1.345	1.350
1957	1.363	1.365	1.368	1.368	1.373
1958	1.381	1.383	1.386	1.386	1.391
1959	1.393	1.395	1.399	1.398	1.403
1960	1.406	1.408	1.411	1.410	1.416
1961	1.426	1.428	1.432	1.431	1.436
1962	1.417	1.419	1.422	1.422	1.427
1963	1.457	1.459	1.462	1.462	1.467
1964	1.476	1.478	1.482	1.481	1.487
1965	1.497	1.499	1.503	1.502	1.507
1966	1.511	1.513	1.517	1.516	1.522
1967	1.534	1.536	1.540	1.539	1.545
1968	1.552	1.554	1.558	1.557	1.563
1969	1.578	1.580	1.584	1.583	1.589
1970	1.599	1.601	1.605	1.604	1.610
1971	1.624	1.627	1.630	1.629	1.635
1972	1.638	1.641	1.644	1.643	1.650
1973	1.658	1.661	1.664	1.663	1.669

P65Ø (Million)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	0.204	0.207	0.208	0.208	0.207
1953	0.209	0.211	0.212	0.212	0.211
1954	0.214	0.215	0.216	0.216	0.215
1955	0.220	0.218	0.219	0.219	0.219
1956	0.225	0.222	0.223	0.223	0.223
1957	0.231	0.228	0.229	0.229	0.229
1958	0.237	0.233	0.234	0.235	0.234
1959	0.243	0.237	0.238	0.238	0.237
1960	0.249	0.241	0.242	0.242	0.241
1961	0.253	0.246	0.248	0.248	0.247
1962	0.256	0.251	0.252	0.252	0.251
1963	0.260	0.255	0.257	0.257	0.256
1964	0.264	0.261	0.262	0.262	0.261
1965	0.268	0.267	0.269	0.269	0.268
1966	0.272	0.271	0.273	0.273	0.272
1967	0.278	0.278	0.280	0.280	0.279
1968	0.283	0.283	0.285	0.286	0.285
1969	0.288	0.291	0.293	0.293	0.292
1970	0.300	0.297	0.300	0.300	0.299
1971	0.314	0.305	0.308	0.308	0.307
1972	0.317	0.309	0.313	0.313	0.312
1973	0.321	0.315	0.319	0.320	0.318

P65Ø (Million)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	5% Increase in UT of OPT/UT Eq.11
1952	0.206	0.207	0.208	0.208	0.209
1953	0.211	0.211	0.212	0.212	0.213
1954	0.214	0.215	0.216	0.216	0.217
1955	0.218	0.218	0.219	0.219	0.220
1956	0.222	0.222	0.223	0.223	0.225
1957	0.228	0.229	0.230	0.229	0.231
1958	0.233	0.234	0.235	0.234	0.236
1959	0.237	0.237	0.238	0.238	0.239
1960	0.240	0.241	0.242	0.242	0.243
1961	0.246	0.247	0.248	0.248	0.249
1962	0.251	0.251	0.252	0.252	0.254
1963	0.255	0.256	0.257	0.257	0.258
1964	0.261	0.261	0.262	0.262	0.264
1965	0.267	0.268	0.269	0.268	0.270
1966	0.272	0.272	0.273	0.273	0.275
1967	0.278	0.279	0.280	0.280	0.281
1968	0.284	0.284	0.286	0.285	0.287
1969	0.292	0.292	0.293	0.293	0.295
1970	0.298	0.299	0.300	0.300	0.302
1971	0.306	0.307	0.308	0.308	0.310
1972	0.311	0.312	0.313	0.313	0.315
1973	0.318	0.318	0.319	0.319	0.321

WS (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	1755.	1634.	1635.	1635.	1634.
1953	1861.	1737.	1739.	1739.	1738.
1954	1962.	1890.	1891.	1892.	1891.
1955	2104.	2012.	2014.	2014.	2013.
1956	2260.	2096.	2097.	2098.	2097.
1957	2323.	2202.	2204.	2204.	2203.
1958	2387.	2327.	2329.	2329.	2328.
1959	2521.	2471.	2473.	2473.	2472.
1960	2597.	2634.	2637.	2637.	2635.
1961	2701.	2770.	2772.	2773.	2771.
1962	2883.	2930.	2932.	2932.	2931.
1963	2986.	3065.	3067.	3067.	3066.
1964	3192.	3213.	3215.	3215.	3213.
1965	3390.	3380.	3383.	3383.	3381.
1966	3719.	3583.	3587.	3587.	3585.
1967	4057.	3853.	3857.	3857.	3855.
1968	4459.	4166.	4172.	4172.	4169.
1969	4872.	4481.	4488.	4489.	4486.
1970	5323.	4881.	4890.	4891.	4888.
1971	5646.	5298.	5307.	5307.	5304.
1972	6171.	5766.	5777.	5778.	5774.
1973	6815.	6190.	6205.	6207.	6202.

WS (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	5% Increase in UT of OPT/UT Eq.11
1952	1633.	1634.	1635.	1935.	1636.
1953	1737.	1737.	1739.	1738.	1740.
1954	1890.	1890.	1892.	1891.	1893.
1955	2012.	2012.	2014.	2014.	2016.
1956	2095.	2096.	2098.	2097.	2100.
1957	2201.	2202.	2204.	2204.	2206.
1958	2327.	2327.	2329.	2329.	2331.
1959	2470.	2471.	2473.	2473.	2475.
1960	2634.	2635.	2637.	2636.	2639.
1961	2770.	2771.	2773.	2772.	2775.
1962	2930.	2931.	2932.	2932.	2935.
1963	3065.	3066.	3068.	3067.	3070.
1964	3212.	3213.	3215.	3215.	3218.
1965	3380.	3381.	3383.	3383.	3386.
1966	3583.	3585.	3587.	3586.	3590.
1967	3854.	3855.	3857.	3857.	3861.
1968	4168.	4169.	4172.	4171.	4176.
1969	4484.	4486.	4489.	4488.	4493.
1970	4886.	4888.	4891.	4890.	4895.
1971	5301.	5304.	5307.	5306.	5312.
1972	5771.	5774.	5777.	5776.	5783.
1973	6200.	6202.	6206.	6205.	6212.

EXRT (Unit)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	2.977	2.917	2.916	2.916	2.917
1953	2.806	2.910	2.909	2.909	2.910
1954	2.881	2.904	2.903	2.903	2.904
1955	2.818	2.901	2.900	2.900	2.900
1956	2.855	2.896	2.895	2.895	2.896
1957	2.904	2.890	2.889	2.889	2.890
1958	2.934	2.885	2.883	2.883	2.884
1959	2.919	2.881	2.880	2.880	2.880
1960	2.899	2.877	2.875	2.875	2.876
1961	2.934	2.871	2.869	2.869	2.870
1962	2.842	2.865	2.864	2.864	2.865
1963	2.916	2.861	2.860	2.860	2.860
1964	2.928	2.855	2.853	2.853	2.854
1965	2.819	2.848	2.947	2.847	2.848
1966	2.864	2.844	2.843	2.843	2.843
1967	2.870	2.841	2.839	2.838	2.840
1968	2.809	2.834	2.832	2.831	2.832
1969	2.816	2.826	2.823	2.823	2.824
1970	2.862	2.819	2.817	2.817	2.818
1971	2.772	2.814	2.812	2.812	2.813
1972	2.701	2.810	2.807	2.807	2.808
1973	2.800	2.804	2.801	2.800	2.801

EXRT (Unit)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	5% Increase in UT of OPT/UT Eq.11
1952	2.918	2.917	2.916	2.916	2.914
1953	2.911	2.910	2.909	2.909	2.908
1954	2.905	2.904	2.903	2.903	2.902
1955	2.901	2.901	2.900	2.900	2.898
1956	2.897	2.896	2.895	2.895	2.894
1957	2.891	2.890	2.889	2.889	2.888
1958	2.885	2.884	2.883	2.883	2.882
1959	2.881	2.881	2.880	2.880	2.878
1960	2.877	2.876	2.875	2.876	2.874
1961	2.871	2.870	2.869	2.870	2.868
1962	2.866	2.865	2.864	2.864	2.862
1963	2.861	2.861	2.859	2.860	2.858
1964	2.855	2.854	2.853	2.853	2.852
1965	2.848	2.848	2.847	2.847	2.845
1966	2.844	2.844	2.843	2.843	2.841
1967	2.840	2.840	2.839	2.839	2.837
1968	2.833	2.832	2.831	2.832	2.830
1969	2.925	2.824	2.823	2.823	2.822
1970	2.818	2.818	2.817	2.817	2.815
1971	2.813	2.813	2.812	2.812	2.810
1972	2.809	2.808	2.807	2.808	2.806
1973	2.802	2.801	2.801	2.801	2.799

HS (Million)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	0.677	0.670	0.672	0.672	0.671
1953	0.684	0.679	0.681	0.681	0.679
1954	0.691	0.687	0.688	0.688	0.687
1955	0.698	0.693	0.695	0.695	0.694
1956	0.705	0.701	0.703	0.703	0.702
1957	0.713	0.713	0.715	0.715	0.714
1958	0.720	0.723	0.725	0.725	0.724
1959	0.727	0.730	0.732	0.732	0.731
1960	0.735	0.736	0.739	0.739	0.738
1961	0.746	0.748	0.750	0.750	0.749
1962	0.757	0.756	0.759	0.759	0.757
1963	0.768	0.764	0.767	0.767	0.765
1964	0.779	0.775	0.778	0.778	0.776
1965	0.791	0.787	0.789	0.790	0.788
1966	0.803	0.794	0.797	0.797	0.796
1967	0.814	0.806	0.809	0.810	0.808
1968	0.826	0.817	0.820	0.821	0.819
1969	0.839	0.830	0.834	0.835	0.833
1970	0.851	0.841	0.846	0.847	0.845
1971	0.864	0.855	0.860	0.861	0.858
1972	0.876	0.862	0.868	0.869	0.867
1973	0.889	0.871	0.879	0.880	0.878

HS (Million)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	5% Increase in UT of OPT/UT Eq.11
1952	0.669	0.670	0.672	0.672	0.674
1953	0.678	0.679	0.681	0.680	0.683
1954	0.686	0.687	0.689	0.688	0.691
1955	0.692	0.693	0.695	0.695	0.698
1956	0.701	0.702	0.704	0.703	0.706
1957	0.713	0.713	0.715	0.715	0.718
1958	0.722	0.723	0.725	0.724	0.727
1959	0.729	0.730	0.732	0.732	0.735
1960	0.736	0.737	0.739	0.739	0.742
1961	0.748	0.749	0.751	0.750	0.753
1962	0.756	0.757	0.759	0.759	0.762
1963	0.764	0.765	0.767	0.766	0.769
1964	0.775	0.776	0.778	0.777	0.780
1965	0.787	0.788	0.790	0.789	0.792
1966	0.794	0.795	0.797	0.797	0.800
1967	0.807	0.808	0.810	0.809	0.813
1968	0.818	0.819	0.821	0.820	0.823
1969	0.831	0.833	0.834	0.834	0.837
1970	0.844	0.845	0.847	0.846	0.850
1971	0.857	0.858	0.860	0.860	0.863
1972	0.865	0.867	0.869	0.868	0.872
1973	0.876	0.878	0.879	0.879	0.882

PR (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	1332.	1046.	1047.	1048.	1046.
1953	1340.	1184.	1186.	1186.	1185.
1954	1231.	1325.	1327.	1327.	1326.
1955	1286.	1388.	1390.	1390.	1389.
1956	1331.	1410.	1411.	1412.	1410.
1957	1421.	1445.	1447.	1447.	1446.
1958	1650.	1514.	1516.	1516.	1515.
1959	1673.	1655.	1657.	1658.	1656.
1960	1793.	1771.	1774.	1774.	1772.
1961	1897.	1808.	1811.	1811.	1809.
1962	1854.	1936.	1939.	1940.	1937.
1963	1951.	1900.	1904.	1904.	1902.
1964	2088.	1978.	1981.	1981.	1979.
1965	2321.	2047.	2052.	2052.	2049.
1966	2476.	2177.	2183.	2183.	2180.
1967	2694.	2391.	2397.	2398.	2394.
1968	2863.	2641.	2648.	2648.	2645.
1969	3056.	2741.	2750.	2751.	2747.
1970	3373.	3082.	3092.	3093.	3089.
1971	3593.	3369.	3381.	3381.	3376.
1972	3931.	3697.	3711.	3712.	3707.
1973	4743.	3865.	3886.	3887.	3882.

PR (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	5% Increase in UT of OPT/UT Eq.11
1952	1045.	1046.	1048.	1047.	1050.
1953	1183.	1184.	1186.	1186.	1189.
1954	1324.	1325.	1328.	1327.	1330.
1955	1387.	1388.	1390.	1390.	1392.
1956	1409.	1410.	1412.	1411.	1414.
1957	1444.	1445.	1447.	1447.	1450.
1958	1513.	1514.	1516.	1516.	1519.
1959	1654.	1655.	1658.	1657.	1661.
1960	1770.	1772.	1774.	1774.	1777.
1961	1807.	1809.	1811.	1811.	1815.
1962	1936.	1937.	1940.	1939.	1943.
1963	1900.	1902.	1904.	1904.	1908.
1964	1977.	1979.	1982.	1981.	1985.
1965	2047.	2049.	2052.	2051.	2056.
1966	2178.	2180.	2183.	2182.	2187.
1967	2393.	2394.	2398.	2397.	2403.
1968	2643.	2645.	2648.	2647.	2653.
1969	2745.	2747.	2751.	2750.	2756.
1970	3086.	3089.	3093.	3092.	3099.
1971	3374.	3377.	3381.	3380.	3388.
1972	3703.	3706.	3711.	3710.	3718.
1973	3878.	3881.	3886.	3885.	3894.

OKTT (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	187.8	180.1	174.4	173.9	178.0
1953	196.2	194.2	187.8	187.3	191.6
1954	203.6	206.0	199.9	199.4	203.6
1955	210.4	218.3	212.1	211.5	215.5
1956	229.6	224.6	217.6	217.0	221.1
1957	235.7	239.3	231.2	230.5	235.5
1958	246.5	248.4	239.9	239.2	244.5
1959	256.3	258.7	249.5	248.8	254.3
1960	275.4	272.4	262.2	261.3	267.2
1961	285.1	291.4	279.9	279.0	285.4
1962	307.9	303.6	291.2	290.2	297.8
1963	321.9	327.3	313.9	312.9	320.5
1964	332.3	337.1	323.7	322.7	333.1
1965	357.6	351.4	336.1	335.0	343.8
1966	388.7	382.7	363.9	362.5	371.8
1967	401.0	408.4	386.8	385.2	397.1
1968	427.5	434.2	410.9	409.1	420.9
1969	472.6	462.8	432.8	430.7	444.3
1970	502.1	515.4	480.4	477.8	491.0
1971	540.9	549.1	511.8	509.1	525.0
1972	649.4	605.4	557.9	554.5	570.3
1973	691.2	708.5	635.0	629.8	649.2

OKTT (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	5% Increase in UT of OPT/UT Eq.11
1952	182.5	179.4	173.3	174.9	174.8
1953	196.4	193.2	186.7	188.2	188.2
1954	209.0	205.6	198.7	200.3	200.3
1955	221.3	218.0	210.9	212.5	212.4
1956	227.4	223.8	216.4	218.0	218.0
1957	241.7	237.9	229.9	231.7	231.7
1958	250.6	246.8	238.7	240.5	240.4
1959	260.5	257.0	248.2	250.2	250.0
1960	274.1	269.6	260.9	262.9	262.7
1961	292.2	287.6	278.6	280.8	280.5
1962	304.0	299.2	289.9	292.2	291.8
1963	327.3	322.3	312.6	315.0	314.6
1964	337.7	332.5	322.5	324.8	324.4
1965	351.0	345.2	334.9	337.5	336.9
1966	379.5	373.5	362.7	365.4	364.8
1967	403.6	397.0	385.6	388.6	387.7
1968	428.2	421.6	409.7	412.8	411.8
1969	451.2	444.2	431.8	434.8	434.0
1970	500.7	492.5	479.4	482.6	481.6
1971	533.8	524.6	510.8	514.0	513.0
1972	582.0	571.8	557.1	560.6	559.4
1973	662.4	650.3	634.5	638.3	636.9

PYP (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	2826.	2631.	2632.	2632.	2631.
1953	3004.	2787.	2789.	2789.	2788.
1954	3109.	3038.	3040.	3040.	3039.
1955	3251.	3223.	3224.	3224.	3223.
1956	3418.	3330.	3331.	3331.	3330.
1957	3581.	3474.	3476.	3476.	3475.
1958	3795.	3655.	3657.	3657.	3656.
1959	3987.	3870.	3872.	3872.	3871.
1960	4183.	4115.	4117.	4117.	4116.
1961	4388.	4303.	4305.	4305.	4304.
1962	4567.	4540.	4542.	4542.	4541.
1963	4756.	4707.	4709.	4709.	4708.
1964	5008.	4908.	4910.	4910.	4908.
1965	5332.	5119.	5122.	5123.	5121.
1966	5725.	5409.	4513.	5413.	5411.
1967	6188.	5803.	5808.	5808.	5806.
1968	6701.	6272.	6277.	6278.	6275.
1969	7259.	6726.	6732.	6733.	6730.
1970	7909.	7340.	7348.	7348.	7346.
1971	8525.	7967.	7975.	7976.	7973.
1972	9246.	8689.	8698.	8699.	8696.
1973	10270.	9308.	9322.	9323.	9319.

PYP (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	5% Increase in UT of OPT/UT Eq.11
1952	2631.	2631.	2632.	2632.	2634.
1953	2787.	2787.	2789.	2789.	2790.
1954	3038.	3038.	3040.	3039.	3041.
1955	3222.	3223.	3224.	3224.	3226.
1956	3329.	3330.	3331.	3331.	3333.
1957	3474.	3475.	3476.	3476.	3478.
1958	3655.	3656.	3657.	3657.	3659.
1959	3870.	3871.	3872.	3872.	3875.
1960	4115.	4116.	4117.	4117.	4119.
1961	4303.	4304.	4306.	4305.	4308.
1962	4539.	4540.	4542.	4542.	4545.
1963	4707.	4708.	4709.	3709.	4712.
1964	4907.	4908.	4910.	4910.	4913.
1965	5120.	5121.	5123.	5122.	5125.
1966	5410.	5411.	5413.	5412.	5416.
1967	5804.	5806.	5808.	5807.	5811.
1968	6274.	6275.	6278.	6277.	6281.
1969	6728.	6730.	6732.	6732.	6736.
1970	7344.	7345.	7348.	7347.	7352.
1971	7971.	7973.	7976.	7975.	7980.
1972	8693.	8696.	8699.	8698.	8704.
1973	9317.	9319.	9322.	9321.	9328.

GPT (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq. 1	PR/WS of Eq. 1	EXRT of Eq. 1	RS/P of Eq. 1
1952	26.03	24.98	24.19	24.12	24.69
1953	27.38	27.11	26.22	26.15	26.75
1954	31.11	31.48	30.54	30.47	31.11
1955	29.00	30.08	29.23	29.14	29.70
1956	32.12	31.42	30.44	30.36	30.93
1957	34.01	34.53	33.36	33.26	33.98
1958	34.11	34.38	33.20	33.11	33.84
1959	33.75	34.07	32.86	32.77	33.49
1960	32.97	32.61	31.39	31.28	31.98
1961	33.97	34.71	33.34	33.23	33.99
1962	34.46	33.97	32.59	32.47	33.32
1963	35.63	36.23	34.75	34.64	35.48
1964	37.96	38.53	37.00	36.88	38.07
1965	38.48	37.81	36.16	36.05	36.99
1966	39.92	39.30	37.37	37.23	38.18
1967	45.46	46.31	48.86	43.68	45.03
1968	45.86	46.59	44.09	43.90	45.16
1969	48.22	47.21	44.14	43.93	45.32
1970	50.54	51.90	48.38	48.11	49.44
1971	51.28	52.05	48.52	48.26	49.77
1972	73.34	68.35	62.99	62.60	64.39
1973	96.98	88.35	79.18	78.54	80.96

GPT (Million dollars)

Static Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq. 3	FC/P of Eq. 4	VR/P of Eq. 5	PYP/P of Eq. 6	5% Increase in UT of OPT/UT Eq. 11
1952	25.31	24.88	24.04	24.26	24.24
1953	27.42	26.97	26.06	26.27	26.27
1954	31.94	31.42	30.36	30.61	30.61
1955	30.50	30.04	29.06	29.28	29.27
1956	31.81	31.31	30.27	30.50	30.50
1957	34.88	34.33	33.17	33.43	33.43
1958	34.68	34.16	33.04	33.29	33.27
1959	34.31	33.85	32.69	32.95	32.93
1960	32.81	32.27	31.23	31.47	31.45
1961	34.80	34.25	33.18	33.44	33.41
1962	34.02	33.48	32.44	32.70	32.65
1963	36.23	35.71	34.60	34.87	34.83
1964	38.60	38.01	36.86	37.12	37.08
1965	37.77	37.14	36.04	36.32	36.25
1966	38.97	38.36	37.25	37.53	37.46
1967	45.77	45.02	43.73	44.07	43.97
1968	45.95	45.24	43.96	44.29	44.19
1969	46.02	45.31	44.04	44.35	44.27
1970	50.42	49.59	48.28	48.60	48.50
1971	50.60	49.73	48.42	48.73	48.63
1972	65.71	64.56	62.90	63.29	63.16
1973	82.60	81.09	79.12	79.60	79.42

APPENDIX D

Dynamic Simulation Results

Of Parameter Increase

IT (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	9.696	12.53	6.653	6.148	6.733
1953	9.173	14.71	8.147	7.577	8.223
1954	9.409	11.13	9.086	9.136	9.092
1955	10.43	16.30	10.71	10.14	10.79
1956	12.12	17.06	11.99	11.89	12.01
1957	12.57	18.81	12.41	11.80	12.49
1958	13.49	19.78	13.61	13.45	13.66
1959	14.96	21.63	14.47	13.85	14.56
1960	16.78	24.01	16.43	16.17	16.48
1961	17.88	27.39	18.38	17.69	18.49
1962	19.13	29.63	19.68	19.28	19.77
1963	19.02	32.34	21.70	20.97	21.82
1964	21.78	35.15	22.96	22.40	23.07
1965	26.48	36.54	24.23	23.47	24.37
1966	30.34	40.57	26.76	26.10	26.90
1967	32.44	43.94	29.04	28.20	29.21
1968	41.36	50.85	34.03	33.20	34.20
1969	47.80	58.74	38.78	37.69	39.00
1970	50.53	67.60	44.41	43.27	44.64
1971	63.65	78.23	52.00	50.65	52.28
1972	97.72	106.2	69.71	67.88	70.07
1973	105.1	129.0	85.07	82.90	85.50

IT (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	Increase in UT of OPT/UT of Eq.11 5%	50%
1952	6.726	6.731	6.739	6.737	6.738	6.74
1953	8.216	8.220	8.230	8.228	8.228	8.23
1954	9.097	9.094	9.087	9.088	9.099	9.18
1955	10.78	10.79	10.80	10.80	10.79	10.71
1956	12.02	12.02	12.01	12.01	12.03	12.18
1957	12.48	12.48	12.50	12.50	12.48	12.36
1958	13.67	13.66	13.65	13.65	13.68	13.87
1959	14.55	14.56	14.57	14.57	14.55	14.42
1960	16.50	16.49	16.48	16.48	16.51	16.73
1961	18.47	18.48	18.50	18.49	18.47	18.33
1962	19.78	19.78	19.77	19.77	19.81	20.05
1963	21.80	21.81	21.83	21.83	21.80	21.66
1964	23.08	23.08	23.07	23.07	23.11	23.37
1965	24.35	24.36	24.39	24.38	24.36	24.22
1966	26.91	26.91	26.90	26.90	26.94	27.22
1967	29.19	29.20	29.23	29.22	29.20	29.02
1968	34.21	34.21	34.20	34.20	34.25	34.55
1969	38.98	38.99	39.02	39.01	38.99	38.85
1970	44.65	44.66	44.64	44.64	44.70	45.06
1971	52.26	52.27	52.31	52.30	52.27	52.13
1972	70.08	70.08	70.06	70.07	70.14	70.57
1973	85.48	85.49	85.54	85.53	85.51	85.42

CIT (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	8.852	7.76	7.763	7.763	11.33
1953	8.536	8.184	8.188	8.188	12.02
1954	7.844	8.964	8.696	8.696	9.555
1955	8.150	9.745	9.747	9.747	13.12
1956	9.797	10.30	10.31	10.31	12.46
1957	10.45	10.69	10.70	10.70	14.04
1958	10.84	11.16	11.16	11.16	13.83
1959	11.28	11.96	11.96	11.96	15.44
1960	12.17	12.66	12.67	12.67	15.92
1961	14.68	13.50	13.50	13.50	17.34
1962	14.57	14.39	14.39	14.39	18.32
1963	20.67	15.25	15.25	15.25	19.56
1964	16.86	16.19	16.20	16.20	20.77
1965	17.09	16.27	16.28	16.28	21.13
1966	22.32	18.66	18.67	18.67	23.62
1967	21.50	18.24	18.25	18.25	23.89
1968	24.22	20.85	20.86	20.86	26.36
1969	22.13	22.24	22.25	22.25	28.97
1970	27.48	24.13	24.14	24.14	30.86
1971	25.21	26.16	26.18	26.18	33.99
1972	28.03	29.71	29.73	29.73	38.24
1973	35.43	32.42	32.45	32.45	42.36

CIT (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	Increase in UT of OPT/UT of Eq.11	
					5%	50%
1952	7.759	7.761	7.764	7.763	7.763	7.76
1953	8.183	8.185	8.188	8.187	8.188	8.19
1954	8.694	8.695	8.696	8.696	8.700	8.73
1955	9.744	9.745	9.747	9.747	9.749	9.77
1956	10.30	10.31	10.31	10.31	10.31	10.34
1957	10.69	10.69	10.70	10.69	10.70	10.72
1958	11.16	11.16	11.16	11.16	11.17	11.19
1959	11.96	11.96	11.96	11.96	11.96	11.99
1960	12.66	12.67	12.67	12.67	12.67	12.70
1961	13.50	13.50	13.50	13.50	13.51	13.54
1962	14.39	14.39	14.39	14.39	14.40	14.43
1963	15.25	15.25	15.25	15.25	15.26	15.29
1964	16.19	16.19	16.20	16.19	16.20	16.24
1965	16.27	16.28	16.28	16.28	16.29	16.33
1966	18.67	18.67	18.67	18.67	18.68	18.72
1967	18.24	18.24	18.25	18.25	18.25	18.30
1968	20.86	20.86	20.86	20.86	20.87	20.91
1969	22.24	22.25	22.25	22.25	22.26	22.32
1970	24.13	24.14	24.14	24.14	24.15	24.20
1971	26.17	26.17	26.18	26.18	26.19	26.25
1972	29.72	29.73	29.73	29.73	29.74	29.81
1973	32.44	32.44	32.45	32.45	32.46	32.54

GST (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	41.00	38.28	38.33	38.33	38.30
1953	43.30	40.48	40.53	40.54	40.50
1954	43.50	42.24	42.24	42.24	42.24
1955	46.25	45.26	45.32	45.33	45.29
1956	49.16	47.87	47.87	47.87	47.88
1957	49.75	49.47	49.54	49.55	49.50
1958	50.66	51.11	51.12	51.12	51.13
1959	54.84	53.07	53.15	53.16	53.10
1960	56.20	55.45	55.46	55.45	55.46
1961	58.19	58.67	58.77	58.78	58.72
1962	60.36	60.84	60.86	60.15	60.86
1963	62.85	63.54	63.65	63.66	63.59
1964	66.42	65.89	65.92	65.91	65.92
1965	69.22	68.12	68.23	68.25	68.17
1966	74.10	70.71	70.75	70.74	70.75
1967	75.74	75.73	75.86	75.88	75.79
1968	79.54	78.49	78.54	78.53	78.54
1969	87.00	84.94	85.09	85.11	85.01
1970	93.84	88.37	88.45	88.44	88.45
1971	101.2	98.24	98.43	98.46	98.35
1972	113.2	102.0	102.1	102.1	102.1
1973	125.1	110.5	110.7	110.8	110.6

GST (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	Increase in UT of OPT/UT of Eq.11 5%	: 50%
1952	46.55	38.29	38.33	38.32	38.32	38.32
1953	49.26	40.49	40.54	40.53	40.53	40.53
1954	43.57	42.25	42.24	42.24	42.31	42.81
1955	53.42	45.27	45.33	45.32	45.30	45.18
1956	51.15	47.89	47.87	47.87	47.97	48.68
1957	57.52	49.47	49.56	49.54	49.50	49.22
1958	55.57	51.15	51.11	51.12	51.25	52.17
1959	56.46	53.07	53.17	53.15	53.08	52.64
1960	61.04	55.50	55.44	55.45	55.62	56.74
1961	66.90	58.67	58.79	58.76	58.68	58.10
1962	67.74	60.91	60.84	60.86	61.05	62.36
1963	72.12	63.54	63.67	63.64	63.54	62.83
1964	73.87	65.97	65.90	65.91	66.14	67.61
1965	77.16	68.11	68.26	68.22	68.10	67.30
1966	79.51	70.81	70.73	70.75	70.99	72.61
1967	85.45	75.73	75.89	75.85	75.71	74.83
1968	88.58	78.61	78.51	78.53	78.82	80.61
1969	95.79	84.95	85.13	85.08	84.93	83.97
1970	100.3	88.53	88.42	88.44	88.76	90.71
1971	110.5	98.28	98.47	98.42	98.26	97.28
1972	116.2	102.2	102.1	102.1	102.5	104.6
1973	124.8	110.6	110.8	110.7	110.5	109.5

MFT (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	42.51	41.50	41.56	41.57	41.52
1953	44.80	43.88	43.96	43.96	43.91
1954	46.56	45.96	45.99	45.99	45.98
1955	47.90	47.97	48.04	48.05	48.00
1956	51.57	50.24	50.30	50.31	50.28
1957	52.78	52.78	52.85	52.86	52.81
1958	57.12	54.47	54.54	54.55	54.51
1959	56.34	56.47	56.55	56.56	56.51
1960	58.56	59.12	59.21	59.21	59.17
1961	59.90	61.12	61.22	61.23	61.18
1962	62.63	63.48	63.59	63.59	63.54
1963	65.28	65.49	65.61	65.61	65.56
1964	67.50	67.92	68.05	68.06	68.00
1965	70.48	70.96	71.10	71.10	71.04
1966	74.55	74.18	74.32	74.33	74.27
1967	77.89	77.55	77.71	77.72	77.65
1968	80.74	81.34	81.51	81.52	81.45
1969	86.22	85.40	85.60	85.61	85.53
1970	90.89	89.47	89.69	89.70	89.62
1971	96.67	93.43	93.68	93.69	93.60
1972	102.9	97.66	97.99	98.00	97.91
1973	109.3	104.6	104.9	104.9	104.8

MFT (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	Increase in UT of OPT/UT of Eq.11 5%	50%
1952	41.47	46.59	41.58	41.56	41.56	41.56
1953	43.85	49.39	43.97	43.95	43.96	43.96
1954	45.97	46.83	45.99	45.98	46.10	46.92
1955	47.94	53.27	48.05	48.03	48.05	48.14
1956	50.27	51.99	50.31	50.30	50.42	51.23
1957	52.75	58.06	52.87	52.85	52.88	53.07
1958	54.50	56.89	54.55	54.54	54.66	55.47
1959	56.46	61.75	56.57	56.55	56.59	56.85
1960	59.14	62.21	59.21	59.20	59.32	60.14
1961	61.12	66.52	61.23	61.21	61.26	61.60
1962	63.52	67.16	63.59	63.58	63.70	64.54
1963	65.51	71.05	65.62	65.60	65.66	66.07
1964	67.97	72.14	68.05	68.04	68.17	69.02
1965	70.99	76.83	71.11	71.09	71.16	71.65
1966	74.23	79.05	74.32	74.31	74.44	75.32
1967	77.60	83.85	77.72	77.70	77.78	78.37
1968	81.41	86.91	81.51	81.49	81.63	82.55
1969	85.48	92.30	85.61	85.59	85.69	86.37
1970	89.58	95.86	89.69	89.67	89.82	90.80
1971	93.55	100.9	93.69	93.66	93.78	94.56
1972	97.86	104.9	97.99	97.97	98.13	99.16
1973	104.8	113.2	104.9	104.9	105.0	106.0

VOT (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	23.69	22.50	22.56	22.56	22.52
1953	25.25	24.65	24.71	24.71	24.67
1954	27.03	26.26	26.29	26.30	26.28
1955	29.12	27.69	27.74	27.75	27.71
1956	32.66	30.18	30.23	30.23	30.21
1957	33.41	32.00	32.08	32.08	32.04
1958	34.59	34.60	34.67	34.67	34.64
1959	36.17	35.42	35.50	35.51	35.46
1960	38.45	36.38	36.47	36.47	36.43
1961	39.50	38.05	38.16	38.16	38.11
1962	41.27	40.50	40.60	40.61	40.56
1963	43.37	42.32	42.44	42.45	42.39
1964	46.09	44.56	44.69	44.69	44.64
1965	48.23	47.23	47.37	47.38	47.31
1966	51.54	50.30	50.45	50.45	50.39
1967	53.44	52.72	52.90	52.91	52.83
1968	57.47	56.17	56.35	56.35	56.29
1969	61.71	59.29	59.51	59.53	59.43
1970	65.70	62.46	62.69	62.70	62.62
1971	68.08	66.52	66.80	66.82	66.71
1972	73.28	69.55	69.90	69.92	69.82
1973	77.37	73.32	73.73	73.75	73.62

VOT (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	Increase in UT of OPT/UT of Eq.11 5%	50%
1952	22.48	22.51	21.32	22.55	22.56	22.56
1953	24.63	24.66	23.48	24.70	24.71	24.71
1954	26.27	26.28	26.25	26.29	26.38	27.02
1955	27.66	27.69	26.53	27.74	27.77	27.94
1956	30.19	30.21	30.11	30.23	30.33	31.01
1957	31.99	32.02	30.89	32.07	32.11	32.34
1958	34.62	34.64	34.48	34.67	34.78	35.54
1959	35.41	35.44	34.34	35.50	35.54	35.83
1960	36.41	36.43	36.22	36.46	36.58	37.40
1961	38.05	38.09	37.00	38.15	38.20	38.53
1962	40.54	40.57	40.30	40.60	40.72	41.57
1963	42.34	42.37	41.31	42.43	42.49	42.89
1964	44.61	44.65	44.33	44.68	44.81	45.74
1965	47.25	47.29	46.25	47.36	47.42	47.89
1966	50.36	50.40	50.05	50.43	50.59	51.59
1967	52.77	52.81	51.80	52.88	52.96	53.52
1968	56.25	56.29	55.92	56.33	56.50	57.59
1969	59.37	59.42	58.46	59.49	59.59	60.24
1970	62.59	62.64	62.25	62.67	62.86	64.06
1971	66.64	66.70	65.77	66.78	66.89	67.65
1972	69.78	69.84	69.47	69.88	70.09	71.40
1973	73.56	73.62	72.74	73.70	73.83	74.69

DGT (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	3.211	2.678	2.690	2.691	2.682
1953	3.002	3.463	3.475	3.476	3.468
1954	3.342	3.738	3.474	3.474	3.742
1955	3.354	3.814	3.827	3.828	3.819
1956	3.987	3.981	3.994	3.995	3.988
1957	4.068	4.392	4.409	4.410	4.400
1958	5.049	4.552	4.569	4.569	4.561
1959	5.188	5.138	5.157	5.159	5.148
1960	6.398	5.308	5.329	5.330	5.320
1961	7.140	6.346	6.372	6.373	6.360
1962	7.288	6.524	6.554	6.556	6.542
1963	7.112	7.678	7.711	7.714	7.697
1964	9.555	8.254	8.293	8.295	8.278
1965	9.809	8.564	8.608	8.611	8.590
1966	12.90	8.670	8.714	8.717	8.698
1967	13.32	10.98	11.03	11.04	11.01
1968	12.99	10.97	11.04	11.04	11.01
1969	14.58	14.15	14.22	14.23	14.20
1970	14.46	14.48	14.58	14.59	14.55
1971	16.72	15.33	15.44	15.44	15.40
1972	18.73	17.30	17.44	17.45	17.41
1973	17.49	17.94	18.11	18.12	18.07

DGT (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	Increase in UT of OPT/UT of Eq.11 5%	50%
1952	2.672	2.679	2.692	3.058	2.690	2.69
1953	3.458	3.465	3.477	3.837	3.745	3.48
1954	3.738	3.741	3.748	4.077	3.765	3.90
1955	3.810	3.816	3.829	4.198	3.835	3.90
1956	3.983	3.987	3.995	4.383	4.013	4.15
1957	4.390	4.397	4.411	4.827	4.419	4.50
1958	4.555	4.560	4.570	5.028	4.590	4.75
1959	5.137	5.144	5.160	5.635	5.169	5.26
1960	5.313	5.319	5.331	5.870	5.254	5.53
1961	6.348	6.357	6.374	6.941	6.386	6.50
1962	6.533	6.542	6.555	7.232	6.584	6.80
1963	7.683	7.694	7.714	8.406	7.728	7.87
1964	8.269	8.280	8.295	9.115	8.329	8.59
1965	8.573	8.586	8.612	9.482	8.630	8.80
1966	8.687	8.699	8.715	9.630	8.753	9.04
1967	11.00	11.01	11.04	11.99	11.06	11.25
1968	11.00	11.02	11.04	12.23	11.09	11.45
1969	14.18	14.19	14.23	15.43	14.25	14.49
1970	14.54	14.56	14.58	16.14	14.65	15.11
1971	15.38	15.40	15.44	17.03	15.47	15.80
1972	17.39	17.42	17.44	19.18	17.51	18.00
1973	18.04	18.07	18.12	20.10	18.16	18.57

RS (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	1948.	1794.	1796.	1796.	1795.
1953	2025.	1887.	1888.	1888.	1887.
1954	2100.	1989.	1989.	1989.	1989.
1955	2176.	2134.	2135.	2135.	2134.
1956	2251.	2255.	2257.	2257.	2256.
1957	2326.	2325.	2326.	2326.	2325.
1958	2402.	2416.	2418.	2418.	2417.
1959	2501.	2519.	2521.	2521.	2520.
1960	2602.	2650.	2652.	2652.	2651.
1961	2702.	2802.	2804.	2804.	2803.
1962	2800.	2919.	2921.	2921.	2920.
1963	2901.	3050.	3053.	3053.	3052.
1964	3246.	3165.	3168.	3168.	3167.
1965	3406.	3271.	3274.	3274.	3273.
1966	3535.	3416.	3419.	3419.	3418.
1967	3649.	3571.	3574.	3574.	3572.
1968	4110.	3811.	3815.	3815.	3814.
1969	4389.	4067.	4071.	4071.	4069.
1970	4406.	4346.	4351.	4351.	4350.
1971	4921.	4658.	4663.	4663.	4661.
1972	5405.	5016.	5023.	5024.	5021.
1973	6072.	5396.	5404.	5405.	5402.

RS (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	Increase in UT of OPT/UT of Eq.11	
					5%	50%
1952	1794.	1794.	1796.	1796.	1796.	1796.
1953	1886.	1887.	1888.	1888.	1888.	1888.
1954	1989.	1989.	1989.	1989.	1991.	2005.
1955	2133.	2134.	2135.	2135.	2135.	2139.
1956	2256.	2256.	2257.	2257.	2258.	2272.
1957	2324.	2325.	2326.	2326.	2327.	2333.
1958	2416.	2417.	2418.	2417.	2419.	2432.
1959	2519.	2520.	2521.	2521.	2522.	2530.
1960	2650.	2651.	2652.	2651.	2653.	2667.
1961	2802.	2803.	2804.	2804.	2805.	2815.
1962	2919.	2920.	2921.	2921.	2923.	2937.
1963	3051.	3051.	3053.	3052.	3054.	3065.
1964	3166.	3167.	3168.	3168.	3170.	3185.
1965	3272.	3273.	3274.	3274.	3276.	3288.
1966	3417.	3418.	3419.	3418.	3421.	3436.
1967	3572.	3572.	3574.	3573.	3575.	3589.
1968	3813.	3814.	3815.	3814.	3817.	3834.
1969	4069.	4069.	4071.	4071.	4073.	4089.
1970	4349.	4350.	4351.	4351.	4354.	4373.
1971	4660.	4662.	4663.	4663.	4666.	4684.
1972	5020.	5022.	5023.	5023.	5026.	5048.
1973	5401.	5403.	5404.	5404.	5407.	5429.

FC (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	805.7	782.9	783.9	784.0	783.3
1953	825.7	840.2	841.4	841.5	840.7
1954	841.1	882.8	883.3	883.3	883.1
1955	940.2	921.8	922.8	922.9	922.2
1956	968.8	972.5	973.5	973.5	973.1
1957	969.8	1027.0	1029.	1029.	1028.
1958	1035.0	1037.	1038.	1038.	1037.
1959	1141.	1073.	1075.	1075.	1074.
1960	1190.	1125	1126.	1126.	1125.
1961	1183.	1153.	1155.	1155.	1154.
1962	1228.	1181.	1182.	1182.	1182.
1963	1246.	1214.	1216.	1216.	1215.
1964	1273.	1231.	1233.	1233.	1232.
1965	1347.	1298.	1300.	1300.	1299.
1966	1419.	1348.	1350.	1350.	1349.
1967	1447.	1418.	1420.	1420.	1419.
1968	1526.	1482.	1484.	1484.	1483.
1969	1597.	1573.	1576.	1576.	1575.
1970	1694.	1642.	1645.	1645.	1644.
1971	1762.	1712.	1716.	1716.	1715.
1972	1837.	1794.	1799.	1799.	1798.
1973	1921.	1986.	1991.	1992.	1990.

FC (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	Increase in UT of OPT/UT of Eq.11 5%	50%
1952	782.4	783.0	784.2	783.9	783.9	783.9
1953	839.8	840.4	841.6	841.3	841.4	841.4
1954	883.0	883.1	883.3	883.2	885.0	897.7
1955	921.3	921.8	923.0	922.7	923.0	924.7
1956	972.9	973.1	973.6	973.4	975.3	987.9
1957	1027.	1028.	1029.	1028.	1029.	1033.
1958	1037.	1037.	1038.	1038.	1040.	1052.
1959	1073.	1074.	1075.	1075.	1075.	1080.
1960	1125.	1125.	1126.	1126.	1128.	1140.
1961	1153.	1154.	1155.	1155.	1155.	1161.
1962	1181.	1182.	1182.	1182.	1184.	1197.
1963	1214.	1215.	1216.	1216.	1217.	1223.
1964	1232.	1233.	1233.	1233.	1235.	1248.
1965	1298.	1299.	1300.	1299.	1300.	1308.
1966	1348.	1349.	1350.	1350.	1352.	1365.
1967	1418.	1419.	1420.	1420.	1421.	1430.
1968	1483.	1483.	1484.	1484.	1486.	1500.
1969	1574.	1575.	1576.	1576.	1577.	1587.
1970	1643.	1644.	1645.	1645.	1647.	1662.
1971	1714.	1715.	1716.	1716.	1717.	1729.
1972	1797.	1798.	1799.	1799.	1801.	1817.
1973	1989.	1990.	1991.	1991.	1993.	2007.

VR (Million)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	0.892	0.832	0.834	0.834	0.833
1953	0.929	0.891	0.894	0.894	0.892
1954	0.963	0.933	0.934	0.934	0.933
1955	1.026	0.966	0.968	0.968	0.966
1956	1.052	1.030	1.031	1.031	1.030
1957	1.072	1.072	1.075	1.075	1.073
1958	1.090	1.135	1.137	1.137	1.136
1959	1.143	1.147	1.150	1.150	1.148
1960	1.184	1.161	1.164	1.164	1.163
1961	1.222	1.198	1.201	1.201	1.200
1962	1.275	1.248	1.251	1.251	1.250
1963	1.333	1.287	1.290	1.291	1.289
1964	1.380	1.328	1.332	1.332	1.331
1965	1.438	1.387	1.391	1.391	1.389
1966	1.495	1.446	1.450	1.450	1.448
1967	1.542	1.495	1.500	1.500	1.498
1968	1.610	1.559	1.564	1.564	1.562
1969	1.650	1.623	1.628	1.629	1.626
1970	1.714	1.675	1.681	1.682	1.680
1971	1.808	1.756	1.703	1.763	1.760
1972	1.887	1.802	1.811	1.811	1.809
1973	1.985	1.871	1.881	1.822	1.878

VR (Million)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	Increase in UT of OPT/UT of Eq.11 5%	50%
1952	0.831	0.833	0.835	0.834	0.834	0.83
1953	0.891	0.892	0.895	0.894	0.894	0.89
1954	0.933	0.934	0.934	0.934	0.937	0.96
1955	0.965	0.966	0.969	0.968	0.969	0.97
1956	1.030	1.031	1.031	1.031	1.034	1.06
1957	1.071	1.072	1.075	1.074	1.075	1.08
1958	1.136	1.136	1.137	1.137	1.141	1.17
1959	1.146	1.148	1.150	1.150	1.151	1.16
1960	1.162	1.163	1.164	1.163	1.167	1.19
1961	1.198	1.199	1.202	1.201	1.202	1.21
1962	1.249	1.250	1.251	1.251	1.255	1.28
1963	1.287	1.288	1.291	1.290	1.291	1.30
1964	1.330	1.331	1.332	1.332	1.336	1.36
1965	1.387	1.389	1.391	1.391	1.392	1.40
1966	1.539	1.449	1.450	1.449	1.454	1.48
1967	1.496	1.498	1.501	1.500	1.502	1.51
1968	1.561	1.562	1.564	1.563	1.568	1.60
1969	1.624	1.626	1.629	1.628	1.630	1.65
1970	1.679	1.680	1.681	1.681	1.686	1.72
1971	1.759	1.760	1.763	1.762	1.765	1.78
1972	1.808	1.810	1.811	1.810	1.816	1.85
1973	1.877	1.878	1.881	1.880	1.883	1.90

DTMR (1,000 persons)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	8.900	9.113	9.124	9.125	9.117
1953	8.998	9.167	9.178	9.179	9.171
1954	9.198	9.224	9.227	9.227	9.226
1955	8.998	9.251	9.261	9.262	9.255
1956	9.300	9.313	9.319	9.319	9.317
1957	9.602	9.361	9.371	9.372	9.366
1958	9.699	9.445	9.457	9.457	9.453
1959	9.699	9.459	9.469	9.470	9.464
1960	9.796	9.532	9.540	9.540	9.537
1961	9.699	9.566	9.578	9.579	9.572
1962	9.796	9.645	9.656	9.656	9.652
1963	9.796	9.662	9.674	9.675	9.668
1964	9.796	9.749	9.760	0.761	9.756
1965	9.602	9.791	9.804	9.805	9.799
1966	10.10	9.865	9.877	9.877	9.873
1967	10.00	9.906	9.920	9.921	9.914
1968	10.20	9.997	10.01	10.01	10.01
1969	10.10	10.04	10.06	10.06	10.05
1970	10.30	10.13	10.15	10.15	10.15
1971	9.602	10.19	10.21	10.21	10.20
1972	10.30	10.25	10.27	10.27	10.27
1973	10.10	10.25	10.28	10.28	10.27

DTMR (1,000 persons)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	Increase in UT of OPT/UT of Eq.11	
					5%	50%
1952	9.109	9.114	9.126	9.123	9.124	9.12
1953	9.163	9.168	9.180	9.177	9.178	9.18
1954	9.225	9.226	9.227	9.227	9.243	9.36
1955	9.247	9.252	9.263	9.260	9.261	9.26
1956	9.316	9.318	9.319	9.319	9.335	9.45
1957	9.358	9.362	9.373	9.371	9.372	9.38
1958	9.453	9.455	9.457	9.456	9.472	9.59
1959	9.456	9.460	9.471	9.468	9.470	9.48
1960	9.536	9.538	9.540	9.540	9.556	9.67
1961	9.565	9.569	9.579	9.577	9.579	9.59
1962	9.651	9.653	9.655	9.655	9.671	9.78
1963	9.661	9.666	9.675	9.673	9.675	9.69
1964	9.755	9.758	9.760	9.759	9.776	9.89
1965	9.792	9.796	9.806	9.803	9.806	9.82
1966	9.872	9.875	9.877	9.876	9.892	10.00
1967	9.908	9.912	9.922	9.919	9.922	9.94
1968	10.01	10.01	10.01	10.01	10.03	10.13
1969	10.04	10.05	10.06	10.05	10.06	10.08
1970	10.14	10.15	10.15	10.15	10.17	10.27
1971	10.19	10.20	10.21	10.21	10.21	10.23
1972	10.26	10.27	10.27	10.27	10.29	10.39
1973	10.27	10.27	10.28	10.28	10.28	10.31

P (Million persons)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	2.183	2.150	2.154	2.155	2.152
1953	2.141	2.171	2.176	2.176	2.173
1954	2.157	2.195	2.196	2.196	2.196
1955	2.186	2.208	2.212	2.212	2.209
1956	2.239	2.226	2.229	2.229	2.228
1957	2.273	2.257	2.261	2.261	2.258
1958	2.271	2.280	2.283	2.283	2.282
1959	2.301	2.297	2.301	2.302	2.299
1960	2.328	2.314	2.318	2.318	2.316
1961	2.353	2.341	2.346	2.346	2.344
1962	2.378	2.361	2.365	2.365	2.363
1963	2.403	2.379	2.384	2.385	2.382
1964	2.428	2.406	2.410	2.410	2.409
1965	2.453	2.432	2.437	2.437	2.435
1966	2.478	2.455	2.460	2.460	2.458
1967	2.510	2.482	2.488	2.488	2.485
1968	2.525	2.510	2.516	2.516	2.514
1969	2.542	2.538	2.545	2.545	2.542
1970	2.559	2.570	2.577	2.577	2.575
1971	2.610	2.599	2.607	2.607	2.604
1972	2.633	2.618	2.628	2.628	2.626
1973	2.663	2.640	2.651	2.652	2.648

P (Million persons)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PY/P of Eq.6	Increase in UT of OPT/UT of Eq.11 5%	50%
1952	2.148	2.150	2.155	2.154	2.154	2.15
1953	2.170	2.172	2.177	2.176	2.176	2.18
1954	2.196	2.196	2.196	2.196	2.202	2.25
1955	2.206	2.208	2.213	2.211	2.212	2.21
1956	2.228	2.228	2.229	2.229	2.235	2.28
1957	2.255	2.257	2.261	2.260	2.261	2.26
1958	2.281	2.282	2.283	2.283	2.289	2.33
1959	2.296	2.298	2.302	2.301	2.302	2.31
1960	2.316	2.317	2.318	2.317	2.324	2.37
1961	2.341	2.342	2.347	2.346	2.347	2.35
1962	2.363	2.364	2.365	2.365	2.371	2.42
1963	2.379	2.381	2.385	2.384	2.385	2.39
1964	2.408	2.409	2.410	2.410	2.417	2.46
1965	2.432	2.434	2.438	2.437	2.438	2.45
1966	2.458	2.459	2.460	2.460	2.466	2.51
1967	2.483	2.485	2.489	2.488	2.489	2.50
1968	2.514	2.515	2.516	2.516	2.522	2.57
1969	2.540	2.541	2.545	2.544	2.546	2.56
1970	2.575	2.576	2.577	2.577	2.583	2.63
1971	2.602	2.603	2.607	2.606	2.608	2.62
1972	2.625	2.627	2.628	2.627	2.634	2.68
1973	2.646	2.648	2.652	2.650	2.653	2.69

PY (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	3087.	2679.	2682.	2682.	2680.
1953	3201.	2921.	2924.	2925.	2923.
1954	3193.	3080.	3080.	3080.	3081.
1955	3390.	3397.	3400.	3400.	3398.
1956	3591.	3583.	3584.	3584.	3584.
1957	3744.	3732.	3736.	3736.	3734.
1958	4037.	3876.	3877.	3877.	3877.
1959	4194.	4094.	4098.	4098.	4096.
1960	4390.	4392.	4394.	4394.	4394.
1961	4598.	4685.	4689.	4690.	4687.
1962	4737.	4880.	4883.	4883.	4882.
1963	4937.	5203.	5208.	5209.	5206.
1964	5280.	5313.	5318.	5318.	5317.
1965	5711.	5615.	5621.	5621.	5618.
1966	6195.	5838.	5843.	5843.	5842.
1967	6751.	6234.	6240.	6241.	6237.
1968	7322.	6728.	6734.	6734.	6732.
1969	7928.	7335.	7344.	7345.	7340.
1970	8696.	7786.	7795.	7795.	7793.
1971	9239.	8632.	8644.	8645.	8640.
1972	10100.	9319.	9334.	9334.	9331.
1973	11560.	10230.	10250.	10250.	10240.

PY (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	Increase in UT of OPT/UT of Eq.11 5%	50%
1952	2678.	2680.	2683.	2682.	2682.	2682.
1953	2920.	2922.	2925.	2924.	2924.	2924.
1954	3081.	3081.	3080.	3080.	3085.	3116.
1955	3395.	3397.	3400.	3400.	3399.	3393.
1956	3585.	3585.	3584.	3584.	3590.	3630.
1957	3731.	3732.	3737.	3736.	3735.	3726.
1958	3878.	3878.	3877.	3877.	3884.	3928.
1959	4092.	4094.	4099.	4098.	4096.	4088.
1960	4394.	4395.	4394.	4394.	4401.	4449.
1961	4683.	4685.	4690.	4689.	4688.	4680.
1962	4883.	4883.	4883.	4883.	4891.	4944.
1963	5202.	5204.	5209.	5208.	5207.	5201.
1964	5317.	5318.	5317.	5318.	5326.	5383.
1965	5614.	5617.	5622.	5620.	5620.	5615.
1966	5842.	5843.	5843.	5843.	5852.	5911.
1967	6233.	6236.	6241.	6240.	6239.	6237.
1968	6732.	6734.	6733.	6733.	6743.	6806.
1969	7337.	7339.	7345.	7343.	7343.	7345.
1970	7793.	7795.	7794.	7794.	7805.	7875.
1971	8636.	8639.	8645.	8643.	8644.	8649.
1972	9331.	9333.	9333.	9333.	9346.	9425.
1973	10240.	10240.	10250.	10250.	10250.	10260.

P21Ø (Million persons)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	1.320	1.286	1.290	1.290	1.288
1953	1.273	1.301	1.305	1.305	1.303
1954	1.281	1.319	1.320	1.320	1.319
1955	1.305	1.328	1.331	1.331	1.329
1956	1.353	1.342	1.344	1.344	1.343
1957	1.380	1.364	1.368	1.368	1.366
1958	1.372	1.382	1.384	1.384	1.383
1959	1.395	1.394	1.397	1.398	1.396
1960	1.416	1.408	1.410	1.410	1.409
1961	1.410	1.426	1.430	1.430	1.428
1962	1.454	1.443	1.446	1.446	1.445
1963	1.473	1.431	1.434	1.435	1.433
1964	1.492	1.501	1.504	1.504	1.503
1965	1.511	1.472	1.476	1.476	1.474
1966	1.530	1.537	1.540	1.540	1.539
1967	1.554	1.509	1.514	1.514	1.512
1968	1.564	1.578	1.582	1.582	1.581
1969	1.575	1.551	1.557	1.558	1.555
1970	1.586	1.624	1.629	1.629	1.628
1971	1.627	1.599	1.606	1.606	1.604
1972	1.650	1.661	1.668	1.668	1.666
1973	1.680	1.629	1.638	1.639	1.636

P21Ø (Million persons)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	Increase in UT of OPT/UT of Eq.11 5%	50%
1952	1.285	1.287	1.290	1.289	1.290	1.29
1953	1.300	1.302	1.305	1.305	1.305	1.31
1954	1.319	1.319	1.320	1.320	1.324	1.36
1955	1.327	1.328	1.332	1.331	1.331	1.33
1956	1.030	1.343	1.344	1.343	1.348	1.38
1957	1.363	1.365	1.368	1.367	1.368	1.37
1958	1.383	1.384	1.384	1.384	1.389	1.42
1959	1.393	1.395	1.398	1.397	1.398	1.40
1960	1.409	1.309	1.410	1.410	1.415	1.45
1961	1.426	1.427	1.431	1.430	1.430	1.44
1962	1.445	1.445	1.446	1.446	1.451	1.48
1963	1.431	1.432	1.435	1.434	1.435	1.44
1964	1.502	1.503	1.504	1.504	1.509	1.54
1965	1.472	1.473	1.476	1.475	1.477	1.49
1966	1.539	1.539	1.540	1.540	1.545	1.58
1967	1.510	1.511	1.514	1.514	1.515	1.53
1968	1.581	1.582	1.582	1.582	1.587	1.62
1969	1.553	1.555	1.558	1.557	1.559	1.57
1970	1.627	1.628	1.629	1.628	1.633	1.66
1971	1.602	1.603	1.606	1.606	1.608	1.62
1972	1.666	1.667	1.667	1.667	1.672	1.70
1973	1.634	1.634	1.639	1.638	1.640	1.66

P65Ø (Million persons)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	0.204	0.207	0.208	0.208	0.207
1953	0.209	0.211	0.212	0.212	0.211
1954	0.214	0.216	0.216	0.216	0.216
1955	0.220	0.218	0.219	0.219	0.219
1956	0.225	0.223	0.223	0.223	0.223
1957	0.231	0.228	0.229	0.229	0.228
1958	0.237	0.234	0.234	0.234	0.234
1959	0.243	0.236	0.237	0.237	0.237
1960	0.249	0.241	0.242	0.242	0.242
1961	0.253	0.246	0.247	0.247	0.246
1962	0.256	0.251	0.252	0.252	0.252
1963	0.260	0.254	0.255	0.256	0.255
1964	0.264	0.261	0.262	0.262	0.262
1965	0.268	0.266	0.267	0.268	0.267
1966	0.272	0.272	0.273	0.273	0.273
1967	0.278	0.278	0.279	0.279	0.278
1968	0.283	0.285	0.281	0.286	0.286
1969	0.288	0.291	0.292	0.293	0.292
1970	0.300	0.300	0.300	0.301	0.300
1971	0.314	0.306	0.308	0.308	0.307
1972	0.317	0.311	0.313	0.313	0.313
1973	0.321	0.315	0.318	0.318	0.317

P65Ø (Million persons)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	Increase in UT of OPT/UT of Eq.11 5%	50%
1952	0.206	0.207	0.208	0.208	0.208	0.21
1953	0.218	0.211	0.212	0.212	0.212	0.21
1954	0.216	0.216	0.216	0.216	0.217	0.227
1955	0.218	0.218	0.219	0.219	0.219	0.220
1956	0.223	0.223	0.223	0.223	0.224	0.234
1957	0.228	0.228	0.229	0.229	0.229	0.230
1958	0.234	0.234	0.234	0.234	0.236	0.247
1959	0.236	0.237	0.237	0.237	0.238	0.239
1960	0.242	0.242	0.242	0.242	0.243	0.252
1961	0.246	0.246	0.247	0.247	0.247	0.250
1962	0.252	0.252	0.252	0.252	0.254	0.262
1963	0.254	0.255	0.256	0.255	0.256	0.259
1964	0.262	0.262	0.262	0.262	0.264	0.272
1965	0.266	0.267	0.268	0.267	0.268	0.271
1966	0.273	0.273	0.273	0.273	0.275	0.283
1967	0.278	0.278	0.279	0.279	0.279	0.284
1968	0.286	0.286	0.286	0.286	0.287	0.296
1969	0.291	0.292	0.293	0.292	0.293	0.300
1970	0.300	0.300	0.301	0.300	0.302	0.310
1971	0.307	0.307	0.308	0.308	0.308	0.314
1972	0.313	0.313	0.313	0.313	0.315	0.323
1973	0.317	0.317	0.318	0.318	0.319	0.324

WS (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	1755.	1634.	1635.	1635.	1634.
1953	1861.	1737.	1739.	1739.	1738.
1954	1962.	1851.	1852.	1852.	1851.
1955	2104.	2009.	2010.	2010.	2009.
1956	2260.	2149.	2150.	2150.	2150.
1957	2323.	2240.	2242.	2242.	2241.
1958	2387.	2357.	2359.	2359.	2358.
1959	2521.	2485.	2487.	2487.	2486.
1960	2597.	2645.	2647.	2647.	2646.
1961	2701.	2830.	2832.	2832.	2831.
1962	2883.	2979.	2981.	2982.	2980.
1963	2986.	3149.	3152.	3152.	3151.
1964	3192.	3313.	3316.	3316.	3315.
1965	3390.	3455.	3458.	3458.	3457.
1966	3719.	3658.	3661.	3661.	3659.
1967	4057.	3861.	3864.	3864.	3863.
1968	4459.	4175.	4179.	4180.	4178.
1969	4872.	4505.	4510.	4510.	4508.
1970	5323.	4872.	4877.	4878.	4876.
1971	5646.	5278.	5284.	5285.	5282.
1972	6171.	5759.	5667.	5768.	5765.
1973	6815.	6247.	6257.	6258.	6255.

WS (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	Increase in UT of OPT/UT of Eq.11 5%	50%
1952	1633.	1634.	1635.	1635.	1635.	1635.
1953	1737.	1737.	1739.	1738.	1739.	1739.
1954	1851.	1851.	1852.	1852.	1853.	1866.
1955	2008.	2009.	2010.	2010.	2010.	2014.
1956	2149.	2150.	2150.	2150.	2152.	2165.
1957	2240.	2241.	2242.	2241.	2242.	2249.
1958	2357.	2358.	2359.	2358.	2360.	2373.
1959	2485.	2486.	2487.	2487.	2488.	2496.
1960	2646.	2646.	2647.	2647.	2649.	2662.
1961	2830.	2831.	2832.	2832.	2834.	2843.
1962	2980.	2980.	2982.	2981.	2983.	2998.
1963	3150.	3150.	3152.	3151.	3153.	3165.
1964	3314.	3315.	3316.	3316.	3318.	3334.
1965	3456.	3457.	3458.	3458.	3460.	3473.
1966	3659.	3659.	3661.	3660.	3663.	3679.
1967	3862.	3863.	3864.	3864.	3866.	3882.
1968	4177.	4178.	4179.	4179.	4182.	4200.
1969	4507.	4509.	5410.	4510.	4513.	4531.
1970	4875.	4876.	4877.	4877.	4880.	4902.
1971	5281.	5283.	5285.	5284.	5287.	5309.
1972	5764.	5766.	5667.	5767.	5771.	5796.
1973	6254.	6255.	6257.	6257.	6261.	6286.

EXRT (No. of Exemption/No. of Returns)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	2.977	2.917	2.916	2.916	2.917
1953	2.806	2.910	2.909	2.909	2.910
1954	2.881	2.905	2.905	2.905	2.905
1955	2.818	2.900	2.899	2.899	2.899
1956	2.855	2.898	2.898	2.898	2.898
1957	2.904	2.889	2.887	2.887	2.888
1958	2.934	2.886	2.885	2.885	2.886
1959	2.919	2.879	2.878	2.878	2.878
1960	2.899	2.878	2.877	2.877	2.878
1961	2.934	2.868	2.867	2.867	2.868
1962	2.842	2.868	2.867	2.867	2.867
1963	2.916	2.859	2.857	2.857	2.858
1964	2.928	2.858	2.857	2.857	2.857
1965	2.819	2.846	2.845	2.845	2.845
1966	2.864	2.847	2.846	2.846	2.846
1967	2.870	2.935	2.834	2.834	2.834
1968	2.809	2.937	2.836	2.836	2.836
1969	2.816	2.821	2.820	2.819	2.820
1970	2.862	2.823	2.822	2.822	2.822
1971	2.772	2.808	2.806	2.806	2.807
1972	2.701	2.815	2.813	2.813	2.813
1973	2.800	2.800	2.797	2.797	2.797

EXRT (No. of Exemption/No. of Returns)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	Increase in UT of OPT/UT of Eq.11 5%	50%
1952	2.918	2.917	2.916	2.916	2.916	2.916
1953	2.911	2.910	2.909	2.909	2.909	2.909
1954	2.905	2.905	2.905	2.905	2.904	2.892
1955	2.90	2.900	2.899	2.899	2.899	2.899
1956	2.898	2.898	2.898	2.898	2.896	2.884
1957	2.889	2.888	2.887	2.888	2.887	2.888
1958	2.886	2.885	2.885	2.885	2.884	2.872
1959	2.879	2.879	2.878	2.878	2.878	2.878
1960	2.878	2.878	2.877	2.877	2.876	2.864
1961	2.869	2.868	2.867	2.867	2.867	2.867
1962	2.867	2.867	2.867	2.867	2.865	2.853
1963	2.859	2.858	2.857	2.858	2.857	2.858
1964	2.857	2.857	2.857	2.857	2.855	2.843
1965	2.846	2.846	2.844	2.845	2.845	2.845
1966	2.846	2.846	2.846	2.846	2.844	2.832
1967	2.835	2.835	2.834	2.834	2.834	2.834
1968	2.836	2.836	2.936	2.836	2.834	2.822
1969	2.821	2.820	2.819	2.820	2.820	2.820
1970	2.822	2.822	2.822	2.822	2.820	2.808
1971	2.807	2.807	2.806	2.806	2.806	2.806
1972	2.813	2.813	2.813	2.813	2.811	2.800
1973	2.798	2.798	2.797	2.797	2.797	2.797

HS (Million)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	0.677	0.670	0.672	0.672	0.671
1953	0.684	0.679	0.681	0.681	0.679
1954	0.691	0.688	0.688	0.688	0.688
1955	0.698	0.694	0.695	0.695	0.694
1956	0.705	0.701	0.702	0.702	0.702
1957	0.713	0.713	0.715	0.715	0.714
1958	0.720	0.723	0.724	0.724	0.724
1959	0.727	0.729	0.731	0.731	0.730
1960	0.735	0.738	0.739	0.739	0.739
1961	0.746	0.747	0.752	0.749	0.748
1962	0.757	0.757	0.758	0.759	0.758
1963	0.768	0.763	0.769	0.765	0.764
1964	0.779	0.775	0.776	0.777	0.776
1965	0.791	0.786	0.792	0.788	0.784
1966	0.803	0.796	0.796	0.798	0.797
1967	0.814	0.806	0.813	0.809	0.807
1968	0.826	0.819	0.820	0.821	0.820
1969	0.839	0.830	0.839	0.833	0.832
1970	0.851	0.844	0.845	0.847	0.846
1971	0.864	0.857	0.867	0.861	0.859
1972	0.876	0.864	0.867	0.868	0.867
1973	0.889	0.874	0.886	0.879	0.877

HS (Million)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	Increase in UT of OPT/UT of Eq.11 5%	50%
1952	0.669	0.670	0.672	0.672	0.672	0.672
1953	0.678	0.679	0.681	0.680	0.681	0.681
1954	0.688	0.688	0.688	0.688	0.691	0.710
1955	0.693	0.694	0.695	0.695	0.695	0.696
1956	0.702	0.702	0.702	0.702	0.705	0.724
1957	0.712	0.713	0.715	0.715	0.715	0.716
1958	0.724	0.724	0.724	0.724	0.727	0.745
1959	0.729	0.729	0.731	0.731	0.731	0.733
1960	0.738	0.739	0.739	0.739	0.742	0.760
1961	0.747	0.747	0.749	0.749	0.749	0.752
1962	0.758	0.759	0.759	0.759	0.762	0.779
1963	0.763	0.763	0.765	0.765	0.765	0.769
1964	0.776	0.777	0.777	0.777	0.780	0.797
1965	0.786	0.786	0.788	0.788	0.788	0.793
1966	0.797	0.797	0.798	0.798	0.800	0.817
1967	0.806	0.807	0.809	0.808	0.809	0.815
1968	0.820	0.821	0.821	0.821	0.824	0.841
1969	0.831	0.832	0.833	0.833	0.834	0.840
1970	0.846	0.846	0.847	0.847	0.849	0.866
1971	0.858	0.859	0.861	0.860	0.861	0.868
1972	0.867	0.868	0.868	0.868	0.871	0.888
1973	0.877	0.877	0.879	0.878	0.879	0.887

PR (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	1332.	1046.	1047.	1048.	1046.
1953	1340.	1184.	1186.	1186.	1185.
1954	1231.	1229.	1229.	1229.	1229.
1955	1286.	1338.	1390.	1390.	1389.
1956	1331.	1434.	1434.	1434.	1434.
1957	1421.	1492.	1494.	1495.	1493.
1958	1650.	1519.	1519.	1519.	1519.
1959	1673.	1609.	1611.	1612.	1610.
1960	1793.	1747.	1748.	1747.	1748.
1961	1897.	1854.	1857.	1857.	1855.
1962	1854.	1901.	1902.	1902.	1902.
1963	1951.	2054.	2057.	2057.	2055.
1964	2088.	2000.	2002.	2002.	2002.
1965	2321.	2160.	2163.	2163.	2162.
1966	2476.	2181.	2182.	2182.	2182.
1967	2694.	2373.	2376.	2376.	2374.
1968	2863.	2552.	2555.	2554.	2554.
1969	3056.	2829.	2834.	2834.	2832.
1970	3373.	2914.	2918.	2918.	2917.
1971	3593.	3354.	3360.	3360.	3357.
1972	3931.	3560.	3566.	3567.	3566.
1973	4743.	3983.	3991.	3992.	3988.

PR (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	Increase in UT of OPT/UT of Eq.11 5%	50%
1952	1045.	1046.	1048.	1047.	1047.	1047.
1953	1183.	1184.	1186.	1186.	1186.	1186.
1954	1230.	1229.	1229.	1229.	1231.	1249.
1955	1387.	1388.	1391.	1390.	1389.	1379.
1956	1435.	1435.	1434.	1434.	1438.	1465.
1957	1491.	1492.	1495.	1494.	1492.	1478.
1958	1520.	1520.	1519.	1519.	1523.	1555.
1959	1607.	1609.	1612.	1611.	1609.	1592.
1960	1749.	1749.	1747.	1747.	1753.	1787.
1961	1853.	1854.	1858.	1857.	1854.	1837.
1962	1903.	1903.	1901.	1902.	1908.	1946.
1963	2053.	2054.	2058.	2057.	2054.	2036.
1964	2003.	2003.	2001.	2002.	2008.	2049.
1965	2159.	2160.	2164.	2163.	2160.	2142.
1966	2183.	2184.	2182.	2182.	2189.	2231.
1967	2372.	2373.	2377.	2376.	2373.	2355.
1968	2556.	2556.	2554.	2554.	2561.	2606.
1969	2829.	2830.	2835.	2834.	2831.	2814.
1970	2918.	2919.	2917.	2917.	2925.	2974.
1971	3355.	3356.	3361.	3360.	3357.	3340.
1972	3567.	3568.	3566.	3566.	3575.	3629.
1973	3985.	3986.	3992.	3990.	3987.	3972.

OKTT (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	187.8	180.1	174.4	173.9	178.0
1953	196.2	194.2	187.8	187.3	191.6
1954	203.6	200.1	198.2	198.2	199.0
1955	210.4	216.7	211.4	210.8	214.7
1956	229.6	224.9	219.9	219.8	222.1
1957	235.7	238.5	232.3	231.7	235.6
1958	246.5	248.4	242.4	242.2	245.0
1959	256.3	258.4	251.5	250.9	255.0
1960	275.4	270.5	263.1	262.9	266.3
1961	285.1	291.9	293.2	282.6	287.0
1962	307.9	303.2	293.5	293.1	297.5
1963	321.9	329.2	319.0	318.3	323.2
1964	332.3	341.6	329.7	329.2	334.3
1965	357.6	351.7	339.9	339.1	344.7
1966	388.7	379.4	365.9	365.3	370.9
1967	401.0	402.1	387.7	386.9	393.3
1968	427.5	425.4	409.0	408.2	414.6
1969	472.6	455.9	436.6	435.6	443.3
1970	502.1	499.6	477.1	476.0	483.9
1971	540.9	537.1	511.7	510.5	519.5
1972	649.4	591.8	556.3	554.5	564.9
1973	691.2	683.2	640.5	638.4	650.5

OKTT (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	Increase in UT of OPT/UT of Eq.11 5%	50%
1952	182.5	179.4	173.3	174.9	174.5	174.5
1953	196.4	193.2	186.7	188.2	187.9	187.9
1954	199.4	199.0	198.1	198.5	198.5	200.7
1955	219.3	216.5	210.3	211.8	211.4	211.6
1956	223.1	221.6	219.8	220.3	220.3	222.8
1957	240.2	237.5	231.3	232.8	232.4	232.5
1958	246.7	244.7	242.2	242.8	242.8	245.7
1959	259.2	256.6	250.5	252.1	251.6	251.7
1960	268.6	266.2	262.9	263.7	263.6	266.8
1961	291.2	288.4	282.2	283.9	283.3	283.4
1962	300.4	297.2	293.3	294.3	294.1	297.6
1963	327.3	324.3	318.0	319.8	319.1	319.2
1964	337.6	333.9	329.5	330.6	330.4	334.2
1965	348.7	345.5	338.9	340.9	340.0	340.2
1966	374.6	370.8	365.7	367.0	366.7	370.8
1967	397.2	393.8	386.9	388.8	387.9	388.3
1968	419.0	414.6	408.7	410.4	409.9	414.4
1969	447.2	443.3	435.9	438.0	436.9	437.4
1970	488.9	483.5	476.8	478.8	478.0	483.1
1971	523.7	519.0	511.1	513.6	512.1	512.9
1972	570.4	563.6	556.2	558.3	557.4	562.9
1973	654.6	648.8	640.0	642.9	641.0	642.2

PYP (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq.1	PR/WS of Eq.1	EXRT of Eq.1	RS/P of Eq.2
1952	2826.	2631.	2632.	2632.	2631.
1953	3004.	2787.	2789.	2789.	2788.
1954	3109.	2960.	2961.	2961.	2961.
1955	3251.	3218.	3219.	3219.	3218.
1956	3418.	3431.	3433.	3433.	3432.
1957	3581.	3550.	3551.	3551.	3550.
1958	3795.	3710.	3712.	3712.	3711.
1959	3987.	3897.	3899.	3899.	3898.
1960	4183.	4134.	4136.	4136.	4135.
1961	4388.	4413.	4415.	4415.	4414.
1962	4567.	4621.	4623.	4623.	4622.
1963	4756.	4871.	4873.	4873.	4872.
1964	5008.	5076.	5079.	5079.	5078.
1965	5332.	5274.	5277.	5277.	5276.
1966	5725.	5526.	5529.	5529.	5528.
1967	6188.	5834.	5837.	5837.	5836.
1968	6701.	6273.	6277.	6278.	6276.
1969	7259.	6791.	6795.	6796.	6794.
1970	7909.	7305.	7310.	7310.	7308.
1971	8525.	7946.	7953.	7953.	7951.
1972	9246.	8662.	8670.	8670.	8668.
1973	10270.	9432.	9442.	9442.	9439.

PYP (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq.3	FC/P of Eq.4	VR/P of Eq.5	PYP/P of Eq.6	Increase in UT of OPT/UT of Eq.11 5%	50%
1952	2631.	2631.	2632.	2632.	2632.	2632.
1953	2787.	2787.	2789.	2789.	2789.	2789.
1954	2960.	2961.	2961.	2961.	2963.	2975.
1955	3218.	3218.	3219.	3219.	3220.	3225.
1956	3432.	3432.	3433.	3433.	3434.	3446.
1957	3550.	3550.	3551.	3551.	3552.	3560.
1958	3710.	3711.	3712.	3711.	3713.	3725.
1959	3897.	3898.	3899.	3899.	3900.	3910.
1960	4134.	4135.	4136.	4135.	4137.	4149.
1961	4413.	4414.	4415.	4415.	4416.	4428.
1962	4621.	4622.	4623.	4623.	4625.	4639.
1963	4871.	4872.	4873.	4873.	4875.	4888.
1964	5077.	5078.	5079.	5079.	5081.	5096.
1965	5275.	5276.	5277.	5277.	5279.	5294.
1966	5527.	5528.	5229.	5529.	5531.	5547.
1967	5835.	5836.	5837.	5837.	5839.	5856.
1968	6275.	6276.	6277.	6277.	6280.	6298.
1969	6793.	6794.	6795.	6795.	6798.	6817.
1970	7307.	7308.	7310.	7310.	7313.	7334.
1971	7949.	7951.	7953.	7952.	7955.	7977.
1972	8667.	8668.	8670.	8669.	8673.	8699.
1973	9438.	9440.	9442.	9441.	9445.	9471.

GPT (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	Actual	PY/P of Eq. 1	PR/WS of Eq. 1	EXRT of Eq. 1	RS/P of Eq. 2
1952	26.03	24.98	24.19	24.12	24.69
1953	27.38	27.11	26.22	26.15	26.75
1954	31.11	30.58	30.28	30.28	30.41
1955	29.00	29.86	29.13	29.05	29.59
1956	32.12	31.46	30.34	30.75	31.07
1957	34.01	34.42	33.52	33.43	34.00
1958	34.11	34.38	33.55	33.52	33.91
1959	33.75	34.03	33.12	33.04	33.58
1960	32.97	32.38	31.49	31.47	31.88
1961	33.97	34.77	33.73	33.66	34.18
1962	34.46	33.93	32.87	32.80	33.29
1963	35.63	36.44	35.31	35.21	35.78
1964	37.96	39.04	37.68	37.63	38.21
1965	38.48	37.84	36.57	36.49	37.09
1966	39.92	38.96	37.58	36.18	38.09
1967	45.46	45.60	42.94	43.87	44.60
1968	45.86	45.65	43.89	43.80	44.49
1969	48.22	46.50	44.53	44.43	45.22
1970	50.54	50.31	48.04	47.93	48.73
1971	52.28	50.92	48.51	48.40	49.25
1972	73.34	66.81	62.81	62.60	63.78
1973	96.98	85.20	79.87	79.61	81.12

GPT (Million dollars)

Dynamic Simulation Results of 5 Percent Increase in Parameter of

Year	RS/P of Eq. 3	FC/P of Eq. 4	VR/P of Eq. 5	PYP/P of Eq. 6	Increase in UT of OPT/UT of Eq. 11 5%	50%
1952	25.31	24.88	24.04	24.26	24.20	24.20
1953	27.42	26.97	26.06	26.27	26.23	26.23
1954	30.47	30.41	30.27	30.33	30.33	30.67
1955	30.22	29.83	28.98	29.19	29.13	29.16
1956	30.21	31.00	30.75	30.82	30.82	31.17
1957	34.66	34.27	33.38	33.59	33.54	33.55
1958	34.14	33.87	33.52	33.60	33.60	34.00
1959	34.14	33.79	32.99	33.20	33.14	33.15
1960	32.15	31.86	31.47	31.56	31.55	31.94
1961	34.68	34.35	33.61	33.81	33.74	33.75
1962	33.61	33.26	32.82	32.93	32.91	33.30
1963	36.23	35.90	35.20	35.40	35.32	35.34
1964	38.55	38.16	37.66	37.79	37.76	38.20
1965	37.52	37.18	36.47	36.68	36.58	36.61
1966	38.47	38.08	37.56	37.69	37.66	38.08
1967	45.04	44.66	43.87	44.09	43.99	44.03
1968	44.96	44.49	43.85	44.04	43.98	44.47
1969	45.61	45.25	44.46	44.68	44.56	44.61
1970	49.23	48.69	48.01	48.22	48.13	48.65
1971	49.65	49.20	48.45	48.69	48.55	48.62
1972	64.40	63.63	62.79	63.03	62.93	63.55
1973	81.63	80.91	79.81	80.17	79.93	80.08