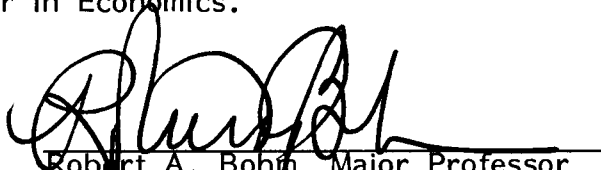
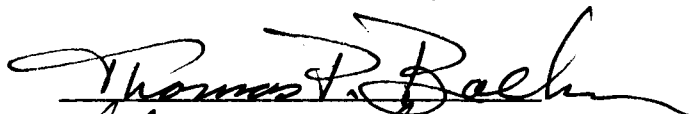


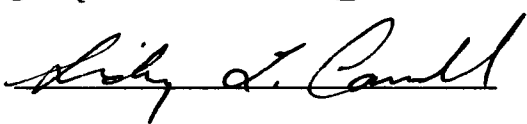
To the Graduate Council:

I am submitting herewith a dissertation written by Samuel Roberts Carter, Jr., entitled "Performance and Adequacy of a State Tax System: The Case of Tennessee." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Economics.

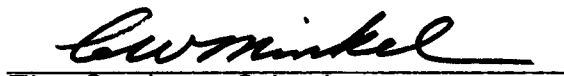

Robert A. Bohn, Major Professor

We have read this dissertation
and recommend its acceptance:





Accepted for the Council:


The Graduate School

PERFORMANCE AND ADEQUACY OF A STATE TAX SYSTEM:
THE CASE OF TENNESSEE

A Dissertation
Presented for the
Doctor of Philosophy
Degree
The University of Tennessee, Knoxville

Samuel Roberts Carter, Jr.

June 1984

To my partner in life, Sharon.

ACKNOWLEDGMENTS

It is doubtful that anyone could complete a dissertation without assistance. This work is no exception. First of all, I would like to acknowledge the assistance of my committee members, Professors Boehm, Carroll and Garrison. Their valuable comments and questions expanded my understanding of the field. Most of all, however, I owe a deep debt of gratitude to my chairman, mentor and friend, Professor Bohm, without whose patience, insight and loyalty I might never have completed this work. Also, I would like to thank Professor Fox for valuable suggestions and encouragement.

During the course of conducting research, several members of the University's computing center staff assisted me by consistently adding to my seemingly insatiable requests for computing resources. I would especially like to thank Jim Dunigan, who stayed with me on many occasions late into the night so that I might finish my analysis.

On a personal basis, much of the inspiration, love and support for this entire effort came from my wonderful family, who put up with the long hours and grouchy father and husband. Most especially, I owe so very much to my wife, Sharon, for her love, support and encouragement.

ABSTRACT

This study traces the development of the concept of state tax revenue adequacy as a major criterion in the evaluation of a state tax system. It is seen that the concept of adequacy has become synonymous with responsive tax structures. This responsiveness implies that an adequate tax structure should not have to be modified continually through rate and base changes in order to meet the demands for public expenditures. A key indicator of adequacy is the degree of elasticity with respect to per capita income.

Following the tradition in the literature, the major research vehicle is the revenue model. A nine sector model is developed and estimated using the seemingly unrelated regressions technique. On the basis of the results obtained from this model, it is determined that the present Tennessee tax system responds adequately to changes in population but inadequately to changes in per capita income.

Due to the demonstrated inability of the present tax structure to provide revenues corresponding to the growth in demand for public expenditures, an income tax is proposed. As a means of evaluating the potential impact on the adequacy of the Tennessee tax system of such an action, a simulation is performed. The results of this simulation indicate that the recurring problem of poor responsiveness of tax revenues to economic growth can be overcome through the introduction of a flat rate income tax, based either on federal taxable income or the federal tax obligation. A tax system which includes both the current sales tax and the proposed income tax would be responsive to both

income and population growth, which are the major indicators of growth in the demand for public expenditures. Revenues produced by relatively low rates would be comparable to those generated now by a sales tax with a very high rate.

The proposed two base system will place Tennessee in a much better position to weather the fiscal stresses of the eighties. Additionally, a revision of tax system emphasis incorporating income and sales taxes provides spillover benefits in the areas of equity, efficiency and administration.

TABLE OF CONTENTS

CHAPTER	PAGE
1. INTRODUCTION	1
The Purpose of This Study	1
The Concept of Adequacy	2
Tax Evaluation Criteria	2
Adequacy as an Evaluation Criteria	3
The Need for an Adequacy Criterion	4
Adequacy vs. Stability	6
Efficiency, Equity and Administration	7
Organization of This Study	7
2. THEORETICAL AND EMPIRICAL ASPECTS OF STATE TAX SYSTEMS	9
Historical Considerations	9
Revenue Models and the Development of the Concept of Tax Revenue Adequacy	11
The Mix of Theory and Measurement	11
Single Equation Models	12
Groves and Kahn	12
Wilford	14
Legler and Shapiro	16
System Models	19
Auten and Robb	19
Tennessee Econometric Model	22
Summary	25
Specification	25
Income Elasticities and Adequacy	26
Systems Considerations	27
3. TENNESSEE'S PRESENT TAX SYSTEM	29
Historical Evolution	29
Nineteenth Century	29
Twentieth Century: Pre-Sales-Tax Period	31
The Present Tennessee Tax Structure	33
Sales and Use Tax	34
Motor Vehicle Fuel Taxes	38
Corporate Taxes	38
Selective Sales Taxes	42
Motor Vehicle Taxes	44
Tobacco Taxes	44
Alcohol Taxes	46
Income Taxes	46

CHAPTER	PAGE
Inheritance Taxes	49
Summary	49
An Evaluation of the Tennessee Tax System	51
Equity and Adequacy	52
Efficiency and Adequacy	53
Administrative Issues	54
Adequacy and the Tennessee Economy	55
Summary	57
4. A TAX REVENUE MODEL FOR TENNESSEE	58
A General Model Framework	58
The Tax Base and Rate	58
Income, Income per Capita, and Population	59
Estimation Methodology and Data Sources	60
Estimation Methodology	60
Selection of an Estimation Method	62
Data Sources	63
Specification and Estimation of the Model	64
General Considerations	64
Real versus Nominal Dollars	65
Sales and Use Tax Sector	66
Motor Vehicle Fuels Sector	69
Corporate Tax Sector	72
Selective Sales Tax Sector	72
Motor Vehicle Registration and Title Sector	76
Tobacco Tax Sector	77
Alcohol Sector	80
Income Tax Sector	83
Inheritance Sector	85
An Aggregate Model	88
Summary	89
5. ADEQUACY AND A TENNESSEE INCOME TAX	92
Defining a Tennessee Income Tax	92
Federal Income Tax Definitions	92
Adequacy Considerations	93
Income Tax versus Sales Tax	96
Income Tax Evaluation	100
Equity and Economic Efficiency	100
Sales Tax Reform	100
The Choice of Income Tax Base	101
Summary	101

CHAPTER	PAGE
6. CONCLUSION	103
Summary	103
Conclusion	104
REFERENCES	106
APPENDIX	114
VITA	116

LIST OF TABLES

TABLE	PAGE
1. Classification of Taxes Following Groves and Kahn	12
2. Selected Elasticity Estimates: Groves and Kahn Model	14
3. Elasticities of State Tax Revenue with Respect to Per-Capita Income and Population: Legler and Shapiro Model	19
4. Additional Estimates of the Revenue-Income Elasticity of State Sales Taxes	26
5. Performance and Importance of the Tennessee Sales Tax	36
6. Tennessee Sales Tax Base Changes	37
7. Revenues from Motor Vehicle Fuel Taxes	39
8. Revenues from Corporate Taxes	41
9. Revenues from Selective Sales Taxes	43
10. Revenues from Motor Vehicle Taxes (Non-Fuel)	45
11. Tobacco Tax Revenues and Cigarette Tax Rates	47
12. Revenues from Alcohol Related Taxes	48
13. Revenues from Inheritance and Hall Income Taxes	50
14. Composition of the Tennessee Tax System: 1981-1982	51
15. Compound Annual Growth Rates for Selected Variables	56
16. Sales and Use Sector: Parameter Estimates	68
17. Motor Vehicle Fuel Tax Sector: Parameter Estimates	71
18. Corporate Tax Sector: Parameter Estimates	73
19. Selective Sales Tax Sector: Parameter Estimates	75
20. Motor Vehicle Tax Sector: Parameter Estimates	77

TABLE	PAGE
21. Tobacco Tax Sector: Parameter Estimates	79
22. Alcohol Tax Sector: Parameter Estimates	82
23. Hall Income Tax Sector: Parameter Estimates	84
24. Inheritance Tax Sector: Parameter Estimates	87
25. Aggregate Legler-Shapiro Type Model for Tennessee 1950-80	90
26. Responsiveness of Income Tax Bases to Per Capita Income . .	94
27. Responsiveness of Income Tax Bases to Per Capita Income and Population	95
28. Revenue Simulations Using Federal Taxable Income	97
29. Revenue Simulations Using Federal Tax Obligation	97
30. Income Tax Rates Required to Replace Sales Tax Revenues .	99

CHAPTER 1

INTRODUCTION

The Purpose of This Study

In the literature on state and local taxation, the concept of adequacy is usually defined as the ability of a tax or tax system to provide for revenue growth that keeps pace with the growth of the local economy without the need for continued modification of tax rates or tax bases. For most states, adequacy has been an elusive standard of performance either due to over-reliance on income-inelastic commodity-based consumption taxes or a mismatch between tax system emphasis and sources of economic growth. Economic conditions (e.g., recession, stagflation) and government policies ("Reaganomics," The New Federalism) of the late nineteen seventies and early nineteen eighties have served to make the relatively poor revenue productivity and inadequacy of most state tax systems readily apparent. Public fiscal affairs in Tennessee are a prime example of this phenomenon where recurring fiscal crises have been manifest in budget impoundments, service cut-backs, increased tax rates and expanded tax bases, searches for new sources of revenue, and a growing desire for tax reform (Hood, 1982; Lyons, 1982; McGrory, 1982).

This study represents an evaluation of the adequacy of the Tennessee tax system. The first step in this process is to develop an understanding of the evolution of the system. However, the major

research objective of the effort is the construction of a comprehensive revenue model that is capable of explaining the performance of the Tennessee tax system over the thirty year time period from 1950 to 1980.

In addition to its value as an explanatory tool, the model developed in this study will have two other important uses. First, it will also have predictive capability. Thus, it can be used as a guide to revision of the tax sector of the Tennessee Econometric Model (Fox and Quindry, 1984). Second, the model will be used in this study to partially evaluate an important policy issue, namely, the enactment of a Tennessee individual income tax. This evaluation will focus on the effect of an income tax on adequacy, particularly in comparison to the existing general sales tax.

The Concept of Adequacy

Tax Evaluation Criteria

Adam Smith offered four "canons" of taxation, specifically, those of equality, certainty, convenience of payment, and economy of collection (Smith, 1776). More recently, Musgrave and Musgrave have elaborated on this classical list by providing the following set of requirements of a "good" tax system:

1. The distribution of the tax burden should be equitable. Everyone should be made to pay his "fair share."
2. Taxes should be chosen so as to minimize interference with economic decisions in otherwise efficient markets. At the same time, taxes may be used to correct inefficiencies in the private sector provided they are a suitable instrument for doing so.

3. The tax structure should facilitate the use of fiscal policy for stabilization and growth objectives.
4. The tax system should permit efficient and nonarbitrary administration and it should be understandable to the taxpayer.
5. Administration and compliance cost should be as low as is compatible with the other objectives. (Musgrave and Musgrave, 1984)

Note that in the Musgrave and Musgrave list, the first three requirements refer to the allocation, distribution and stabilization functions of government while the last two deal with administration. Note also that the word "good" is used here in the standard ethical context normally associated with debates about the distribution question, i.e., there may be irreconcilable conflict between some of the requirements.

Adequacy as an Evaluation Criteria

The Musgrave and Musgrave list of requirements pertains specifically to national governments (as did Adam Smith's). The notion of adequacy has grown from concern about state and local government finances and as a result does not normally appear on lists such as these. The necessary revision is simple, however, for adequacy is nothing more than the stabilization and growth objectives restated for state and local governmental units. This is accomplished by recognizing counter-cyclical fiscal policy as appropriate for national governments only and restating requirement three as follows:

- 3a. The tax structure should provide an adequate flow of revenue assuring a fiscal environment that is responsive to prevailing economic conditions.

This statement appears to be consistent with the traditional notion of adequacy for state and local governments developed by Wilford, ". . .

the ability to provide automatically revenues for a state government as the region's economic growth increases" (Wilford, 1965). The notion of adequacy in this context tells us that the method in which revenues are raised makes a difference and that this difference is not restricted to the traditional areas of economic efficiency, equity and administration. Revenue productivity also matters for a single tax or a tax system and adequacy tells us if it is acceptable.

The Need for an Adequacy Criterion

Concern over the adequacy of state and local tax systems is a relatively recent phenomenon dating from the seminal work of Groves and Kahn (1952). During the nineteen-sixties, the recognition that the demand for state services was growing at a pace far in excess of that of traditional financial resources added a sense of urgency to the search for adequate tax instruments and structures (Hirsch, 1970). In the south this factor has been exacerbated in the nineteen-seventies by the rapid economic expansion of the states lying in the so-called sunbelt.

In addition, the need for taxes and tax structures that meet the adequacy criterion can be found in the peculiarities of state government finance itself. For example, most states have limits on the amount and type of expenditure that can be financed by debt. In Tennessee and many other states, balanced budgets are required by law. The ability to exploit tax sources may also be limited. State leaders may fear tax competition will have serious negative economic effects. Alternatively,

there may be specific legal constraints. For example, in Tennessee the rate of growth of revenues in a single year cannot exceed the rate of growth of the state's economy. Also in Tennessee, until recently, it has been assumed widely that an individual income tax is prohibited by the state constitution (Bohm and Goolsby, 1974).

For the period 1965-1980, it appeared that intergovernmental transfers in the form of federal grants would be the salvation of states with inadequate tax structures. Grant monies could be used to fill the perennial ex-ante revenue shortfall caused by expenditure demand growth continually exceeding revenue growth (Weidenbaum, 1967). Heavy reliance on federal transfers, however, tended to separate the responsibility for spending public money from the responsibility of raising it. The New Federalism of the Reagan Administration should represent a serious test for state revenue structures as this separation is reduced and revenue responsibilities shifted back to the states (Musgrave and Musgrave, 1984).

As an illustration of the problem faced by Tennessee, consider the fact that during the 1970-80 period the rate and base of the state sales tax had to be modified six times (Biennial Report, 1982). This suggests that the Tennessee tax system was inadequate even during a period of sizable intergovernmental transfers and that major tax reform energies need to be focused on the adequacy issue in the nineteen-eighties. The only alternatives are spending reductions in a state with an already low per-capita expenditure in most categories or continued politically unpopular piecemeal revision of the tax system.

Adequacy vs. Stability

Although the revision of criterion three above eliminates stabilization policy from the purview of state government finance, some confusion still arises from the use of these two concepts. For example, Groves and Kahn (1952) considered stability a special case of adequacy and in their writing used the two terms almost interchangeably. The modern distinction between adequacy and stability dates from the work of Wilford (1965) and has been clarified further by Fox (1984). Stability refers to the cyclical responsiveness of tax revenues to the business cycle and hence should be considered a short run phenomenon. Adequacy, on the other hand, is a long run concept, i.e., how does tax revenue growth compare with growth and development of the state economy over time?

The conventional use of the term stability in the public finance literature is to describe a tax yield that is not volatile over the course of the business cycle. Traditionally, taxes with low elasticities of revenue with respect to income have been thought to be stable in this context. While lacking counter-cyclical automatic stabilizer qualities, these taxes could provide state governments with a reliable source of income.

It is apparent that Groves and Kahn could use the terms stability and adequacy in a manner that is inconsistent with modern definitions because the policy issue they were addressing was one of depression and deflation and the disastrous effect of these economic conditions on state government finances during the nineteen-thirties. By the

mid-sixties, however, the problem had become growth and inflation. Under these conditions stable revenues could no longer be considered adequate. To the contrary, a tax with a high revenue to income elasticity (i.e., an unstable tax) would appear to be desirable on adequacy grounds.

Efficiency, Equity and Administration

Although the focus of this study is the adequacy issue, the other tax evaluation criteria will not be ignored. However, they will be relegated to a lower level of consideration. To a large extent this setting of priorities comes from the fact that studies of tax incidence and economic impact abound while those on adequacy are rather scarce. In a study of sales taxation, for example, John Due noted, "The literature on shifting and burden distribution of sales taxation is voluminous; this is the only aspect of sales taxation which ever attracted much attention on the part of economists" (Due, 1957).

Organization of This Study

This study is organized into six chapters. Chapter 2 is devoted to developing the theoretical and empirical foundations for the revenue model that is used to evaluate the Tennessee tax system. A relevant body of literature is summarized in this chapter, and the concept of adequacy is traced. The next chapter can be divided into three parts: (1) a brief description of the somewhat haphazard evolution of the Tennessee tax system, (2) a description of the current Tennessee tax

system, (3) a summary evaluation of the current Tennessee tax system using all the criteria cited earlier. In Chapter 4 a model of the Tennessee tax system is specified and estimated. An evaluation of the results of the model is also presented in Chapter 4. In Chapter 5, the effect of introducing an individual income tax is considered in terms of its impact on the adequacy of the Tennessee tax system. This exercise will focus on the tradeoff between a system based on consumption taxes (in particular, a general sales tax), and a system having both a sales tax and an individual income tax. The final chapter of this study contains a summary and the conclusions that can be derived from the research.

CHAPTER 2

THEORETICAL AND EMPIRICAL ASPECTS OF STATE TAX SYSTEMS

Historical Considerations

Many of the problems facing state governments today also were problems during the times of the earliest writings in economics. Following Musgrave's precedent (Musgrave, 1959), the present work will not include a lengthy discussion of the early development of the theory of taxation. Nonetheless, a few references to early writings will demonstrate parallels to present situations.

Schumpeter argues that the theory of public finance and modern taxation was first developed during the 1400s in the German free-towns and Italian city-republics (Schumpeter, 1954). The antecedents to present day sales taxes were popular during this time since indirect taxation (using general excise and turnover taxes) was easier to implement than direct taxation.

However, since it was not easy to introduce or reform indirect taxes either--which, by the way, shows how far those monarchies were from being 'absolute'--revenue from this source had to be increased according to opportunity rather than any rational plan. And since, furthermore, governments were rarely in a position to abandon revenue from old fiscal rights however irrational, burdensome, or vexatious, the result was an almost unbelievable--the only word is 'mess,' the mere straightening out of which was an extremely difficult task which, when taken in hand in the seventeenth and eighteenth centuries, exercised the ingenuity of administrators and writers alike. (Schumpeter, 1954)

Early economists were unable to develop fiscal systems while ignoring political systems. Schumpeter observed that the two spheres

were almost inseparable, ". . . for everything that happens in the political sphere reflects itself more truly in the prevailing ideas about fiscal policy than it does in anything else" (Schumpeter, 1954).¹ Early writers such as Davila and Vauban suggested income taxation as a substitute for the complicated systems which had developed. Davila's proposal appeared to be a rough approximation to a proportional income tax. Vauban, writing later, favored progressive income taxation. Schumpeter considered Vauban to be one of the best writers in public finance.

This is one of the outstanding performances in the field of public finance, unsurpassed, before or after, in the neatness and cogency of the argument. The recommendation itself does not greatly matter here. Essentially it was that the unwieldy and irrational welter of taxes that had grown up in an entirely unsystematic way should be scrapped--excepting a rationalized salt tax, certain excises, and export and import duties--and replaced by a general income tax that was to apply to all kinds of income, though at varying rates, of which the highest was to be 10 per cent (hence the name dixme); similar ideas had occurred before. The features that do matter are these . . . the method of raising a given amount of revenue may make all the difference between paralysis and prosperity . . . he based his conclusions in every detail on numerical fact. (Schumpeter, 1954)

The early writings also included arguments concerning tax equity. By today's standards, these were somewhat odd mixtures of ability-to-pay and benefits received concepts due largely to the fact that taxes were paid primarily to support armies, i.e., those with more ability-to-

¹ It should also be mentioned that early writers were not the only ones to consider the essentially political nature of public finance. Musgrave points out that a major contribution of Knut Wicksell was his emphasis on the political nature of tax programs (Musgrave, 1959).

pay had more to protect and, therefore, received more benefit. This viewpoint is evident in the writings of Palmieri in the 1400s (Schumpeter, 1954) and received perhaps its best statement by Smith in 1776 (Spiegel, 1971). Spiegel observed further that Smith's best known contribution to public finance was his "four canons of taxation", noted earlier (Spiegel, 1971). These maxims form the basis for what Musgrave and Musgrave discuss as having evolved as the requirements for a good tax system. They observe that the concept of a good tax system is the product of the evolution of economic, political, and social ideas rather than an absolute standard derived from some master plan (Musgrave and Musgrave, 1984).

Revenue Models and the Development of the Concept of Tax Revenue Adequacy

The Mix of Theory and Measurement

The purpose of this section is two-fold. First, the development of the concept of adequacy will be traced in greater detail than was possible in Chapter 1. Second, the importance of several key variables in determining the productivity of taxes will be identified.

These objectives can be reached by means of selective consideration of the literature. As will be seen, this literature has traditionally been a mix of theory and empiricism focusing largely on the concept of the elasticity of tax revenue with respect to income. More recent work goes beyond this simple formulation to include additional determinants of yield, for example, population, tax rates, and base changes. In the

discussion, single equation models will be considered first followed by a briefer discussion of systems models.

Single Equation Models

Groves and Kahn. The pioneering work in the modern study of state tax adequacy is that of Harold M. Groves and C. Harry Kahn (1952). In this work the concept of adequacy is added to the language of public finance. However, recall from the discussion in Chapter 1 that an adequate tax is a stable tax for Groves and Kahn due to their concern for revenue patterns over business cycles.

Groves and Kahn classified taxes into three categories based on the elasticity of revenue with respect to income. Their categorization scheme is summarized in Table 1. The first category is that of taxes with a very stable yield. This is defined as having an income elasticity "substantially less than unity." Somewhat arbitrarily, Groves and Kahn place taxes with an income elasticity of .80 or less into this group.

Table 1. Classification of Taxes Following Groves and Kahn

Category	Description	Income Elasticity
I	Very Stable	0 - .80
II	Proportional	.81 - 1.20
III	Highly Sensitive	1.21 and over

Source: Groves and Kahn, 1952.

The next category of taxes is that of proportional yield, or income elasticity "close to unity." Groves and Kahn defined this category as including taxes with income elasticities between .80 and 1.2.² The third category is that of taxes with "a high sensitivity to changes in income." This includes taxes with an elasticity coefficient above 1.2. According to Groves and Kahn, this last case would occur in two situations:

1. Whenever the tax base varies more than in proportion to income, or
2. The average rate of tax rises as income rises due to a graduated rate schedule.

Groves and Kahn next classified various taxes according to their income elasticities using a simple model of the form:

$$\log T = \log a + b \log Y \quad (1)$$

where T is total tax yield or revenue and Y is total income. Some representative results for state sales and individual income taxes are shown in Table 2. Although these estimates mask important differences in rate structures and tax bases, as can be seen, sales taxes are generally found to be roughly proportional (Category II) and income taxes highly elastic (Category III). For states experiencing substantial growth in income, therefore, income taxes would appear more adequate than sales taxes.

²There is some confusion on this point since the discussion in the text of their article repeatedly referred to 1.5 as the cutoff point, but their tables listed 1.2 (Groves and Kahn, 1952).

Table 2. Selected Elasticity Estimates: Groves and Kahn Model

Tax	State	Period	Income Elasticity
Sales	N. Carolina	1940-49	1.00
Sales	Michigan	1934-49	1.09
Sales	California	1934-49	1.11
Income	Indiana	1934-49	1.41
Income	Maryland	1942-49	1.54
Income	N. Carolina	1938-49	1.81

Source: Groves and Kahn, 1952.

Many writers have pointed out (Wilford, 1965; Legler and Shapiro, 1968) that the Groves and Kahn model ignores several key variables and interdependencies, resulting in specification error. The seriousness of the problem depends on the degree of correlation between Y and the omitted explanatory variable(s) (Kmenta, 1971; Theil, 1971). However, despite the econometric deficiency of their elasticity estimates, the contribution of Groves and Kahn is extremely important. They provided the first steps toward the development of a general theory of state tax revenues and focused attention on revenue productivity as an important subject of inquiry in taxation studies.

Wilford. Wilford further developed and clarified the concepts of adequacy and stability:

The problem of adequacy is basically two-fold, for it involves, on the one hand, stability of the revenue structure during changes in levels of economic activity, and, on the other, the ability of the tax structure to increase yields to meet new social needs as population growth, urbanization, and

changing technology dictate. . . . In recent years it has become apparent that adequacy for state revenue structures requires that revenues rise more rapidly than personal income to meet increased expenditure needs. (Wilford, 1965)

He went on to point out that the built-in ability of tax structures to respond to economic growth is more important than the traditional concept of stability.

Wilford's empirical contribution is his addition of rate changes to the revenue-personal income elasticity model of Groves and Kahn. In Wilford's formulation, revenues are regressed on income and the tax rate. The actual income statistics used in the regression vary depending on the state in question due to Wilford's distinction between economic growth and development. Economic growth and an increase in aggregate income (the variable used by Groves and Kahn) are one and the same; however, an increase in per capita income is brought about by economic development. When development was evident (i.e., per capita incomes are rising), Wilford used per capita income in his regressions, otherwise, aggregate income was the variable of choice.

The Wilford model is an improvement on that of Groves and Kahn but still may be subject to the stigma of specification error. In general, when the effects of rates are controlled, Wilford's results indicate higher elasticities for state income taxes and lower elasticities for sales taxes compared with results presented in Table 2. Wilford found that the elasticity of revenue to the tax rate varied from near unity to close to 0.5 in his study of the Texas tax system (Wilford, 1965).

Wilford's estimates of the revenue-income elasticity show state tax structures to be inelastic. Wilford argued that this was undesirable

since it necessitated "substantial alterations of state tax structures and upward revision of tax rates" (Wilford, 1965). Faced with stable growth and diversified economic bases, states should opt for flexibility and leave stabilization (i.e., counter cyclical activity) to the federal government, according to Wilford. A recurring theme in Wilford's article was the need for a new concept of adequacy.

It is suggested here that the (Wilford's emphasis) criterion, in terms of revenue insensitivity to income changes, is obsolete. The relevant question of adequacy is now the ability to provide automatically revenues for a state government as the region's economic growth increases. (Wilford, 1965)

Legler and Shapiro. The fullest treatment of the concept of state tax adequacy is found in the work of Legler and Shapiro (1968). In an attempt to develop a general theory of state tax revenues, their model is designed to evaluate the appropriateness of a state's tax structure to its particular economic climate. Thus, unlike the earlier models of Groves and Kahn, and Wilford, the Legler and Shapiro model does not examine taxes on an individual basis. Rather, a revenue function for the entire tax structure is specified.

The Legler and Shapiro model starts with three assumptions:

1. There are only two distinct types of taxes:
 - a. an income tax, and
 - b. a sales or consumption type tax.
2. The supply of both taxed and untaxed consumption goods is perfectly elastic.
3. State income and growth are independent of tax yields.

After these assumptions are made, two identities are formed:

$$C \equiv C_u + C_t(1 + r_2) \quad (2)$$

$$R \equiv r_1 Y + r_2 C_t \quad (3)$$

The first relation states that total consumption expenditures (C) are the sum of consumption expenditures for untaxed goods (C_u) and taxed goods (C_t), as well as the amount spent on the tax ($r_2 C_t$), where r_2 is the tax rate on taxable consumption goods. The second relation follows from the first assumption. It states that total tax revenues (R) are the sum of the receipts from the two sources. These receipts are determined by multiplying the appropriate rate times its source (e.g., $r_1 Y$, where r_1 is the income tax rate and Y is income). To handle states with multiple tax rates the second relation can be viewed as the sum of two vector products, where r_1 and r_2 are the vectors of income and sales tax rates, respectively, Y is the vector of incomes in the various brackets, and C_t is the vector of gross sales of the various taxed items.

To these assumptions and relations a behavioral function is added:

$$C_t = C_t(y, N, p, r_2) \quad (4)$$

where

y is per capita income,

N is population,

p is relative before tax sales price,

and other variables are as before.

A state tax revenue function is then derived by substituting (4) into (3)

$$R = R(y, N, p, r_1, r_2) . \quad (5)$$

The regression equation used in estimation is derived from equation (5)

$$\ln R = a + b_1 \ln y + b_2 \ln N + b_3 \ln r_1 + b_4 \ln r_2 + b_5 p + u_t \quad (6)$$

where u_t is the random error term.

In their empirical work, Legler and Shapiro drop the variable p , the relative price of taxed versus nontaxed goods, by assuming that relative prices had not changed over the estimation period. The model is estimated for eight states over the period 1945-64 and includes tax rates for six taxes (sales, motor fuels, alcoholic beverages, tobacco, personal income, and corporate income). Estimates of the elasticity of revenue with respect to rate changes are all quite inelastic, generally in the 0.3-0.6 range when statistically significant. However, in one case (Maryland) the rate elasticity for the corporate income tax is negative and significant at about the 0.5 level.

Table 3 summarizes the major contribution of Legler and Shapiro, namely, relating state revenues to the growth in per-capita income and population. Note from these results that only two states (California and Connecticut) have tax structures that are responsive to changes in per-capita income. For the other six a tax structure that responded to the growth in population would be more likely to be judged adequate. Only one state, Connecticut again, appears to have a tax structure somewhat equally responsive to both per-capita income and population.

Table 3. Elasticities of State Tax Revenue with Respect to
Per-Capita Income and Population:
Legler and Shapiro Model

State	Per-Capita Income Elasticity	Population Elasticity
California*	2.1**	0.2
Colorado	0.5**	1.2**
Connecticut*	1.1**	0.9**
Illinois	0.5	3.5**
Iowa	0.4**	3.6**
Maryland*	0.8**	1.4**
Michigan	0.6**	2.0**
Ohio*	0.8**	2.5**

*Food exempted from sales tax.

**Statistically significant at the 0.10 level or better.

Source: Legler and Shapiro, 1968.

System Models

System models have tended to differ from single equation models both in the thrust of the research involved as well as in estimation methodology. In general, these studies have as their central purpose the development of a predictive econometric model. As such, relatively less information was sought or furnished concerning the factors which explained the revenues from the various sources. Two examples of this type of model are discussed here.

Auten and Robb. Gerald E. Auten and Edward H. Robb (1976) present a tax sector model obtained as an outgrowth of work on an econometric model for the state of Missouri. Their model starts out

with the explicit recognition that state revenues come from different, but related sources and that the tax revenue model itself is part of a larger economic structure (Auten and Robb, 1976).

The Auten and Robb model incorporates five identities:

$$GF_t \equiv ST_t + PIT_t + CIT_t + IP_t + INH_t + ALCO_t + CF_t + OGF_t . \quad (7)$$

This relation states that total general fund receipts (GF_t) are the sum of total sales tax collections (ST_t), gross individual income tax collections (PIT_t), gross corporate income tax collections (CIT_t), insurance premium tax collections (IP_t), inheritance tax collections (INH_t), liquor and beer tax collections ($ALCO_t$), corporation franchise tax collections (CF_t), and other general fund receipts (OGF_t) in time period t .

$$ST_t \equiv TS_t CT_t . \quad (8)$$

Total sales tax collections are the product of taxable consumption expenditures (TS_t) and the sales tax rate (CT_t).

$$T \equiv (LIB/YT)_t . \quad (9)$$

The average effective individual income tax rate (T) is obtained by dividing the individual income tax liabilities (LIB) by the calendar year individual taxable income (YT).

$$YD_t \equiv Y_t - PIT_t - OPT_t . \quad (10)$$

Disposable income (YD_t) is what results from subtracting gross individual income tax collections and other personal tax and non-tax-payments (OPT_t) from total fiscal year income.

$$CIT_t \equiv (BCIT_t)(TC) . \quad (11)$$

Gross corporation income tax collections are the product of the corporation income tax base ($BCIT_t$) and the statutory corporation income tax rate (TC).

A sixth equation is labeled as an identity, but it is actually a behavioral equation depicting consumption as an adaptive expectation model of current and the two previous years' disposable income figures. The income tax subsector is described by four equations. One of these is (9) above which defines the average effective individual income tax rate. Other smaller revenue sources were estimated, predominantly as a function of disposable income.

Auten and Robb employ the three stage least squares (3SLS) estimation technique, and consistent estimates are obtained. The model yields estimates of revenues which are generally within 1% to 2% of actual revenues. The important thing to note about this model, however, is that in most cases revenues are not generated by behavioral equations but are computed by means of identities. The behavioral component of the model lies in other sectors. While suitable for predictive purposes, this approach is not desirable for judging tax system adequacy.³

³Auten and Robb are able to calculate revenue to income elasticities from the coefficients in their model. Generally for the income tax, the elasticity is near 2.0. For the sales tax the elasticity is about 0.7.

Tennessee Econometric Model. The Tennessee Econometric Model (TEM) has been developed to simulate the state economy and the principal use of the model is prediction. However, unlike the Auten and Robb model, the TEM tax sector is based on behavioral equations. Thus it provides a useful point of departure for the model to be developed in Chapter 4, below.

Chang (1976) observes that tax collections in any category should be the product of the tax rate times its base. He goes on to point out that tax bases for each category are usually unavailable and proxy variables must be used in place of the theoretical ideal. Some recommended proxy variables for a tax base in the TEM are disposable income, personal income, and gross state product.

Equations in the TEM representing state tax revenues are as follows (Fox and Quindry):

Sales and Use Tax:

$$\begin{aligned} \ln TTRVSU = & 0.5236 (\ln TRSTOT - 0.9038 \ln TRSTOT_{-1}) \\ & (20.318) \quad (7.904) \\ & + 1.1911 (\ln TTRRSU - 0.9038 \ln TTRRSU_{-1}) \\ & (7.510) \quad (7.904) \\ & + 0.9038 \ln TTRVSU_{-1} \end{aligned} \quad (12)$$

Selective Sales Taxes:

$$\ln TTRVSELS = -18.5235 + 0.0027 \ln TGSPF \quad (13)$$

(-6.36) (20.38)

Tobacco Taxes:

$$\text{TTRVTOB} = -3.5816 + 3.1206 \text{ TTRRTOB} + 0.0015 \text{ TDPYFY} \quad (14)$$

$$(-4.00) \quad (25.09) \quad (22.54)$$

Alcohol Taxes:

$$\text{TTRVALC} = -10.0970 + 0.0016 \text{ TDPYFY} + 4.4798 \text{ TTRRALC} \quad (15)$$

$$(-6.62) \quad (25.37) \quad (8.50)$$

Gasoline Tax:

$$\text{TTRVGAS} = -50.5629 + 0.1111 \text{ TGASO} \quad (16)$$

$$(-10.086) \quad (44.091)$$

Corporate Taxes:

$$\ln \text{ TTRVCORP} = -2.0953 + 1.6554 \ln \text{ TTRRCE} \quad (17)$$

$$(-8.60) \quad (9.06)$$

$$+ 0.8522 \ln ((\text{CPUBT\$} + \text{CPUBT\$}_{-1})/2) \quad (17)$$

$$(10.36)$$

Motor Vehicle Taxes:

$$\text{TTRVMV} = -26.1544 + 0.0389 \text{ TMVRTOT} \quad (18)$$

$$(-5.42) \quad (18.48)$$

Other Taxes:

$$\text{TTRVOTH} = -2.1518 + 0.0019 \text{ TGSPF} \quad (19)$$

$$(-0.910) \quad (17.493)$$

Identity:

$$\text{TTRVTOT} \equiv \text{TTRVSU} + \text{TTRVSELS} + \text{TTRVTOB} + \text{TTRVALC} \quad (20)$$

$$+ \text{TTRVGAS} + \text{TTRVCORP} + \text{TTRVMV} + \text{TTRVOTH}$$

where the variables were as follows:

TTRVSU	revenue from sales and use taxes
TRSTOT	total retail sales
TTRRSU	sales and use tax rate
TTRVSELS	revenue from selective sales taxes
TGSPF	gross state product, fiscal year
TDPYFY	disposable personal income, fiscal year
TTRVTOB	tobacco products tax revenue
TTRRTOB	cigarette tax rate
TGASO	state consumption of gasoline
TTRVGAS	gasoline and motor fuel tax revenue
TTRVALC	tax revenue from alcoholic products
TTRRALC	tax rate on alcoholic spirits
TTRVCORP	revenue from corporate taxes
TTRRCE	corporate excise tax rate
CPUBT\$	US corporate profits before taxes
TTRVMV	tax revenue from motor vehicles
TTMVRTOT	motor vehicle registrations
GNPPCGO	U.S. personal consumption expenditures on gasoline and oil
TTRVOTH	revenue from other taxes
TTRVTOT	total tax revenue

This model features a limited menu of explanatory variables. Also, to use the tax sector of the TEM requires estimation of the entire model. Such complexity may be unnecessary for the task of measuring the responsiveness of particular taxes to changes in economic

conditions. Still, the TEM represents an improvement over the type of specification used by Auten and Robb.

Summary

In this chapter the development of the concept of tax adequacy has been traced by means of examining several revenue models that have appeared in the literature. The concept of adequacy has become synonymous with responsive tax structures, i.e., tax structures that relate to prevailing economic conditions. An adequate tax structure should not require continual adjustment of rates and bases to provide the revenue to fund expenditures that are warranted by the rate of economic expansion in the state.

Specification

Since the appearance of the work of Groves and Kahn (1952), the specification of revenue models has improved considerably. Today it is generally recognized that revenues respond to income per capita, population and tax rates. These three variables represent a correct first line of attack in any empirical study of tax revenues irrespective of whether the topic is a specific tax or, as with Legler and Shapiro, a comprehensive state revenue function. Still, the specification of revenue models can be improved further. The importance of prices and the expectation of inflation cannot be denied following the experience of the late nineteen-seventies and early nineteen-eighties. In addition, factors that are pertinent to only one tax, one state, or one time period should not be ignored.

Income Elasticities and Adequacy

Studies of state tax systems focus considerable attention on the revenue to income per capita (or total income) elasticity. If this coefficient is greater than one, then for states with rising incomes, adequacy seems assured. On the other hand, states such as Tennessee, which rely almost exclusively on consumption type taxes, seem doomed to perennial budget battles. Both Groves and Kahn (1952) and Wilford (1965) reported elasticities of one or below for sales taxes. Additional findings by Davies (1962), Friedlander, Swanson and Due (1973), the Tennessee Department of Revenue (Bohm and Goolsby, 1974), and Wilford (1975) also paint a gloomy picture. Results from these latter four studies are presented in Table 4. Note that all three estimates for Tennessee are below one.

Table 4. Additional Estimates of the Revenue-Income Elasticity of State Sales Taxes

Author	State	Income Measure	Elasticity
Davies	Tennessee	Total Income	0.80
Davies	Colorado	Total Income	0.97
Tenn. Dept. of Revenue	Tennessee	Total Income	0.90
Friedlander, Swanson & Due	Tennessee	Income/Capita	0.96
Friedlander, Swanson & Due	Colorado	Income/Capita	0.84
Wilford (1975)	Louisiana	Income or State Product	0.66

Sources: Davies (1962); Bohm and Goolsby (1974); Friedlander, Swanson and Due (1973); Wilford (1975).

Systems Considerations

Single equation models of individual taxes are rich sources of information on the determinants of revenue on a case by case basis. Improved specification will make this type of model even more useful both for explanatory and projection purposes. On the other hand, these models cannot show system effects on the revenue generated by a given tax. Nor can they be used to evaluate the adequacy of the tax system.

It is possible to argue that the Legler and Shapiro model is an aggregate system model. Unfortunately, while this model may incorporate system interdependencies, it is impossible to interpret them. Likewise, true rate effects are essentially indiscernible as is the responsiveness to changes in specific tax bases.

The preceding comments bring us to the overriding criticism of the Legler and Shapiro type formulation of state revenue responsiveness, namely, that one is never sure of the relationship between revenues, specific taxes and the independent variables of the model (Liu, 1969; Friedlander, Swanson and Due, 1973). For example, the notion that an adequate tax system can be designed which is responsive to population but not income growth is certainly compelling. However, the question remains which taxes are, in fact, responsive to population growth. Is the estimated relationship between aggregate revenue and population spurious? Isn't the specific tax revenue to income relationship superior on theoretical grounds? Finally, how does one explain the extremely low rate elasticities in the Legler and Shapiro model?

The Legler and Shapiro model need not be rejected out of hand for it does provide provocative information. To achieve the goal of designing a tax system that can be termed adequate, however, a complete system model is required. Unlike the multiple equation efforts discussed earlier, such a model must be designed to explain first and predict second. The value of such a model is that the responsiveness of a single or group of similar taxes to such factors as income and population can be judged independently but with the knowledge that system interactions are incorporated into the estimates. A full system model is more expensive in terms of complexity and data, but there is no viable alternative. The specification and estimation of a multi-equation tax revenue model for Tennessee will be the subject of Chapter 4, below. By way of introduction, the next chapter will present a brief overview of the current Tennessee tax system.

CHAPTER 3

TENNESSEE'S PRESENT TAX SYSTEM

In order to better understand Tennessee's present tax structure, a brief examination will be made of its historical evolution. This examination will be limited to the period following the Civil War, since it was not until this time that public education, currently the major state government expense, came into being. The second section of this chapter contains a description of the current Tennessee tax system. Finally, in section three a brief evaluation of the current system is presented using the criteria for a good tax or tax system discussed in Chapter 1.

Historical Evolution

Nineteenth Century

There was no master architect for the Tennessee tax system. Rather, the existing structure is the result of a century of political reaction to recurring fiscal problems. In many ways it resembles the situations noted in the earliest writings in public finance (see Chapter 2). This process of reaction has created revenue sources with little regard for efficiency, equity or adequacy as defined above. The system has had to be restructured several times, and some sources have had to be abandoned.

The period of reconstruction following the Civil War saw a society in disarray. The old tax system had collapsed. Many who were unable

to adjust to new circumstances turned to criminal acts and the penal system was pushed beyond its capacity. With an empty state treasury and a bleak economy, officials instituted a convict leasing system in July of 1866, in order to provide revenue to meet state obligations. Under this arrangement the prison system could be operated at a profit and the prisoners could relieve the problem of a low level of labor availability. By the end of the century public outcry over prison conditions and labor unrest in the coal industry had forced an end to the practice (Folmsbee, 1960).

The first workable system of public education in Tennessee was not achieved until late in the nineteenth century (Corlew, 1981). The Education Law of 1873 set up a statewide system with funding from a property tax, and 6% semiannually of a fictional "school fund" of 2.5 million dollars. In reality no fund had actually been created to provide for the semiannual appropriation. The year 1873 also saw a financial panic, and education would have been badly damaged had it not been for money provided by the Peabody Fund, a private philanthropic venture.

In 1891, the General Assembly awarded pensions to totally disabled Confederate veterans and enriched the school system. The poll tax requirement was strengthened, and Tennessee passed its first inheritance tax. This tax was only on property going to collateral heirs. The rate was 5%. A common thread was that the primary impetus for new tax legislation during the later nineteenth century was the fiscal necessity of providing funding for politically required programs.

Twentieth Century: Pre-Sales-Tax Period

During the twentieth century, education continued to require major funding. With the advent of the automobile, however, another major line item would appear in the state budget. It was during Governor Rye's two terms in office (1915-1919) that Tennessee saw the creation of the State Highway Commission, a Motor Vehicle Registration Act and a special highway tax to match federal funds (Corlew, 1981).

By 1919, the state had been operating at a deficit for more than a decade. Legislation proposed by Governor Roberts and enacted by the legislature ended the much abused practice of local assessment of railroads and utilities. The State Railroad Commission was empowered to assess taxes for all utilities, as well as railroads. A 5% tax on general property was also levied, the proceeds from which were remitted to the state treasury (Folmsbee, 1960).

The legislation of 1919 was the first major revision of Tennessee's tax structure in the post Civil War period. It provided for the immediate needs of the post World War I economy, but it did not offer the capacity for real growth. Even with additions, the tax revenues of the decade of the twenties could not cover Tennessee's quickly growing expenses. Ambitious new programs were too much for the revenue structure to handle. The highway program was the largest growing expense. In 1920 it had ranked fourth in budget expenditures behind education, Confederate pensions, and charitable institutions. Yet highway development received more total revenue than all other expenses combined during the ensuing decade (Corlew, 1981).

Throughout the 1920s, additional tax laws were enacted in an effort to keep pace with expenditures. In 1921, the property tax was increased by 3¢. Part of the proceeds were remitted to participating counties which were then required to levy a 30¢ property tax on their respective residents. A 3% tax on corporate net profit was instituted in 1923, during Governor Austin Peay's administration. A property tax increase, first levied in 1925 as a temporary measure to help defray education expenses, was made permanent in 1927. A tax on gasoline was initiated at 2¢ per gallon and raised twice by 1931.

By 1930 the highway program had resorted to bond financing. This program was to have been on a "pay-as-you-go" basis, funded by auto registration fees, federal aid, and the gasoline tax. School expenditures had doubled, and by 1933 there was a state deficit of 16.4 million dollars. Debt was 89 million dollars and the state had to assume 29.8 million dollars in highway bonds. Furthermore, over half the revenues to the state government were delinquent (Corlew, 1981; Folmsbee, 1960).

The financing of government in Tennessee had by this time developed a pattern. Conditions were allowed to deteriorate until a tax had to be imposed. When that point was reached, the most politically expedient source was chosen. These sources did not, unfortunately, grow sufficiently to keep up with the rapidly rising governmental expenditures.

By the mid-thirties the state finances were in an extremely poor condition. State bonds were unsaleable and school teachers were owed

back pay. State colleges were barely kept open and all state appropriations were drastically reduced (Folmsbee, 1960). Governor McAlister, with the support of the educational community, sought a general sales tax. The Shelby County delegation, controlled by former Memphis mayor and political boss, Ed Crump, led the fight against the tax and prevented any appropriation bill from being passed during the regular session. McAlister was forced to continue without the sales tax. Incoming Governor Gordon Browning was able to secure the passage of a plan to systematically retire indebtedness and the financial chaos was brought under control by 1938 (Corlew, 1981).

With the increased economic activity resulting from World War II, the state's finances were somewhat more stable. This stability, however, was not achieved without cost. The school system was neglected and teachers began leaving for better paying jobs in defense-related industries. It was against this background that Governor McCord achieved his major accomplishment, the passage of the sales tax, in 1947. This success was also the cause of his political downfall, for in the 1948 election the voters displayed their displeasure by turning McCord out of office (Folmsbee, 1972).

The Present Tennessee Tax Structure

For purposes of exposition, the Tennessee tax system has been divided into nine sectors. Relatively small or similar taxes have been grouped together in a manner similar to that employed in the Tennessee Econometric Model (Fox and Quindry, 1984). The nine sectors are:

sales and use tax, motorvehicle fuel taxes, corporate taxes, selective sales taxes, motor vehicle taxes, tobacco taxes, alcohol taxes, income tax, and inheritance taxes.

Sales and Use Tax

The 2% sales and use tax (or simply sales tax) at its inception was sufficient for generous funding of schools as well as the institution of a statewide teacher retirement system. In 1955, Governor Clement, faced with teachers leaving the profession for more lucrative fields, sought additional funding from the legislature. Under pressure from the politically powerful Tennessee Education Association as well as the popular governor, the General Assembly passed an increase in the sales tax to 3% (Folmsbee, 1960). In 1963, Governor Clement was successful in broadening the sales tax base to include utility bills and other items. A measure authorizing counties to levy an additional 1% sales tax was also passed in 1963. This local option was increased to 1.5% in 1968 (Folmsbee, 1972).

The decade of the 1960s was a time of economic prosperity. The economy was growing and inflation was not yet the problem it was destined to become during the 1970s. As long as there was economic growth in real terms, the existing tax structure was capable of preventing fiscal stress.

In 1971 the legislature approved a record 68 million dollar increase in the state budget. The sales tax was also increased to 3.5% to fund the new programs proposed by Governor Dunn. In 1974, the legislature approved a 2 billion dollar budget, a 72% increase over the record

budget of 1971. The economic downturn of 1974 forced the 1975 General Assembly to cut an additional 50 million dollars from Governor Blanton's already austere budget, which had been reduced 73 million from the 1974 level. Pay increases for state employees were limited to 2.5%. Revenues were, nevertheless, insufficient, and in 1976 the sales tax was increased to 4.5%. At the same time, the local option was raised to 2.25% or one half the permanent state rate (Corlew, 1981).

Table 5 illustrates the rates and revenues of the sales tax since its inception in 1947. From Table 5, it can be seen that sales and use tax revenues have grown to contribute approximately half of all state tax revenues. The sales tax in Tennessee is rather broad based. Food, clothing, and most other retail purchases as well as some services and many business purchases are taxed. Many counties have chosen to implement the local option of 1.5% over and above the state levy, as provided by the legislature. When combined with the current rate of 4.5%, the combined rate of 6.75% is among the highest in the country.⁴ In addition to the several rate changes during the period 1947-1981, it can be seen from Table 6 that there have been several modifications to the base. On several occasions the base was both narrowed and expanded at the same time. By comparing Table 5 and Table 6, it can be seen that rate increases also coincided with modifying the base on several occasions.

⁴On April 1, 1984, the state portion of the sales tax rose to 5.5%. The local option rate could be raised to 2.75% by action of the legislature. (See Appendix A.)

Table 5. Performance and Importance of the Tennessee Sales Tax

Year	Rate (%)	Sales Tax Revenues (\$mil)	Total Tax Revenues (\$mil)	Sales Tax % of Total
1947	2.00	0.05	74.6	-
1948	2.00	41.07	125.3	32.78
1949	2.00	42.75	134.5	31.78
1950	2.00	42.52	142.7	29.80
1951	2.00	49.41	158.4	31.19
1952	2.00	50.03	170.4	29.36
1953	2.00	51.26	177.1	28.94
1954	2.00	53.09	187.3	28.34
1955	2.00	55.11	194.1	28.39
1956	3.00	89.11	237.4	37.54
1957	3.00	92.42	252.7	36.57
1958	3.00	91.57	254.8	35.94
1959	3.00	98.32	268.2	36.66
1960	3.00	104.93	288.4	36.38
1961	3.00	106.77	295.7	36.11
1962	3.00	112.60	310.3	36.29
1963	3.00	121.27	334.4	36.26
1964	3.00	147.31	385.3	38.23
1965	3.00	160.57	423.8	37.89
1966	3.00	177.73	457.5	38.85
1967	3.00	188.46	487.9	38.63
1968	3.00	204.39	554.8	36.84
1969	3.00	227.20	618.3	36.75
1970	3.00	239.19	658.0	36.35
1971	3.00	262.06	705.4	37.15
1972	3.50	351.86	857.5	41.03
1973	3.50	399.44	1969.4	41.20
1974	3.50	447.29	1055.4	42.38
1975	3.50	474.57	1106.0	42.91
1976	3.75	554.00	1230.0	45.04
1977	4.50	730.67	1487.8	49.11
1978	4.50	831.33	1630.5	50.99
1979	4.50	938.66	1795.9	52.27
1980	4.50	978.12	1848.9	52.90
1981	4.50	1039.46	1930.0	53.86

Source: Biennial Report, 1947-1982.

Table 6. Tennessee Sales Tax Base Changes

Year	Change
1949	Exempted sales to churches and eleemosynary institutions. Exempted agricultural gasoline.
1951	Excluded carrying charges and repairs.
1955	Included alcoholic beverages and beer. Extended to transient accommodations. Extended to services for parking and storing motor vehicles. Exempted sales to Atomic Energy Commission. Exempted sales to other government agencies.
1963	Extended to telephone service and repair services. Extended to laundry and dry cleaning. 1% tax imposed on water and energy fuels.
1965	Decreased tax from 3% to 1% on new purchases of farm machinery and repair parts.
1967	Extended to manufactured tobacco products. Reduced tax to 1% on water and air pollution machinery.
1970	Extended to national banks.
1971	Extended to casual motor vehicle sales and installation of tangible personal property.
1972	Extended to casual and isolated sales of aircraft, vessels and trailers, and special motor equipment. Reduced rate to 1% on new and used farm machinery where price per article exceeds \$250.
1976	Prescription drugs exempted. Consumption of industrial, residential energy fuels taxed at 1.5%.

Source: Biennial Report, 1947-1982.

Motor Vehicle Fuel Taxes

This group of taxes includes the gasoline tax, special petroleum tax, and the motor vehicle fuel tax. It can be seen from Table 7 that the gasoline tax is by far the largest component of this group, contributing over 70% of the revenues in 1981. There were no increases in gasoline tax rates between 1931 and 1981. Aviation fuel, however, was exempted in 1950. In 1981 the gasoline tax rate was increased from 7¢ per gallon to 9¢.

The special petroleum products tax, or oil and gasoline inspection fee as it was formerly known, provided approximately the same amount of revenue in 1981 as the motor vehicle fuel tax. The special petroleum tax rate was increased from 20¢ per barrel to 30¢ per barrel in 1955. In 1961, this was converted to a gallonage tax with the rate set at 0.6¢ per gallon. This rate was increased to a penny per gallon in 1967. The motor vehicle fuel tax was passed in 1941 with a rate of 7¢ per gallon. This was increased to 8¢ per gallon in 1963, and to 12¢ per gallon in 1981. This tax on diesel fuel contributed approximately 15% to the total of all collections from this sector in 1981 (Biennial Report, 1982).

Corporate Taxes

Corporate tax revenues are obtained from the franchise tax, corporate excise tax, and corporate filing fees. There have been no changes in the franchise tax rate since 1937, when it was set at \$1.50 per \$1000.00 of corporate stock, surplus, and undivided profits of domestic and foreign corporations in Tennessee. Amendments over the years

Table 7. Revenues from Motor Vehicle Fuel Taxes

Year	Gasoline (\$mil)	Special Petroleum (\$mil)	Motor Fuel (\$mil)	Motor Vehicle Total (\$mil)
1947	32.650	2.589	0.138	35.377
1948	34.761	2.583	0.193	37.807
1949	38.827	3.124	0.207	42.158
1950	41.425	3.471	0.260	45.156
1951	45.442	3.863	0.340	49.645
1952	49.185	4.109	0.415	53.709
1953	52.343	4.316	0.533	57.192
1954	59.261	4.514	0.642	64.417
1955	58.490	4.693	0.760	63.943
1956	64.080	7.447	1.353	72.880
1957	64.830	7.568	1.880	74.278
1958	65.470	7.686	2.240	75.396
1959	69.794	8.223	2.749	80.766
1960	72.981	8.496	3.295	84.772
1961	74.215	8.674	3.632	86.521
1962	76.498	8.916	4.004	89.418
1963	81.898	9.552	4.491	95.941
1964	83.776	9.669	5.535	98.980
1965	88.050	0.087	6.192	104.329
1966	94.370	1.052	7.006	112.428
1967	101.601	11.798	8.063	121.462
1968	104.090	19.657	9.099	132.846
1969	112.367	21.743	11.027	145.137
1970	118.476	22.623	12.149	153.248
1971	126.590	24.583	13.524	164.697
1972	136.805	26.305	16.474	179.584
1973	146.590	28.754	19.654	194.998
1974	152.848	29.726	21.651	204.225
1975	153.013	29.924	20.127	203.064
1976	160.304	31.598	22.817	214.719
1977	166.982	34.219	25.825	227.026
1978	172.057	35.415	28.747	236.219
1979	178.870	35.978	31.757	246.605
1980	163.782	32.079	31.174	227.035
1981	157.182	30.710	32.541	220.433

Source: Biennial Report, 1947-1982.

have tended to narrow the base. For example, property under construction but not utilized was removed from the base in 1972, and in 1976 recodification omitted Treasury stock from the base, increased the multiple on rental property from five to eight and enacted a new apportionment formula. The franchise tax represented less than 20% of revenues in this category and approximately 2.4% of total tax revenues in 1981. From Table 8, it can be seen that the excise tax is the largest revenue producer in this category and contributed just over 10% of total state revenues in 1981. This tax is essentially a profits tax with the base defined as net earnings. The rate has changed three times between 1947 and 1981. It was increased from 3.75% to 4% in 1963, from 4% to 5% in 1967, and from 5% to 6% in 1971. Deductions for federal income tax were prohibited in 1951, and dividends from wholly-owned subsidiaries were excluded the same year. An amendment in 1980 provided for an investment tax credit on purchases of industrial machinery.

The corporation filing fee is included with corporation taxes and not sales type taxes since most corporations elect to base their fees on an alternate method of computation. The law provides for either a fee of 0.5% of gross receipts of business done entirely within the state, or, as an alternative, a fee based on the capital stock of the corporation. This later fee varies from \$5 for \$25,000 or less capital stock to \$150 on capital stock in excess of \$1,000,000. The rates have never changed, and the corporation filing fee contributed approximately 0.25% to this category in 1981 (Tennessee State Tax System, 1972; Biennial Report, 1982).

Table 8. Revenues from Corporate Taxes

Year	Corporate Rate	Excise Revenues (\$mil)	Corporate Franchise (\$mil)	Corporate Filing Fees (\$mil)	Total (\$mil)
1947	3.75	4.237	1.908	0.173	6.318
1948	3.75	7.072	2.517	0.192	9.781
1949	3.75	8.509	3.100	0.164	1.773
1950	3.75	10.443	4.740	0.218	15.401
1951	3.75	12.163	4.005	0.190	16.358
1952	3.75	16.791	3.993	0.199	20.983
1953	3.75	16.275	5.087	0.216	21.578
1954	3.75	16.266	5.324	0.246	21.836
1955	3.75	14.390	5.382	0.228	20.000
1956	3.75	13.819	4.243	0.176	18.238
1957	3.75	19.647	7.099	0.295	27.041
1958	3.75	19.285	7.362	0.259	26.906
1959	3.75	16.482	7.224	0.269	23.975
1960	3.75	21.392	7.830	0.280	29.502
1961	3.75	21.093	7.952	0.307	29.352
1962	3.75	21.516	8.489	0.309	30.314
1963	3.75	22.881	8.505	0.313	31.699
1964	4.00	28.392	10.556	0.246	39.194
1965	4.00	31.059	10.959	0.327	42.345
1966	4.00	38.082	12.179	0.364	50.625
1967	4.00	43.279	13.311	0.380	56.970
1968	5.00	49.956	14.763	0.387	65.106
1969	5.00	61.633	15.803	0.424	77.862
1970	5.00	59.633	16.802	0.442	76.877
1971	5.00	59.499	19.758	0.464	79.721
1972	6.00	77.804	24.607	0.517	102.928
1973	6.00	102.978	24.396	0.486	127.860
1974	6.00	112.974	27.316	0.500	140.790
1975	6.00	126.715	29.826	0.511	157.052
1976	6.00	128.621	31.267	0.557	160.445
1977	6.00	156.042	32.249	0.615	188.906
1978	6.00	170.848	37.749	0.616	209.213
1979	6.00	186.088	41.001	0.596	227.685
1980	6.00	198.222	43.938	0.692	242.852
1981	6.00	195.065	45.705	0.606	241.376

Source: Biennial Report, 1947-1982.

Selective Sales Taxes

Tennessee's tax system includes three minor selective sales taxes. These are the gross receipts tax, privilege tax, and the business tax. Gross receipts taxes in the state are essentially privilege taxes based on the gross receipts of theaters, vending machine operators, etc. However, Tennessee Valley Authority (TVA) in-lieu-of-tax payments based on the power sales of the agency in the state are also included and in fact are the largest single component. Privilege taxes in Tennessee are based primarily on realty transfers, the recording of debt instruments and litigation taxes. Prior to 1971, there were over 100 more privilege taxes, however, in that year most were combined with several minor gross receipts taxes to form the business tax. The business tax is based on the gross receipts of businesses, with proceeds based on wholesale business going to the state and proceeds based on retail business going to cities and counties (Biennial Report, 1982). Another privilege tax in Tennessee is the severance tax. It has provided an extremely small amount of revenue, most of which is returned to the county where it is collected. Revenues from this tax are not reported separately in the Biennial Report.

The amount of revenue received from each of these taxes is small, as can be seen from the data in Table 9. The total gross receipts tax revenues in 1981 were approximately 10.5% of the sales and use tax collections, or 5.5% of total tax revenues for the state. Privilege tax collections were less than 1.5% of total tax collections in 1981, and business tax collections were approximately 0.5% of all tax collections.

Table 9. Revenues from Selective Sales Taxes

Year	Gross Receipts (\$mil)	Privilege (\$mil)	Business (\$mil)	Total (\$mil)
1947	1.801	2.385	0	4.186
1948	2.242	2.543	0	4.785
1949	2.397	2.492	0	4.889
1950	2.521	2.599	0	5.120
1951	2.720	2.789	0	5.509
1952	2.957	2.856	0	5.813
1953	3.346	2.825	0	6.171
1954	3.562	3.049	0	6.611
1955	3.953	3.344	0	7.297
1956	3.432	3.574	0	7.006
1957	3.848	3.494	0	7.342
1958	4.383	3.485	0	7.868
1959	5.063	3.925	0	8.988
1960	5.078	4.181	0	9.259
1961	5.543	4.176	0	9.719
1962	5.840	4.471	0	10.311
1963	5.930	4.658	0	10.588
1964	7.378	5.495	0	12.873
1965	7.917	5.847	0	13.764
1966	9.208	6.691	0	15.899
1967	10.539	6.734	0	17.273
1968	12.715	8.112	0	20.827
1969	12.112	9.979	0	22.091
1970	15.856	9.843	0	25.699
1971	17.044	11.221	0.083	28.348
1972	21.506	11.723	1.474	34.703
1973	22.560	14.152	1.751	38.463
1974	26.910	15.036	2.418	44.364
1975	32.653	13.425	3.058	49.136
1976	40.860	17.647	3.358	61.865
1977	41.963	21.800	3.633	67.396
1978	70.030	26.106	3.903	100.039
1979	72.971	29.257	4.050	106.278
1980	89.450	29.438	5.357	124.245
1981	109.714	29.573	5.525	144.812

Source: Biennial Report, 1947-1982.

Motor Vehicle Taxes

Non-fuel-motor-vehicle taxes provided about \$93 million in 1981, as shown in Table 10, which represents about 4.7% of total tax revenues. There are two taxes in this group, namely registration fees and title fees. When enacted in 1951, the purpose of the Motor Vehicle Registration Law was to prevent theft and provide for the handling of liens on motor vehicle titles. The primary purpose of registration fees has been to defray administrative costs. Prior to 1965, there were two classes of automobiles based on weight classification. Their rates had been \$11.50 annually for automobiles less than 3600 pounds and \$15.00 annually for those greater. The average rate of \$13.25 was chosen when the classes were combined in 1965. This rate was increased to \$17.75 in 1967. Trucks, motorcycles, and other vehicles had different rates. Motor vehicle title fees represented less than 1.0% of total tax revenues in 1981 and have historically held that position or slightly lower.

Tobacco Taxes

There are actually three taxes on tobacco in Tennessee, namely, a cigarette tax, a privilege tax on the sale of tobacco products, and a wholesale and retail employee permit. The cigarette tax rate changed four times since 1947; from 3¢ per package to 5¢ in 1951, from 5¢ to 7¢ in 1963, from 7¢ to 8¢ in 1967, and from 8¢ to the present 13¢ in 1969. The tax on other tobacco products was changed from a 10% retail rate to a 6% wholesale rate in 1972. Employee permits were increased from

Table 10. Revenues from Motor Vehicle Taxes (Non-Fuel)

Year	Registration Revenues (\$mil)	Title Revenues (\$mil)	Total (\$mil)
1947	8.428	0	8.428
1948	9.426	0	9.426
1949	9.785	0	9.785
1950	11.360	0	11.360
1951	12.222	0	12.222
1952	11.738	0	11.738
1953	12.192	0	12.192
1954	13.244	0	13.244
1955	19.332	0	19.332
1956	20.797	0	20.797
1957	20.830	0	20.830
1958	20.689	0	20.689
1959	22.258	0	20.258
1960	24.019	0	24.019
1961	23.862	0	23.862
1962	25.625	0	25.625
1963	26.452	0	26.452
1964	32.239	1.141	33.380
1965	35.314	1.196	36.510
1966	36.769	1.289	38.058
1967	38.441	1.376	39.817
1968	50.900	1.950	52.850
1969	54.193	2.044	56.237
1970	55.716	2.052	57.768
1971	57.728	2.165	59.893
1972	62.270	2.505	64.775
1973	68.508	2.722	71.230
1974	73.503	2.797	76.300
1975	73.440	2.683	76.123
1976	77.906	2.943	80.849
1977	85.809	3.099	88.908
1978	84.301	3.090	87.391
1979	89.893	3.237	93.130
1980	90.761	3.171	93.932
1981	89.785	3.090	92.875

Source: Biennial Report, 1947-1982.

\$1.00 per year to \$3.75 per year in 1971. As shown in Table 11, revenues from these taxes totaled \$72 million in 1981. This amounts to 3.7% of all tax revenues in the state for that year.

Alcohol Taxes

Taxes on alcoholic beverages include the alcoholic beverage tax, beer tax and the mixed drink tax. The latter tax is of relatively recent origin, beginning in 1967. From Table 12, it can be seen that by 1981, mixed drink tax collections had surpassed beer tax collections and were almost one half the amount produced by the alcoholic beverage tax on wine and spirits. The overall distribution of revenues in this group in 1981 was approximately 55% wine and spirits, 25% mixed drinks, and 20% beer. The tax rate on alcoholic spirits changed twice during the period 1947-81, from \$3.75 a gallon to \$2.50 in 1964, and from \$2.50 to the present \$4.00 in 1968. The tax rate on wine changed only once, from \$.70 a gallon to the present \$1.10 a gallon in 1968. The beer tax was raised to its present \$3.40 per barrel in 1947, and the rate has remained unchanged since that date. These taxes produced \$53 million for the treasury in 1981.

Income Taxes

The income tax in Tennessee (known as the Hall Income Tax) is rather limited, applying only to interest and dividend income from stocks and bonds. The rate has remained unchanged since 1937, when it was increased from 5% to 6%. Legislation since 1947 has narrowed the base, with blind persons exempted in 1953, and the low income elderly

Table 11. Tobacco Tax Revenues and Cigarette Tax Rates

Year	Revenues (\$mil)
1947	7.649
1948	8.011
1949	8.242
1950	8.555
1951	9.757
1952	13.262
1953	13.687
1954	13.421
1955	13.614
1956	13.974
1957	14.659
1958	15.027
1959	16.344
1960	17.447
1961	18.619
1962	19.480
1963	21.187
1964	27.214
1965	28.612
1966	29.272
1967	30.566
1968	33.265
1969	36.586
1970	50.703
1971	53.448
1972	56.050
1973	58.103
1974	61.248
1975	62.820
1976	65.896
1977	67.829
1978	70.767
1979	72.029
1980	73.820
1981	72.029

Source: Biennial Report, 1947-1982.

Table 12. Revenues from Alcohol Related Taxes

Year	Alcoholic Beverage Tax (\$mil)	Beer Tax (\$mil)	Mixed Drink Tax (\$mil)	Total (\$mil)
1947	4.603	1.737	0	6.340
1948	5.348	3.180	0	8.528
1949	4.897	3.170	0	8.067
1950	5.067	3.054	0	8.121
1951	5.629	3.060	0	8.689
1952	5.428	2.889	0	8.317
1953	5.586	2.765	0	8.351
1954	5.246	2.736	0	7.982
1955	5.318	2.700	0	8.018
1956	5.429	2.527	0	7.956
1957	5.672	2.680	0	8.352
1958	5.591	2.441	0	8.032
1959	5.691	2.686	0	8.377
1960	5.473	2.898	0	8.371
1961	5.501	3.006	0	8.507
1962	6.296	3.121	0	9.417
1963	6.793	3.372	0	10.170
1964	7.934	3.580	0	11.514
1965	8.630	3.911	0	12.541
1966	9.671	4.174	0	13.845
1967	0.060	4.679	0	14.739
1968	17.630	4.723	0.207	22.560
1969	16.608	5.407	0.627	22.642
1970	17.456	5.957	1.074	24.487
1971	18.001	6.323	1.733	26.057
1972	18.265	7.164	2.329	27.758
1973	22.313	7.429	3.547	33.289
1974	23.121	8.030	4.602	35.753
1975	23.990	8.224	5.511	37.725
1976	25.232	8.458	6.636	40.326
1977	25.805	8.893	7.938	42.636
1978	26.984	9.147	9.722	45.853
1979	27.875	9.815	11.145	48.835
1980	28.697	9.332	12.295	50.324
1981	29.130	10.059	13.967	53.156

Source: Biennial Report, 1947-1982.

exempted in 1976. As can be seen from Table 13, revenues from the tax are of little significance. For example, revenues from this tax were approximately 1.4% of total tax revenues in 1981.

Inheritance Taxes

Like the Hall Income Tax, Tennessee inheritance taxes have not been significant revenue producers for the state. The data presented in Table 13 indicate that inheritance taxes represented slightly less than 2% of total tax revenues in 1981. Rates are progressive and vary depending on amount and relationship of heirs. They were last modified in 1967. Important changes made to comply with federal law regarding surviving spouses significantly reduced the base in 1972 and 1979. Revenues from this tax have been so minimal that proceeds from a single individual's death have often caused noticeable jumps in revenues. As a practical matter, the inheritance tax is only of passing interest due to its minimal impact on the state's finances.

Summary

Two overriding factors should be apparent from this review of the Tennessee tax system. First, unlike 44 other states, Tennessee has no general individual income tax. Perhaps more importantly, only three other southern states do not have an income tax. These three all have special circumstances which are not present in Tennessee. For example, Texas and Louisiana rely heavily on severance taxes due to generous natural resource endowments, while Florida can take advantage of tourism and a large retirement community. The second factor is that Tennessee

Table 13. Revenues from Inheritance and Hall Income Taxes

Year	Inheritance (\$mil)	Hall Income (\$mil)
1947	1.700	2.131
1948	1.874	2.573
1949	2.310	2.995
1950	1.947	3.045
1951	2.958	3.749
1952	2.919	3.608
1953	3.163	3.474
1954	3.198	3.446
1955	3.128	3.646
1956	3.496	3.939
1957	3.362	4.422
1958	4.692	4.623
1959	4.328	4.806
1960	4.844	5.218
1961	6.390	5.984
1962	6.659	6.462
1963	10.369	6.773
1964	8.323	6.541
1965	9.507	6.862
1966	10.601	8.216
1967	11.623	8.974
1968	12.197	10.187
1969	19.566	11.381
1970	18.118	12.113
1971	19.574	12.383
1972	26.781	13.598
1973	31.488	15.103
1974	29.611	16.464
1975	27.538	18.436
1976	30.683	22.131
1977	41.247	22.385
1978	57.588	24.857
1979	37.493	26.032
1980	28.307	30.800
1981	37.493	26.032

Source: Biennial Report, 1947-1982.

tax revenue is derived almost exclusively from sales type taxes with one tax, the sales and use tax providing over 50% of all tax revenue. This can be seen from Table 14 which summarizes the composition of the Tennessee tax system for 1981-1982.

Table 14. Composition of the Tennessee Tax System: 1981-1982

Tax	Percent of Total Revenue
Sales and Use	52.2
Motor Vehicle Fuel	13.2
Corporate	12.0
Selective Sales	7.6
Motor Vehicle Registrations	6.1
Tobacco	3.7
Alcoholic Products	2.7
Hall Income	2.1
Inheritance	1.3

Source: Biennial Report, 1982.

An Evaluation of the Tennessee Tax System

The composition of the Tennessee tax system suggests that any evaluation of the system will become a critique of sales taxes in general and the Tennessee sales and use tax in particular. The purpose of this section is to utilize the five tax evaluation criteria introduced in Chapter 1 as a means of highlighting the trade-offs between goals prior to beginning a thorough evaluation of the adequacy of the Tennessee tax system.

Equity and Adequacy

Sales taxes and tax systems dominated by sales taxes are normally indicted first and foremost over the equity or fairness issue. Reed Hansen (1962) suggests that sales taxes are regressive, perverse and capricious, i.e., they take disproportionately larger shares from lower income taxpayers, they do not make adjustments for differences in family size, and for families of the same size produce differing tax burdens as a result of differing buying patterns with regard to taxed versus untaxed commodities. For general sales taxes such as the Tennessee Sales and Use Tax, much of the problem stems from the fact that the tax base does not include all types of consumption, creating a price differential between those goods included and those excluded from the tax base. Many of the excluded products fit the economic definition of luxuries, while the included items are often necessities. Thus, as income rises the tax base tends to become a smaller and smaller percentage of income and lower income households find themselves paying high proportions of income in taxes.

Suggestions to improve equity are generally of two kinds. One approach is to concentrate on a single tax such as the general sales tax. This type of tax can be made less regressive if the tax base is modified to remove the relative dominance of necessities. A common example in this regard is to exempt food. An alternative is to broaden the base to include services that fit the definition of luxuries, for example, the fees of doctors and lawyers. The second approach is to

look at the entire system in terms of its equity implications. Recommendations in this vein might include the elimination of a particularly onerous tax. More commonly, however, regressive taxes such as sales taxes might be balanced with less regressive or progressive taxes such as income based taxes (Bohm and Goolsby, 1974).

Equity and adequacy can be related through the revenue to income elasticity of a tax or tax system. Low income elasticities suggest poor responsiveness to income growth and a need for continual rate revision if public service demands increase at a pace equal to or greater than the rate of growth of income. Likewise, low income elasticities are a symptom of regressivity. Since it is common to consider a regressive tax or tax system as inequitable, it would appear that efforts to raise the elasticity of a tax (e.g., exempt food from the sales tax base) or incorporate income elastic taxes into the tax system can lead to improvement in both equity and adequacy. The several estimates of the revenue to income elasticity of the Tennessee sales tax considered earlier were all less than one. An estimate of the overall income elasticity of the Tennessee tax system prepared by the Tennessee Department of Revenue is 0.79 (Bohm and Goolsby, 1974). It would appear that the Tennessee tax system can be indicted on at least two counts in this regard.

Efficiency and Adequacy

Taxes raise the relative prices of taxed versus untaxed items and thus can affect resource allocation (Musgrave and Musgrave, 1984). In

general, no tax with the possible exception of the head tax, can escape having some influence on supply and demand. These effects can be quite small for commodities with low price elasticities of demand, and it is often argued that broader based taxes are preferable to narrow based taxes. However, the traditional argument that income taxes are clearly superior to sales taxes on economic efficiency grounds is generally not valid. While it is true that a sales tax can bias choices between taxed versus untaxed commodities, income taxes in turn bias choices between consumption and saving, working and not working, and residence (Musgrave, 1959).

Current economic thinking suggests that effects of taxes on economic efficiency cannot be avoided and should be directed toward desirable social objectives (Hyman, 1983). Still, it remains desirable to minimize the interference to efficient market operations caused by taxes. Such a goal can be reached most easily by utilizing numerous broad based sources and keeping rates low. The tie between efficiency and adequacy is therefore clear. A one base system, such as the Tennessee system, must meet demands for higher revenue by raising rates to high levels. Resource allocation effects would be reduced and adequacy improved if a second tax base such as income were utilized.

Administrative Issues

Low administrative costs are often achieved at the expense of equity. For example, costs are commonly reduced by providing minimal enforcement and auditing, resulting in relatively larger burdens on

honest taxpayers. Sales taxes and privilege taxes in Tennessee are especially vulnerable to abuse in this area due to under-reporting or total failure to report. While adequate enforcement is expensive, low enforcement levels result in lost revenue and inequities. Increases in the sales tax rate aggravate this problem since potential rewards from tax evasion are greater at higher rates. On the other hand, income taxes are administratively more attractive. This desirability is due to two points. First, there is a single point of collection as opposed to multiple agents for the state as in the case of the sales tax. Second, an already existing federal structure can be expanded upon for the state's purposes.

Adequacy and the Tennessee Economy

The heart of the adequacy issue is simply how well a tax system relates to conditions in the local economy over time. Table 15 provides an overview of the Tennessee economy during the period from 1947 to 1980. The annual compound growth rates of Tennessee tax revenue, total income, per capita income, and population are shown for several time periods. In addition, a comparable figure is shown for the U. S. Gross National Product (GNP) deflator. The three decennial rows are perhaps the most interesting. Note, for example, that the tax revenue growth rate is highest in the 1970-80 decade. Also, that the tax revenue growth rates generally exceed those for income, income per capita, and population. Closer examination of the data, however, reveals some disturbing features. A rough adjustment for inflation using the GNP

Table 15. Compound Annual Growth Rates for Selected Variables

Time Period	Rates per Year				
	Total Tax Revenue (Tn)	Income (Tn)	Income Per Capita (Tn)	Population (Tn)	GNP Deflator (US)
1947-80	9.7	7.7	6.6	1.1	3.9
1950-80	8.7	7.9	6.8	1.1	4.0
1950-60	7.0	5.3	4.6	0.8	2.5
1960-70	8.2	7.7	6.7	1.0	2.9
1970-80	10.3	10.7	9.1	1.6	6.6

Source: Biennial Report, 1947-1982 and Center for Business and Economic Research (CBER) Data Bank, The University of Tennessee, Knoxville.

deflator suggests a resounding drop in real revenue dollars in the 1970-80 period. For the 1970-80 decade, tax revenue did not keep pace with income growth, a decade when population growth picked up appreciably, and during this period the impact of inflation on tax revenue became significant. Finally, recall that the revenue growth observed has been achieved through considerable rate and base manipulation, particularly of the sales tax. In general, therefore, the data presented in Table 15 suggest that the Tennessee tax system has not "adequately" kept up with the growth of the economy and, in fact, it appears to become less adequate as time passes.

Summary

From the discussion in this chapter, it is possible to draw several conclusions. Clearly, the Tennessee tax system is dominated by sales taxes and by one tax in particular, the sales and use tax. As a result, the tax system performs poorly with respect to equity considerations, and the data examined suggest that it is also inadequate. A final determination on adequacy, however, cannot be made on the basis of the superficial analysis made thus far. In the next chapter a detailed revenue model of the Tennessee tax system will be specified and estimated. Using this model, it will be possible to judge accurately the responsiveness of individual taxes to economic conditions.

CHAPTER 4

A TAX REVENUE MODEL FOR TENNESSEE

In this chapter a nine equation model of the Tennessee tax system will be specified and estimated. Each equation will pertain to one of the sectors discussed in Chapter 3. The chapter also contains a discussion of the estimation techniques employed and identifies the sources of the data utilized.

A General Model FrameworkThe Tax Base and Rate

In general form a tax revenue model should include an equation describing each tax sector. This implies a general specification as follows:

$$T_{it} = f(B_{it}, R_{it})$$

where the terms are defined as follows:

T_{it} the revenue obtained from a tax in the i th sector in time t

B_{it} the tax base of the i th sector in time t

R_{it} the tax rate of the i th sector in time t

Therefore, total tax revenue in time t , TT_t , can be defined as

$$TT_t = \sum_i T_{it} \text{ for } i = 1, 2, \dots, n$$

where there are n sectors.

This model is perfectly general and could be applied to any taxing jurisdiction. Unfortunately, however, tax bases are often not readily observable and as Chang (1976) points out, "data on specific bases are typically unavailable."

Although a proxy for the tax base must be found, tax rates are directly observable influences on revenue. Thus, this general formulation supports the practice of Wilford (1965), Legler and Shapiro (1968) and others of incorporating rate variables into revenue models. Clearly, the expectation is always that an increase in rates will lead to higher revenue flows, although substitution effects often lead to new revenues being less than projected (Musgrave and Musgrave, 1984).

Income, Income per Capita, and Population

Income, income per capita, and population are the variables that have been suggested as measures of economic activity that will permit a judgement on tax system adequacy. These variables are also the appropriate proxies for the missing information on the specific tax bases. In effect, broad measures of economic activity are substituted for detailed measures of economic activity. In the revenue equations presented below, the combination of choice will be income-per-capita and population as the best representation of (1) the size of the base, and (2) the economic status of the members of the base. The alternative is to employ total income, a variable that essentially makes it impossible to discern an independent population effect on revenues. (In cases where population and income per capita fail to perform in a satisfactory manner, total income will be employed as an alternate.)

Revenues will always be expected to respond positively to these income and population variables. The key determinant of adequacy will be their respective elasticities. All variables will be stated in nominal terms, since the state operates on current dollars. Also, this practice allows effects of inflation to be incorporated into the model. Since both income per capita and population are increasing in Tennessee, it would appear that there is a possibility of dual criteria, i.e., preferably an adequate tax should respond to both. At a minimum, a tax should be responsive to either population or income per capita. In all cases, responsiveness will be defined as an elasticity greater than one.

Other variables will be incorporated into the revenue equations in an attempt to avoid the specification errors of past studies. Before turning to the specific equations, however, it is necessary to discuss briefly estimation methodology and data sources.

Estimation Methodology and Data Sources

Estimation Methodology

The model of the Tennessee tax system developed here contains apparently related equations. A major question which needs to be answered is: Which estimation method should be used? The present study has a relatively large sample on which to base estimates. Therefore, asymptotic properties are of somewhat greater importance than would be the case with the smaller samples so common to econometric models.

M. Dutta and P. L. Sharma (1975) conducted a Monte Carlo experiment based on the Christ model of the United States. With this model,

Dutta and Sharma evaluated five estimation techniques, ordinary least squares (OLS), two-stage least squares (2SLS), limited information single equation (LISE), three-stage least squares (3SLS), and iterative instrumental variables (IIV). Based on their research, the 3SLS approach was found to be the best, with IIV second. 2SLS and LISE were found to be superior to OLS. The key factor determining this ranking was the amount of information employed by the estimation technique, i.e., the fuller information techniques yielded better results since they were able to employ information on additional interrelationships between equations.

Kmenta notes that there is no gain in efficiency from systems methods (3SLS, FIML) if there is no more than one overidentified equation in the system. When there are two or more overidentified equations in the system, however, then the systems methods clearly perform better. In terms of small sample properties, OLS estimators tend to have a larger bias but smaller variance than 2SLS or LIML. Kmenta also notes that 2SLS usually leads to smaller mean square errors than LIML. Of potentially greater significance are the results of experiments by Cragg and by Summers, which lead Kmenta to conclude that on the basis of usefulness in hypothesis testing or interval estimation, the OLS is inferior to the consistent methods (Kmenta, 1971).

Additional arguments concerning the superiority of full-information methods (e.g., 3SLS) over single equation systems (e.g., 2SLS) are available in Theil's Principles of Econometrics (1971). He cautions, however, that full-information methods may lose their superiority if the

equations are "sufficiently misspecified." This should be obvious, since misspecification of a single equation can cause bias in the estimates of its parameters; therefore, misspecification in a system carries over to other equations in the system, resulting in a situation analogous to the single equation problem.

Selection of an Estimation Method

The Groves and Kahn, and Wilford models discussed earlier can be described as special cases of a more general multivariate regression model, with variables omitted. The degree of seriousness of omitting variables from a model is directly related to the correlation between the omitted and included variables. If they are not related, then ordinary least squares (OLS) estimates of these models' parameters would be unbiased (Kmenta, 1971).

Based on an assumption that the correlation between omitted and included variables is zero, the foregoing discussion implies that a multiequation revenue model could be estimated by applying OLS to each equation. Although OLS estimates would be expected to be unbiased in these circumstances, OLS results, in general, would not be expected to be efficient. This lack of efficiency derives from the fact that the ordinary least squares regression technique does not make use of all of the information that is available from the entire system. The disturbances in the different equations generally cannot be expected to be mutually uncorrelated. This linkage between regression equations which appear to be unrelated is referred to in the literature as a system of

seemingly unrelated regression (SUR) equations (Kmenta, 1971). Therefore, efficient estimators could be obtained only by applying the seemingly unrelated regressions technique, which makes use of the information contained in the disturbances of the other equations in the system in estimating the parameters.

If independent variables in all of the equations are exogenous, then the seemingly unrelated regressions technique would be appropriate. However, when independent variables appear which are endogenous, a methodology which incorporates that information should be used (e.g., 3SLS). The structure of the model in this study suggests that the best estimation method would be one of the fuller information methods such as SUR or 3SLS, depending on the characteristics of the explanatory variables in the equations. As will be seen below, there does not appear to be significant simultaneity present in the Tennessee tax system model. This has led to the use of SUR as the systems estimation technique.

Due to their relative lack of sensitivity to specification bias, single equation estimates are also reported. These OLS estimates often exhibit significant autocorrelation, and standard adjustments are made utilizing the AUTOREG procedure available in the Statistical Analysis System package.

Data Sources

This study has been greatly aided by the existence of the Tennessee Data Bank developed by the University of Tennessee Center for Business and Economic Research (CBER). This data bank spans the

period from 1947 to 1980 and includes national as well as state economic and demographic variables. For most variables data are available for the entire period, however, tax revenue data are available only from 1964 to 1980. This problem has been resolved by obtaining copies of the relevant pages of the Biennial Report from the Tennessee Department of Revenue. These data include tax collections by source for fiscal years 1937 through 1981.

Federal Income Tax revenue data are not available in published reports for almost half of the study period. This problem has been resolved by contacting the Internal Revenue Service in Washington, D.C. and obtaining hand written reports from their records. Similarly, hand written reports have been obtained from the U.S. Department of Agriculture for cigarette prices. This information was augmented by a report from the Tobacco Institute and phone conversations with the Institutes of Health.

For purposes of estimation, comparable data on all variables could be obtained for the years 1950 to 1980. The time series for each tax sector is therefore 31 years, an interval which covers all but three of the years since the passage of the Tennessee sales tax in 1947. All continuous variables have been converted to natural logarithmic form prior to making calculations.

Specification and Estimation of the Model

General Considerations

The nine tax sectors of the model will be presented in the same order as used in Chapter 3. For each sector, the specification of the

equation will include the appropriate rate, income per capita and population variables noted above plus other variables that are pertinent. In some cases, rate variables will be omitted (due to constant rates over the estimation period) or a variation of the standard income and population variables will be necessary. These issues will be discussed first in each section.

Due to the number of equations to be presented, variables which failed normally acceptable significance tests will simply be noted and omitted from further discussion. Thus, for each sector a final specification of the equation will be stated and results for that specification will be presented and analyzed. Normally, three estimates of each equation will be presented, an ordinary least squares estimate (OLS), an estimate corrected for autocorrelation (AUTOREG), and a seemingly unrelated regressions estimate (SUR). The SUR estimate should always be considered the most desirable of the three on the basis of statistical properties.

Real versus Nominal Dollars

As mentioned above, nominal dollars are preferable in this environment to real dollars. In addition to the already mentioned statements concerning the need for nominal dollar results for state governments and the desirability of including inflation measures, it is worth noting that all of the sectors have been estimated using both nominal and real formulations, and the results obtained were substantially the same.

Sales and Use Tax Sector

As already noted, this tax provides over 50% of the tax revenue in Tennessee and must, therefore, dominate any discussion of adequacy for the state. In addition to per capita income, population, and the tax rate, three other variables are included in this equation. It can be seen from Table 15 (p. 56), that during the decade 1970-1980 inflation began to have a significant impact on Tennessee tax revenues. The aspect which needs to be represented in the sales tax equation is the effect of inflationary expectations on purchases. The hypothesis here is that anticipation of higher prices in the future will lead to increased spending (and hence higher sales tax revenue) today. Expectations are often based on recent experience so the empirical specification of this variable is the change in the GNP deflator in the previous year (Aaron, 1976; Bailey, 1971).

A second factor that needs representation is the development of credit, particularly consumer credit, in Tennessee and the South during the period under study. The effect of this factor is to allow present purchases to be financed out of future incomes and profits. As a result, the annual ratio of consumption to income can be inflated for short periods leading to higher sales tax revenue collections. The variable used to reflect credit growth is per capita loans to individuals in the state. A final set of variables includes the several adjustments and alterations to the sales tax base noted in Chapter 3. Table 6 (p. 37) listed ten changes. Each has been included in the sales tax equation as a zero/one dummy variable. Preliminary results indicated that only the

exclusion of government services in 1955 had a significant effect on revenues.

The final specification of the sales tax revenue equation is:

$$ST = s(PCY, POPUL, STR, INFLEXP, CREDIT, GOVT)$$

where

ST	annual revenue from sales and use tax
PCY	per capita income
POPUL	population
STR	sales and use tax rate
INFLEXP	change in the GNP deflator
CREDIT	per capita loans to individuals
GOVT	dummy for exclusion of government services from tax base (one for the years 1955-1980; zero otherwise).

The OLS, AUTOREG, and SUR estimates of the sales tax equation are presented in Table 16. Note that although the Durbin-Watson statistic is in the inconclusive range (it is in the lower portion of the range), correction is made due to the importance of this equation. There appears to be little difference between the OLS and AUTOREG estimates.

The results presented in Table 16 clearly indicate the nature and the problems of the Tennessee sales and use tax. Revenues respond well to population, however, population in the state has been on a noticeable upswing only during the 1970-1980 decade. Thus, for most of the period under study, adequacy for this tax (and therefore essentially for the entire system) would have to rely on responsiveness to the

Table 16. Sales and Use Sector: Parameter Estimates

Variable	OLS	AUTOREG	SUR
PCY	0.518629* (0.113771)	0.491615* (0.141201)	0.466915* (0.092586)
POPUL	1.900562* (0.597767)	2.046016* (0.754970)	1.879226* (0.477949)
STR	0.920953* (0.075082)	0.938211* (0.071058)	0.941170* (0.054847)
INFLEXP	0.047504* (0.016155)	0.039948* (0.015024)	0.069448* (0.014266)
CREDIT	0.257098* (0.066190)	0.257582* (0.076935)	0.270204* (0.053583)
GOVT	-0.083915** (0.032744)	-0.074077** (0.030346)	-0.067154 (0.025018)
Intercept	-15.127656* (4.577731)	-16.135594* (5.629044)	-14.592142* (3.651472)
R ²	0.9991	0.9980	n
DW	1.2232 ^l	-	-

*Significance of error of 0.01 or better.

**Significance of error of 0.05 or better.

ⁿNot reported.

^lInconclusive Durbin-Watson Test.

Note: Numbers in parentheses are standard errors of the estimate.

growth in income. In this regard, the sales tax has performed miserably with an elasticity of revenue with respect to per capita income of 0.47 in the SUR column of Table 16.¹ With estimated income elasticities for most state services at 1.0 or higher (Musgrave and Musgrave, 1984), the basis for expecting continued fiscal stress is clear. Fortunately for the state, rate changes have been effective in raising revenue with coefficients for this variable near 1.0. Substantial substitution effects away from taxed items do not appear to have taken place in Tennessee, at least during the period under study.

Both the inflationary expectations and credit availability variables are statistically significant and of the correct sign. These results support the hypothesis that inflation and the growth of money markets in the state have altered the time path of purchases. Finally, the dummy variable for the exclusion of government services from the tax base has the expected negative influence on revenue.

Motor Vehicle Fuels Sector

This sector combines the gasoline tax with the motor fuels tax and yields about 13% of total Tennessee tax revenue. Note that the combined revenues from this sector and the sales and use tax account for nearly two-thirds of the total. In this equation, a surrogate for the population variable has been employed, namely, the number of motor vehicle inspections in the state. This variable comes closer to a true measure of the bases of these taxes and, in addition, performed better than population

¹An estimate using the total income variable provided an elasticity of 0.67.

in preliminary regressions. Per capita income appears in the final specification as expected, however, the respective tax rates did not vary sufficiently over the study period to be useful.

During the 1970s, the price of energy rose rapidly, with the price of gasoline nearly tripling. Although estimates of the price elasticity of demand for gasoline and other motor fuels are normally low (Henry, et al., 1980), there is still some cause for concern that over relatively long periods of time some impact on consumption might occur, for example, through increased purchases of fuel efficient vehicles. To represent this factor, the price of regular gasoline is included in this equation. A negative relationship is expected.

The final specification of the motor vehicle fuel sector equation is:

$$MVFT = m(PCY, MVINSP, PREG)$$

where

MVFT	annual revenue from motor vehicle fuels taxes
PCY	per capita income
MVINSP	number of motor vehicle inspections
PREG	price of regular gasoline.

Estimates of this equation are presented in Table 17. Quite interestingly, the income elasticity is approximately 1.0. This proportional income effect, however, is counterbalanced by a negative influence of rising gasoline prices. The significance of this point for the future derives from the fact that rising fuel prices are not a factor before

Table 17. Motor Vehicle Fuel Tax Sector: Parameter Estimates

Variable	OLS	AUTOREG	SUR
PCY	1.032601* (0.057393)	1.114658* (0.059669)	1.057240* (0.038436)
MVINSP	0.209145* (0.060553)	0.081902 (0.054213)	0.161503* (0.038582)
PREG	-0.496648* (0.066115)	-0.524307* (0.075007)	-0.510243* (0.045384)
Intercept	-0.168433 (0.547122)	-1.340837** (0.520235)	-0.543351 (0.355970)
R ²	0.9952	0.9793	n
DW	0.8596	-	-

*Significance of error of 0.01 or better.

**Significance of error of 0.05 or better.

ⁿNot reported.

Note: Numbers in parentheses are standard errors of the estimate.

1973. Thus, the influence of this variable is probably somewhat diluted in the estimates shown. Revenues in this sector do not respond well to the population proxy, MVINSP, with an elasticity of only 0.16 when estimated by SUR. At least in this sector, it does not appear that revenue growth will be engendered simply by larger numbers of people.

Corporate Tax Sector

This sector is dominated by the so-called corporate excise (i.e., profits) tax. (Also included in this sector are two minor taxes discussed in Chapter 3.) The standard approach with this type of tax is to utilize a corporate profits variable (Fox and Quindry, 1984). Over the period covered by this study, however, total income has performed better in all preliminary estimates. The second variable in this equation is the tax rate.

The final specification is:

$$CT = c(INCOME, CORPRATE)$$

where

CT	annual revenue from the corporate tax sector
INCOME	total income
CORPRATE	corporate excise tax rate.

Results for this sector are reported in Table 18. The income variable exhibits an elasticity slightly greater than one. To the extent that this variable proxies for a measure of business activity, it would appear that revenues are roughly proportional. Changes in the principal tax rate influencing revenues in this sector are not as productive as changes in the sales tax rate are in that sector. This factor may reflect the ability of business firms to alter their behavior to avoid the tax.

Selective Sales Tax Sector

This sector includes the Business Tax, Gross Receipts Tax, Privilege taxes, and the Severance Tax. The incorporation of rate variables

Table 18. Corporate Tax Sector: Parameter Estimates

Variable	OLS	AUTOREG	SUR
INCOME	1.097637* (0.045898)	1.110766* (0.055615)	1.091943* (0.042228)
CORPRATE	0.561347* (0.156849)	0.502378* (0.190604)	0.558361* (0.137672)
Intercept	-6.832237* (0.213267)	-6.866760* (0.272840)	-6.773320* (0.209720)
R ²	0.9953*	0.9905	n
DW	1.0838	-	-

*Significance of error of 0.01 or better.

ⁿNot reported.

Note: Numbers in parentheses are standard errors of the estimate.

in this equation did not prove to be practical. However, per capita income and population were employed, although the population variable did not perform satisfactorily.

Several variables have been experimented with in order to reflect the forms of economic activity influenced by the taxes in this group. For example, since the privilege tax is primarily a tax on interest rate sensitive transactions such as realty transfers, several interest rate variables have been tried with the U.S. prime rate performing best. Likewise to reflect the fact that revenues from the Gross Receipts Tax are dominated by TVA in-lieu-of-tax payments (which are determined by the gross receipts of electricity sales), the price of electricity to

Tennessee consumers has been included in the equation. Finally, to incorporate the contribution of the revenue from the severance tax, Tennessee coal shipments have been employed as a variable. It is expected that interest rates will be negatively related to revenues (i.e., high interest rates suggest lower real estate market activity) while higher electricity prices will lead to higher revenue (i.e., higher gross receipts). The coal variable is included primarily for control purposes, for prior to 1972 revenues from taxes on extractive sectors were collected through the privilege tax mechanism.

Although the interest rate variable (PRIME) and coal shipments (COAL) variable performed well in OLS regressions, these variables are not significant under SUR. Thus, the final specification is:

$$SST = ss(PCY, POPUL, ELECPR)$$

where

SST	revenue from selective sales taxes
PCY	per capita income
POPUL	population
ELECPR	average price of electricity to Tennessee consumers

From Table 19, it can be seen that revenues from this sector respond well to per capita income. This fact is based undoubtedly on the income elasticity of many of the items in the respective tax bases of the taxes in this group (e.g., electricity, real estate). POPUL, while not significant in the OLS estimates, proved highly so in the SUR estimates. The

Table 19: Selective Sales Tax Sector: Parameter Estimates

Variable	OLS1	OLS2	SUR
PCY	1.673561* (0.188867)	1.699661* (0.057094)	1.158813* (0.126119)
POPUL	0.141255 (0.972397)		2.014965* (0.716920)
PRIME	-0.125928** (0.054945)	-0.126481** (0.053771)	
ELECPR	0.115177** (0.056687)	0.112310** (0.052130)	0.256363* (0.041543)
COAL	-0.155139** (0.061409)	-0.158279* (0.056386)	
Intercept	-9.749001 (6.854761)	-8.757337* (0.608996)	-22.831135* (4.955424)
R ²	0.9975	0.9975	n
DW	1.8504 ⁺	1.8580 ⁺	

*Significance of error of 0.01 or better.

**Significance of error of 0.05 or better.

ⁿNot reported.

⁺Absence of autocorrelation at 0.01 significance of error.

Note: Numbers in parentheses are standard errors of the estimate.

elasticities of PRIME (U.S. prime interest rate) and ELECPR are low but of the correct sign, however, PRIME loses its significance in the SUR estimate and is dropped. The variable COAL (shipments of coal from Tennessee mines) exhibits a negative sign. This result appears due to

the fact that for most of the period the coal industry was in a state of stagnation. Thus, coal shipments were often declining while revenues were increasing due to higher levels of activity elsewhere (e.g., electric sales, real estate transfers, etc.). COAL loses its significance in the SUR estimate and is dropped also.

Motor Vehicle Registration and Title Sector

This sector is the most straightforward of the nine considered here. Excellent data on motor vehicle registrations are available. Combining these data with the motor vehicle registration rate comes close to creating an identity. Naturally, revenues would be expected to be positively related to both variables. This case illustrates the point made at the beginning of this chapter that when data are available on the tax base, it is not necessary to resort to proxies such as income and population.

The specification is:

$$MVT = v(MVREG, MVRATE)$$

where

MVT	annual revenue from motor vehicle registrations
MVREG	number of vehicles registered
MVRATE	motor vehicle registration rate

An elastic coefficient is found for MVREG, as seen in Table 20. Apparently a 1.0% increase in registrations has led over time to a 1.5% increase in revenue. Rates, on the other hand, exhibit inelastic

Table 20. Motor Vehicle Tax Sector: Parameter Estimates

Variable	OLS	AUTOREG	SUR
MVREG	1.589844* (0.086489)	1.472786* (0.114606)	1.526710* (0.072760)
MVRATE	0.462538 (0.236697)	0.738321* (0.264254)	0.649694* (0.190580)
Intercept	-9.453741* (0.338355)	-9.336123* (0.676370)	-9.492894* (0.334107)
R ²	0.9823	0.9319	n
DW	0.6822	-	-

*Significance of error of 0.01 or better.

ⁿNot reported.

Note: Numbers in parentheses are standard errors of the estimate.

coefficients in the 0.65 range. This sector yields approximately 6% of tax revenue in Tennessee. The two motor vehicle sectors (fuel and registrations) combined produce close to 20%. The sales and use tax and motor vehicle taxes represent more than 70% of all tax revenue.

Tobacco Tax Sector

This sector yields 4% of total Tennessee tax revenue. Both population and income have been used in preliminary regressions with only the population variable performing well. The representation of rates for this sector requires some explanation. This sector includes all taxes on

tobacco products. The major component is the cigarette tax, which is on a per pack basis. Other tobacco products are taxed on their wholesale cost. Cigarette prices are used as a proxy for all tobacco products taxed in this manner. Inelastic demand for cigarettes combined with the value based taxation of other tobacco products imply that a positive coefficient can be expected.

The effect of health warnings on tobacco sales has been incorporated through two dummy variables: (1) for the 1966 Surgeon General's warning on cigarette packages, and (2) for the 1971 ban on television advertising of cigarettes. Only inclusion of the former provided a statistically significant estimate.

The final specification is:

$$TOBT = t(POPUL, CIGPRICE, TOBRATE, WARNING)$$

where

TOBT	annual revenue from tobacco taxes
POPUL	population
CIGPRICE	price of cigarettes per package
TOBRATE	tax rate per package of cigarettes
WARNING	dummy variable to reflect Surgeon General's warning on cigarette packages. One for the years 1967-1980; zero otherwise.

Results of estimating this equation are reported in Table 21 and are quite interesting. Tobacco tax revenues can be seen to be highly responsive to the population variable with elasticities close to 5.0. (On

Table 21. Tobacco Tax Sector: Parameter Estimates

Variable	OLS1	OLS2	SUR
POPUL	4.925993* (0.909904)	5.058091* (0.882065)	4.833884* (0.724128)
PCY	-0.951170 (0.487829)		
CIGPRICE	1.203344 (0.779934)	0.944523 (0.683581)	1.362087** (0.540736)
TOBRATE	0.683148* (0.070668)	0.684316* (0.069951)	0.544341* (0.058756)
WARNING	0.088103 (0.044459)	0.089470** (0.043979)	0.132965* (0.035705)
BAN	-0.036232 (0.050793)		
Intercept	-35.400818* (6.175732)	-36.432068* (5.944866)	-34.608744* (4.878116)
R ²	0.9950	0.9949	
DW	2.1050 ⁺	1.9488 ⁺	

*Significance of error of 0.01 or better.

**Significance of error of 0.05 or better.

ⁿNot reported.

⁺Absence of autocorrelation at 0.01 significance of error.

Note: Numbers in parentheses are standard errors of the estimate.

the other hand, per capita income proved statistically insignificant as shown in column one of Table 21.) Based on the hypothesis advanced above, revenues are correctly found to be positively related to cigarette prices. This relationship is also extremely strong with the SUR coefficient at 1.36. The elasticity of revenue with respect to the cigarette tax rate is 0.54 suggesting greater price elasticity of demand than is normally expected for this type of tax (Musgrave and Musgrave, 1984). Alternatively, and perhaps more likely, it probably indicates a significant border problem (i.e., cigarettes are easily transportable from nearby states where they are taxed at lower rates). Finally, the dummy variable for the Surgeon General's warning has a positive sign. Rather than reducing cigarette smoking in Tennessee, this action appears to have had an advertising effect in the opposite direction. (Note in Table 21, however, that the 1971 advertising ban (BAN) has a negative sign although the coefficient is far from having a normally acceptable statistical significance level.)

Alcohol Sector

Alcohol taxes produce approximately 3% of the tax revenues in Tennessee. This sector includes several taxes (the beer tax, mixed drink tax, and alcoholic beverage tax). Preliminary regressions indicated that a total income rather than a per capita income and population specification was superior for this sector. Experiments with price variables yielded insignificant results. Only the alcoholic spirits and wine rates changed during the study period, with the later changing only

once. Preliminary results with the wine rate yielded insignificant results, so only the alcoholic spirits rate was used in the final equation.

During the period covered by this study, several important changes in Tennessee law pertaining to the sale of alcoholic beverages have taken place. The most important of these is the sale of liquor by the drink in the major metropolitan areas of the state. Dummy variables have been utilized in the alcoholic sector equation to reflect these changes. Early results suggested that only the initiation of liquor by the drink in Knox (denoted KNOX) and Shelby counties proved worthy of continued study. In the final form of the equation, only the dummy variable for Shelby County was retained. The expected sign of the dummy variable is always positive.

The specification of the alcohol tax sector equation is:

$$ALCT = t(INCOME, ALCRATE, SHELBY)$$

where

ALCT	annual revenue from alcohol taxes
INCOME	total income
ALCRATE	tax rate on alcoholic spirits
SHELBY	dummy variable for the legislation of liquor by the drink in Shelby County. One for the years 1969-1980; zero otherwise.

Table 22 contains the results of estimating the alcohol sector equation. The elasticity of revenue with respect to income is 0.61 under SUR.

Table 22. Alcohol Tax Sector: Parameter Estimates

Variable	OLS	AUTOREG	SUR
INCOME	0.445545* (0.058971)	0.625553* (0.065307)	0.608353* (0.041693)
ALCRATE	0.670732* (0.131092)	0.418503* (0.067323)	0.473000* (0.086312)
SHELBY	0.156635** (0.077502)	0.133568* (0.034863)	0.232362* (0.044651)
KNOX	0.199031* (0.061901)	-0.001853 (0.035046)	
Intercept	-2.092578* (0.448983)	-3.331456* (0.579967)	-3.347243* (0.326129)
R ²	0.9894	0.9083	n
DW	0.5503	-	-

*Significance of error of 0.01 or better.

**Significance of error of 0.05 or better.

ⁿNot reported.

Note: Numbers in parentheses are standard errors of the estimate.

Likewise, the rate elasticity is low, possibly indicating border problems as the alcoholic spirits rate is relatively high in comparison to several neighboring states. The dummy variable SHELBY is significant and of the expected sign.

Income Tax Sector

The so-called Hall Income tax is a very narrow based tax limited to dividends and interest from stocks and bonds paid to residents of the state. The yield is about 2% of total tax revenue. To reflect the unique character of this tax two special variables have been added to per capita income and population. First, revenues from this tax should be sensitive to prevailing interest rates. In this regard, the Moody's industrial rate proved most successful after preliminary tests. The interest rate hypothesis is that higher interest rates would result in greater revenues. Also, the hypothesis that the age distribution of the population may be a factor can be tested by including a variable indicating the percentage of population 65 years and over. The assumption here is that ownership of stocks and bonds is positively correlated with age. As a result an aging population should result in a higher revenue yield from the Hall Income Tax. This latter variable is denoted AGE in Table 23, below. At first it appeared that it would perform well; however, after corrections were made for autocorrelation, its significance level fell, and it was dropped from the equation. A rate variable was not included in this sector since the Hall Income Tax rate was constant over the entire period of study.

Table 23. Hall Income Tax Sector: Parameter Estimates

Variable	OLS	AUTOREG	SUR
PCY	0.229314** (0.107916)	0.283266 (0.139765)	0.257173** (0.102512)
POPUL	4.816878* (0.698120)	4.422810* (0.853587)	4.498530* (0.658309)
MOODY	0.464006* (0.089727)	0.382071* (0.107498)	0.391577* (0.082811)
AGE	-0.741626 (0.368749)	-0.473585 (0.451956)	-0.417334 (0.341011)
Intercept	-38.501762* (4.631783)	-36.119535* (5.699636)	-36.681233* (4.375856)
R ²	0.9974	0.9947	n
DW	1.2770	-	-

*Significance of error of 0.01 or better.

**Significance of error of 0.05 or better.

ⁿNot reported.

Note: Numbers in parentheses are standard errors of the estimate.

The final specification of the Hall Income Tax equation is:

$$\text{HIT} = h(\text{PCY}, \text{POPUL}, \text{MOODY})$$

where

HIT	annual revenue from the Hall Income Tax
PCY	per capita income
POPUL	population
MOODY	Moody's industrial rate

Results for this sector are presented in Table 23. Somewhat surprisingly, the elasticity for per capita income is quite low while that for population is about 4.0. These results are in part explained by the narrow base of the tax, but more importantly may be the result of widespread avoidance. Noncompliance appears almost certainly to be the major factor behind the low income elasticity. The high population elasticity suggests that a relatively constant rising proportion of the population pays the tax, hence, in a state with rising incomes, the larger the population, the higher the revenue. The variable MOODY indicates that changing interest rates can have large dollar amount effects on the yield from this tax.

Inheritance Sector

This group of taxes represent the only attempt at direct taxation of wealth in Tennessee. Included are the inheritance tax, estate tax, and gift tax. As discovered in Chapter 3, this sector makes the smallest contribution of any to Tennessee tax revenues. Also, the amount of

revenue yielded is expected to fall rapidly as changes in the law increase exemptions significantly.

Inheritance taxes, as wealth taxes, do not fit the general specification set out at the beginning of this chapter. Rather than an income related variable, some measure related to wealth is more appropriate. The variable that performed best in preliminary regressions was per capita property income. Here, the idea is to represent the flow of income generated by the stock of wealth with higher per capita property income leading to greater revenue. Also, since the revenues generated by this sector are all related to the death rate or the passing of estates from one generation to another, two factors that are related to population size, the population variable is included in this equation. The expectation is for a positive sign. The age structure of the population is an obvious factor, i.e., an elderly population should lead to more inheritance tax activity than a young population. The variable AGE introduced in the previous section was included in several estimates of the inheritance sector equation, one of which is shown in Table 24, below. This variable, however did not pass the usual significance tests, although the coefficients were consistently of the correct sign.

Two dummy variables were employed to reflect the changes in the inheritance tax base in 1972 and 1979. As discussed in Chapter 3, the most important of these reforms was the 1979 increase in marital exemptions. As expected, only the 1979 dummy variable performed satisfactorily.

Table 24. Inheritance Tax Sector: Parameter Estimates

Variable	OLS1	OLS2	SUR
WEALTH	0.232018 (0.501315)	0.555214 (0.368271)	0.443459 (0.343444)
POPUL	6.751461** (2.769912)	6.338495** (2.633977)	7.016358* (2.433027)
EXEMPT	-0.447061* (0.131394)	-0.500781* (0.116611)	-0.437697* (0.104664)
AGE	1.333773 (1.531888)		
Intercept	-55.901694** (23.835941)	-49.121609** (22.222801)	-54.866944* (20.530547)
R ²	0.9813	0.9822	n
DW	1.2841 ^l	1.3165 ^l	

*Significance of error of 0.01 or better.

**Significance of error of 0.05 or better.

ⁿNot reported.

^lInconclusive Durbin-Watson Test.

Note: Numbers in parentheses are standard errors of the estimate.

The specification of the inheritance sector equation is:

$$\text{INHT} = d(\text{WEALTH}, \text{POPUL}, \text{EXEMPT})$$

where

INHT	annual revenue from inheritance tax sector
WEALTH	per capita property income
POPUL	population
EXEMPT	dummy variable for the 1979 increase in marital exemptions. One for the years 1979-1980; zero otherwise.

Estimates of the inheritance tax equation are presented in Table 24. The preliminary estimate shown in the first column includes the variable AGE. Note that R^2 improves when this variable is removed in the second column. Under SUR, it is clear that the population variable is the major determinant of revenue in this sector with a coefficient of 7.0. The dummy, EXEMPT, has the expected negative sign but is not particularly large in comparison with the intercept estimate. The variable, WEALTH, actually fails to satisfy the normal significance tests by a small margin. This variable was left in the final specification due to the improvement in R^2 over preliminary estimates without it.

An Aggregate Model

As a means of summing up the overall performance and adequacy of the Tennessee tax system, a Legler and Shapiro type model has also

been estimated. Recall that in this formulation, total tax revenue is regressed against per capita income, population and tax rates with positive signs expected in all cases. Only one tax rate has been used for our case, specifically, the sales and use tax rate.

The results of estimating this equation are shown in Table 25. As can be seen, the population variable is statistically significant. The coefficient of this variable is 2.88, which indicates excellent responsiveness of revenue to population changes. Note that the estimate of the income variable, although insignificant statistically, is far below the overall system elasticity for the entire Tennessee tax system reported above. This supports the fact that the income elasticity in the sales and use tax equation is well below earlier estimates, also. The rate variable is significant at the 10% level. These results attest to the robustness of this variable found in the sales and use tax equation and is a reminder of the importance of the sales and use tax in the Tennessee tax system.

Summary

This chapter has had two purposes. The first has been to develop an explanatory model of the Tennessee tax system. This has been done by means of specifying and estimating a nine equation model. This model represents a significant improvement over earlier models of this type with several important variables heretofore omitted included in the estimates. The most important contributions to our understanding come from the variables reflecting inflationary expectations, specific price

Table 25. Aggregate Legler-Shapiro Type Model
for Tennessee 1950-80⁺

Variable	Elasticity
Per Capita Income	0.57
Population	2.88*
Sales and Use Tax Rate	0.33**

*Significance of error of 0.05 or better.

**Significance of error of 0.10 or better.

⁺The dependent variable is total annual tax revenue.

effects, the influence of interest rates, the availability of credit, and adjustments in tax bases.

The second purpose of this chapter has been to utilize the model of the Tennessee tax system to evaluate its adequacy. In this regard, it is safe to conclude that the Tennessee tax system provides adequate responsiveness to changes in population but not to changes in income. (Recall that income, income per capita, and population have all been increasing at relatively high rates in the 1970-1980 period.) This conclusion is most obvious from the estimates of the sales and use tax equation and from the Legler and Shapiro type model. Of the larger revenue sources, such as motor vehicle fuels and corporate sector taxes, a roughly proportional relationship with income is observed. Also, due to the rather peculiar nature of the taxes included in the selective sales tax sector, a high income elasticity is reported. However, these two

instances are not sufficient to overcome the lack of responsiveness to income of the sales and use tax. The remaining minor taxes all respond most favorably to population or total income (which includes a population factor).

Based on the results of the analysis of this chapter, it appears that improvement of the adequacy of the Tennessee tax system should be in the direction of improving the responsiveness to per capita income. Such an objective can be reached in two ways. First, existing taxes can be modified albeit at the risk of losing responsiveness to population changes. A more reasonable approach would be to introduce new taxes that are more responsive to income changes and attempt to achieve a balance between income elastic and population elastic taxes. Failure to take one of these paths means continued reliance on the strength of the sales and use elasticity of revenues to rate changes.

CHAPTER 5

ADEQUACY AND A TENNESSEE INCOME TAX

The purpose of this chapter is to investigate the implications of instituting a flat rate income tax in Tennessee based on federal income tax definitions. The first part of the discussion will address the impact of such a tax on revenue adequacy in the state. The second part of the chapter will present additional arguments that favor the introduction of a Tennessee income tax.

Defining a Tennessee Income TaxFederal Income Tax Definitions

Although it is possible for Tennessee to construct an independent income tax system, it is far simpler administratively to employ the structure already in place at the federal level. The state has three alternatives on which to base a definition of state taxable income:

1. Federal Adjusted Gross Income
2. Federally Defined Taxable Income
3. Federal Income Tax Obligation

Utilizing either the second or third alternative immediately incorporates the progressivity of the federal system resulting from its adjustments, deductions, and exemptions. Using the third alternative incorporates the federal rate structure as well (Musgrave and Musgrave, 1984). Federal Adjusted Gross Income would be the most inclusive concept as it precedes the computation of deductions and exemptions in the federal system.

Tennessee could adopt either of these three definitions directly or modify them. For example, if adjusted gross income is selected, some family based allowance may be desirable. Still, it would again appear simpler administratively to choose among the three on the basis of state objectives with regard to the degree of progressivity and comprehensiveness desired and apply a flat rate to the base chosen.

Adequacy Considerations

The discussion in Chapter 4 suggests that one method of improving the overall adequacy of the Tennessee tax system is through the introduction of a tax that is responsive to per capita income. Which of the three alternative definitions of state taxable income would be the most responsive under the flat rate scheme proposed?

Data have been obtained from Federal publications and hand written reports from the Internal Revenue Service, Washington, D.C., on Tennessee Adjusted Gross Income, Taxable Income, and Federal Tax Obligation. Data on Adjusted Gross Income and federal tax obligations are available for the entire study period 1950-1980. Data on taxable income are available only from 1956 forward. Variables employing each income definition have been regressed against state per capita income alone and state per capita income and population in double log transformation. Results are presented in Tables 26 and 27. The top part of each table presents OLS estimates while the bottom half presents estimates corrected for autocorrelation (AUTOREG estimates). The key coefficient is the per capita income elasticity. In all cases, it appears from the corrected

Table 26. Responsiveness of Income Tax Bases to Per Capita Income

Dependent Variable	Coefficient of Per Capita Income
A. OLS Estimates:	
Adjusted Gross Income DW = 0.4526	1.192759* (0.012237)
Taxable Income DW = 0.7358	1.457255* (0.028076)
Federal Income Tax DW = 0.3928	1.410949* (0.030136)
B. AUTOREG Estimates:	
Adjusted Gross Income	1.194369* (0.021351)
Taxable Income	1.457931* (0.049630)
Federal Income Tax	1.448492* (0.058094)

*Significance of error of 0.01 or better.

Note: Numbers in parentheses are standard errors.

Table 27. Responsiveness of Income Tax Bases
to Per Capita Income and Population

Dependent Variable	Coefficients of	
	Per Capita Income	Population
A. OLS Estimates:		
Adjusted Gross Income DW = 0.5789	0.927748* (0.094961)	1.605535* (0.571391)
Taxable Income DW = 0.9697	0.989521* (0.190656)	2.912934** (1.176782)
Federal Income Tax DW = 0.4392	1.128852* (0.257673)	1.709051 (1.550437)
B. AUTOREG Estimates:		
Adjusted Gross Income	0.993871* (0.112849)	1.218823 (0.677018)
Taxable Income	1.105691* (0.275467)	2.172301 (1.679621)
Federal Income Tax	1.429230* (0.274943)	0.116412 (1.643792)

*Significance of error of 0.01 or better.

**Significance of error of 0.05 or better.

Note: Numbers in parentheses are standard errors.

estimates that either federal taxable income or federal tax obligation would provide the greatest amount of responsiveness with elasticities in the 1.4 range. Note in Table 26 that the inclusion of the population variable lowers the income per capita elasticity, but for the taxable income case, the population coefficient is not statistically significant. (This decision criterion is based on the simple regression found in Table 25, p. 90.)

Income Tax versus Sales Tax

The symptom of an inadequate tax system is the repeated need to redefine tax bases and adjust rates. In Tennessee, the sales and use tax rate has been raised in 1955, 1972, and 1976. In addition, the base has been redefined five times over the 1970 to 1980 period. Given the dominance of the sales tax in the Tennessee revenue structure, these symptoms seem sufficient to declare that the state tax system is inadequate.

The purpose of this section is to explore the trade-off between the historical case of increasing reliance on the sales tax and an income tax. In the simulations to follow, the years 1972 and 1976 (both years when the sales tax rate was increased significantly) are used as points of departure. The objective of the simulations is to compare actual sales tax revenue in 1980 with estimates of revenue from a modified system that includes both a sales tax and an income tax.

Results of the simulations are reported in Tables 28 and 29. Table 28 reports the results of the experiment assuming that federal

Table 28. Revenue Simulations Using Federal Taxable Income

Year	Sales Tax Revenue		Estimates of Total of Sales and Income Taxes			
	Estimated	Actual	1972 Change		1976 Change	
			2% Rate	3% Rate	2% Rate	3% Rate
1970	241.91	239.19	-	-	-	-
1971	263.46	262.06	-	-	-	-
1972	343.38	351.86	353.82	349.35	-	-
1973	399.29	399.44	414.53	403.90	-	-
1974	446.91	447.29	466.95	454.55	-	-
1975	482.97	474.57	495.84	488.86	-	-
1976	551.34	554.00	549.50	532.64	611.35	590.73
1977	724.02	730.67	675.87	610.32	737.19	740.63
1978	818.32	831.33	776.99	692.34	848.99	845.34
1979	918.99	938.66	845.56	765.95	921.89	928.15
1980	997.70	978.12	925.86	831.88	1010.54	1011.83

Table 29. Revenue Simulations Using Federal Tax Obligation

Year	Sales Tax Revenue		Estimates of Total of Sales and Income Taxes			
	Estimated	Actual	1972 Change		1976 Change	
			2% Rate	3% Rate	2% Rate	3% Rate
1970	241.91	239.19	-	-	-	-
1971	263.46	262.06	-	-	-	-
1972	343.38	351.86	352.43	351.19	-	-
1973	399.29	399.44	408.27	404.47	-	-
1974	446.91	447.29	460.30	455.34	-	-
1975	482.97	474.57	481.80	487.13	-	-
1976	551.34	554.00	532.59	530.36	635.46	603.00
1977	724.02	730.67	604.54	590.13	730.93	732.32
1978	818.32	831.33	682.37	664.76	825.60	825.90
1979	918.99	938.66	758.65	741.49	916.86	919.47
1980	997.70	978.12	853.22	813.22	1040.03	1023.39

taxable income is used as the Tennessee income tax base, while Table 29 assumes that the federal tax obligation is the base. In each table, the first two columns present data on revenues from the in place sales and use tax from 1970 to 1980. The first column includes estimated collections based on the sales and use tax equation estimated in Chapter 4. The second column includes actual collections. Note that the average error is about 0.21%.

In columns three and four of Tables 28 and 29, it is assumed that the sales tax rate was not increased in 1972. Rather, it is assumed that it was reduced to 2.0% (column three) or held constant at 3.0% (column four). The revenue shortfall is made up by a flat rate income tax. The data shown in the columns are the projected combined revenues of both taxes assuming no further changes in rates or bases of either tax (e.g., the 1976 increase in the sales tax does not take place).

Columns five and six of the two tables repeat the experiment assuming it begins in 1976. The sales tax rate is dropped to either 2.0% or 3.0% rather than raising it to 4.5%. Flat rate income taxes are again used to eliminate the revenue shortfall in the initial year. For example, with federal taxable income as the base (Table 28), assuming the sales tax rate was dropped to 2.0% in 1976, the combined sales-income tax system would have yielded an estimated 1010.54 million dollars in 1980. From column two, it can be seen that the 4.5% sales tax yielded 978.12 million dollars. Table 30 presents a list of the income tax rates required in either 1972 or 1976 to produce the revenue lost by reducing or not increasing the sales tax rate. The results of the simulation are clear.

Table 30. Income Tax Rates Required to Replace Sales Tax Revenues

Case	Income Tax Rates	
	Federal Taxable Income Base	Federal Tax Obligation Base
1972 Case:		
Sales Tax Rate = 2.0%	2.20%	10.1%
Sales Tax Rate = 3.0%	0.75%	6.2%
1976 Case:		
Sales Tax Rate = 2.0%	2.60%	14.9%
Sales Tax Rate = 3.0%	1.60%	9.0%

Turning to an income tax in 1972 could have produced a tax system featuring low rates on both the sales and income tax. With no changes since 1972, estimated revenues are only slightly below actual sales tax collections. If the income tax were incorporated in 1976, estimated revenue collections of the combined system are actually ahead of actual sales tax collections. This evidence seems sufficient to declare that a Tennessee tax system based on both an income tax and a sales tax would have proven more adequate than the existing sales tax only system. Furthermore, if needs for more revenue arise, the combined system presents a much wider range of untapped potential.

The final choice of base (federal taxable income or federal tax obligation) does not affect the conclusion. Thus, this determination can be made on other grounds, such as equity, economic efficiency, or

administration. In addition, the presence of an income tax in the system provides other possibilities for making improvements in the system.

Income Tax Evaluation

Equity and Economic Efficiency

In addition to improving the adequacy of the Tennessee tax system, a flat rate system such as proposed should have beneficial spillover into the efficiency and equity areas. Recall that a low income elasticity is also a symptom of regressivity. Thus, the incorporation of an income tax with a high income elasticity would result in a more progressive system. Such a system would be more equitable if policy makers in the state equate equity with greater progressivity.

Working on the hypothesis that lower rates produce smaller disturbances to resource allocation, the proposed sales tax-income tax system would be preferred. This may also be an argument for the taxable income base as the apparent rate would be low. On administrative grounds, low rates are usually preferred as a means of inhibiting attempts to avoid paying the tax (Musgrave and Musgrave, 1984).

Sales Tax Reform

The presence of an income tax permits a more flexible approach to reforming the existing Tennessee sales tax (and other taxes as well). For example, one common proposal is to exempt food from the sales tax base. This proposal is normally advocated on equity grounds. Opponents, however, point out that such an exemption would reduce the

revenue productivity of the tax and create enforcement difficulties (Due, 1968). With an income tax in place, superior equity effects could be achieved by means of tax credits without altering the structure of the sales tax (Billings, 1972). Revenue losses could be made up through increases in the income tax rate.

The Choice of Income Tax Base

The existing federal definitions of income are not necessarily ideal. They have been advocated largely on the basis of expediency. The literature is replete with critiques of the federal income tax system and suggestions for alternative definitions of income (Goode, 1964; Kaldor, 1955; Musgrave, 1959). Careful examination, however, often reveals that many reforms merely create new problems to replace old ones.

The expenditure tax proposal of Kaldor (1955) may have some relevance in Tennessee due to the possibility that direct taxes on income may be unconstitutional (Bohm and Goolsby, 1974). The expenditure tax, however, would be a rather superficial attempt at circumventing a constitutional ban as it is equivalent to a direct income tax with savings exempted. A more likely, albeit undesirable alternative, is a payroll tax on wages justified as a privilege tax on employment.

Summary

In this chapter, the improvement in adequacy that could be expected from incorporating an income tax into the Tennessee tax system has been explored. It has been found that a flat rate income tax based

either on federal taxable income or federal tax obligations would improve adequacy considerably. With the income tax, revenues would increase in closer accord with the state economy with fewer changes in tax rates or bases required. The existence of an income tax would also permit greater flexibility in addressing tax reform in other areas.

CHAPTER 6

CONCLUSION

During the winter of 1984, the Tennessee legislature and governor raised the state sales tax rate to 5.5% and further expanded the base to include amusements. When combined with the existing local option sales tax, the overall rate approaches 8.0%. The need for revenue to support education was the major impetus for adjusting the sales tax rate and base. Recent history suggests that the basic inadequacy of the sales tax will lead to renewed fiscal difficulties in the near future.

Summary

This study traces the development of the concept of state tax revenue adequacy as a major criterion in the evaluation of a state tax system. It is seen that the concept of adequacy has become synonymous with responsive tax structures. This responsiveness implies that an adequate tax structure should not have to be modified continually through rate and base changes in order to meet the demands for public expenditures. A key indicator of adequacy is the degree of elasticity with respect to per capita income.

Following the tradition in the literature, the major research vehicle is the revenue model. A nine sector model is developed and estimated using the seemingly unrelated regressions technique. On the basis of the results obtained from this model, it is determined that the present Tennessee tax system responds adequately to changes in population but inadequately to changes in per capita income.

Due to the demonstrated inability of the present tax structure to provide revenues corresponding to the growth in demand for public expenditures, an income tax is proposed. As a means of evaluating the potential impact on the adequacy of the Tennessee tax system of such an action, a simulation is performed. The results of this simulation indicate that the recurring problem of poor responsiveness of tax revenues to economic growth can be overcome through the introduction of a flat rate income tax, based either on federal taxable income or the federal tax obligation. A tax system which includes both the current sales tax and the proposed income tax would be responsive to both income and population growth, which are the major indicators of growth in the demand for public expenditures. Revenues produced by relatively low rates would be comparable to those generated now by a sales tax with a very high rate.

The proposed two base system will place Tennessee in a much better position to weather the fiscal stresses of the eighties. Additionally, a revision of tax system emphasis incorporating income and sales taxes provides spillover benefits in the areas of equity, efficiency and administration.

Finally, potential constitutional problems with implementing an income tax were examined and alternatives were discussed which would provide much of the desirable features for the Tennessee tax system.

Conclusion

This examination into the performance and adequacy of the Tennessee tax system has provided valuable insight into the basis for recurring

fiscal stress in state government. It has been shown that continued reliance on the present system will not provide a lasting solution to the state's financial problems, and, indeed, they are likely to get worse. The most practical solution available is the institution of a flat rate income tax against either federal taxable income or the federal tax obligation. In this way both inadequacy with respect to income and equity can be improved significantly. While on the surface the institution of a personal income tax would appear to be politically unpalatable, it must be considered that the alternative of constantly adjusting tax bases and rates or reducing services may be even more so.

REFERENCES

REFERENCES

1. Aaron, Henry. "Inflation and the Income Tax," American Economic Review, Proceedings, Vol. 66 (2), May 1976, pp. 193-199.
2. Adams, F. Gerard, Carl G. Brooking, and Norman J. Glickman. "On the Specification and Simulation of a Regional Econometric Model: A Model of Mississippi," The Review of Economics and Statistics, Vol. 57 (3), August 1975, pp. 286-298.
3. Allen, R. G. D. Mathematical Analysis for Economists. New York: St. Martin's Press, 1938.
4. Arnott, Richard and Ronald E. Grieson. "Optimal Fiscal Policy for a State or Local Government," Journal of Urban Economics, Vol. 9 (1), January 1981, pp. 23-48.
5. Auten, Gerald E. and Edward H. Robb. "A General Model for State Tax Revenue Analysis," National Tax Journal, Vol. 29 (4), December 1976, pp. 422-435.
6. Bailey, Martin J. National Income and the Price Level. New York: McGraw-Hill Book Company, 1971.
7. Barnard, Jerald R. and Warren T. Dent. "State Tax Revenues--New Methods of Forecasting," The Annals of Regional Science, Vol. 13 (3), November 1979, pp. 1-14.
8. Barnard, J. R., W. T. Dent, and A. P. Reznick. "An Econometric Model of a State Government Sector," Regional Science Perspectives, Vol. 11 (1), 1981, pp. 3-21.
9. Beaton, James R. "Family Tax Burdens by Income Levels," National Tax Journal, Vol. 15 (1), March 1962, pp. 15-25.
10. Berney, Robert E. and Bernard H. Frerichs. "Income Elasticities for State Tax Revenues: Techniques of Estimation and Their Usefulness for Forecasting," Public Finance Quarterly, Vol. 1 (4), October 1973, pp. 409-425.
11. Biennial Report. (Series) Nashville: Tennessee Department of Revenue, 1947-1982.
12. Billings, R. Bruce. "Income Tax Credits to Reduce the Regressivity of State-Local Tax Systems," The American Journal of Economics and Sociology, Vol. 31 (4), October 1972, pp. 397-411.
13. Bohm, Robert A. and William C. Goolsby. Analysis and Proposals for Tax Reform. Nashville: State of Tennessee, 1974.

14. Box, G. E. P. and D. R. Cox. "An Analysis of Transformations," Journal of Royal Statistical Society, Series B, Vol. 26 (2), 1964, pp. 211-251.
15. Bradford, D. F., R. A. Malt, and W. E. Oates. "The Rising Cost of Public Services: Some Evidence and Reflections," National Tax Journal, Vol. 22 (2), June 1969, pp. 185-202.
16. The Budget 1981-82. Nashville: State of Tennessee, 1981.
17. Chang, Hui S. "A Computer Program for Box-Cox Transformation and Estimation Technique," Econometrica, Vol. 45 (7), October 1977, p. 1741.
18. Chang, Hui S. "Functional Forms and the Estimation of a State's Sales Tax Revenue: Tennessee as a Case Study," The Annals of Regional Science, Vol. 13 (2), July 1979, pp. 8-18.
19. Chang, Hui S. Tennessee Econometric Model: Phase I. Knoxville: Center for Business and Economic Research, The University of Tennessee, 1976.
20. Chiang, Alpha C. Fundamental Methods of Mathematical Economics. New York: McGraw-Hill, Inc., 1967.
21. Corlew, Robert E. Tennessee. Knoxville: The University of Tennessee Press, 1981.
22. Darby, Michael R. "Postwar U.S. Consumption, Consumer Expenditures, and Saving," American Economic Review, Vol. 65 (2), May 1975, pp. 217-224.
23. Davies, David G. "The Sensitivity of Consumption Taxes to Fluctuations in Income," National Tax Journal, Vol. 15 (3), September 1962, pp. 281-290.
24. Davies, David G. and David E. Black. "Equity Effects of Including Housing Services in a Sales Tax Base," National Tax Journal, Vol. 28 (1), March 1975, pp. 135-137.
25. Due, John F. Sales Taxation. Urbana: University of Illinois Press, 1957.
26. Due, John F. "The New State Sales Taxes," National Tax Journal, Vol. 21 (3), September 1968, pp. 266-287.
27. Due, John F. State and Local Sales Taxation. Chicago: Public Administration Service, 1971.

28. Due, John F. and John L. Mikesell. "State Sales Tax Structure and Operation in the Last Decade - A Sample Study," National Tax Journal, Vol. 33 (1), March 1980, pp. 21-43.
29. The Sales Tax. Durham: Duke University Law School, 1932.
30. Dutta, M. Econometric Methods. Cincinnati: South-Western Publishing Company, 1975.
31. Folmsbee, Stanley J., et al. History of Tennessee, Vol. II. New York: Lewis Historical Publishing Company, Inc., 1960.
32. Folmsbee, Stanley J., et al. Tennessee. Knoxville: The University of Tennessee Press, 1969.
33. Fox, William F. and Charles Campbell. "Stability of the State Sales Tax Income Elasticity," National Tax Journal, Vol. 37 (2), June, 1984.
34. Fox, William F. and Kenneth E. Quindry. "Public and Private Sector Effects of State and Local Government Fiscal Constraints," Public Finance Quarterly, Vol. 12 (4), October, 1984.
35. Friedlander, Ann F., Gerald J. Swanson and John F. Due. "Estimating Sales Tax Revenue Changes in Response to Changes in Personal Income and Sale Tax Rates," National Tax Journal, Vol. 26 (1), March 1973, pp. 103-110.
36. Friedman, Milton. A Theory of the Consumption Function. Princeton: National Bureau of Economic Research, 1957.
37. Goode, Richard. The Individual Income Tax. Washington, D.C.: The Brookings Institution, 1964.
38. Greytak, David and Richard McHugh. "Inflation and the Individual Income Tax," Southern Economic Journal, Vol. 45 (1), July 1978, pp. 168-180.
39. Greytak, David and Jerry Thursby. "Functional Forms in State Income Elasticity Estimation," National Tax Journal, Vol. 32 (2), June 1979, pp. 195-200.
40. Greytak, David and Jerry Thursby. "The Elasticity of State Income Taxes: A Further Consideration," National Tax Journal, Vol. 33 (4), December 1980, pp. 497-499.
41. Groves, Harold M. and C. Harry Kahn. "The Stability of State and Local Tax Yields," American Economic Review, Vol. 42 (1), March 1952, pp. 87-102.

42. Haig, R. M. and Carl Shoup. The Sales Tax in the American States. New York: Columbia University Press, 1934.
43. Hansen, Reed R. "An Empirical Analysis of the Retail Sales Tax With Policy Recommendations," National Tax Journal, Vol. 15 (1), March 1962, pp. 1-13.
44. Heathfield, D. F., ed. Topics in Applied Macroeconomics. New York: Academic Press, Inc., 1977.
45. Henry, Harold W., et al. Energy Management Theory and Practice. New York: Marcell Dekker, 1980.
46. Hirsch, Werner Z. The Economics of State and Local Governments. New York: McGraw-Hill Book Company, 1970.
47. Hood, Lisa. "UT Faculty Raises Salary Beefs," The Knoxville News-Sentinel. Knoxville: 9 October 1982, p. 11.
48. Hyman, David N. Public Finance. New York: The Dryden Press, 1983.
49. Intrilligator, Michael D. Mathematical Optimization and Economic Theory. Englewood Cliffs: Prentice-Hall, Inc., 1971.
50. Johnston, J. Econometric Methods, Second Edition. New York: McGraw-Hill Book Company, 1972.
51. Kaldor, Nicholas. An Expenditure Tax. London: Unwin University Books, 1955.
52. Kmenta, Jan. Elements of Econometrics. New York: The Macmillan Company, 1971.
53. Knight, Frank H. Risk, Uncertainty and Profit. Chicago: University of Chicago Press, 1971.
54. "State Sales Tax May Be Broadened," The Knoxville News-Sentinel. Knoxville: 29 December 1983, p. B5.
55. Legler, John B. and Perry Shapiro. "The Responsiveness of State Tax Revenue to Economic Growth," National Tax Journal, Vol. 21 (1), March 1968, pp. 47-56.
56. Legler, John B. and Perry Shapiro. "The Responsiveness of State Tax Revenue to Economic Growth: A Reply," National Tax Journal, Vol. 22 (2), June 1969, pp. 299-300.

57. Liu, Ben-Chieh. "Comments on The Responsiveness of State Tax Revenue to Economic Growth," National Tax Journal, Vol. 22 (2), June 1969, pp. 294-298.
58. Lyons, David. "Tax Take in State is Dismal," The Knoxville News-Sentinel. Knoxville: 9 October 1982, p. 7.
59. McClintic, Joseph O. "California's Ability to Finance Higher Education," National Tax Journal, Vol. 15 (2), June 1962, pp. 170-183.
60. McGrory, Brian. "Fund Squeeze Hurts Colleges, Report Warns," The Knoxville News-Sentinel. Knoxville: 9 October 1982, p. 9.
61. McKessy, Steven M. "Corporate and Individual Tax Reform Considered from a States and Local Viewpoint," National Tax Journal, Vol. 28 (3), September 1975, pp. 377-381.
62. McLure, Jr., Charles E. "Integration of the State Income Taxes: Economic and Administrative Factors," National Tax Journal, Vol. 34 (1), March 1981, pp. 75-94.
63. Maxwell, James A. Financing State and Local Governments, rev. ed. Washington, D.C.: The Brookings Institution, 1969.
64. Mikesell, John L. "Income Elasticities of State Sales Tax Base Components," Quarterly Review of Economics and Business, Vol. 17 (1), Spring 1977, pp. 83-94.
65. Mishkin, Frederic S. "Illiquidity, Consumer Durable Expenditure, and Monetary Policy," American Economic Review, Vol. 66 (4), September 1976, pp. 642-654.
66. Morgan, Daniel C., Jr. Retail Sales Tax. Madison: The University of Wisconsin Press, 1964.
67. Musgrave, Richard A. The Theory of Public Finance. New York: McGraw-Hill Book Company, 1959.
68. Musgrave, Richard A. and Peggy B. Musgrave. Public Finance in Theory and Practice. New York: McGraw-Hill Book Company, 1984.
69. Mushkin, S. J. and G. C. Lupo. "Project '70: Projecting the State and Local Sector," Review of Economics and Statistics, Vol. 42, May 1967, pp. 237-245.
70. Sales Taxes: General, Selective and Retail. New York: National Industrial Conference Board, Inc., 1932.

71. Nelson, C. L. et al. Sales Taxes. Minneapolis: League of Minnesota Municipalities, 1935.
72. Newman, Philip C., A. D. Gayer, and M. H. Spencer. Source Readings in Economic Thought, New York: W. W. Norton and Company, Inc., 1954.
73. Pechman, Joseph A. Federal Tax Policy, rev. ed. New York: The Brookings Institution, 1971.
74. Ray, C. L. "A Note on State Tax Stability Criteria," National Tax Journal, Vol. 19 (2), June 1966, pp. 207-209.
75. Reeves, H. Clyde. "Higher Education and State Tax Policy," National Tax Journal, Vol. 15 (3), September 1962, pp. 291-296.
76. Ricardo, David. Principles of Political Economy and Taxation, Hartwell edition. Middlesex, England: Penguin Books, 1971.
77. Roll, Eric. A History of Economic Thought, third edition. Englewood Cliffs: Prentice-Hall, Inc., 1956.
78. Schumpeter, Joseph A. History of Economic Analysis. New York: Oxford University Press, 1954.
79. Shapiro, Perry and John B. Legler. "Estimating Tax Revenue Changes in Response to Changes in Tax Rates," National Tax Journal, Vol. 26 (1), March 1973, pp. 111-113.
80. Singer, Neil M. "The Use of Dummy Variables in Estimating the Income-Elasticity of State Income Tax Revenues," National Tax Journal, Vol. 21 (2), June 1968, pp. 200-204.
81. Singer, Neil M. "Estimating State Income Tax Revenues - a New Approach," Review of Economics and Statistics, Vol. 52, November 1970, pp. 427-433.
82. Smith, Adam. An Inquiry into the Nature and Causes of the Wealth of Nations, Cannan edition. Dunwoody, Georgia: Norman S. Berg, 1976 (originally published in 1776).
83. Solari, L. and J.-N. DuPasquier, eds. Private and Enlarged Consumption, Amsterdam: North-Holland Publishing Co., 1976.
84. Spiegel, Henry W. The Growth of Economic Thought. Englewood Cliffs: Prentice-Hall, Inc., 1971.
85. State and Local Taxes. New York: Tax Foundation, Inc., 1970.
86. Tennessee Business Taxes. Nashville: State of Tennessee, 1978.

87. The Tennessee State-Local Tax System. Nashville: State of Tennessee, 1978.
88. Tennessee State Tax System. Nashville: State of Tennessee, 1972.
89. Theil, Henri. Principles of Econometrics. New York: John Wiley and Sons, Inc., 1971.
90. U.S. Bureau of the Census. State Tax Collections (Series) Washington, D.C.: U.S. Government Printing Office, 1965-1979.
91. Vogel, Robert C. and Robert P. Trost. "The Response of State Government Receipts to Economic Fluctuations and the Allocation of Counter-Cyclical Revenue Sharing Grants," Review of Economics and Statistics, Vol. 61 (3), August 1979, pp. 389-400.
92. von Furstenberg, George M. "Individual Income Taxation and Inflation," National Tax Journal, Vol. 28 (1), March 1975, pp. 117-125.
93. Wasylenko, Michael. "Estimating the Elasticity of State Personal Income Taxes," National Tax Journal, Vol. 28 (1), March 1975, pp. 139-142.
94. Wiedenbaum, Murray L. Federal Aid to State and Local Governments: The Policy Alternatives. St. Louis: Washington University Department of Economics. (Working Paper Number 6706)
95. Wilford, Walton T. "State Tax Stability Criteria and the Revenue-Income Elasticity Coefficient Reconsidered," National Tax Journal, Vol. 18 (3), September 1965, pp. 304-312.
96. Wilford, Walton T. "A Comment on 'The Stability, Growth, and Stabilizing Influence of State Taxes'," National Tax Journal, Vol. 28 (4), December 1975, pp. 452-458.
97. Williams, W. V., et al. "The Stability, Growth, and Stabilizing Influence of State Taxes," National Tax Journal, Vol. 26 (2), June 1973, pp. 267-274.
98. Zwick, Burton. "The Interest-Induced Wealth Effect and the Behaviors of Real and Nominal Interest Rates," Journal of Finance, Vol. 29 (5), December 1974, pp. 1425-1435.

APPENDIX

1984 TAX LAW CHANGES

As was already mentioned, the state portion of the sales tax rose to 5.5%. Additionally, the legislature is considering changing the provision for the local option rate to be based on the current rate as opposed to the permanent rate. This would increase the local option rate to 2.75%. The legislature also is planning to phase out the sales taxation of food consumed in the home.

VITA

Samuel Roberts Carter, Jr., was born in Knoxville, Tennessee, on November 19, 1949. His family moved from Tennessee to South Carolina the following year and to Winter Park, Florida, when he was four. He attended elementary and junior high schools in that city and was graduated from Winter Park High School in June 1967. That month he enrolled in The University of Tennessee, Knoxville, and attended there for two years before transferring to Florida Technological University (now the University of Central Florida). In June 1971, he received a Bachelor of Science degree in Finance, and he received a Bachelor of Arts degree in Economics in December 1971.

He continued full-time employment with Aldoors of Florida until the fall of 1971, when he accepted an assistantship at The University of Tennessee, Knoxville. He received the Master of Arts degree with a major in Economics in 1975.

At the end of course work toward the doctorate, he accepted a position as a research associate with the University's Office of Institutional Research in September 1975. In June 1978, he accepted a position with International Business Machines Corporation, where he is currently employed. He received the Doctor of Philosophy degree with a major in Economics in June 1984.

The author is a member of Omicron Delta Epsilon. He is married to the former Sharon Lynn Steidley of Maitland, Florida. They have two sons, Samuel Roberts Carter III and Scott Thomas Carter, and a daughter, Katherine Elizabeth Carter.