This is to certify that the

dissertation entitled

DETERMINANTS OF STATE AND LOCAL GOVERNMENT BORROWING

presented by

JUDY ANN TEMPLE

has been accepted towards fulfillment
of the requirements for

Ph.D. degree in ECONOMICS

Major professor

Date 11/9/90

DETERMINANTS OF STATE AND LOCAL GOVERNMENT BORROWING

By

Judy Ann Temple

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Economics

1990

ABSTRACT

DETERMINANTS OF STATE AND LOCAL GOVERNMENT BORROWING

By

JUDY ANN TEMPLE

The objective of this research is to explain the variation across states in the issuance of long-term bonds by state and local governments. These governments issue two types of bonds: general obligation bonds that typically are issued for traditional government or public purposes, and revenue bonds that are more likely to be issued in support of non-traditional government activity.

I develop a model of state and local government borrowing in which three important decisions are made. First, the government official determines the optimal share of debt finance associated with any desired level of state and local capital expenditures. At the same time, the median voter selects the level of state and local capital spending. Finally, the government selects the optimal share of debt finance associated with the desired level of economic development activity. The quantity of general obligation bonds and revenue bonds issued depends on both the level of the activity being financed and the method of financing that level of activity. The purpose of this research is to identify and then estimate the significance of the proposed determinants of each of these decisions.

The hypotheses generated by the model are tested using state and local government borrowing levels by state as units of observation. The

research uses general obligation bond data from the Securities Data Company and newly-available data on private-activity bond issues from the U.S. Treasury for the sample years of 1983 and 1984. Income and past and future population growth are shown to be important determinants of the variation in general obligation bond issues. The positive relationship between income and the general obligation debt share contradicts the predictions of recent arbitrage models of government borrowing. Although the variation in some types of revenue bonds cannot be explained by economic factors, a significant portion of the across-state variation in industrial development bonds can be explained by variables in the model.

ACKNOWLEDGMENTS

I wish to express my gratitude to my dissertation advisor, Professor Ronald Fisher, for his endless patience and enthusiasm. I also greatly appreciate the efforts of Professor John Goddeeris. Professors Larry Martin and Paul Menchik generously read a draft of my dissertation for the oral defense.

Fellow students Tom Schuster and Pat Redmon provided valuable assistance at earlier stages of this research, while colleague Bill Sjostrom provided assistance at a latter stage. For encouragement, advice and friendship, I want to thank Arthur Reynolds. Last but not least, I thank the Temple family for their support.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

I.A. General Overview.

Long-term bonds issued by state and local governments are of two types: general obligation bonds and revenue bonds. The former are usually issued by the state and local governments themselves and are backed by the "full faith, credit, and taxing power" of the issuing jurisdiction. General obligation bonds tend to be issued for what are typically referred to as "public purposes," such as the construction of roads, bridges, correctional facilities, and elementary and secondary schools. Revenue bonds are issued by state and local governments and their special districts and statutory authorities to finance public utilities and a wide variety of nontraditional government activities such as aid for industrial development, hospitals and colleges, student loans, and mortgage subsidies. Unlike general obligation bonds, revenue bonds are not backed by the taxing power of the jurisdiction. Instead, the payment of interest and principal comes exclusively from the earnings of the particular investment project. In many cases, revenue bonds can be thought of as corporate bonds that are issued as municipal revenue bonds so as to qualify for the federal income tax exemption of municipal bond interest.

The majority of research on state and local borrowing has concentrated on the determination of the yield differential between taxable and tax-exempt bonds. In many studies, the supply of state and local bonds is ignored because it is believed that only changes in the

demand for tax-exempt bonds and/or the supply of taxable bonds will affect the yield ratio. Studies that have analyzed general obligation bond supply traditionally assume that long-term debt is issued to finance capital expenditures. Evidence reported in Tables 1.1 and 1.2 suggests, however, that actual borrowing levels are always well below 100% of capital expenditures and that this debt share varies dramatically by state. The data in the tables also show substantial interstate variation in per-capita borrowing levels for both general obligation and revenue bond issues, and per-capita state and local capital expenditures.[1]

Per capita long-term general obligation bond issues averaged $56 over the two-year period. State and local governments spent an average of $316 per capita on capital expenditures, and the share of debt in the financing these capital expenditures averaged .18. Interestingly, the variation in the level of general obligation bond issues is driven primarily by the variation in the debt share rather than the variation in capital spending. The coefficient of variation (100 times the standard deviation divided by the mean) is 76 for per capita general obligation bond issues, 72 for the debt share, and only 47 for per capita capital spending. Per capita revenue bond issues averaged $204 with a coefficient of variation of 49.[2]

The purpose of this research is to examine possible explanations for the existence of differences in general obligation and revenue bond amounts by state with the intent that this framework can be used to explore these differences empirically. While the traditional view maintains that the demand for state and local capital investment will influence the level of borrowing, there has been no explanation of variation in the debt share and hence the volume of new general obligation issues. The volume of general obligation bonds will be equal to the

Table 1.1 State and Local Government Borrowing in 1983

STATES	GENERAL OBLIGATION ISSUES PER CAPITA	STATE AND LOCAL CAPITAL EXPENDITURES PER CAPITA	SHARE OF GO BOND ISSUES IN FINANCING GOVT CAPITAL	REVENUE BOND ISSUES PER CAPITA
Alabama	$ 6.96	$ 262.34	.03	$ 168.26
Alaska	1827.00	2786.13	.66	494.82
Arizona	55.75	517.64	.11	492.78
Arkansas	0	150.43	.00	98.88
California	35.29	243.11	.15	146.91
Colorado	11.92	386.82	.03	217.92
Connecticut	104.35	189.14	.55	99.68
Delaware	76.07	332.67	.23	191.42
Florida	53.79	340.10	.16	222.08
Georgia	26.40	361.26	.07	187.24
Hawaii	220.80	402.55	.55	75.56
Idaho	0	285.83	.00	74.90
Illinois	79.07	239.87	.33	148.45
Indiana	12.11	187.58	.06	192.48
Iowa	15.54	282.55	.05	109.12
Kansas	38.32	313.51	.12	200.16
Kentucky	0	229.74	.00	160.43
Louisiana	128.02	388.14	.33	233.00
Maine	52.42	193.03	.27	42.72
Maryland	95.83	341.34	.28	223.31
Massachusetts	65.74	269.68	.24	270.05
Michigan	36.07	202.52	.18	82.82
Minnesota	55.53	331.19	.17	302.22
Mississippi	10.98	187.96	.06	90.59
Missouri	26.26	191.34	.14	212.69
Montana	49.79	332.23	.15	261.03
Nebraska	13.81	396.99	.03	78.90
Nevada	56.05	509.70	.11	208.47
New Hampshire	100.18	202.29	.50	256.52
New Jersey	79.56	224.14	.35	191.05
New Mexico	49.62	455.78	.11	175.46
New York	79.32	327.84	.24	97.51
North Carolina	34.13	184.25	.19	52.29
North Dakota	8.19	341.85	.02	180.62
Ohio	20.13	223.82	.09	126.79
Oklahoma	20.72	309.78	.07	118.96
Oregon	10.90	281.95	.04	45.49
Pennsylvania	40.22	216.55	.19	195.06
Rhode Island	6.18	160.00	.04	109.95
South Carolina	37.39	206.18	.18	148.48
South Dakota	0	324.75	.00	233.19
Tennessee	58.88	235.02	.25	188.02
Texas	76.16	355.00	.21	212.86
Utah	122.91	615.35	.20	267.54
Vermont	101.68	220.91	.46	201.52
Virginia	38.99	221.53	.18	259.40
Washington	96.70	650.70	.15	55.99
West Virginia	4.25	257.08	.02	107.43
Wisconsin	81.67	248.92	.33	62.75
Wyoming	67.49	917.64	.07	459.30

Table 1.2 State and Local Government Borrowing in 1984

STATES	GENERAL OBLIGATION ISSUES PER CAPITA	STATE AND LOCAL CAPITAL EXPENDITURES PER CAPITA	SHARE OF GO BOND ISSUES IN FINANCING GOVT CAPITAL	REVENUE BOND ISSUES PER CAPITA
Alabama	$ 2.84	$ 268.74	.01	$ 261.52
Alaska	1341.48	2577.03	.52	273.27
Arizona	106.64	491.51	.22	340.71
Arkansas	0	153.22	.00	93.74
California	58.04	252.28	.23	145.00
Colorado	99.27	435.33	.23	228.53
Connecticut	127.49	198.86	.64	152.24
Delaware	183.22	337.13	.54	395.77
Florida	29.99	373.82	.08	346.82
Georgia	48.71	295.47	.16	488.19
Hawaii	184.36	408.30	.45	153.47
Idaho	5.50	270.80	.02	72.00
Illinois	76.32	260.56	.29	201.32
Indiana	17.17	222.68	.08	171.13
Iowa	27.83	319.90	.09	105.72
Kansas	23.85	295.66	.08	195.33
Kentucky	0	263.26	.00	189.58
Louisiana	111.12	397.98	.28	332.36
Maine	27.55	196.63	.14	66.49
Maryland	118.93	362.88	.33	291.17
Massachusetts	109.49	266.63	.41	237.40
Michigan	33.13	220.28	.15	176.67
Minnesota	158.93	378.89	.42	291.31
Mississippi	4.68	188.23	.02	156.98
Missouri	18.07	214.59	.08	233.77
Montana	0	420.87	.00	389.56
Nebraska	17.20	390.16	.04	215.58
Nevada	63.69	470.34	.14	179.93
New Hampshire	35.79	192.43	.19	302.66
New Jersey	69.50	229.11	.30	254.49
New Mexico	55.49	498.95	.11	121.93
New York	89.16	353.44	.25	193.98
North Carolina	16.35	193.34	.08	129.98
North Dakota	9.44	392.29	.02	337.70
Ohio	25.85	225.04	.11	111.32
Oklahoma	121.24	335.60	.36	123.19
Oregon	167.07	302.24	.55	113.60
Pennsylvania	43.15	192.27	.22	319.76
Rhode Island	52.74	183.75	.29	447.92
South Carolina	44.74	192.69	.23	244.84
South Dakota	11.44	338.01	.03	164.54
Tennessee	33.89	249.10	.14	280.82
Texas	113.84	368.21	.31	264.57
Utah	106.09	836.08	.13	395.32
Vermont	64.22	251.51	.26	222.64
Virginia	31.20	205.41	.15	353.97
Washington	117.56	496.71	.24	108.97
West Virginia	7.14	214.55	.03	103.48
Wisconsin	95.99	273.17	.35	113.14
Wyoming	63.73	1013.25	.06	711.50

chosen debt share in the financing of capital investment times the quantity of capital investment. Similarly, the volume of revenue bonds will be a portion of the total amount of state and local aid in support of nontraditional government activity. In order to explain the determinants of both state and local general obligation and revenue bond supply, a newer view of the determinants of municipal financial policy is emphasized where the focus is on the relative attractiveness of tax and bond finance and the possibilities for substitution between them.

I.B. Related Studies.

The first empirical analyses of the state and local bond market were done in the early 1970's by Galper and Petersen (1971) and Fortune (1973). Their objective was to examine Congressional proposals to subsidize the costs of state and local borrowing. Both studies incorporate aggregate measures of state and local general obligation bond issues into a demand and supply model in order to explain the behavior of tax-exempt yields over time.

Galper and Petersen assume that state and local borrowing is undertaken to finance public construction expenditures. They find that the amount of construction (and hence borrowing) depends negatively on the municipal bond rate (r_m). Fortune also assumes that state and local bonds are issued to finance capital expenditures. He expresses municipal bond supply as a function of lagged interest rates and disposable income, where disposable income serves as a proxy for the demand for state and local capital goods. Fortune finds a positive relationship between municipal bond issues and disposable income over time.

While both of these general obligation bond supply models assume that

the level of borrowing is related to the demand for state and local capital, neither of them attempt to estimate the determinants of the jurisdiction's demand for capital. Allman (1982) appears to be the only one who has incorporated a demand equation for state and local capital into a model of municipal bond supply. In his model, the median voter's demand for municipal capital investment is derived from the voter's demand for municipal goods and services. In his empirical work, however, Allman uses a measure of total national income (rather than median) as a determinant of capital demand. Allman also suggests that there is an optimal share of debt in the financing of capital investment that depends solely on voter "tastes." Unfortunately, his use of the ratio of total state and local government spending to voter incomes as a proxy for the preference for debt finance is done without explanation.

In a somewhat different empirical analysis of the demand and supply of tax-exempt bonds, Hendershott and Koch (1977) use a government accounting framework to explain tax-exempt bond issues. They utilize a sources versus uses statement where the sources of funds (bond issues, federal grants, tax revenues and the municipal surplus) must equal the uses of funds (capital purchases, other outlays, and financial asset purchases.) They express bond supply as a function of the exogenous sources and uses (capital outlays, other outlays, and grants.) Their time-series results for the sample period 1963-1974 are generally consistent with the standard view that state and local governments typically finance half of their capital outlays with debt. Research in this dissertation incorporates this sources versus uses framework as a description of the government's budget constraint.

It is important to note that the objective of all four of the studies

described above is to explain the aggregate amount of tax-exempt bonds issued in the U.S. The variation in the volume of bond issues across jurisdictions is not addressed.

Several recent studies have attempted to analyze the determinants of state and local borrowing behavior using a cross-sectional framework. Adams (1977), Asefa, et. al. (1981), Gordon and Slemrod (1986) and Metcalf (1989) argue that municipal governments issue bonds in order to engage in arbitrage. One type of arbitrage is direct: jurisdictions issue tax-exempt bonds and invest the proceeds in higher-yield taxable bonds. This behavior, however, is limited by law. Indirectly, jurisdictions can engage in two other types of arbitrage. In the first, residents are expected to let their jurisdictions save for them because the jurisdiction can earn the pre-tax rate of return on taxable investments. Higher-income residents are expected to prefer that their governments collect greater tax revenues from them and use the proceeds to purchase taxable securities because these residents would earn a relatively low after-tax rate of return on their own investments. (Presumably, taxes will be less in the future.)

The second type of arbitrage is more closely related to government borrowing behavior. Jurisdictions can take advantage of the differing pre-tax yields on tax-exempt and taxable bonds by issuing tax-exempt bonds and using the proceeds to lower the current tax rate. Residents are then free to invest their higher after-tax income in taxable securities. This substitution of debt for tax finance is a form of arbitrage that is expected to be preferred by lower-income residents because they earn the greatest after-tax yield on taxable securities.

While the traditional view of state and local borrowing assumes that

long-term debt is issued to finance capital expenditures, this type of bond supply model does not include capital spending as a determinant of bond issues. Instead, the emphasis is on the relative attractiveness of tax and bond finance and the possibilities for substitution between them. An important determinant of bond supply is the relationship between the federal marginal tax rate of the residents in the jurisdiction and the marginal tax rate implied by the tax-exempt/taxable bond yield ratio ($t = 1 - r_m/r_t$.)

While the entire area of state and local borrowing has been relatively under-worked, especially little has been done to explain the decisions of state and local governments to issue revenue bonds. Descriptive analyses of revenue bond issues (for example, see Clark and Neubig (1984), Clark (1985) focus on the perceived costlessness to the jurisdiction of this type of borrowing. State and local governments are not responsible for the repayment of principal and interest. Rather, the income from the particular investment project is used to service the debt. The cost of these revenue bond issues is borne primarily by the U.S. taxpayer because revenue bond interest is not subject to federal taxation.

Allman (1982) provides an interesting model of revenue bond supply in which the decision maker is an elected official who attempts to satisfy his constituency by providing as many services as possible. This official decides to issue revenue bonds only when he expects the revenues from future user fees to fully cover costs. In his empirical work, Allman assumes that the official examines recent trends in the amount of user fees collected. Because increasing user fees are viewed as a sign of increasing demand for (and hence profitability of) the revenue bond-financed projects, revenue bond supply is assumed to depend

positively on the recent trends in user fee collections. This assumption is supported by his empirical results. Allman makes a valuable contribution in this first attempt to model the aggregate level of revenue bond issues, but a problem with his use of user fees as a determinant of bond issues is that only a small fraction of revenue bond-financed projects use this type of user fees to service the debt.

Finally, research in this dissertation draws on a variety of studies concerning the determinants of borrowing costs and the implications these costs have for the jurisdiction's debt/tax choice. Many researchers (Leonard (1983), Hendershott and Kidwell (1978), and others) have noted a positive relationship between bond issue volume and interest costs. Hendershott and Kidwell find that a change in the supply of tax-exempt bonds in a geographical region may affect the interest costs in that market relative to those nationwide. Kidwell, Koch and Stock (1984) find that jurisdictions in states that exempt from the state income tax the interest income from bonds issued within that state can issue bonds at a lower interest cost. This assumption that issuing governments are not price-takers in the market for loanable funds is an important component of the model developed in this dissertation.

To an extent, the study of the determinants of the debt/tax decision in the financing of state and local capital is analogous to the debt/equity decision in the financing of the firm. While Miller (1977) argues that the debt-equity ratio is indeterminate for any particular firm, Auerbach (1979) and Feldstein, Green and Sheshinski (1979) claim that a unique optimal debt-equity ratio will exist if the cost of capital varies with the degree of debt finance, or "leverage." This is also the assumption made in more recent work such as Nadeau (1989). In this

dissertation, the fact that interest costs vary with the level of borrowing may similarly serve to guarantee a unique optimal debt/tax choice for each jurisdiction.

I.C. Conclusion.

State and local government borrowing has been a relatively under-worked topic in public finance. Interestingly, while this dissertation is one of a relatively few studies that have analyzed the borrowing of state and local governments in a cross-sectional framework, this thesis topic has also been chosen by two other recent Ph.D students. Cunningham (1989) attempts to explain the determinants of state (not local) debt using primarily cross-sectional data from 1972. (He also derives some time-series estimates for 1940-1987 for a subsample of 21 states.) In his model, the equilibrium amount of debt is determined by equating the marginal welfare burdens of debt and taxes. He combines this argument with a political one in which high-income residents are assumed to prefer debt finance because these residents benefit most from the inclusion of tax-exempt bonds in their portfolios. He finds that his dependent variable (the ratio of outstanding state debt to personal income) is positively related to income and (less strongly) unemployment, but is not related to past capital spending and expected population growth.

In a paper from his dissertation, Capeci (1990) examines the impact of local fiscal policy on the jurisdiction's borrowing costs. Using a sample of 243 bond issues made by New Jersey counties, towns and school districts in 1975-1977, Capeci finds that the amount borrowed per dollar of property value has a positive effect on the borrowing rate while the

level of discretionary revenues per dollar of property value has a negative effect. The relationship between his work and the research done in this dissertation will be discussed in the final chapter.

In contrast to most of the other studies (including the work of Cunningham and of Capeci), the model used here incorporates directly the traditional assumption that state and local government general obligation bonds are issued to finance public capital expenditure. This study may be the first to use bond issue data separated by type (general obligation and revenue) in a cross-sectional analysis and may be the first to take advantage of a new revenue bond data set collected by the U.S. Treasury.

CHAPTER I - FOOTNOTES

1. The data used in Tables 1.1 and 1.2 come from the following sources. The general obligation issues are from the files of the Securities Data Company. These issues are for "new money" so they do not include bonds issued for refunding. Revenue bond issues are listed in "Private Activity Tax-Exempt Bonds" in the Statistics of Income Bulletin, U.S. Department of the Treasury. Population figures are from the Statistical Abstract of the U.S. Capital expenditures are listed in Government Finances, U.S. Department of Commerce, Census Bureau.

2. These summary statistics exclude Alaska due to its obvious outlier status.

CHAPTER II

STATE AND LOCAL BORROWING COSTS

II.A. Introduction.

The effects of a jurisdiction's borrowing activity on its own costs of borrowing are described in this chapter. It is argued that because jurisdiction-specific factors may affect borrowing costs, the jurisdiction may not be a price taker in the market for municipal funds. It is also argued that the jurisdiction bases its borrowing decisions on a marginal cost of borrowing that may be greater than the observed or reported interest cost.

In order to understand how a jurisdiction's financial policy can affect its costs of borrowing, it is important to distinguish between the general market effect of an increase in the quantity of state and local government bonds supplied and the additional effect of an increase in jurisdiction i's borrowing on its own cost of borrowing r_{mi} relative to the average tax-exempt rate r_m. The general market effect occurs because an increase in the supply of municipal bonds increases borrowing costs for all municipal issuers. Evidence suggests that an increase in total state and local borrowing of $1 billion increases the tax-exempt rate by an amount ranging from a low of .37 basis points to a high of approximately 9.0 basis points. (Tuccillo and Weicher (1981), Kormendi and Nagle (1981), and Toder and Neubig (1985).) The magnitude of this market effect, however, suggests that a particular jurisdiction will not perceive its borrowing costs to be affected by its own borrowing in this manner

because the borrowing by any one jurisdiction will have such a small impact on the average r_m. Recent evidence supports this assumption that the effect of a jurisdiction's own amount of borrowing on its own cost of borrowing dominates the general market effect. Capeci (1990) finds that a million dollar increase in the size of a particular bond issue is associated with an increase in borrowing costs of 3.5 basis points.[1] (The previously mentioned estimates of .37 to 9.0 basis points were from a billion dollar increase in total borrowing.)

In effect, I claim that the ratio of jurisdiction i's interest cost r_{mi} to the average state and local government rate of r_m is a positive function of the level of borrowing undertaken by jurisdiction i. In the next section, however, I make the simplifying assumption that the average rate r_m is unaffected by an increase in jurisdiction i's borrowing so that the ratio of borrowing costs (r_{mi}/r_m) can be replaced by r_{mi} alone.

II.B. General Obligation and Revenue Bond Interest Costs.

To show clearly the manner in which the jurisdiction's borrowing costs are affected by its own bond-financing policies, I write the tax-exempt rate r_{mi} facing the ith jurisdiction as:

$$r_{mi}^{GO} = r_{mi}^{GO}\ (GO_i,\ RB_i,\ W_i) \text{ and}$$
$$r_{mi}^{RB} = r_{mi}^{RB}\ (GO_i,\ RB_i,\ W_i')$$

where r_{mi}^{GO} and r_{mi}^{RB} are jurisdiction i's interest costs on its general obligation issues and revenue bond issues, respectively. GO_i is the level of general obligation bonds issued by jurisdiction i during a particular time period, RB_i is the level of revenue bond issues, W_i is a vector of

variables representing the jurisdiction's credit worthiness and W_i' consists of factors reflecting the likely profitability of the projects being financed.[2] The effects of macroeconomic variables are less important in a cross-sectional study such as this one. Indeed, if the relevant interest cost variable were (r_{mi}/r_m) as discussed above, then an increase in the general level of interest rates would leave the ratio unchanged. One important macro variable that will be included in W_i and W_i' is the state unemployment rate, because variations in the health of regional economies may have an important impact on r_{mi} (as well as (r_{mi}/r_m).)

I assume that the costs of each type of borrowing (GO and RB) are positive functions of both types of borrowing. The next section is devoted to explaining these assumptions in detail.

II.C. Interest Costs and the Level of Borrowing.

I claim that r_{mi}^{GO} is a positive function of GO_i and that r_{mi}^{RB} is a positive function of RB_i. It may also be true that r_{mi}^{GO} depends positively on RB_i and that r_{mi}^{RB} may depend positively on GO_i. I next explain each of these assertions in turn.

Numerous studies (Hendershott and Kidwell (1978), Leonard (1983), and others) have found that interests costs are positively related to the size of the particular bond issue.[3] This suggests that the jurisdiction is not able to issue any chosen level of bonds at a given market rate. One reason is the possible existence of regional segmentation in the market for state and local bonds. Hendershott and Kidwell find that an increase in bond issues from a particular state is associated with an increase in the interest costs on those bonds relative to bonds issued from other jurisdictions. Hendershott and Kidwell suggest that bonds that are

marketed regionally and bonds that are marketed nationally are not perfect substitutes in the portfolios of investors.

The variation across states in the tax treatment of state and local bond interest income may also serve to segment the market. Many states exempt from state taxation the interest income that residents earn on that state's bonds while at the same time taxing the interest income earned by the state's residents on out-of-state (or "foreign") bonds. Kidwell, Koch and Stock (1984) find that this discriminatory taxation allows jurisdictions to issue bonds to state residents at a lower interest cost. Interest cost savings are more likely to be realized when the bond issue is relatively small due to the requirement that the marginal bondholder be a resident of the particular state. This is less likely to be true for large bond issues that are marketed nationally. If markets are segmented by state so that the pool of potential investors is small relative to that for bonds that are sold nationally, then an increase in the level of bonds issued may require that the jurisdiction increase the interest rate in order to induce more in-state buyers to hold the bonds. According to the above discussion of segmentation, however, the positive relationship between borrowing levels and interest costs that is caused by the state's tax policy is expected to exist only for regionally-marketed bond issues.[4]

A second reason interest costs may depend positively on bond issue size has to do with the nature of the criteria used by the rating agencies. While the regional segmentation argument is relevant for regionally marketed issues that tend to be fairly small in size, this credit rating explanation applied to large, nationally marketed issues as well. Independent agencies such as Moody's Investors Service and Standard and Poor's Corporation provide ratings for virtually all municipal bond

issues. The ratings are intended to reflect probability of default and are based on the jurisdiction's willingness and capacity for timely repayment of principal and interest. The better the rating, the lower the jurisdiction's borrowing costs. While the rating process takes into account many diverse factors (some are included in the vector W_i or W_i' to be discussed below), an important determinant of the credit rating will be the level of borrowing undertaken by the jurisdiction. Greater levels of new bond volume will be associated with lower credit ratings as the rating agencies express concern over the jurisdiction's capacity for servicing the debt.

A third explanation for the positive relationship between borrowing costs and bond issues involves agency costs and/or reputation costs that may be associated with state and local debt financing. Gordon and Slemrod (1986) suggest that agency costs may serve to limit state and local borrowing. While they do not elaborate, it seems likely that they are referring to the fear bondholders may have that voters or bureaucrats may operate in a manner that will adversely affect the value of their claims.[5] If agency costs are recognized by potential investors and these costs are a positive function of the level of borrowing, then jurisdictions will have to pay higher interest rates as the level of borrowing increases.

A second way in which agency costs or reputation costs may affect borrowing decisions is more complicated. It is possible that the jurisdiction bases its borrowing decisions on a cost of borrowing that is comprised of the market interest rate plus a premium representing the marginal agency and/or reputation cost to the jurisdiction of additional debt finance. This premium is perceived only by the jurisdiction, and it causes the level of borrowing to be less than it would otherwise be at the

market rate of interest. This idea has been used in the analysis of corporate financial policy by Barnea, et al. (1981). In contrast to the standard Miller (1977) analysis in which the firm is assumed to be able to supply any quantity of debt at a particular interest rate, Barnea, et al. maintain that firms base their borrowing decisions on the sum of the actual rate of interest and a differential agency cost which is an increasing function of the volume bonds issued. In Barnea, et. al.'s work, the agency cost is not part of the actual interest to be paid. Instead, the firm is assumed to base its borrowing decision on the actual interest rate plus this added agency cost.

Another factor that may play a part in increasing the jurisdiction's perceived cost of borrowing involves the importance of the jurisdiction's reputation. A bond default (such as the one by the Washington Public Power Supply System (WPPSS) in 1984) will certainly damage the jurisdiction's reputation and may increase current and future borrowing costs. Even though the jurisdiction may not be liable in case of a revenue bond default, a default (either on general obligation or revenue bonds) may be viewed by bondholders as revealing new information about the credit-worthiness of the jurisdiction.

Epple and Spatt (1986) suggest that jurisdictions face rising reputation cost schedules as a function of the level of borrowing. Although the actual interest rate itself contains a default premium that investors require in order to hold the bonds, this reputation cost (like the agency cost in Barnea, et. al.) is viewed by the jurisdiction as an additional cost of borrowing. Hence the jurisdiction bases its borrowing decision on a cost of borrowing that includes both the actual rate of interest and a perceived reputation cost which is a positive function of

the level of borrowing.

The discussion above suggest numerous explanations for the positive relationship between r_{mi}^{GO} and GO_i, and r_{mi}^{RB} and RB_i. Several of these factors can also explain why r_{mi}^{GO} may be a positive function of RB_i and r_{mi}^{GO} a positive function of GO_i.

The segmentation arguments presented by Hendershott and Kidwell (1978) and Kidwell, et. al. (1984) may imply that the interest costs associated with issuing general obligation bonds will increase with increase in the level of revenue bond issues and vice versa. If regional market segmentation exists, then the two types of bonds (RB and GO) issued by a jurisdiction may be viewed by the bondholder as closer substitutes for each other than are bonds issued by other jurisdictions (particularly those in other states.) If so, then local holders of jurisdiction i's GO and/or RB bonds may have to be offered higher RB and/or GO yields in order to increase their holdings. Reputation effects also may be important. Epple and Spatt cite evidence that the WPPSS's default on $2.5 billion of revenue bonds has had an adverse effect on that state's GO borrowing costs. Because the jurisdiction typically is not responsible for repayment of principal and interest in case of a revenue bond default, a default of this type should not have any impact on the jurisdiction's balance sheet and hence its credit worthiness. But because the revenue bond-financed project was approved by a jurisdiction official, investors may view the revenue bond default as evidence that the jurisdiction is being run by officials with poor financial judgement and/or as evidence of a downward turn in economic conditions.[6] The jurisdiction's concern for its good name in the market for general obligation bonds may serve to limit its revenue bond issues, and vice versa.

II.D. Other Factors Affecting Interest Costs.

The cost of borrowing also depends on jurisdiction-specific factors other than current borrowing levels. The financial health of the jurisdiction will also be important, because jurisdictions that are better credit risks can borrow at a lower interest rate. Potential bondholders require information on the overall ability of the jurisdiction to repay the interest and principal. Because it obviously would be too costly for each individual investor to collect the relevant information about all state and local debt issues, rating agencies help investors by providing information about the credit-worthiness of jurisdictions.[7]

The factors affecting borrowing costs are contained here in W_i for jurisdiction i's general obligation issues and in W_i' for the jurisdiction's revenue bond issues. While many of these factors will be important for both types of borrowing, some of the factors may differ by borrowing type due to the nature of the borrowing contract. Because the jurisdiction itself is responsible for the repayment of the general obligation issues, the credit worthiness of the jurisdiction is an important determinant of the costs of borrowing. W_i includes the factors in which rating agencies are particularly interested, such as the ratio of total general obligation debt to the taxable wealth in the jurisdiction, GO debt per capita, GO debt as a percentage of personal income. Because it is the proceeds of the revenue-bond financed project itself that are pledged to repay revenue bond debt, W_i' includes information about the expected profitability of the project.

II.E. Conclusion.

Numerous explanations for the positive relationship between the jurisdiction's borrowing costs and its level of bond issues are presented

in this chapter. The borrowing cost facing the jurisdiction depends on its own level of borrowing in addition to the factors affecting the jurisdiction's credit worthiness. In corporate finance research, the introduction of endogenous borrowing costs serves to limit borrowing and results in a optimal debt/equity ratio for individual firms as well as for the corporate sector as a whole (Barnea, et. al. (1981)). Similarly, the assumption that state and local borrowing costs are endogenous will help explain why the optimal share of debt in both the financing of state and local capital expenditures and private economic activity will tend to be less than 100%. The determination of the optimal debt share in the financing of capital expenditures will be discussed in the next chapter.

CHAPTER II - FOOTNOTES

1. Actually, Capeci finds that an increase in the amount borrowed of $6.3 million is associated with an increase in borrowing costs of approximately 22 basis points.

2. The credit worthiness information in W is from the recent past. W represents the component of a jurisdiction's credit rating that is independent of current borrowing. It is W_i' rather than W_i that affects r_{mi}^{RB} because the potential bondholders are assumed to look through the issuing jurisdiction to the credit-worthiness of the project being financed. The repayment of principal and the payment of interest on revenue bonds come from the proceeds of the project being financed.

3. Capeci also surveys studies that find an empirical relationship between bond issue size and interest costs. This has recently become a popular assumption as it is used by both Metcalf (1988) and Capeci (1990). Metcalf takes the existence of this positive relationship as a given, while Capeci explicitly tests for it.

4. Cunningham (1989) repeatedly argues that the existence of this discriminatory tax policy implies that there are 50 separate markets in the U.S. for tax-exempt bonds. I claim that this is not necessarily the case, and in Chapter VI I will test the effect of this state tax policy on state and local government borrowing behavior.

5. For example, bondholders may fear that the jurisdiction may increase its reliance on debt financing in the future, thereby reducing the value of the current bondholders' claims. Jensen and Meckling (1976) explain that it is possible to write bond covenants to restrict future excessive borrowing (hence reducing the agency costs) but then the associated contract costs and subsequent monitoring costs may themselves be considered agency costs.

6. Actually, the State of Washington was later found to be liable for a small portion of the damages in the WPPSS case. Hence the increased general obligation borrowing costs that accompanied the WPPSS default may have been due to the ability of the investors to foresee the state government's financial loss. In general, however, the jurisdiction is not liable in the case of a revenue bond default.

7. R. Lamb and S. Rappaport (1987) provide a good discussion of the ratings process.

CHAPTER III

THE SHARE OF DEBT IN THE FINANCING OF STATE AND LOCAL CAPITAL EXPENDITURES

III.A. Introduction.

In this section, I discuss the determinants of the portion of state and local capital expenditures financed through the issuance of general obligation bonds. Capital expenditures are financed through a combination of the proceeds from long-term bond issues, current taxation, and intergovernmental grants. I assume that a government official establishes the optimal debt share schedule as a function of current and expected future tax prices and the jurisdiction's cost of borrowing. The optimal debt share function will be announced to the residents of the jurisdiction who then use this information in making their spending decisions. The residents are assumed to act as though the specific debt share function established by the government official will remain in effect indefinitely.

It is useful to think that this debt/tax choice is determined in a government agency where a government official selects the mix of financing methods that minimizes the cost of a dollar of per capita public expenditure to the residents of the jurisdiction. In this research I assume that the official operates as a dedicated civil servant who provides technical expertise in order to contribute to the efficient operation of the public sector. Because the residents are not homogenous with respect to their current and expected future tax prices, the official is assumed to establish the debt share schedule that minimizes the cost of

government spending to the median voter.

The notion that residents will have preferences for either debt or tax finance assumes that capitalization is imperfect. This assumption is consistent with the summary of the evidence regarding the effect of local property taxes presented by Bloom, et al. (1983). Many jurisdictions in the sample used in the current research rely on sources of revenues other than property taxes. Most importantly, it seems logical that parents living in a multi-jurisdictional world are less likely to feel the need to make Barro-type bequests because their children may live in other jurisdictions.

III.B. The Optimal Debt Share.

I assume that the government official chooses the debt share that minimizes the median voter's price (at the margin) of the jurisdiction's capital expenditures. In a two-period model, the price P_1 of a dollar of public capital expenditure I to a representative individual residing in jurisdiction i can be written:

$$P_1 = (1-h)t^c + h(t^f)p[1+r_{mi}](1+d)^{-1} \qquad (1)$$

where h = the bond-financed share of capital spending

t^c = the net cost (after deductibility) to the individual of a dollar of tax-financed capital expenditure

t^f = the net cost facing the individual in the future of a dollar of tax-financed capital expenditure

p = the probability that the individual will be a resident of the jurisdiction in the future

r_{mi} = jurisdiction i's cost of borrowing

$(1+d)^{-1}$ = the discount factor used to calculate the present value of the individual's expected future tax liability due to debt finance

As written, equation (1) represents the individual's average price of capital. Assuming, however, that the jurisdiction issues its bonds all at one time rather than throughout the year, the average price will equal the marginal price. As discussed in the previous chapter, the interest rate r_{mi} on jurisdiction i's general obligation bonds will be affected by the jurisdiction's borrowing activity so that the interest cost is a positive function of both hI and RB, where hI represents the level of general obligation bonds and RB represents the level of revenue bonds issued by the jurisdiction. The interest rate is also a function of W, a vector of attributes reflecting the jurisdiction's credit-worthiness. More generally, W can be thought of as the component of the jurisdiction's credit-rating that is unaffected by current borrowing. The expected future tax price is expressed as the product of p and t^f. It is assumed that p is exogenous - specifically, that residents do not move in response to the debt/tax choices made in the various jurisdictions. Conversely, because the optimal debt share schedule is established once and then is assumed to remain in effect forever, a change in the level of migration into or out of the jurisdiction is not assumed to affect the debt/tax choice.

I assume that the official chooses the value of h that minimizes the average cost of capital expenditures P_1 from equation (1) by equating the marginal costs of debt and tax finance:

$$t^f p(1+d)^{-1}[1 + r_{mi} + (\delta_{mi}/\delta h)h] = t^c \qquad (2)$$

The marginal cost of debt finance (the left-hand side above) incorporates the fact that the interest rate increases as the reliance on debt increases. As previously discussed, the interest cost r_{mi} is a function of hI, RB, and W. It will be useful to specify an explicit functional form for the jurisdiction's cost of borrowing. I make the assumption that r_{mi} is a linear function of these three variables, so that the interest cost can be written $r_{mi} = ehi + fRB + gW$.[1] Because W consists of all determinants of the jurisdiction's cost of borrowing other than the current volume of bond issues, a jurisdiction that issues no bonds faces an interest rate of gW. Equation (2) can be rewritten as follows:

$$t^f p(1+d)^{-1}[1 + ehI + fRB + gW + ehI] = t^C \qquad (3)$$

The optimal debt share is the debt share h that satisfies equation (3). It can also be found by differentiating equation (1) with respect to h and setting $\delta P_1/\delta h$ equal to zero. The optimal debt share can be written:

$$h^* = \frac{t^C - t^f p[1+fRB+gW](1+d)^{-1}}{2t^f peI(1+d)^{-1}} \qquad (4)$$

The official is assumed to communicate to the residents the optimal debt share for all possible levels of the tax prices and other parameters. The optimal debt share necessarily will be between zero and one, inclusive.[2] The formulation of the optimal debt share in equation (4) can be examined using comparative statics in order to generate testable hypotheses. The comparative static results are found in Appendix A. These results suggest

that differences in the debt share across jurisdictions will depend upon the following factors, where the signs in parentheses represent the effect of the variable on the optimal value of h:

1. the current tax price t^c (+)
2. the future tax price t^f (-)
3. the probability of the resident remaining in the jurisdiction p (-)
4. the amount of revenue bonds issued RB (-)
5. the level of state and local capital investment I (-)
6. the tax-exempt rate r_{mi} (-)
7. credit worthiness W (+)
8. the rate of discount d (+)

Residents are expected to compare their current and expected future tax prices, where the term "tax price" refers to the price that an individual resident must pay for a dollar of per-capita state and local expenditure. Residents who must pay a relatively higher tax price t^c for a dollar of per-capita state and local capital expenditure in the current period are expected to prefer postponement of their tax liability until the future and consequently a higher debt share. On the other hand, residents who face a higher future tax price t^f and/or a greater probability of remaining in the jurisdiction in the future are expected to prefer a lower debt share. The probability p depends on the resident's future plans regarding geographic mobility and on the resident's view of his or her own life expectancy. The product of t^f and p represents the resident's expected future tax price.

Factors influencing the cost of borrowing are also expected to have

an effect on the debt/tax choice. The chosen debt share should be inversely related to the interest rate r_{mi} paid by jurisdiction i on its general obligation bond issues. As discussed in Chapter II, it is expected that the cost of issuing general obligation bonds r_{mi} will be a positive function of the quantity of both jurisdiction i's general obligation issues and its revenue bond issues. Because the level of general obligation bonds is equal to the product of the debt share and the level of the jurisdiction's capital investment, the cost of borrowing is assumed to be a positive function of the level of capital investment. Hence the debt share is expected to be inversely related to the level of public capital investment and to the level of revenue bonds issued by the jurisdiction. Other variables representing the credit-worthiness of the jurisdiction are expected to have an impact on the chosen debt share. The unemployment rate, for example, may be inversely related to the jurisdiction's ability to fulfill its debt-service requirements. Another example of a credit-worthiness measure is the level of debt outstanding to the total wealth of the jurisdiction. This ratio can be expected to be negatively related to jurisdiction's credit rating and consequently positively related to r_{mi}.

Finally, the resident's rate of discount d is expected to have an effect on the chosen debt share. A higher discount rate implies that the future tax liability incurred because of debt financing of current expenditure will appear relatively "smaller" to current residents, implying that a higher discount rate will be associated with a greater debt share.

III.C. The Importance of General Obligation Debt Limits.

It is possible that the existence of binding statutory debt limits may affect the official's ability to select the optimal debt share according to equation (2). A common restriction is that debt is to be used only to finance capital expenditures. The evidence presented in Chapter I suggests that this type of constraint is not binding.[3] Another common type of restriction is that debt should be limited to a certain percentage of assessed value in the jurisdiction. The assumption made in this research is that debt limits are not binding, an assumption that has also been made recently by Gordon and Slemrod (1986). The fact that borrowing levels doubled in 1985 before the new tax law took effect provides additional evidence that overall debt limits could not have been binding in the sample years of 1983-84.

III.D. Conclusion.

A common assumption in studies of state and local government borrowing is that jurisdictions finance capital expenditures through the issuance of general obligation bonds. Indeed, previous state and local public finance writers have noted a traditional "rule of thumb" that suggests that approximately 50% of state and local capital expenditures are to be financed through the issuance of long-term bonds (Peterson (1984) and Petersen (1981)). Data presented in this dissertation suggests that the average debt share of state and local governments by state in 1983 and 1984 was less than 50% and that this debt share varied dramatically across states.

The model of optimal debt financing developed in this chapter generates several testable hypotheses regarding the role of various

economic factors in the determination of the debt share. These hypotheses will be tested in Chapter VI. The level of general obligation bonds issued will be equal to the debt share times the level of capital to be financed. The determination of the level of capital investment will be discussed in Chapter V. It is important to note at this time that the chosen level of capital expenditure may depend on the debt share, just as the debt share depends on the level of capital expenditure.

The next chapter focuses on the determination of the share of debt in the financing of state and local government support of non-traditional activity. In that chapter, the government official seeks to find the optimal mix of financing methods that will minimize the cost of providing a certain level of private-sector support.

CHAPTER III - FOOTNOTES

1. The additive form of the interest rate equation is obviously a simplification. It will be suggested in this research that hI and RB are not independent of each other. An increase in hI, for example, may lead to a decrease in the chosen level of revenue bond issues. Because this effect is second-order in nature, the overall effect of an increase in hI on the interest cost r_{mi} is still expected to be positive. This linear approximation would not be appropriate if the goal were to estimate the parameters e and f. That, however, is not the objective here.

2. An early explanation of the desirability of an interior solution for the optimal debt share problem is provided by Buchanan (1967). Buchanan argues that risk aversion on the part of the taxpayers will prevent the jurisdiction from selecting an all-debt financial policy. Buchanan's reference resident fears that other residents will fail to accumulate enough savings over time to pay off the jurisdiction's debt when it comes due. The awareness of this contingent liability leads the residents to prefer at least some tax finance. Buchanan also suggests that residents' uncertainty about their future income (and future tax bracket) will serve to limit borrowing.

Buchanan also believes in the existence of "asset illusion" under which residents systematically undervalue a long-lived capital investment. If asked to finance capital entirely in the current period, the residents would select an amount of capital investment that would be "too low." Although Buchanan does not seem to believe so, it is possible that the bias caused by asset illusion could work in the opposite direction. If residents tend to overvalue their future benefits from long-lived capital, then 100% tax finance might lead them to prefer too much.

3. Unfortunately, it is impossible to tell from the aggregate data if the constraint is binding in an individual jurisdiction. While Gordon and Slemrod (1986) have this same problem, they suggest that it is unlikely that any jurisdiction would be constrained by the debt limit.

CHAPTER IV

THE USE OF STATE AND LOCAL REVENUE BONDS IN THE FINANCING OF NON-TRADITIONAL GOVERNMENTAL ACTIVITY

IV.A. Introduction.

The use of revenue bonds in the financing of private sector development is discussed in this chapter. Because the jurisdiction can support private economic activity by offering a variety of fiscal incentives, the emphasis here is on the determination of the chosen composition of investment incentives. An extensive literature exists regarding the effects of state and local fiscal incentives on economic activity. For example, many researchers (including Bartik (1985), Carlton (1979) and (1983), Papke (1987) and Sullivan and Newman (1988)) have examined the impact of the state tax climate on business location decisions. To date, the positive analysis of the jurisdiction's decision to provide investment incentives has not been emphasized. The analysis in this chapter attempts to provide an economic explanation of the chosen mix of investment incentives offered by state and local governments.

While the chosen mix of financial incentives is one of several decisions that are made simultaneously, in this research the jurisdiction is assumed to make its tax abatements versus revenue bond issues choice as the third decision in a three-stage sequential choice process. The first choice is the optimal share of general obligation debt h in the financing of state and local capital expenditure. The second choice is the level of state and local capital expenditures I. Finally, the jurisdiction is

assumed to take the information regarding the level of h and I into account while selecting the optimal combination of investment incentives to offer to potential investors.

IV.B. The Choice Between Revenue Bonds and Other Fiscal Incentives in the Support of Non-traditional Governmental Activity.

Jurisdictions attempting to promote private sector development may offer a variety of incentives to potential investors. These development incentives include low-cost tax-exempt financing through the issuance of government revenue bonds, tax reductions such as property tax abatements and investment tax credits, direct grants and loans, and subsidies in the form of worker training programs and management assistance.

The objective of jurisdictions offering development incentives such as revenue bonds and tax abatements is to induce firms, organizations or individuals to locate new facilities or expand old ones within the jurisdiction. The choice among the different incentive tools is essentially a debt/tax choice analogous (to an extent) to the one involved in the financing of state and local public capital investment. Tax abatements, direct grants and loans, and management and training programs each impose costs on taxpayers in the year in which they are granted. As a result, residents end up paying higher taxes in order to pay for these incentives. Because of the similar nature of the costs these incentives impose on taxpayers, in the discussion that follows I will combine all of these tools together and refer to them as "tax abatements." The choice to be made by the jurisdiction is the share of revenue bonds and tax abatements in the provision of the subsidy.

While residents pay directly for tax abatements in the form of higher

current taxes, revenue bond issues do not lead to a reduction in tax revenues collected nor do they have a direct impact on government expenditures.[1] By issuing revenue bonds, the jurisdiction serves as a conduit for funds to the private sector. The jurisdiction is not responsible for the payment of the interest and principal on revenue bond debt. Instead, the profits or the proceeds of the project being funded are used to pay the debt service requirements.

In this chapter, I assume that the desired level of investment incentives is exogenous. As mentioned previously, the emphasis here is on the determinants of the mix of incentives chosen by the jurisdiction. There are two main issues to address. The first is the nature of the production function for state and local government support of private economic activity. Jurisdictions tend to offer a package of various fiscal incentives to potential investors, and I suggest that there may be some degree of substitutability among incentive types. The second issue is the nature of the relative prices to the jurisdiction of the different types of incentives. I claim that all incentives are costly, and the chosen mix of incentives depends on their relative prices. The standard view that tax abatements are costly while revenue bond issues are costless would lead one to expect jurisdictions to place little or no emphasis on the use of incentives other revenue bond issues. This is not what is observed, and I suggest that the issuance of revenue bonds does impose a cost on the jurisdiction.

The chosen mix of tax abatements and revenue bond issues is modeled as though the jurisdiction is a cost-minimizing firm choosing the optimal combination of inputs to produce a certain output level. The financial officer of the jurisdiction is assumed to operate in the interest of the

median voter. The chosen mix can be shown graphically as the point of tangency between an iso-subsidy curve and an isocost line.

IV.C. Graphical Illustration of the Optimal Debt Share.

The subsidy provided by the jurisdiction to the private sector is proportional to the value of the revenue loss estimates of the tax abatements Z and to $(r_{ti} - r_{mi})$ RB. This latter expression represents the interest cost saving in jurisdiction i from borrowing an amount RB at the tax-exempt rate rather than at the higher taxable rate r_{ti}.

The level of the subsidy S provided by jurisdiction i is written:

$$S_i = s\ (Z_i, (r_{ti} - r_{mi})RB_i) \qquad (1)$$

Because the tax-exempt rate r_{mi} is an increasing function of RB_i, an increase in revenue bond issues will have the effect of reducing the interest cost savings associated with revenue bond issues. Hence the iso-subsidy curve showing possible combinations of tax abatements and revenue bonds is convex to the origin. The convexity is due also to the varying marginal rate of substitution between the two inputs. At a point on the iso-subsidy curve where the jurisdiction grants a large amount of tax abatements (Z) relative to its issuance of revenue bonds (RB), it is possible to trade a large amount of Z for an additional unit of RB holding constant the level of the subsidy. As the jurisdiction begins to rely more heavily on revenue bonds, the issuance of additional revenue bonds does not permit a very large reduction in the use of tax abatements. The diminishing rate of substitution of RB for Z will arise if the different incentives are not equally valued by the recipients of the subsidy. For

example, only firms with taxable income will have any use for tax abatements. Similarly, revenue bonds will be of greater use to firms which finance their activities by borrowing.

In Figure 4.1, the subsidy curve S shows the combinations of tax abatements and revenue bonds that could be offered by the jurisdiction to provide a private-sector subsidy of $100,000. Assuming an initial yield differential of 2%, a jurisdiction interested in financing private development solely through the use of revenue bonds would issue $5 million worth of revenue bonds. If half of the subsidy ($50,000) were to come from the use of tax abatements, the jurisdiction would need to issue a quantity of revenue bonds less than $2.5 million to provide the additional subsidy equal to $50,000. This is because r_{mi} is assumed to fall as revenue bond issues fall, so the yield differential will increase. If the yield differential increased from 2% to 2.5 %, then the quantity of revenue bonds required to provide a $50,000 subsidy would equal $2 million. As shown in Figure 4.1, the iso-subsidy curve S showing the possible combinations of tax abatements and tax-exempt revenue bonds is convex to the origin.

The total cost to the jurisdiction of granting the fiscal incentives can be represented by an iso-cost line. The cost of tax abatements Z is merely the revenue loss estimates of these abatements. Residents incur this cost in the form of higher taxes. The cost of revenue bond issues is the increase in borrowing costs for the jurisdiction's general obligation bond issues. Although increased revenue bond issues reduce the interest cost saving (r_{ti} - r_{mi}) to revenue bond financed projects, this effect of increased revenue bond issues on the subsidy is already incorporated into the iso-subsidy curve.

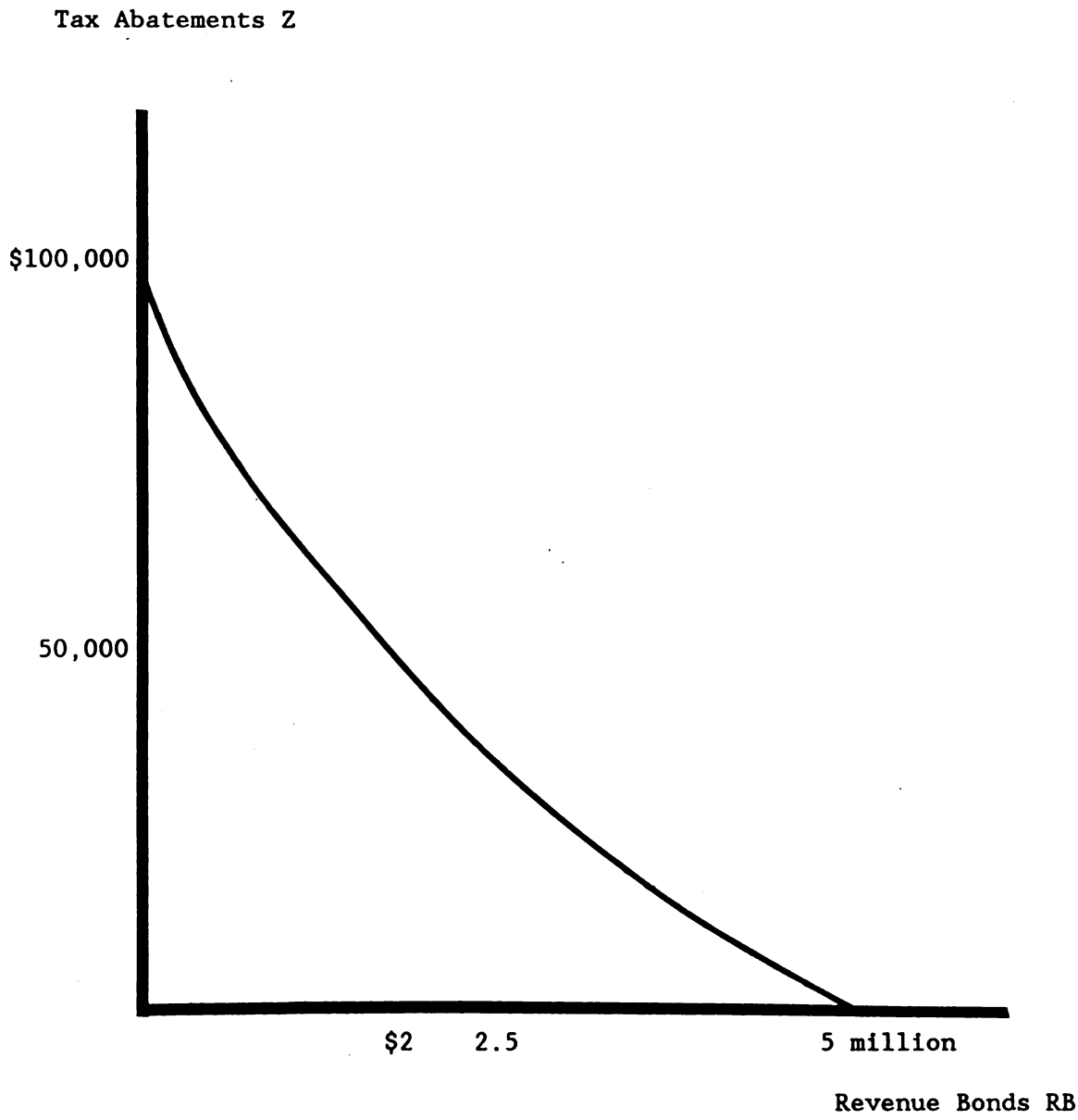

Figure 4.1 The iso-subsidy curve is convex.

The total cost of the fiscal incentives granted by jurisdiction i is written:

$$C_i = [(\delta r_{mi}/\delta RB_i)GO_i]\ RB_i + Z_i \qquad (2)$$

where $(\delta r_{mi}/\delta RB_i)GOi$ is the cost of a dollar of jurisdiction i's revenue bond issues. As discussed in Chapter III, it is convenient to represent the jurisdiction's cost of borrowing by the expression $r_{mi}(hI,RB,W) = ehI+fRB+gW$, so that $(\delta r_{mi}/\delta RB)$ is equal to f. The slope of the iso-cost line is equal to $-fGO_i$, or $-fh_iI_i$. As discussed in Chapter II, an increase in RB_i will increase the cost of jurisdiction i's general obligation bond issues. While this specification does not include the administrative costs of the revenue bond issues or tax abatements, these costs could be incorporated easily.

The cost-minimizing framework for analyzing the determinants of the optimal share of revenue bonds in the financing of private-sector development assistance is useful because some of the determining factors will vary by jurisdiction. The main factor that is expected to vary by jurisdiction is the level of general obligation issues h_iI_i.

One prediction is that the share of (revenue bond) debt in the financing of the subsidy will be inversely related to the share of (general obligation) debt in the financing of the public capital expenditures and also to the level of public capital expenditures. This is due to the effect of the debt share h and the level of capital spending I on the jurisdiction's cost of borrowing. Recall from Chapter II that an increase in the quantity of general obligation bonds (hI) issued by the jurisdiction is expected to have a positive effect on the interest rate on

the jurisdiction's revenue bond issues. In order to illustrate the effect of an increase in the debt share h and/or the level of public capital I on the jurisdiction's chosen mix of investment incentives graphically, let C^0 and S^0 in Figure 4.2 be the original iso-cost and iso-subsidy curves. Point A shows the cost-minimizing mix of investment incentives to achieve the level of subsidy S^0.

An increase in h_i (or I_i) will affect the slope of both curves. C^1 and S^1 are the new iso-cost and iso-subsidy curves. Point B shows the point of tangency between the new curves. The iso-cost line becomes steeper as h_i (and/or I_i) increases because the revenue bond issue price depends positively on the level of general obligation bond issues. An increase in h_i or I_i also affects the slope of the iso-subsidy curve by making it flatter. Both of these effects work in the same direction so that an increase in h_i and/or I_i will unambiguously lead to an increase in the share of tax abatements in the financing of the subsidy activity.

In addition, it is also possible that the current tax price will also be positively related to the share of debt in the financing of the subsidy. Because the tax price is really the price to the residents of the jurisdiction of a dollar of per capita tax abatements, an increase in the tax price will make the isocost line flatter and will lead to an increase in the share of revenue bond issues in the financing of the subsidy.

Finally, it should be noted that the derivative of the tax-exempt rate with respect to the level of revenue bond issues is expected to be inversely related to the share of debt in the financing of the subsidy. If the tax-exempt rate is very sensitive to the level of revenue bonds issued by the jurisdiction, then a jurisdiction hoping to keep borrowing

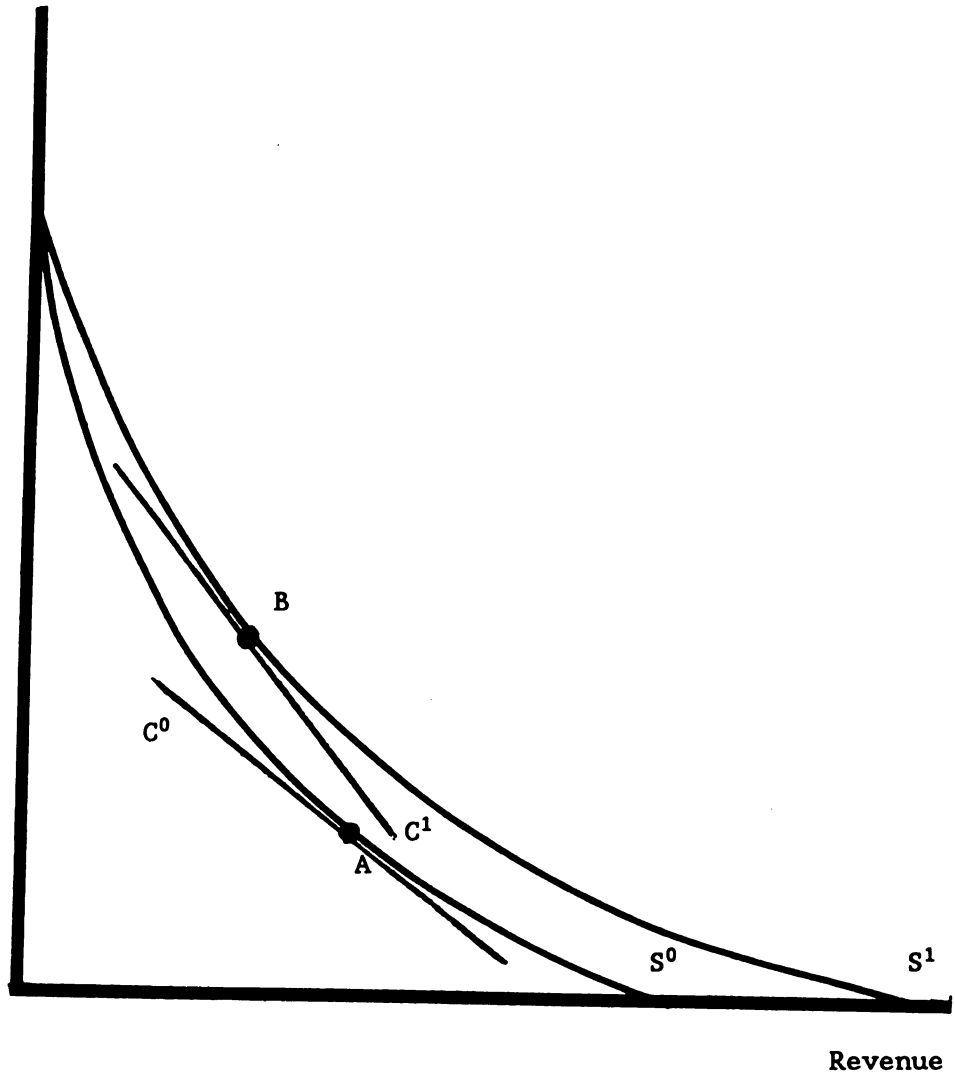

Figure 4.2 The effect of a change in h and/or I on the cost-minimizing combination of Z and RB

costs low will want to rely more heavily on tax abatements in the financing of the subsidy. Lacking information to the contrary, however, this factor is not assumed to vary by jurisdiction.

IV.D. Algebraic Formulation of the Debt/Tax Choice.

The economic factors affecting the jurisdiction's reliance on debt financing rather than tax financing of non-traditional government activity can be illustrated algebraically in the standard cost-minimization framework. Consider the problem where the level of the subsidy S is modeled using a Cobb-Douglas production function:

$$S = Z^{\alpha}[(RB)(r_{ti}-r_{mi})]^{1-\alpha} \qquad (3)$$

The graphical analysis in the previous section illustrates that the cost-minimizing combination of tax abatements Z and revenue bonds RB occurs at the tangency of the iso-subsidy curve and the iso-cost line. At that point, the marginal rate of technical substitution of RB for Z is equal to the ratio of the relative prices of RB and Z. Hence the cost-minimizing combination of Z and RB can be expressed by the following equation:

$$\frac{(1-\alpha)Z(r_{ti} - ehI - gW - 2fRB)}{\alpha RB(r_{ti} - ehI - gW - fRB)} = fhI \qquad (4)$$

The left-hand side of the expression above represents the MRTS of RB for Z. It incorporates the assumption made in the previous chapter that the interest rate r_{mi} is equal to ehI+fRB+gW. The right-hand side represents

the ratio of relative prices fhI (the price of one dollar of RB) and one (the price of a dollar of Z.)

It is possible to derive factor demand functions for RB and Z. These demand functions can be obtained by minimizing the total cost of providing a certain level of the subsidy. The problem is as follows:

minimize $C(RB,Z) = (RB)fhI + Z$

subject to: $S = Z^{\alpha}[(RB)(r_{ti} - r_{mi})]^{1-\alpha}$

After replacing r_{mi} by ehI+fRB+gW and then substituting the term m for r_{ti}-ehI-gW, the subsidy can be written as $S = Z^{\alpha}[(RB)m-(RB)^2f]^{1-\alpha}$. A consequence of this cost-minimizing behavior is that the first partial derivatives of the following Lagrangean function equal zero.

$$L = (RB)fhI + Z + u(S - Z^{\alpha}[(RB)m-(RB)^2f]^{1-\alpha} \quad (5)$$

The following first-order conditions can be obtained by partially differentiating the Lagrangean function by RB, Z and the Lagrangean multiplier u.

$$L_Z = 1 - u\alpha Z^{\alpha-1}[(RB)m-(RB)^2f]^{1-\alpha}$$

$$L_{RB} = fhI - uZ^{\alpha}(1-\alpha)[(RB)m-(RB)^2f]^{-\alpha}[m-2(RB)f]$$

$$L_u = S - Z^{\alpha}[(RB)m - (RB)^2f]^{1-\alpha}$$

Given that the sufficient second-order conditions for a minima are satisfied, the factor demands for revenue bonds RB and tax abatements Z can be obtained from the first-order conditions.[2] The factor demand for revenue bonds is:

$$RB^* = (2f)^{-1}\{m + 2fQ - [m^2+(2fQ)^2]^{.5}\} \qquad (6)$$

where as previously stated $m = r_{ti}$-ehI-gW. The expression Q is written as $Q = S(1-\alpha)^{\alpha}(fhI\alpha)^{-\alpha}$. The comparative static results are shown below for the following factors, where the signs in parentheses represent the effect of the variable on the jurisdiction's demand for revenue bonds:

1. the level of state and local public capital investment I (-)
2. the share of general obligation debt h in the financing of I (-)
3. the credit-worthiness of the jurisdiction W (+)

Of course, these results are the same as those obtained in the graphical analysis. Holding the level of the subsidy S constant, the comparative static results indicate that an increase in I will lower the chosen share of RB debt in the financing of non-traditional government activity. Similarly, an increase in the general obligation debt share will lower the RB debt share. Finally, jurisdictions that are a better credit risk are expected to issue relatively more revenue bonds.

IV.E. The Relationship Between the Two Debt/Tax Choices.

If the total amount of subsidy activity is assumed to be constant, then the share of debt in the financing of state and local capital

expenditure and the share of debt in the financing of state and local government assistance in support of private sector development will be inversely related. But to the extent that both debt/tax decisions represent preferences for paying now for government spending versus paying later, it is possible that the two debt shares may be positively related. In the case of the financing of public capital expenditure, residents compare the current tax liability with their expected future tax liability. The future tax liability depends on the probability that the resident will be a resident of the jurisdiction in the future.

Assuming imperfect capitalization, residents who do not have an operative bequest motive or do not have children who will be living in the jurisdiction in the future can escape payment of the future debt service by dying or moving to other jurisdictions.

The nature of the expected future liability from debt finance is somewhat different in the case of the financing of state and local aid to the private sector because the repayment of the revenue bond debt service does not come from the general pool of tax revenues. Many revenue bond-financed projects use user fees such as medical service fees in the case of hospitals, tuition and board in the case of colleges, and tolls and entrance fees in the case of roads, bridges, stadia and parks to pay the debt service requirements. The resident's liability will depend on his usage of these bond-financed goods and services. For bonds issued to finance private business, the debt service payments may be passed on to consumers of the good in the form of higher prices, the workers in the form of lower wages, or the shareholders. In many cases the economic incidence will not be clear.

Because the nature of the taxpayer's future liability for revenue

bond debt service is fundamentally different from the taxpayer's future liability for general obligation debt service, the analogy between the two debt share decisions is not a close one. To the extent, however, that taxpayer preferences for current financing rather than future financing of government activity may apply to both the financing of public capital and the financing of aid to economic development, then the preferences for debt versus tax finance may be positively rather than negatively related.

IV.F. Why Do State and Local Governments Subsidize Private Activity?

I assume that the jurisdiction's objective in pursuing economic development activities is to increase the income of the median voter of the jurisdiction. Presumably the individual's income will be affected positively by these development activities, and can be written:

$$Y = f(S), \quad \text{where } S = s[Z,(r_{ti} - r_{mi})RB] \tag{7}$$

Z is the amount of tax abatements granted by the jurisdiction, and $(r_{ti} - r_{mi})RB$ is the subsidy provided to those entities that borrow an amount RB at the tax-exempt rate r_{mi} rather than the higher taxable rate r_{ti}. It is interesting to note that while increased revenue bond issues will increase the income of the median voter, an increasing quantity of revenue bonds supplied also will increase the jurisdiction's borrowing costs on both GO and RB issues. The jurisdiction is then faced with a tradeoff between its various goals: its desire to increase incomes, to keep r_{mi} low in order to provide a sizeable subsidy (through the issuance of revenue bonds) to non-public economic activities, and to keep the costs of borrowing for traditional public purposes low as well.

An assumption made in this research is that the level of subsidy activity undertaken by each jurisdiction is exogenous. In equilibrium, the desired level of subsidy activity can be thought of as being beyond the control of the individual jurisdiction. For example, suppose that in equilibrium all jurisdictions experience the same level of economic growth from one year to the next. In order for this equilibrium to be attained, some jurisdictions are going to have to offer a larger amount of private-sector subsidies than are other jurisdictions. Jurisdictions that have greater amenities (such as a cheaper labor force or closer proximity to transportation centers) will be able to achieve this equilibrium level of economic growth by offering little or no subsidies.

While different jurisdictions will engage in different levels of subsidy activity, the level of this activity chosen by the jurisdiction can be viewed as exogenous and will be denoted as S^*. As a consequence, the level of private incomes in the jurisdiction also can be viewed as exogenous. These assumptions will be used in the complete model of borrowing presented in Chapter V.

IV.G. The Importance of General Obligation Debt Limits.

As discussed in Chapter III, jurisdictions may issue revenue bonds in order to circumvent the general obligation debt limits if state and local constraints on general obligation bond issues are binding. While the importance of these borrowing limits is debatable,[3] if constraints are binding there may be a positive relationship between the level of general obligation issues and revenue bond issues, instead of the negative relationship suggested above in Section C.

IV.H. Conclusion.

By issuing revenue bonds, the jurisdiction is often serving as a conduit for funds to the private sector. Revenue bonds, however, are just one of several fiscal incentives that can be offered by jurisdictions attempting to promote economic development. Although many researchers have investigated the effect of state and local fiscal incentives on private economic activity, the analysis presented in this chapter may be the first to provide an economic explanation of the jurisdiction's chosen mix of incentives. I suggest that the jurisdiction's choice can be modeled in a manner analogous to the firm's cost-minimizing combination of inputs. Assuming that there is some substitutability between the incentives, an important economic determinant of the jurisdiction's chosen mix of incentives will be the relative costs of each incentive type.

It is commonly observed that jurisdictions offer a package of fiscal incentives to potential investors. This observation, however, seems inconsistent with the claim often made that revenue bonds can be offered at no expense to the jurisdiction itself. If tax abatements are costly but revenue bonds are virtually without cost, one would expect that jurisdictions would place little or not emphasis on the use of tax abatements. Moreover, the view that jurisdictions perceive revenue bonds as costless seems to imply that revenue bond issues should be at much greater levels than are observed. The logical question to ask is, "What is limiting the use of revenue bonds in equilibrium?"

I argue that the issuance of revenue bonds does entail a cost to the jurisdiction. An increase in revenue bonds may increase the cost of issuing general obligation bonds and hence the cost of state and local government capital expenditures, and an increase in revenue bonds reduces

the effectiveness of the revenue bond as a subsidy because the yield differential (r_{ti} - r_{mi}) will decrease.

CHAPTER IV - FOOTNOTES

1. The issuance of revenue bonds is not done without cost. In addition to the administrative costs of the bond issue, it has been suggested in Chapter II that an increase in revenue bonds does increase the cost of issuing general obligation bonds and consequently the cost of public capital. I view this interest rate effect as an indirect cost.

2. The expression for the demand for RB actually consists of two equations because solving the first-order conditions for RB involves a quadratic equation. Only the demand equation presented in the text represents a solution to the cost-minimization problem. The existence of two possible solutions is due to the specific functional forms chosen to represent S and r_{mi}. The subsidy curve starts to slope up at high levels of revenue bond issues when (m-2RBf) switches sign from positive to negative.

3. Gordon and Slemrod (1986) suggest that it is unlikely that debt limits based on the level of capital expenditures are binding. While direct evidence is difficult to obtain, the fact that borrowing levels doubled in 1985 before the tax law took effect suggests that overall debt limits were not binding in the sample years of 1983-84.

CHAPTER V

A MODEL OF STATE AND LOCAL BORROWING

V.A. Introduction.

Because borrowing is only one method of financing capital expenditures and economic development assistance, the level of borrowing undertaken by the jurisdiction is determined by the chosen mix of financing methods and the chosen level of the activity being financed. This chapter incorporates the discussions of the interest cost and optimal debt shares from the three previous chapters into a comprehensive model of state and local borrowing. In this model, three important decisions are made. First, the government (acting on behalf of the median voter) determines the optimal share of debt finance associated with any desired level of state and local capital expenditures. This process was discussed in Chapter III. At the same time, the median voter selects the level of state and local capital spending. In addition, the government also makes a choice between tax abatements and revenue bonds in the financing of economic development activity. The nature of this decision was discussed in Chapter IV.

While the quantities of general obligation bonds and revenue bonds issued are determined simultaneously, I approximate this decision-making process with a sequential choice framework. The optimal debt share for capital expenditures is determined in advance for all possible levels of prices, income, capital spending, revenue bond issues, and other parameters. With this information available, the median voter then

expresses his or her desired level of capital spending as a function of the parameters of the model. Finally, the optimal mix of financial incentives in support of private activity is determined. In this chapter, the median voter expresses his or her preferences for state and local capital investment taking into account the optimal debt share information presented in Chapter III. As the optimal debt share and the voter's demand for capital are both a function of the jurisdiction's revenue bond issues, the final stage of the model involves choosing the level of revenue bonds using the cost-minimizing framework outlined in the previous chapter.

V.B. The Individual's Utility Function.

A common approach to modeling voters' demands for state and local expenditures is to assume that the preferences of a particular individual determine the level of spending in a given jurisdiction. Typically, the decisive voter is assumed to be the voter whose quantity demanded of publicly-provided goods and services is the median quantity demanded. The level of spending preferred by the median voter will (under certain restrictive assumptions[1]) defeat any other level of spending in a majority-rule election. In this research, the individual's utility is represented by a utility function:

$$U = U(K, EXP, X), \tag{1}$$

where the terms in the utility function are defined as follows:

K - the flow of services from the stock of tangible capital possessed by states and localities

EXP = the level of state and local current expenditures

X = a composite bundle of private and federal goods and services consumed by the individual.

The specification of the individual's utility function used here is similar to the government preference function used by Gramlich and Galper (1973). An alternative specification of the utility function might include "state and local goods and services," which would then be produced with both state and local capital and non-capital expenditures as inputs. The approach used here is more direct. I next describe the terms in the utility function in more detail.

- The stock of tangible state and local capital K. The individual prefers a greater flow of services from the stock of state and local capital. If this flow of services is proportional to the actual stock of capital, the utility from this source is also a proportional function of the stock. The capital term in the utility function is proportional to:

$$K = (1-d)K_{-1} + I, \tag{2}$$

where I is the level of current capital expenditures, d is the rate of physical depreciation, and K_{-1} is the capital stock that existed in the previous period. K represents the desired level of the capital stock in the current period. It will be assumed that jurisdictions can adjust the size of their capital stock within a year's time so that the desired level K can always be attained.

- State and local current expenditures EXP. The individual prefers a greater level of non-capital state and local expenditures denoted as EXP. These expenditures include service on past debt as well as any type of expenditure other than current investment expenditures I.

- Expenditures on other goods X. The individual prefers a greater level of consumption of private and federally-provided goods and services.

V.C. The Individual's Budget Constraint.

The individual chooses the amount of each good to consume by maximizing utility subject to the following budget constraint:

$$Y = P_1 I + P_2 EXP + P_3 X \ , \qquad (3)$$

where Y = the individual's pre-tax income

P_1 = the price to the individual of a dollar per-capita addition to the stock of state and local capital

P_2 = the price to the individual of a dollar per-capita state and local current expenditures

P_3 = the price to the individual of a dollar of private and federal goods and services (assumed to equal one.)

As discussed in Chapter IV, income can be affected positively by the jurisdiction's economic development activity. In equilibrium, however, the level of subsidy activity undertaken by the jurisdiction is exogenous. (The jurisdiction does control the composition of the subsidy between revenue bonds and tax abatements.) As a consequence, the level of incomes in the jurisdiction is exogenous.

V.D. The Jurisdiction's Budget Constraint.

The government's budget constraint also can be expressed in a sources versus uses framework. The sources of funds include total tax revenue T, grants G, and the proceeds from general obligation borrowing hI. Government funds are used for current expenditures EXP, capital investment I, and the provision of tax abatements Z.[2] The government's budget identity can be written as follows:

$$T + hI + G = EXP + I + Z \tag{4}$$

The level of tax revenues that can be spent on current expenditures EXP and capital investment I is actually T-Z. Hence an increase in Z requires reduced expenditures on EXP and I. The individual and governmental budget constraint can be combined after recognizing that the individual's share of per capita tax revenues T is t^CT, which is equal to the sum of P_1I and P_2EXP. The individual's budget constraint becomes:

$$Y = X + t^CT \tag{5}$$

Incorporating the budget constraint shown in equation (4) into equation (5), the combined budget constraint is written:

$$Y = X + t^C[EXP + I(1-h) - G + Z] \tag{6}$$

Income is spent on private goods X, current government expenditures EXP, the tax-financed portion of public capital investment I, and the provision of tax abatements Z.

V.E. Derivation of the Median Voter's Demand Functions.

The median voter maximizes his or her utility subject to the two budget constraints (6) and (7). The utility function used here is a Cobb-Douglas utility function:

$$U (K, EXP, X) = j\ln K + m\ln EXP + n\ln X \qquad (7)$$

where j, m and n are demand parameters (j+m+n=1.) The budget constraint does not include the price of purchasing the entire desired capital stock K -- rather, the amount of capital that must be purchased each period so that the actual capital stock equals the desired capital stock is $I = K - (1-d)K_{-1}$, where K_{-1} is the capital stock that existed in the previous period and d is the constant rate of depreciation.

The individual is assumed to choose his or her desired level of capital K, EXP, and X, knowing the particular values of h and RB that will be associated with these demands. The demand equations for K, EXP, and X can be obtained from the first-order conditions given that the sufficient second-order conditions for a maxima are satisfied. The equation that is of most interest for determining general obligation borrowing levels is the demand for investment I, which is actually a demand derived from the individual's demand for capital K.

I assume that the median voter maximizes utility shown in equation (7) subject to the following constraints.

(V.E1) $Y = X + t^{C}[EXP + I(1-h) - G + Z]$

(V.E2) $h = h^{*}$ (from Chapter III)

(V.E3) $S = S^{*}$ (from Chapter IV)

(V.E4) $MRTS_{RB,Z} = P_{RB}/P_Z$ (from Chapter IV)

(V.E5) $K = I + (1-d)K_{-1}$

This maximization problem can be simplified by substituting the K term in the utility function by constraint (V.E5). The details of the maximization are found in Appendix A where the first-order conditions are derived. It is theoretically possible to solve the system of equations for the demands for I, EXP, X, RB, and Z. As mentioned above, the level of general obligation bond issues is a function of the demand for investment I. The demand for I, however, is a cubic equation. Due to the complexity of the expression for I, the investment demand equation estimated in Chapter VI will not be the actual non-linear demand function derived from the maximization process. Instead, I let the investment demand portion of the model suggest which variables are the likely determinants of investment decisions and I test for their significance.

VI.F. The Level of General Obligation Bond Issues.

The level of general obligation bonds issued by the jurisdiction is equal to the product of the level of public capital investment I and the debt share h. The economic factors influencing the level of investment I are as follows:

1. the income of the median voter
2. the cost of borrowing r_{mi}
3. the size of the capital stock in the previous period
4. the current tax price
5. the probability that the median voter will be a resident of the jurisdiction in the future

6. the future tax price
7. the quantity of tax abatements offered
8. the quantity of revenue bond issued
9. the optimal debt share

As stated above, the complexity of the expression of the demand for new investment prohibits the use of comparative statics to derive hypotheses regarding the effect of a change in a particular factor on the quantity of investment demanded. It seems logical, however, to make the following conjectures.

New investment is expected to be positively related to income, assuming capital is a normal good. Investment is also assumed to be negatively related to the cost of borrowing. Investment should also be negatively related to current and future tax prices and the optimal debt share. An increase in the debt share will increase borrowing costs and hence tend to reduce the quantity of I demanded.

Finally, it is interesting to examine the likely effects of an change in the mix of revenue bonds RB and tax abatements Z used to finance the equilibrium level of subsidy activity. An increase in the reliance on RB relative to Z will tend to increase the cost of issuing general obligation bonds to finance public capital investment, thereby reducing the quantity of investment I demanded. However, this negative effect will be mitigate somewhat because the resulting reduction in Z (holding the level of subsidy activity constant) will tend to increase the amount of funds that the jurisdiction has available to spend on both I and EXP.

As shown in Chapter I, the variation in general obligation bond issues across states in the sample period 1983-1984 is driven largely by

the variation in the debt share h. The factors influencing the debt share are derived in Chapter III from a cost-minimization process where the debt share that minimizes the price to the median voter of a dollar of capital expenditure is determined for each level of capital expenditure. Here, the hypothesized effect of a change in each factor on the optimal debt share is the result of applying comparative statics to the optimal debt share equation. Once again, the factors and their expected signs are:

1. the current tax price t^c (+)
2. the future tax price t^f (-)
3. the probability of the resident remaining in the jurisdiction p (-)
4. the amount of revenue bonds issues RB (-)
5. the level of state and local capital investment I (-)
6. the tax-exempt rate r_{mi} (-)
7. credit worthiness W (+)

VI.G. The Level of Revenue Bond Issues.

Just as the volume of general obligation bonds is equal to the chosen debt share in the financing of capital investment times the quantity of capital investment, the volume of revenue bonds is equal to the chosen debt share in the financing of nontraditional government activity times the quantity of this activity. Although the analyses of the two types of borrowing appear conceptually to be symmetrical, in this research they are not. One assumption made is the level of nontraditional governmental activity S is exogenous while the level of public capital investment is exogenous. Data-availability problems also are to blame for the asymmetrical treatment of the two borrowing decisions. As will be

discussed in Chapter VI, no data exist regarding the level of S undertaken by the jurisdiction. As a result, the dependent variable of interest in the empirical analysis will be the level of revenue bond issues rather than the components (the debt share and S) individually. The level of revenue bond issues will depend on factors affecting the revenue bond debt share and the level of S. In contrast to the study of general obligation issues, however, both the revenue bond debt share and the level of S are unobserved. Variables that are assumed to affect the level of revenue bond issues are those that influence the jurisdiction's reliance on revenue bonds versus tax abatements as well as factors that are correlated with the level of the activity being financed. The model suggests that two of the factors affecting revenue bond issues will be the general obligation debt share h and the level of capital investment I.

V.H. Conclusion.

This analysis in this chapter combines the various aspects of state and local borrowing decisions presented in Chapters II-IV. The decisions made by the jurisdiction to issue general obligation bonds and revenue bonds depend on both the level of the activity being financed and the method of financing that level of activity. The purpose of this research is to identify and then estimate the significance of the various determinants of each of these decisions. I suggest that these decisions are linked in such a way that the method of finance (i.e. the debt/tax choice) may depend on the level of the activity being financed and vice versa.

I also suggest that the jurisdiction's decision to issue one type of bond is related to its decision to issue the other type. The main reason

these decisions are linked is due to the nature of the jurisdiction's borrowing costs. An increase in revenue bond issues, for example, may increase the interest cost associated with issuing general obligation bonds. Chapter II provides several explanations for this positive relationship between the level of one type of bond issues and the cost of issuing the other type.

Chapter VI investigates the importance of the various determinants of state and local government borrowing using the framework presented in this and previous chapters. Equations for the debt share h in the financing of capital investment, the quantity of capital investment I, and the level of revenue bonds will estimated in order to investigate empirically the significance of the hypothesized determinants.

CHAPTER V - FOOTNOTES

1. The fact that three decisions are being made may suggest that the median voter model is not applicable due to its requirement that the choice being made is uni-dimensional (i.e. more or less of a particular good.) My assumption that the choice process is sequential rather than simultaneous will alleviate this problem.

Further evidence of the appropriateness of applying the median voter model to state and local borrowing decisions is provided by DeBartolo and Fortune (1982). They find that the level of general obligation bonds issued in their sample of Ohio communities is consistent with the level preferred by the median voter.

2. The jurisdiction's use of funds also could be expanded to include additions both to the budget surplus SURP and to the stock of state and local financial capital FIN. For simplicity, I consider both variables to be part of current expenditures EXP.

CHAPTER VI

ESTIMATION

VI.A. Introduction.

The model provides a useful framework for analyzing the determinants of the variation across jurisdictions in the levels of both general obligation and revenue bond issues. In this chapter, the procedure and the data used to estimate these determinants are described in detail. The economic factors affecting the capital investment decision are estimated first. In the following section, estimates of the economic determinants of the share of debt in the financing of state and local capital expenditure are presented.

Once the factors determining the optimal debt share are identified, the simultaneous estimation of the debt share and capital demand equations will be undertaken. Revised capital demand equations will be presented at that time. Finally, the chapter concludes with the estimation of the determinants of revenue bond issues.

VI.B. General Procedure.

State and local borrowing levels within each state are aggregated in order to explain the interstate differences in total state and local bonds issued. Units of observation are per capita borrowing levels by state. This method of analyzing the determinants of government behavior by combining the activity of all sub-state governments with that of the state government itself has also been used by Feldstein and Metcalf (1986) in

studying tax deductibility. Although the heterogeneity within states is lost in this type of analysis, I believe that the variation in average characteristics across states will allow much to be learned from this broader approach.

A different method would involve trying to explain the borrowing behavior of each government unit by relating the quantity of bonds issued to characteristics of the jurisdiction's decisive voter. This is the method employed by Gordon and Slemrod (1986) in their study of municipal financial policy (although they focus on debt outstanding rather than new bond issues.) The major difficulty with this type of analysis is that the approximately 80,000 governmental units in the U.S. do not always coincide with the governmental units of observation used by the Census to describe individuals. Most importantly, school districts and special districts issue bonds, but little data exist regarding the characteristics of the residents of these jurisdictions.[1] In addition, borrowing activity by local governments is often regulated and controlled by the state government, and in some states local governments pool their borrowing so that it actually is carried out by the state.

VI.C. Data Description.

Data on long-term general obligation issues for 1983 and 1984 were obtained from the files of the Securities Data Company. Revenue bond issues for the same two years were drawn from the IRS's Statistics of Income Bulletin (Clark (1984, 1985)). Previous studies of municipal financial policy (Metcalf (1989), Gordon and Slemrod (1986), and Asefa et. al. (1981)) have relied on data for general obligation debt outstanding collected by the U.S. Census. While the Census does provide information

on new bond issues, it does not break down new bond issues into the general obligation and revenue bond categories. Research in this current paper may be among the first to use the new IRS data set and also appears to be the first to analyze and distinguish between the determinants of the two types of borrowing in a cross-sectional analysis.

The research in this paper is limited to the years of 1983-84 for two reasons. First, 1983 was the first year that comprehensive data on revenue bond issues were collected. The Tax Equity and Fiscal Responsibility Act of 1982 imposed an information reporting requirement for revenue bonds issued after 1982. Second, major tax legislation limiting the supply of tax-exempt bonds was enacted in 1986. Because this legislation was anticipated, there was a large increase in bond volume in 1985 as municipalities rushed their bonds to market before the limits took effect. The borrowing behavior of state and local governments in 1985 (and also 1986 and 1987) has been affected by the effects of this tax change.[2]

The data series used in this chapter are listed in Table 6.1, along with information about the mean values and the standard deviations for each series. Whenever data exist for each year, the results obtained in this chapter are obtained using the average of the 1983 and 1984 data. The majority of the non-bond data come from the Bureau of the Census or the Statistical Abstract of the U.S. Further information about data sources can be found in Appendix B.

Finally, attention needs to be drawn to the appropriateness of using all 50 states in the sample. Jurisdictions in the state of Alaska issued far more general obligation bonds than did jurisdictions in any other state and invested in the greatest amount of capital per capita. Per

Table 6.1 -- Definitions of Variables

		mean*	s.d.*
GO	- general obligation issues per capita	$55.73	42.48
RB	- revenue bond issues per capita	$204.27	99.77
I	- state and local capital expenditure per capita	$316.17	147.14
h	- share of GO debt in the financing of state and local capital expenditure	.18	.13
MED INCOME	- median per capita income (effective buying income)	$8619.37	1204.17
POPULATION	- state population, in thousands	4779.13	4978.38
FED GRANTS	- federal aid to state and local governments per capita	$420.71	117.25
MATCH	- a proxy for the matching ratio for federal grants	.13	.05
TP1	- tax price of $1 of tax-financed capital expenditure (weighted ave. of price faced by itemizers and nonitemizers)	$ 0.89	.02
TP11	- tax price measure similar to TP11 but incorporating reciprocal deductibility	$ 0.92	.02
TP2	- tax price (price faced by itemizers)	$ 0.72	.01
TP22	- tax price measure similar to TP2 but incorporating reciprocal deductibility	$ 0.81	.01
DENSITY	- density (pop. per sq. mile)	157.50	222.54
FUTURE POP	- projected % state population increase to the year 2000	12.30	15.08

MIGRATION	- 1980-84 net state migration as a % of 1980 population	1.06	3.18
ENROLL	- % enrollment change in public elementary and secondary schools 1980-85	-3.21	6.22
OLD	- % of population over 65	12.06	1.82
DISCRIM	- dummy variable for states which exempt their own bonds from state taxation	.76	.43
TREASURER	- dummy variable for states with treasurers who are appointed instead of elected	.22	.42
DEBT/V	- debt outstanding divided by assessed property value	.58	1.79
CONTIG/ STATE POP	- contiguous state population divided by the state's population	8.25	8.71
GOVTS	- number of sub-state governments per 1000 residents	.57	.72
MANUF CAP	- per capita capital expenditures by manufacturing firms in 1983	$1261.55	1384.08
CHANGE IN MANUF CAP	- change in per capita capital expenditures by manufacturing firms (1977-1983)	$63.29	87.04
INCENTIVES	- # of tax expenditures plus # of special services offered in support of industry	23.45	3.62

*Excluding Alaska.

capita general obligation issues averaged $1584 in Alaska, while the next highest state (Hawaii) issued merely $200 per capita. Exclusion of Alaska lowers mean per capita obligation issues from $85 to $55. Its average 1983-84 per capita investment was equal to $2681. Exclusion of Alaska from the sample lowers the national mean from $362 to $316. Alaska also had the highest share of debt in the financing of capital expenditures and was among the highest in terms of per capita bond issues. Some of the reported results from the regression analysis are shown for samples both including and excluding Alaska, but the majority of the tables exclude Alaska altogether due to its obvious outlier status.

VI.D. Estimation of the Demand for Capital Expenditures.

Understanding the determinants of general obligation issues requires estimates of investment demand. Alternative estimates for a conventional cross-sectional public expenditure model where all variables are in logarithms are shown in Tables 6.2 and 6.3. State and local spending traditionally is estimated as a function of population, income, federal grants, tax price, and other variables to control for tastes. Per capita capital demand is estimated here using four different measures of tax price. In addition, the importance of including or excluding Alaska is investigated.

Two demand parameters, income and tax price, warrant further discussion. Traditionally, researchers use pre-tax rather than after-tax income. Unfortunately, median pre-tax income by state is unavailable on an annual basis. The U.S. Treasury does not calculate median income annually, and the most recent Census figures are from 1979. Instead, I use median "Effective Buying Income" (EBI) taken from the Survey of Buying

Power which is published in Sales Management. I transform this family disposable income measure into a per-capita figure by dividing the median family EBI by the size of the average household. Recent work by Holtz-Eakin and Rosen (1988) also utilizes EBI as a measure of median income.

The second important data issue is the construction of a tax-price measure. The tax price is the cost to the resident of a $1 increase in per-capita tax-financed capital expenditure purchased by his or her state or local government. The correct tax price measure would recognize that aggregate state and local capital expenditures are financed by a variety of taxes (such as property, sales, and income) levied by the state and different levels of sub-state governments. The same taxpayer may face different tax prices for state government and local government expenditures, provided that the individual accounts for different shares of the taxes paid in the two cases. In their study of tax deductibility, Feldstein and Metcalf (1986) recognize the difficulties in obtaining tax-price measures for each jurisdiction within a state. They avoid this problem by assuming that taxing and spending decisions can be modeled as if the state and all local governments within the state make their spending decisions using a statewide tax price. I also assume that the spending decisions of all jurisdictions can be modeled using a statewide measure.

My first tax price measure, TP1, is a weighted average marginal tax rate that is assumed to face residents of all jurisdictions within a state. Recent work by Lindsey (1988) and Holtz-Eakin and Rosen (1988) uses a similar measure which assigns a price of one to nonitemizers and one minus the average marginal federal tax rate to itemizers. It is

written: TP1 = (1-M) + M(1-t) where M is the proportion of itemized returns by state and t is the average federal marginal tax rate by state.[3] For example, if 40 percent of taxpayers in a state itemize and the average federal marginal tax rate is 30 percent, then it is assumed that state and local government spending decisions are made using the fact that a dollar of per capita tax-financed spending actually costs $0.88. The federal income tax rate is important because (most) state and local taxes are deductible when determining liability for the federal income tax. The effect of this deductibility is that the tax price of a dollar of per capita spending will tend to be less than a dollar and that the tax price for state and local spending will depend on the federal income tax rate of the residents.

The second tax price measure, TP11, is similar to TP1 but incorporates the effects of reciprocal deductibility using a different measure of the federal marginal tax rate calculated by Feenberg and Rosen (1986). Their federal marginal tax rate takes into account the fact that not only are state and local taxes deductible from the federal, but the federal income tax is often deductible on state tax returns.

The third and fourth tax price measures represent the price facing itemizers only (rather than the weighted average price faced by itemizers and non-itemizers.) Using this type of measure implicitly requires making the assumption that the median voter is an itemizer. The third price measure is written: TP2 = 1-t. The t term is as defined above. Finally, TP22 is equal to one minus the federal marginal tax rate using Feenberg and Rosen's reciprocal deductibility measure.

Another factor affecting the taxpayer's price of state and local expenditure is the matching rate on certain types of federal grants. To

the extent that federal aid to state and local governments takes the form of matching grants, the cost of state and local spending is reduced. I attempt to capture the potentially stimulative effect of matching grants on the voter's quantity of public expenditures demanded by including a measure of the matching rate MATCH in the estimating equations.[4]

Tables 6.2 and 6.3 report the results of ordinary least-squares estimation of the demand for capital services for samples including and excluding Alaska. As is traditional in public expenditure studies, all variables are in logarithms. Per-capita capital expenditure is assumed to be a function of the population of the jurisdiction POPULATION, median income MED INCOME, per-capita federal grants FED GRANTS, the matching rate MATCH on federal grants, the tax price TPi and two taste or need variables. DENSITY is the population density in the state, and ENROLL is the recent percentage change in public school enrollment. The state unemployment rate U RATE is also included to pick up the effects of regional recessions that are not fully reflected in median income.[5] The existence of heteroskedasticity with respect to population and also governments per capita was investigated by visually examining the residuals and by the Goldfeld-Quandt test. The results suggest that the residuals may be heteroskedastic with respect to population. The investment demand equations will be corrected for heteroskedasticity in Section F, where the simultaneity between investment demand and the debt share is also addressed.

Several points can be made about the results in Tables 6.2 and 6.3. First, estimation using the sample which includes Alaska explains more of the variation in capital expenditures. But because Alaska is an obvious outlier, I would argue that the estimates in Table 6.3 are based on a

Table 6.2 - State and Local Capital Expenditure Estimates

Dependent variable: Capital Expenditure (I) per capita (including Alaska)

	(1)	(2)	(3)	(4)
C	-7.07 (-2.30)	-9.04 (-3.09)	-11.96 (-3.20)	-12.59 (-4.38)
POPULATION	.13 (2.00)	.14 (2.02)	.14 (1.98)	.15 (2.03)
MED INCOME	.74 (2.12)	.95 (2.79)	1.28 (2.99)	1.39 (3.99)
FED GRANTS	.75 (3.66)	.76 (3.63)	.75 (3.22)	.77 (3.43)
MATCH	.39 (3.07)	.38 (2.96)	.34 (2.41)	.36 (2.60)
TAX PRICE (TP1)	-4.97 (-2.95)	-	-	-
TAX PRICE (TP11)	-	-5.79 (-2.39)	-	-
TAX PRICE (TP2)	-	-	-.16 (-.07)	-
TAX PRICE (TP22)	-	-	-	2.16 (.64)
DENSITY	-.07 (-1.53)	-.07 (-1.50)	-.07 (-1.21)	-.05 (-.99)
ENROLL	.41 (3.43)	.45 (3.71)	.48 (3.57)	.49 (3.84)
U RATE	-.05 (-.30)	-.04 (-.21)	-.00 (-.02)	.02 (.10)
$\bar{R}^2$	.76	.75	.71	.72
F	20.85**	19.30**	16.31**	16.52**

(Coefficients are elasticity estimates; t-statistics are shown in parentheses, ** denotes F-stat significance at the .01 level.)

Table 6.3 - State and Local Capital Expenditure Estimates

Dependent variable: Capital Expenditure (I) per capita (excluding Alaska)

	(1)	(2)	(3)	(4)
C	-4.89 (-1.36)	-6.37 (-1.80)	-11.12 (-2.95)	-10.16 (-2.96)
POPULATION	.12 (1.90)	.13 (1.91)	.14 (1.95)	.14 (1.93)
MED INCOME	.58 (1.53)	.73 (1.97)	1.31 (3.06)	1.23 (3.35)
FED GRANTS	.66 (3.09)	.67 (3.04)	.69 (2.92)	.68 (2.89)
MATCH	.37 (2.96)	.37 (2.87)	.36 (2.54)	.35 (2.53)
TAX PRICE (TP1)	-5.00 (-2.98)	-	-	-
TAX PRICE (TP11)	-	-6.08 (-2.52)	-	-
TAX PRICE (TP2)	-	-	1.94 (.71)	-
TAX PRICE (TP22)	-	-	-	3.46 (.99)
DENSITY	-.07 (-1.37)	-.07 (-1.34)	-.04 (-.73)	-.04 (-.70)
ENROLL	.38 (3.14)	.41 (3.37)	.48 (3.59)	.45 (3.51)
U RATE	-.10 (-.59)	-.10 (-.56)	-.03 (-.18)	-.03 (-.18)
R^2	.62	.59	.54	.54
F	10.60**	9.81**	7.93**	8.09**

(Coefficients are elasticity estimates; t-statistics are shown in parentheses, ** denotes F-stat significance at the .01 level.)

more valid sample. Second, the selection of the appropriate tax price has a great impact on the estimated price elasticities. TP1 is a popular tax-price measure in current research, and here it produces a rather high price elasticity. State and local government expenditures are typically found to be price inelastic (Fisher (1988, p.294), DeBartolo and Fortune (1982)), although the recent work of Holtz-Eakin and Rosen (1988) also finds demand to be price elastic. The large magnitude of the estimated tax-price elasticity may be due to the smallness of the sample combined with the fact that the tax price varies relatively little across states and the quantity of investment demanded varies greatly.

Both weighted average tax prices TP1 and TP11 have coefficients which are significantly different from zero and are of the expected sign. The tax prices TP2 and TP22 do not appear capable of explaining much of the variation in capital expenditures. Estimated income elasticities also vary greatly but are more in line with traditional estimates. The equation estimated with TP1 as a tax price in Table 6.3 results in an income elasticity estimate of .58. Using TP11, the estimated income elasticity increases to .73, and in columns (3) and (4) the estimates are greater than one. The choice of a tax price can be expected to alter the coefficient on income because tax prices tend to be functions of income. Moreover, the choice of a tax price measure also can be expected to affect the estimated income elasticity in the estimation reported here because the income variable is an after-tax measure. This is also true of the estimation reported in Holtz-Eakin and Rosen (1988).

Further analysis of the determinants of investment demand is undertaken with the estimation reported in Table 6.4. Because it is hypothesized the forecast of future population growth is a factor

Table 6.4 - State and Local Capital Expenditure Estimates

Dependent variable: Capital Expenditure (I) per capita (excluding Alaska)		
	(1)	(2)
C	-3.77 (-.95)	-5.97 (-1.63)
POPULATION	.10 (1.46)	.10 (1.43)
MED INCOME	.53 (1.30)	.73 (1.95)
FED GRANTS	.49 (2.12)	.53 (2.33)
MATCH	.28 (2.08)	.28 (2.08)
TAX PRICE (TP11)	-6.24 (-2.46)	-6.13 (-2.58)
DENSITY	-.11 (-1.97)	-.12 (-2.29)
ENROLL	.35 (2.54)	.23 (1.66)
U RATE	-.01 (-.04)	.15 (.77)
MIGRATION	-	.10 (1.59)
FUTURE POP	-.04 (-.77)	-
RB	.16 (1.91)	.13 (1.69)
h	.12 (1.18)	.07 (.67)
$\bar{R}^2$	.63	.62
F	8.44**	7.86**

(Coefficients are elasticity estimates; t-statistics are shown in parentheses, ** denotes F-stat significance at the .01 level.)

affecting the debt/tax choice, it may be interesting to see if investment decisions are also affected by estimates of future population growth. Equation (1) in Table 6.4 adds a measure of recent past population change MIGRATION, while equation (2) includes the projection of population change in the future FUTURE POP. It appears that investment demand responds with a lag to past increases in population but is unresponsive to forecasts of future population changes.

The model suggests that the chosen level of capital spending may depend on the share of debt in the financing of that capital as well as the level of revenue bond issues. Both equations (1) and (2) in Table 6.4 include h and RB as possible determinants of investment. Although none of the coefficients are significantly different from zero at the 5% level of significance, all of the coefficients are of the unexpected sign. The next section examines the factors associated with the across-state variation in the debt share. Estimation of the determinants of capital demand incorporating the possible simultaneity between investment and the debt share is postponed until after the next section.

VI.E. Estimation of the Debt Share in the Financing of State and Local Government Capital Expenditures.

The debt/tax choice in the financing of capital is a choice concerning the preferred timing of the tax liability. The benevolent government official chooses the optimal debt share by comparing the current tax price of capital expenditures to their expected future tax price. Table 6.5 reports estimates of the determinants of the share of general obligation debt in the financing of capital expenditures. The results reported in this table suggest that the current tax price TP11 is

Table 6.5 - Debt Share Estimates

Dependent Variable: Debt share (h)
Columns (1), (3), and (4) exclude Alaska
Column (2) includes Alaska

	(1)	(2)	(3)	(4)
C	-19.94 (-3.51)	-20.81 (-3.91)	-16.21 (-2.92)	-16.21 (-4.01)
POPULATION	-.07 (-.73)	-.07 (-.70)	-.09 (-.80)	.00 (.01)
FUTURE POP	.16 (2.01)	.17 (2.11)	-	.11 (1.42)
MIGRATION	-	-	.08 (.84)	-
TAX PRICE (TP11)	.55 (.13)	1.06 (.27)	1.97 (.46)	3.73 (.91)
FED GRANTS	-.32 (-.95)	-.28 (-.87)	-.46 (-1.31)	-.11 (-.33)
MATCH	-.31 (-1.66)	-.30 (-1.62)	-.42 (-2.15)	-.10 (-.53)
OLD	-.21 (-.53)	-.32 (-.98)	-.41 (-1.00)	-.22 (-.55)
DISCRIM	.09 (.62)	.09 (.64)	.05 (.36)	.07 (.52)
DEBT/V	.12 (2.10)	.12 (2.11)	.12 (2.00)	.22 (3.50)
MED INCOME	2.23 (3.70)	2.33 (4.12)	1.99 (3.24)	2.48 (4.43)
U RATE	.20 (.69)	.23 (.84)	.10 (.32)	-.14 (-.50)
RB	-	-	-	-.31 (-2.28)
GOVTS	-	-	-	-.20 (-3.05)
I	-	-	-	.01 (.03)
$\bar{R}^2$	.42	.47	.37	.54
F	4.52**	5.33**	3.86**	5.28**

(Coefficients are elasticity estimates; t-statistics are shown in parentheses, ** denotes F-stat significance at the .01 level.)
(Note that equation (2) reproduces the equation (1), but includes Alaska.)

not strongly related to the chosen debt share.[6]

The variables FUTURE POP, OLD, and MIGRATION are used for their effect on the expected future tax price. It is hypothesized that the greater the projected future population increase, the higher the chosen debt share as the government official tries to share the cost of current capital investments with a large pool of future taxpayers. This hypothesis appears to be supported. In equation (1), a one percent increase in FUTURE POP, the state's projected population growth rate from the sample period 1983-84 to 2000, increases the debt share by .18

In equation (3), the variable MIGRATION is used instead of FUTURE POP to see if the government official uses the information about population growth in the recent past rather than the projected future population increase. The fact that MIGRATION appears to have little or no impact on the chosen debt share suggests that government officials are somewhat forward looking.

It is hypothesized that the percentage of the population over the age of 65 will be positively related to the debt share as voters over 65 years in age may prefer debt finance if they believe that the probability is low of their being around in the future to pay off the debt. The discussion in Chapter III of the cost-minimization process used to select the optimal debt share (which assumes incomplete capitalization and no bequest motive)implies that jurisdictions with a large elderly population will have a higher debt share. The sign of the coefficient on OLD, however, is consistently negative although the coefficient itself is never significantly different from zero. The positive relationship between OLD and the tax financing of capital expenditures can be explained in several ways. Old people actually may have a bequest motive and hence do not want

to burden future generations with debts that they themselves incurred. Moreover, it is often claimed that the current cohort of old people have a distaste for debt as a result of their living through the Great Depression. Finally, to the extent that risk aversion increases with age, adversion to risk may also have an impact on older people's relative tastes for debt versus tax finance.

The three variables DISCRIM, DEBT/V, and MED INCOME are included as possible factors affecting the cost of borrowing. DISCRIM is a dummy variable set equal to one if the state's tax code exempts interest earned on municipal bonds issued in that state but taxes the interest on bonds issued in jurisdictions in other states. States which engage in this discriminatory taxation may be able to issue bonds at a lower interest cost if the marginal bondholder is a state resident.[7] This is more likely to be true for small issues which tend to be marketed locally (Kidwell, (1984)). While it is hypothesized that the relationship between DISCRIM and h will be positive because the jurisdiction may issue relatively more bonds when borrowing costs are lower, DISCRIM seems to have no effect on the debt/tax choice.

The ratio of debt outstanding to total assessed property value DEBT/V is expected to be negatively related to the debt share through DEBT/V 's effect on credit-worthiness W. The higher this ratio, the less capable the jurisdiction may be of servicing additional debt. Instead, the effect of DEBT/V on the debt share is positive. (This positive relationship remains even when using lagged measures of DEBT/V.) Income appears to be an important determinant of the debt share. Income in this model affects the chosen debt share through the credit rating effect. As discussed in Chapter II, higher-income jurisdictions typically receive better credit

ratings allowing these jurisdictions to issue bonds at a lower cost. Result indicate that the debt share is strongly positively related to income. A one-percent increase in per capita median income is associated with a debt share increase of 1.99 to 2.48 percent.

Three more variables are added to the estimation in equation (4). GOVTS, the number of local governments in the state per 1000 residents, is included to see if additional governmental units lead to an increased reliance on debt financing. A positive relationship between GOVTS and total borrowing would be especially likely if debt limits based on a level of borrowing per jurisdiction are binding. The results suggest, however, that the reliance on debt financing is inversely related to the number of local governments.[8] This result most likely is due to the fact that smaller governments are less likely to be active participants in the credit market due to the transaction costs of issuing bonds. As hypothesized, an increase in revenue bond issues appears to reduce the chosen debt share. Finally, the results do not support the hypotheses that the debt share is affected by the level of capital investment.

VI.F. Simultaneous Estimation of the Investment Demand and Debt Share Equations.

The level of general obligation bonds issued by all jurisdictions within a state is equal to the debt share h times the level of investment I. Because the model suggests that endogeneity may exist between h and I, proper estimation of the determinants of investment demand and the debt share requires using a simultaneous-equations estimation method. Equations (a) and (b) report the capital expenditure and debt share equations using two-stage least squares in order to take into account the

possible simultaneity of h and I. Both equations are also weighted by population in order to correct for heteroskedasticity.

Equation (a) replicates equation (1) from Table 6.4, except for the fact that the debt share variable on the right-hand side is the debt share fitted from an equation similar to (b) but excluding I. Similarly, equation (b) replicates equation (4) from Table 6.5, except for the fact that the investment variables is fitted from an equation similar to (a) but without h.

The attempt to correct for heteroskedasticity along with the incorporation of the simultaneous estimation framework increases the coefficient of determination in the investment equation from .62 in Table 6.4 to .94 in the equation below. Similarly, the percentage of the variation in the debt share that is associated with the variation in the right-hand side variables increases from .54 in equation (4) in Table 6.5 to .66 in the equation reported here.

a. Dependent Variable: State and Local Capital Investment (I)

$$
\begin{aligned}
I = {} & -8.97\ C + .11\ \text{POPULATION} + .96\ \text{MED INCOME} + .60\ \text{FED GRANTS} \\
& (-2.24) \quad (1.59) \quad (2.43) \quad (2.59) \\
& + .27\ \text{MATCH} - 6.28\ \text{TAX PRICE} - .09\ \text{DENSITY} + .32\ \text{ENROLL} + .14\ \text{U RATE} \\
& (1.93) \quad (-2.54) \quad (-1.66) \quad (2.12) \quad (.77) \\
& + .10\ \text{MIGRATION} + .11\ \text{RB} - .04\ h \\
& (1.48) \quad (1.37) \quad (-.24)
\end{aligned}
$$

$(\bar{R}^2 = .94,\ \text{F-stat} = 63.92)$

b. Dependent Variable: Debt share (h)

$$h = \underset{(-4.12)}{-20.65}\ C + \underset{(.29)}{.03}\ POPULATION + \underset{(.37)}{1.54}\ TAX\ PRICE + \underset{(.27)}{.09}\ FED\ GRANTS$$

$$+ \underset{(.20)}{.04}\ MATCH + \underset{(1.89)}{.15}\ FUTURE\ POP - \underset{(-1.18)}{.52}\ OLD + \underset{(.48)}{.06}\ DISCRIM + \underset{(3.64)}{.22}\ DEBT/V$$

$$+ \underset{(4.67)}{2.59}\ MED\ INCOME - \underset{(-.32)}{.09}\ U\ RATE - \underset{(-1.98)}{.26}\ RB - \underset{(-2.42)}{.16}\ GOVTS - \underset{(-1.35)}{.39}\ I$$

$(\bar{R}^2 = .66,\ F\text{-stat} = 8.29)$

A variable of interest affecting both investment demand and the debt share is the level of median income. The results indicate that higher-income jurisdictions issue more general obligation bonds for two reasons: because an increase in income increases investment demand, and because an increase in income increases the optimal debt share. The positive relationship between income and the debt share is an important finding. It is contrary to the recent results of Gordon and Slemrod (1986). Gordon and Slemrod use an arbitrage argument to suggest that lower-income residents will prefer debt financing by their state and local governments. Because lower-income residents can earn a relatively higher after-tax return on their private investments, they prefer that their jurisdictions rely more heavily on debt rather than tax finance. These residents are able to earn an after-tax return that exceeds the jurisdiction's cost of borrowing.

Even if the potential for this type of indirect arbitrage exists, the results reported in this dissertation suggest that the effect of income on the jurisdiction's borrowing costs dominate the arbitrage effect. I claim that lower-income jurisdictions issue fewer bonds because of the effect of

low private incomes on the jurisdiction's credit rating. Higher-income residents prefer a higher debt share because their jurisdiction is able to issue bonds at a lower cost. The nature of the Gordon and Slemrod study is different from the analysis undertaken here. The two authors rely on debt-outstanding figures (rather than new bond issues or the debt share) using jurisdictions in four states only. Most importantly, they do not address the existence of an inverse relationship between private incomes and state and local government borrowing costs.

Another interesting result involves the relationship between the level of general obligation bond issues and population growth. It is commonly observed that growing jurisdictions issue more bonds. The division of the borrowing decision into two parts (the level of investment and the share of debt in the financing of this investment) sheds light on the nature of this relationship. The estimation of the investment demand equation above (combined with the estimates reported in Table 6.4) suggests that investment depends on past population growth rather than expected future growth. Hence an increase in the recent past migration into a state will tend to increase the level of general obligation bonds issued due to the effect of this past population change on investment demand. An increase in future population projections will lead to an increase in bond issues due to the positive effect of FUTURE POP on the share of debt in the financing of capital investment only.

As expected, the jurisdiction's issuance of revenue bonds has two effects on the level of general obligation issues. An increase in RB is associated with an increase in the quantity of investment, but at the same time an increase in RB reduces the share of debt in the financing of that capital. The latter finding is very important because it is consistent

with the hypothesis that the cost of issuing general obligation bonds is an increasing function of the jurisdiction's revenue bond issues.

The two variables FED GRANTS and MATCH, which represent the effects of federal grants on state and local borrowing decisions, appear to affect the level of general obligation issues primarily though their effect on I rather than h. Finally, it should be noted that the effects of the debt share h on investment I (and vice versa) have never been shown in this research to be significant at a high level of confidence. An increase in h is expected to have a negative effect on I. Similarly, an increase in I is expected to be negatively related to h. While the reported signs are those that are expected, the t-statistics are fairly low.

VI.G. Estimation of the Determinants of Private-Activity Bond Issues.

Unlike the general obligation bond issue data, the Treasury revenue bond data are broken down into various functional categories. The three major categories include student loan bonds (bonds issued to finance the educational expenses of individuals), private exempt-entity bonds (issued for tax-exempt charitable, religious and educational organizations - primarily private, nonprofit hospitals and colleges) and a broad category of industrial bonds (IDB's). This IDB category is further disaggregated into eight additional sub-categories of bonds issued for the following purposes: small issues and industrial park, multi-family housing, sports and convention, airport and dock, sewage and waste disposal, pollution control, electric and gas, and miscellaneous "other exempt activities."

The estimation reported in this section takes advantage of the disaggregated nature of the data set because the determinants of state and local borrowing in support of private activity may depend on the type of

activity being financed. In addition to the three main categories outlined above, the analysis also will involve estimation of the determinants of the factors affecting the jurisdiction's reliance on IDB's issued under the small issue and industrial park exemption. These bonds account for almost half of all IDB's issued and one might argue that they seem to be issued for the most "private" purposes of all the private - activity bonds in that they serve to subsidize the financing of private capital investment.

Table 6.6 Volume of New Issue Private Activity Bonds, 1983 and 1984

Type of Activity	Total (in millions)
Student Loan Bonds	$ 4,456
Exempt-Entity Bonds	17,214
Industrial Development Bonds	69,873
Small Issue and Industrial Park IDB's (a subset of IDB's)	31,384
Total (50 states)	$ 91,543

Table 6.7 Average Private Activity Bond Issues by State, 1983 and 1984

Activity	Average (in millions) (excluding Alaska)	Standard dev.
Student Loan Bonds	$ 90.98	138.41
Exempt-Entity Bonds	350.20	489.84
IDB's	1416.00	1407.21
Small Issue and Industrial Park IDB's	635.04	604.69
Total	1857.18	1923.97

The two tables above illustrate the magnitude and variation in state and local government usage of bonds issued for the various purposes during the sample period 1983-1984.

Conceptually, the analysis of revenue bond issues should be analogous to that used to explain general obligation (GO) issues. Variation in a jurisdiction's quantity of general obligation bonds supplied is analyzed by viewing GO issues as the product of the jurisdiction's demand for capital and the jurisdiction's share of debt in the financing of that capital. The actual debt share measure is derived from the available data on GO bond issues and capital expenditures. Similarly, revenue bond issues can be viewed as the product of the level of the jurisdiction's financial support of private activity and the jurisdiction's share of debt in the financing of that support.

Unfortunately, information concerning the total value of state and local government assistance to private-sector development is unavailable. As discussed in Chapter IV, a jurisdiction can provide financial assistance in support of non-public activities by issuing tax-exempt bonds and/or granting tax abatements along with a variety of other incentives including direct grants, loans, and certain types of management or worker - training assistance.

While the reporting of private-activity bond issues has been required since 1982, very little information is available about the value of tax abatements or other incentives. Although the federal government has a comprehensive tax expenditure budget, few states do. Benker (1986) examines the current status of state tax expenditure reporting and finds that only seventeen states publish tax expenditure reports. Moreover, the methodology used in compiling these reports varies widely across states.[9]

Only three states (Michigan, Minnesota, and Washington) attempt to include the revenue loss estimates from local government tax abatements, but their reports emphasize the difficulties in obtaining these estimates.

Both Eisinger (1987) and Carlton (1979) try to circumvent this data problem by using the number of state incentive policies in existence as a measure of the state's involvement in the subsidizing of economic development. This assumes that the number of available incentive policies is directly correlated with that actual total usage of the incentives. Eisinger uses data from the Industrial Development and Site Selection Handbook to illustrate state economic development activities by region. Similarly, Carlton derives an index of a state's business climate by the absence or presence of 15 state incentive policies.

Without information on total subsidy activity S, the share of revenue bond issues in the financing of S cannot be determined. It is possible, however, that the jurisdiction's support of private-sector activity can be represented by various subsidy instruments. One possible measure is the number of available incentive policies (called INCENTIVES here) in existence in each state as used by Eisinger.

Another approach to modeling subsidy activity is to assume that jurisdictions offer investment incentives in order to either lure businesses away from other jurisdictions or to prevent other jurisdictions from doing the same to them. If jurisdictions do compete against each other in this manner, measures of inter-jurisdictional competition will be appropriate instruments for the level of economic development assistance provided by the jurisdiction. Two measures of inter - jurisdictional competition are used. They are described below.

CONTIG/STATE POP - the population of contiguous states divided by the population of the state itself is used as a measure of inter-state competition. It is hypothesized that the greater this ratio, the greater the likelihood that state and local governments within a state will subsidize private activity.

GOVTS - the number of local governments (including townships, counties, cities, school districts and special districts) per 1,000 residents in each state is used as a measure of intra-state competition. It is hypothesized that the greater the number of local governments per capita in each state, the more development assistance will be granted as each jurisdiction competes against other jurisdictions within the state.

An alternative approach to modeling subsidy activity is to realize that if subsidies do encourage private-sector development, measures of private capital investment may be related to the total value of subsidies granted. The results in this chapter are obtained using two measures of private investment. MANUF CAP is per capita capital expenditures by manufacturing firms in 1983 and CHANGE IN MANUF CAP is the change in MANUF CAP from 1977 to 1983.

State and local government support of economic development could be modeled by constructing an index of subsidy activity S using the proxies discussed above. This index could then be used as the dependent variable in order to estimate the determinants of state and local aid. Another estimating equation could be used to find the determinants of the share of private-activity bonds in the financing of this subsidy. A two-stage estimating procedure could then be used in order to account for the

possible endogeneity of the subsidy and the debt share.

Instead, I choose to enter the subsidy proxies as independent variables into estimating equations using per capita revenue bond issue measures as the dependent variables. Holding subsidy activity constant, the coefficients on any other independent variables will indicate the effect of a change in that variable on revenue bond issues - i.e., on the share of debt in the financing of subsidy activity. While estimation using this one-stage procedure does not address the simultaneity that may exist in the determination of the subsidy level and its associated debt share, I believe that a simultaneous estimation itself may lead to biased estimates because it is unlikely that the subsidy index measures will have measurement errors that are uncorrelated with other variables of interest. Furthermore, it has been shown previously that the evidence regarding the endogeneity of the level of public capital investment and its associated debt share is fairly weak. This may also be true of the relationship between subsidy activity and its associated debt share.

VI.H. Discussion of Results.

The OLS estimation of the determinants of total private-activity bond issues is reported in Table 6.8. As in the analysis of general obligation bond issues, Alaska is excluded from the sample due to its outlier status. The variables POPULATION and U RATE are included in all three equations. It is interesting to note that the level of revenue bond issues is negatively related to the unemployment rate. Because the repayment of principal and the interest payments on revenue bonds are financed from the proceeds of the project itself, a high unemployment rate may be associated with a poor economic climate, consequently making a bond default more

Table 6.8 - Private-Activity Bond Issue Estimates

Dependent Variable: Per Capita Private-Activity Bond Issues (excluding Alaska)			
	(1)	(2)	(3)
C	6.37 (3.61)	-1.10 (-.47)	-8.50 (-1.08)
POPULATION	.09 (.78)	.13 (1.22)	.15 (1.30)
CONTIG/ STATE POP	.18 (1.49)	.22 (1.94)	.27 (2.28)
MANUF CAP	-.02 (-.09)	.28 (1.44)	.35 (1.70)
CHANGE IN MANUF CAP	-.02 (-.09)	.02 (1.44)	-.01 (-.03)
GOVTS	-.09 (-1.10)	-.09 (-1.06)	-.13 (-1.44)
U RATE	-.71 (-2.29)	-.81 (-2.51)	-.76 (-2.15)
INCENTIVES	-.21 (-.42)	-	-
TREASURER	-	.21 (1.04)	.21 (1.03)
DISCRIM	-	.15 (.79)	.18 (1.01)
h	-	-.18 (-1.02)	-.18 (-.82)
I	-	.78 (3.38)	.90 (3.77)
MED INCOME	-	-	.74 (.98)
TAX PRICE (TP11)	-	-	8.15 (1.64)
R2	.03	.19	.22
F	1.19	2.16*	2.10*

(Because all non-dummy variables are in logs, coefficients are elasticity estimates. t-statistics are shown in parentheses. * denotes F-stat significance at the 5% level.)

likely. Hence the unemployment rate, which is part of W' (factors affecting the jurisdiction's credit-worthiness), may be positively related to the cost of borrowing and consequently negatively related to the quantity of bonds issued. Evidence suggests that a one percent increase in the unemployment rate is associated with a reduction in per capita revenue bond issues of .7 to .8 percent.

Five independent variables (CONTIG/STATE POP, MANUF CAP, CHANGE IN MANUF CAP, GOVTS, INCENTIVES) representing the jurisdiction's support of private-activity are included in equation (1). Unfortunately, these effectively explain very little of the inter-state variation in total per capita private-activity bond issues. Starting with equation (2) in Table 6.6, the INCENTIVES variable is dropped from the estimating equations. Although used in other studies as a measure of the subsidy activity, I am not certain that there is a strong relationship between the number of policies in existence and the state's support of private - activity. Further, the incentives included in this measure are for the most part those of the state government itself and not the policies of sub-state governments.

Equation (2) includes four additional explanatory variables: TREASURER, DISCRIM, h, and I. I hypothesize that these variables are determinants of the share of debt in the financing of S. TREASURER is a dummy variable equal to 1 if the state treasurer is appointed and equal to 0 if the treasurer is elected. It is possible that appointed treasurers have a more sophisticated knowledge of financial markets than do political treasurers. While I claim that there are costs to issuing revenue bonds, the marginal benefits may exceed the marginal costs over a relatively large level of private-activity bond issues. One explanation often given

for the rapid increase in the issuance of private-activity bonds over the last decade is that it took a while for state and local financial officers to become aware of the benefits to be obtained through the issuance of these bonds. It is possible that states where the top financial officer is appointed may rely more heavily on debt to finance subsidy activity.

I also expect the sign on the discriminatory tax policy variable DISCRIM to be positive because jurisdictions in states which exempt the interest on in-state bonds from the state income tax may be able to borrow at a lower cost. As with general obligation bond issues, this tax policy measure has the expected sign but is of low significance. Finally, because revenue bond interest costs are assumed to be a positive function of the jurisdiction's level of general obligation bond issues (and hence state and local capital expenditure I and the debt share h) both the level of investment and the debt share are included. The model suggests that the GO debt share h is inversely related to the revenue bond debt share. This appears likely, but as with TREASURER and DISCRIM the effect can not be estimated very precisely. Note that if general obligation debt limits are binding (although I assumed that they are not), I might expect to find a positive relationship between the share of general obligation debt in the financing of state and local capital. The results shown here support my non-binding debt limits assumption.

The level of per-capita capital spending by state and local governments is also expected to be negatively related to revenue bond issues through the interest rate effect because the interest rate is a positive function of hI. Although the increase in investment I may lead to a fall in the debt share h, it is expected that an increase in investment I will increase r_{mi}. The relationship between revenue bond

issues and state and local capital investment, however, is strongly and persistently positive. State and local governments which invest more in physical capital also issue more revenue bonds.

Equation (3) includes income and price measures in order to see if differences in these variables across states are able to explain any of the variation in revenue bond issues. It appears likely that higher - income jurisdictions issue more revenue bonds. The effect on the median income level on borrowing may be entering through W', the credit-worthiness variable in the model. Higher-income jurisdictions may face lower revenue bond borrowing costs and consequently issue more revenue bonds. Recall that income was also an important determinant of the share of general obligation debt in the financing of public capital. Another reason for the positive relationship between MED INCOME and RB is the assumed endogeneity of income. An increase in RB issues may increase the level of income in the jurisdiction resulting in a positive relationship between RB and MED INCOME. Unfortunately, I am unable to distinguish between the two effects.

Results from the estimation of the determinants of the disaggregated borrowing types are shown in Tables 6.9 - 6.11. The independent variables used in all of regressions reported here are largely the same as those used in Table 6.8. In Table 6.9, it is apparent that these variables effectively explain very little of the across-state variation in student loan bonds and exempt-entity bonds. In columns (2) and (4), the four variables representing inter-jurisdictional competition are omitted. I believe that it is unlikely that competition is the rationale for the issuance of these types of bonds to religious, charitable and educational organizations as well as to students. It is interesting to note that in

Table 6.9 - Student Loan and Exempt-Entity Bond Estimates

Dependent Variable: Per Capita Student Loan Bonds (Equations (1) and (2))
Per Capita Exempt-Entity Bonds (Equations (3) and (4))
(excluding Alaska)

	(1)	(2)	(3)	(4)
C	3.79 (1.71)	16.09 (1.28)	2.60 (1.64)	2.60 (.29)
POPULATION	-.07 (-.35)	.01 (.09)	.28 (1.98)	.17 (1.49)
CONTIG/ STATE POP	-.09 (-.41)	-	.13 (.88)	-
MANUF CAP	.10 (.32)	-	-.05 (-.21)	-
CHANGE IN MANUF CAP	.06 (.20)	-	.01 (-.04)	-
GOVTS	.29 (2.01)	-	-.09 (-.84)	-
U RATE	-.56 (-1.02)	- 1.29 (-2.05)	-.71 (-1.80)	-.62 (-1.40)
TREASURER	-	-.42 (-1.22)	-	-.23 (-.94)
DISCRIM	-	.33 (.91)	-	.07 (.27)
h	-	-.08 (-.23)	-	.05 (.21)
I	-	.29 (.70)	-	-.26 (-.87)
MED INCOME	-	-1.42 (-1.06)	-	.22 (.23)
TAX PRICE (TP11)	-	1.21 (.13)	-	-2.82 (-.42)
R2	.03	-.02	.04	.01
F	1.25	.91	1.34	1.09

(Because all non-dummy variables are in logs, coefficients are elasticity estimates. t-statistics are shown in parentheses. * denotes F-stat significance at the 5% level.)

column (1), the number of local governments per capita GOVTS is shown to be positively related to the per capita level of student loan bonds issued. This is surprising because student loan bonds are offered primarily by state as opposed to local governments. The unemployment rate U RATE does appear to be negatively related to both types of bond issues, but only in equation (2) is this effect significantly different from zero. It is also interesting to note that POPULATION seems to have a different effect on the two types of borrowing. It appears that the level of population is positively related to the amount of exempt-entity bonds but unrelated to the amount of student-loan bonds.

Ordinary least-squares estimates of the economic determinants of the broad category of industrial revenue bonds are reported in Table 6.10. As mentioned earlier, this measure of IDB's includes eight sub-categories of bonds ranging from small issues and industrial bonds to pollution control bonds and sports and convention center bonds. In column (1), the four inter-jurisdictional competition variables combined with POPULATION and U RATE explain none of the across-state variation in IDB's.

The results in columns (2) and (3) suggest that the competition variables do affect the across-state variation in IDB issues. States surrounded by high-population states issue more revenue bonds. A one-percent increase in the ratio of contiguous to state popultion leads to a .25 - .32 percent increase in per capita IDB's. Because the CONTIG/STATE POP variable has such a significant impact on the level of IDB issues, it is important to examine the nature of this measure in order to see if it is serving as a proxy for a regional characteristic. It is interesting to note that the seven states with the largest CONTIG/STATE POP measures are (in order) Vermont, Nevada, Delaware, New Mexico, West Virginia, Wyoming,

Table 6.10 - Industrial Development Bond Estimates

Dependent Variable: Per Capita Industrial Development Bonds (excluding Alaska)			
	(1)	(2)	(3)
C	5.10 (3.53)	-3.74 (-1.39)	-13.54 (-1.54)
POPULATION	.08 (.64)	.14 (1.18)	.17 (1.34)
CONTIG/ STATE POP	.19 (1.40)	.25 (1.95)	.32 (2.41)
MANUF CAP	.02 (.12)	.42 (1.89)	.51 (2.21)
CHANGE IN MANUF CAP	-0.03 (-.16)	.06 (.30)	.02 (.09)
GOVTS	-.13 (-1.41)	-.12 (-1.23)	-.17 (-1.71)
U RATE	-.63 (-1.77)	-.69 (-1.87)	-.62 (-1.57)
TREASURER	-	.38 (1.66)	.38 (1.67)
DISCRIM	-	.10 (.50)	.16 (.77)
h	-	-.21 (-1.06)	-.21 (-.86)
I	-	.94 (3.60)	1.11 (4.15)
MED INCOME	-	-	.98 (1.16)
TAX PRICE (TP11)	-	-	11.07 (1.99)
R^2	0.00	.19	.24
F	.96	2.14*	2.25*

(Because all non-dummy variables are in logs, coefficients are elasticity estimates. t-statistics are shown in parentheses. * denotes F-stat significance at the 5% level.)

and South Dakota. Examination of the data suggests that this relative population measure does not appear to be a proxy for a particular region (such as either coast.) Nor does it seem to be a proxy for old states (those with aging infrastructure) or new states.

Not only do states surrounded by more populous states issue more bonds, but the sign of the coefficient on the POPULATION variable suggests that larger states themselves issue more bonds. While the variable MANUF CAP is significantly related to the level of industrial development bonds issued, the level of manufacturing capital may be affected by revenue bond issues as well as vice versa. Finally, the change in manufacturing capital investment does not seem affect the level of borrowing.

Both GOVTS and U RATE can be thought of as representing factors that affect the costs of issuing revenue bonds. As in the case of general obligation bonds, the more governments there are per capita (actually per 1000 residents), the fewer bonds are issued. Again, the transactions costs of issuing bonds may be the reason that states in which there are relatively more but smaller governments issue fewer bonds. A higher unemployment rate may reduce the credit-worthiness of the project being financed. This will increase r_{mi} and reduce the quantity of revenue bonds issued.

Table 6.11 reports the results of estimating the revenue bond equation using the small issue and industrial IDB's subcategory of the IDB's used in Table 6.10. I select this type of IDB to investigate because I expect that decision to issue small issue and industrial bonds will be affected the most by the jurisdiction's desire to engage in inter-jurisdictional competition and because this IDB category alone makes up approximately 45% of all IDB's issued in the sample period 1983-84. The

Table 6.11 - Small Issue and Industrial Park IDB Estimates

Dependent Variable: Per Capita Small Issue and Industrial Park IDB's
The variables in Column (4) are weighted by population

	(1)	(2)	(3)	(4)
C	1.45 (1.08)	-4.82 (-1.86)	-9.35 (-1.09)	-11.03 (-1.34)
POPULATION	.21 (1.76)	.28 (2.43)	.33 (2.65)	.32 (2.51)
CONTIG/ STATE POP	.35 (2.73)	.45 (3.59)	.51 (3.99)	.50 (3.89)
MANUF CAP	.52 (2.71)	.73 (3.40)	.77 (3.44)	.82 (3.74)
CHANGE IN MANUF CAP	-.16 (-.83)	-.02 (-.09)	-.07 (-.39)	-.10 (-.52)
GOVTS	.07 (.85)	.12 (1.27)	.09 (.91)	.09 (.89)
U RATE	-.74 (-2.22)	-.70 (-1.97)	-.73 (-1.88)	-.71 (-1.81)
TREASURER	-	.56 (2.50)	.53 (2.41)	.54 (2.32)
DISCRIM	-	.18 (.89)	.24 (1.17)	.27 (1.34)
h	-	-.15 (-.78)	-.07 (-.31)	-.11 (-.43)
I	-	.56 (.25)	.71 (2.72)	.78 (3.05)
MED INCOME	-	-	.45 (.54)	.56 (.70)
TAX PRICE (TP11)	-	-	9.98 (1.83)	9.74 (1.76)
R^2	.25	.35	.38	.61
F	3.71**	3.64**	3.42**	7.17**

(Because all non-dummy variables are in logs, coefficients are elasticity estimates. t-statistics are shown in parentheses. ** denotes F-stat significance at the 1% level.)

hypothesized determinants of revenue bond issues are most successful as explaining this type of borrowing. The coefficient of determination is .61 in the equation that is the result of using weighted-least squares. In all equations, the F statistic is significant at the .01 level.

Governments located in states that are surrounded by big states and governments located in big states issue more small issue and industrial park IDB's per capita. Both of these effects are larger in magnitude for small issues and industrial park IDB's than they are for the other types of revenue bonds. As before, however, current bond issues are unrelated to the past trend in manufacturing capital investment. Bond issues are negatively related to the unemployment rate, which suggests that credit-worthiness concerns dominate the jurisdiction's desire to provide economic development assistance in order to revive local economies. Once again, the existence of a discriminatory tax policy that taxes interest on in-state bonds at a lower rate than the interest on out-of-state bonds apparently has no effect on the quantity of bonds issued. The effects of the general obligation debt share and the level of public capital investment on small IDB issues is similar to the effects of these variables on the other types of revenue bond issues.

The lack of a significant effect of income on the level of IDB's can be explained in the context of the model. It has been shown that income is an important determinant of the level of general obligation bond issues. An increase in income increases the demand for state and local capital investment, and an increase in income increases the share of debt in the financing of the investment. It is hypothesized that this debt share is inversely related to the level of revenue bond issues, and the empirical evidence is consistent with this hypothesis. To the extent that

the jurisdiction's subsidy activity is successful, it is possible that there will be a positive relationship between income and the level of renvenue bond issues. As a result, the two effects of income on the quantity of revenue bonds will tend to offset each other.

Finally, it is interesting to note that whether the state treasurer is elected or appointed does have a statistically significant effect on the quantity of this type of bond supplied by jurisdictions in that particular state. An one-percent increase in the probability that the treasurer is appointed rather than elected is associated with an increase in per capita small IDB issues of .54 percent. This finding is consistent with my hypothesis that revenue bonds are more likely to be issued by financial managers who have more a more sophisticated knowledge of financial matters and that appointed treasurers are more likely to have this type of knowledge.

CHAPTER VI - FOOTNOTES

1. Because of the matching problem, Gordon and Slemrod limit their study to the municipalities in four states (Connecticut, Maine, Massachusetts, and Rhode Island) where the majority of state and local bonds are issued by "minor civil divisions and places" - jurisdictions where they have data for both the debt outstanding and the characteristics of the residents.

2. One might be troubled at using only two years of data to explain governmental borrowing and capital spending decisions because these types of decisions are lumpy. I argue, however, that this lumpiness problem is less significant at my level of aggregation (e.g., although any one government may only issue bonds to build a bridge once every 10 years, at any one point in time many governments within a state are issuing these bonds.)

The results shown in this section are obtained using the sum of total borrowing levels for 1983 and 1984 divided by the sum of the population in those two years. Future research may involve utilizing both years in a panel data set, but currently this effort is stymied by the lack of a tax price measure that varies annually. Before deciding to use means of the data to estimate the parameters of the model, I investigated the consistency of the borrowing and capital-spending decisions across the two years. The validity of using means as observations depends on the consistency of these decisions over time (i.e., states which engage in a relatively high level of borrowing in 1983 should also borrow heavily in 1984.) The consistency of government behavior was investigated in two ways.

First, I ranked per capita general obligation issues, per capita revenue bond issues, the share of debt in the financing of state and local capital spending, and per capita state and local capital spending levels by state from 1 to 50 and calculated a Spearman rank correlation coefficient in order to test the null hypothesis that the rankings were unrelated from one year to the next. The null hypothesis was overwhelmingly rejected. Second, the 1983-84 consistency was examined by observing the number of states which changed rank by fewer than 10 spaces out of 50. In all cases, at least three-quarters of the 50 states changed rank by fewer than 10 spaces. More remarkably, in the capital spending rankings only 5 states changed rank by 5 or more spaces.

3. Information on M and t comes from the 1982 Statistics of Income data file. This data are not available for the sample years 1983 or 1984 as the Treasury does not calculate the average marginal tax rate t by state on a regular basis.

4. This matching rate is taken to be the average matching rate on all federal grants in a state. An increase in the matching rate effectively lowers the price of state and local capital expenditure and should be included in the estimation of the determinants of state and local public expenditure. Unfortunately, deriving a measure for this rate is very difficult. Information about federal grants is included on an annual basis in Special Analysis H of the U.S. federal budget. Because highway grants are the type of capital expenditure that is most typically financed through matching grants, MATCH is the ratio of federal grants for highway construction to federal grants used for other purposes. Because MATCH is only a crude proxy, care should be taken with the interpretation of its associated coefficient.

5. The variables included in the estimation of state and local investment demand in this chapter are those suggested by the theoretical analysis in Chapter V. The model also suggests, however, that the level of new investment may depend on the size of the capital stock in the preceding period. Because no comprehensive measures of public capital are available at the state and local level, a capital stock variable is not included in the estimating equations. One should be aware that this specification error may cause the estimated coefficients to be biased if the omitted variable is correlated with the included variables. If the capital stock is independent of the included variables, only the t-statistics will be biased. I assume that the effect of omitting K_{-1} on the reported estimates is not significant.

6. In additional regression equations (the results of which are not reported here), the debt share specification (1) in Table 6.5 was re-estimated using the three other tax price measures. The tax price coefficients all have very low t-statistics, the coefficient of determination changes very little, and the coefficients on the other independent variables are not affected very much.

7. The importance of this assumption (that the marginal bondholder must be a state resident) was not mentioned by Kidwell, et. al. (1984) in their paper on the discriminatory tax treatment of municipal bond interest.

8. Further evidence that general obligation debt limits are unlikely to be binding is suggested by the negative relationship between the debt share and the level of revenue bond issues. If revenue bonds are issued in order to circumvent general obligation bond limits, then one would expect to find a positive relationship between h and RB.

9. Some of the states list only the most recent tax expenditures enacted. Others only list revenue loss estimates from "large" tax expenditures (of $1 million or more). Most importantly, the tax expenditure budgets vary with regard to how the "normal" tax code is defined. This is important because tax expenditures are typically defined as deviations from the normal tax code.

CHAPTER VII

CONCLUSION

The objective of this research is to explain the variation across state and local jurisdictions in the issuance of long-term bonds. Jurisdictions can issue two types of state and local bonds: general obligation bonds that are typically issued for traditional governmental or "public" purposes, and revenue bonds which are more likely to be issued in support of nontraditional private-sector activities.

In my model, the government determines public capital expenditures and the optimal share of debt finance associated with that level of spending. At the same time, the government determines how to finance an exogenous level of private sector investment incentives. The crucial factor is that these decisions are all linked.

The optimal debt share is determined as if the government official were acting in the best interest of the median voter. The official determines the debt share that will minimize the cost to the voter of a dollar of government capital spending. The cost-minimizing official in a jurisdiction where the median voter has a high current tax price relative to his or her expected future tax price is expected to select a relatively larger debt share in the financing of state and local capital expenditures. In general, the optimal debt share will depend on the relationship between the residents' current and expected future tax prices. The optimal debt share will also depend on the level of borrowing because the cost of borrowing (and consequently the cost of debt finance)

increases with the amount of borrowing.

The quantity demanded of amount of public expenditures also is determined as if the median voter in the jurisdiction were decisive. The part of the model that deals with the determination of the desired spending levels is basically the standard median voter expenditure model with one exception. The typical demand model assumes that the tax shares or prices are known in advance and do not vary with the level of expenditures. In this model, the method of finance (the debt/tax choice) for public capital expenditures may vary as well as the level of expenditure. Further, the expenditure choice depends on the debt/tax choice and vice versa.

The jurisdiction makes another type of debt/tax choice in deciding how to finance economic development. The incomes of the voters can be affected by the economic development decisions made by their jurisdiction. I assume that the level of the subsidy is exogenous. In essence, it is a required level of economic development activity in which the jurisdiction must engage in order to remain in a country-wide equilibrium. While fiscal incentives may increase private incomes, both revenue bonds and tax abatements entail a cost to the jurisdiction. The cost of granting tax abatements is simply the revenue foregone. The prevailing view of revenue bonds, however, has been that revenue bonds can be issued virtually without cost to the jurisdiction.

An important feature of the research in this dissertation is the claim that there is a cost to the jurisdiction of revenue bond issues. An increase in revenue bonds increases the cost of issuing general obligation bonds to pay for traditional government expenditures such as roads, schools and bridges. At the same time, an increase in revenue bonds

reduces the effectiveness of the revenue bond as a subsidy tool because the yield differential between taxable bonds and the jurisdiction's revenue bonds will decrease.

Estimation of the model yields many interesting findings. One of the strongest results involves the relationship between income and general obligation bonds. The higher-income states issue more bonds not only because they purchase more capital, but because they choose to finance this capital with a higher portion of debt. Population growth positively affects the level of general obligation bonds in two ways. The demand for state and local capital investment is positively related to past population growth, while the chosen debt share is positively related to future population growth. The findings are consistent with my hypothesis that the observed share of general obligation debt in the financing of state and local capital is chosen as if a government official is minimizing the price to the voter of capital expenditure.

A major innovation of this research is the explanation of the determinants of revenue bond issues using a new data set collected by the U.S. Treasury. Although the across-state variation in total revenue bond issues does not seem to be driven by economic factors, some of the factors that explain a significant amount of the variation in industrial development bonds have been identified.

Higher population states issue more IDB's per capita, and states located near high population states also issue more revenue bonds. The results do support the hypothesis that the share of general obligation debt in the financing of public capital expenditures and the share of revenue bonds in the financing of economic development assistance debt share are inversely related. Measures of inter-jurisdictional competition

are important determinants of IDB issues. Surprisingly, whether the state treasurer is elected or appointed has an effect on the issuance of revenue bonds.

While the entire area of state and local borrowing has been underworked, recent dissertation work by Capeci (1990) is consistent with and supportive of assumptions I make in this research. Using a sample of 243 bond issues from jurisdictions in New Jersey, Capeci finds that borrowing rates are responsive to current period fiscal decisions made by the issuing jurisdictions. He suggests that the positive effect of the amount borrowed on interest costs is due to the increased costs of risk bearing and that the proper municipal financial policy (i.e. what I call the debt/tax choice) should weigh these costs against the marginal costs of taxation. The major differences between our two studies is that he uses interest costs as a dependent variable while I use the quantity of bonds issued, and he restricts his sample to the borrowing done in one state instead of all fifty.

APPENDICES

APPENDIX A

This appendix details the derivation of the equation for the optimal share of general obligation debt in the financing of state and local capital expenditure from Chapter III and the investment demand equation from Chapter V.

Chapter III describes the selection of the optimal share of general obligation debt in the financing of state and local public capital expenditure. The government official chooses the optimal debt schedule that minimizes the cost of a dollar of capital expenditure P_1, where

$$P_1 = (1-h)t^c + ht^f p[1 + r_{mi}(hI,RB,W)] \ (1+d)^{-1}. \qquad (A.1)$$

Because the cost of borrowing r_{mi} is assumed to be a linear function of jurisdiction i's amount of general obligation bond issues hI, its revenue bond issues RB, and a vector of credit-worthiness variables W, I replace r_{mi} with the expression $r_{mi} = ehI+fRB+gW$. The optimal debt share h^* is found by taking the partial derivative of P_1 with respect to h and setting it equal to zero. The optimal debt share is written:

$$h^* = \frac{t^c - t^f p(1+d)^{-1} \ [1+fRB+gW]}{2t^f peI(1+d)^{-1}} \qquad (A.2)$$

The comparative static results are as follows:

$$\frac{\delta h}{\delta t^c} = \frac{(1+d)}{2t^f peI} > 0$$

$$\frac{\delta h}{\delta t^f} = \frac{-t^c(1+d)}{2(t^f)^2 peI} < 0$$

$$\frac{\delta h}{\delta p} = \frac{-t^c(1+d)}{2t^f p^2 eI} < 0$$

$$\frac{\delta h}{\delta d} = \frac{t^c}{2t^f peI} > 0$$

$$\frac{\delta h}{\delta RB} = \frac{-f}{2eI} < 0$$

$$\frac{\delta h}{\delta W} = \frac{-g}{2eI} > 0$$

$$\frac{\delta h}{\delta I} = \frac{-[t^c - t^f p(1+fRB+gW)(1+d)^{-1}]}{2t^f peI^2(1+d)^{-1}} < 0$$

The first five results are obvious, but the last two results warrant additional discussion. An increase in the credit-worthiness of the jurisdiction W is expected to lead to an increase in the chosen debt share. The comparative results show that the effect of a change in W on the chosen h depends on g. The term g represents the effect on the cost of borrowing of an increase in W. The effect on h of a change in W is positive because the term g is negative.

The effect of an increase in the level of capital investment I will be inversely related to the chosen debt share if the term in brackets in the numerator in the comparative statics expression above is positive. This expression in brackets is actually the numerator in equation (A.2) above. The fact that h is required to be a non-negative number and is typically observed to be non-zero as well implies that term in brackets is positive. Hence, the effect on h of an increase in I is expected to be negative.

Chapter V describes the median voter's selection of his or her utility-maximizing bundle consisting of three goods: the desired public capital stock K, the level of current (non-capital) expenditures EXP, and a composite good X. The problem is as follows:

$$\text{maximize } U(K, EXP, X) = K^j EXP^m X^n$$

subject to:

(A.4) $Y = X + t^C[EXP + I(1-h) - G + Z]$

(A.5) $h = h^*$ (as shown in equation A.2)

(A.6) $S = S^*$

(A.7) $MRTS_{RB,Z} = P_{RB}/P_Z$

(A.8) $K = I + (1-d)K_{-1}$

The first constraint represents the combined budget constraint of the individual and the jurisdiction. The individual spends his or her income Y on the goods EXP and I that are provided by the state or local jurisdiction and also on the composite good X. The jurisdiction's budget constraint is written T + hI + G = EXP + I + Z, which states that the jurisdiction's sources of funds T, hI, and G must equal its uses of funds EXP, I, and Z. The tax revenue T received by the jurisdiction is paid by the residents for their consumption of EXP and I. The individual's share of the required taxes equals t^CT. Hence the individual's budget constraint can be written as $Y = X + t^CT$. Equation (A.4) combines the two constraints.

The individual chooses the utility-maximizing combination of K, EXP and X knowing that any addition to the capital stock will be financed with the optimal mix of debt and tax finance as represented by h^*. Hence the h term found in (A.4) will be the optimal h^* as shown in (A.2). The cost of borrowing r_{mi} can be replaced by ehI+fRB+gW. Because the model suggests that borrowing in a particular period will depend on the level of new investment I rather than the capital stock K, constraint (A.8) is used to replace the K term in the utility function with a function of investment I and the exogenous level of the past capital stock.

Because the desired demand expressions for the choice variables I, X, RB and Z will be functions of the exogenous variables in the model, it is necessary to incorporate the exogenous level of the subsidy activity S into the maximization problem. Constraints (A.6) and (A.7) require that the level of subsidy S offered by the jurisdiction is the equilibrium level S^*, and that the optimal mix of financing methods occurs when the marginal rate of technical substitution of revenue bonds for tax abatements equals the ratio of the prices of RB and Z. The technology used to produce the subsidy S is assumed to be Cobb-Douglas. Constraint (A.7) gives the following relationship between the inputs Z and RB:

$$Z = \frac{AfhIRB\,(r_{ti} - ehI - gW - fRB)}{r_{ti} - ehI - gW - 2fRB} \qquad \text{where } A = \alpha/(1-\alpha) \qquad (A.9)$$

The production function for S also can be used to provide additional information on the relationship between RB and Z.

$$S = Z^{\alpha}[(RB)(r_{ti} - ehI - fRB - gW)]^{1-\alpha}. \qquad (A.10)$$

An expression for RB in terms of S^* (called S for ease of notation) can be obtained by solving the two equations (A.9) and (A.10) for Z and setting them equal.

$$\frac{AfhIRB\ (r_{ti} - ehI - gW - fRB)}{r_{ti} - ehI - gW - 2fRB} = S^{1/\alpha}[RB(r_{ti}-ehI-fRB-gW)]^{(\alpha-1)/\alpha}$$

With difficulty, this equation could be solved for RB. An expression for Z as a function of S can be obtained in a similar manner, with the resulting expression being even more complicated.

In order to solve the utility-maximization problem, the utility function and the budget constraint can be rewritten in order to take constraints (A.5) - (A.8) into account. The new problem is as follows:

$$\text{maximize } U\ (I+(1-d)K_{-1},\ EXP,\ X) = [I + (1-d)K_{-1}]^{j}EXP^{m}X^{n}$$

subject to:

$$Y = X + t^{c}\{EXP + I - I\{\frac{t^{c} - t^{f}p(1+d)^{-1}\ [1+fRB+gW]\}}{2t^{f}peI(1+d)^{-1}} - G + Z\}$$

Z is the expression for tax abatements Z that can be obtained from equations (A.9) and (A.10). For simplicity, I do not write the expression for *Z* in an explicit form. The expression for *Z* is terms of RB, S, and the other parameters in the model.

A consequence of this utility-maximizing behavior is that the first partial derivatives of the Lagrangian function incorporating the utility function and the budget constraint equal zero. The first-order conditions are derived by taking the partial derivative of the Lagrangean function with respect to I, EXP, X, RB and the Lagrangian multiplier. (Z does not actually appear, as it has been replaced by a function of RB and S.) Due to the great complexity of the problem, the first-order conditions will not be shown here. The five equations can be solved for the five unknowns to obtain demand functions for I, EXP, X and RB. Once RB is known, the demand for Z can be obtained. The demand for investment I is of particular interest here. Unfortunately, the expressions for I, RB, and

the other variables are very complicated. As a result, the investment demand portion of the model that is estimated in Chapter VI is not the actual demand function derived from the maximization process. Due to the complexity of the problem, comparative static results will not be derived. Instead, I let the maximization problem suggest which variables are the likely determinants of investment decisions and I test for their significance.

APPENDIX B

This appendix contains further information about the data used in Chapter VI. The description of each data series is included along with its source.

GO - State and local government issues of long-term new money (non - refunding) general obligation bonds per capita. As used here, GO is the average of the 1983 and 1984 per capita general obligation issues determined by dividing the total borrowing levels in each state for both 1983 and 1984 by the total of the 1983 and 1984 state populations. These data are from the files of the Securities Data Company. Previous studies examining borrowing differences across jurisdictions (Metcalf (1989), Gordon and Slemrod (1986) and Asefa, et. al. (1981)) have used Census data on the change in debt outstanding or on long-term bond issues. Although there seems to be a general consensus among researchers that the Census bond data are unsatisfactory, no other data are publicly available. The Bond Buyer does not publish state level data, and the Public Securities Association does not distinguish between bonds issued to refund earlier obligations at a lower interest rate ("refundings") from "new-money" bonds issued to finance capital expenditures.

RB - state and local government issues of long-term revenue bonds (specifically "private-activity bonds") per capita determined by dividing the 1983 and 1984 totals by the total population in both years. Although revenue bonds have surpassed general obligation bonds in new issue volume, it was only recently that comprehensive data have been collected. The IRS's SOI Bulletin presents detailed data on three major categories of revenue bonds: a broad category of industrial development bonds, student loan bonds, and exempt-entity bonds. Starting in 1985, mortgage subsidy bonds will also be included in the SOI reports. RB refers to the 1983-84 average per capita revenue bond amounts. More information about the SOI data can be found in ACIR (1990).

I - state and local capital expenditure per capita. Capital spending can be found in the 1983 and 1984 Governmental Finances in a table entitled "State and Local Governmental Expenditure for Capital Outlay, by Function and States." Per capita figures were obtained by using 1983 and 1984 state population data from the 1988 Statistical Abstract of the U.S.

h - the share of long-term general obligation in the financing of state and local capital expenditure. This is simply the ratio of GO issues to state and local capital expenditure. The debt share is the average of the 1983 and 1984 debt shares.

TP1, TP2, TP11, and TP22 - tax prices representing the cost to the decisive voter of a $1 increase in per capita tax-financed state and local

expenditure. Using 1982 data on the proportion of returns filed by itemizers M (joint returns counted twice) and the average federal marginal tax rate t faced by these itemizers, the first two tax prices are defined as: TP1 = (1-M) + M(1-t), and TP2 = (1-t). The last two tax prices attempt to incorporate the effect of the reciprocal deductibility of state and local taxes from the federal income tax and vice versa. TP11 is equal to (1-M) + M(1-t') where t' is a measure of the federal marginal tax rate for households earning $10,000 - $20,000 in 1982 calculated by Feenberg and Rosen (1986). The federal tax rate measure t' takes into account the reciprocal deductibility of federal, state and local taxes. Finally, TP22 is equal to (1-t').

FED GRANTS - federal grants to state and local governments per capita, computed as the average of the 1983 and 1984 levels. Per capita federal aid is listed in the 1986 and 1987 Statistical Abstract.

MED INCOME - per capita median "effective buying income." This is from the annual Survey of Buying Power in Sales and Marketing Management Magazine. Median income levels were converted into per capita amounts by dividing by the number of people per household, using information listed in the 1988 Statistical Abstract. MED INCOME is the 1983-84 average.

MATCH - a proxy for the average matching rate to states receiving federal matching grants. This measure is equal to the ratio of federal aid to state and local governments in each state for highways (found in the 1982 Census of Governments) divided by the total amount of federal aid.

ENROLL - the percentage change in public elementary and secondary school enrollment in the years 1980-1985, as listed in the 1988 Statistical Abstract.

MIGRATION - 1980-84 net total migration to a state as a percentage of the state's 1980 population. Net total migration includes net immigration from abroad and net interstate migration. These figures were obtained from the 1986 Statistical Abstract.

FUTURE POP - projected percentage increase in state population to the year 2000. FUTURE POP is the average of the projected population increase from 1983 to 2000 and the 1984-2000 projected increase. The percentage population increase was calculated from data on projected population levels in the 1988 Statistical Abstract, converted to percentage terms using 1983 and 1984 population figures.

OLD - the percentage of the state population 65 years of age and older as of 1986, as reported in the 1988 Statistical Abstract.

U RATE - the average of the 1983 and 1984 state unemployment rates, as a percentage of the civilian labor force. From the U.S. Department of Commerce State and Metropolitan Area Data Book, 1986.

INCENTIVES - the number of state tax expenditures plus the number of "special services" offered in support of industry as catalogued by the Industrial Development and Site Selection Handbook (1985).

GOVTS - the number of local (sub-state) governments in each state in 1982 per 1,000 inhabitants, from the 1982 Census of Governments.

DISCRIM - a dummy variable set equal to one if states exempt interest on in-state bonds from state taxation but tax all out-state bond interest. The list of states which engage in discriminatory taxation comes from Kidwell (1984). I combine his Group 3 (states which exempt all in-state and tax all out-of state bonds) and Group 4 (states which exempt some in-state and tax all out-of-state bonds.) If DISCRIM = 1, then the jurisdictions in that state may be able to issue bonds at a lower interest cost if the marginal bondholder is a resident of that state.

TREASURER - a dummy variable set equal to 1 for states that have appointed treasurers and equal to 0 for states with elected treasurers. From the Book of the States (Council of State Governments 1982-83.)

DENSITY - Persons per square mile in 1980. From the 1988 Statistical Abstract of the U.S.

POPULATION - the average 1983 -1984 population in each state in thousands. From the 1988 Statistical Abstract of the U.S.

CONTIG/STATE POP - contiguous state population divided by the state's population. Determined using a Rand-McNally road atlas and 1983 population figures.

MANUF CAP - per capita capital expenditures by manufacturing firms by state in 1983 from the 1986 Annual Survey of Manufactures, Bureau of the Census.

CHANGE IN MANUF CAP - Per capita change in manufacturing capital expenditures from 1977 to 1983 using 1983 population from the 1986 Annual Survey of Manufactures, Bureau of the Census.

DEBT/V - total state and local debt outstanding in 1982 divided by the total gross assessed value of property subject to local general property taxes in 1981. Both figures are from the 1982 Census of Governments.

BIBLIOGRAPHY

BIBLIOGRAPHY

Adams, Roy (1977) "Individual Preferences as Supply Determinants in the Municipal and Federal Bond Markets." Public Finance Quarterly, vol. 5, pp. 175-202.

Advisory Commission on Intergovernmental Relations, The Volume Cap for Tax-Exempt Private Activity Bonds: State and Local Experience in 1989, Washington, D.C. 1990.

Allman, Phil E. (1982) "A Neoclassical Model of the Tax-exempt Bond Market." Unpublished Ph.D. dissertation, Michigan State University.

Almanac of the 50 States. (1985) A. N. Garwood, ed. Information Publications. Burlington, VT.

Asefa, Sally et.al. (1981) "Municipal Borrowing: Some Empirical Results." Public Finance Quarterly, vol. 9, pp. 271-80.

Auerbach, Alan J. (1979) "Wealth Maximization and the Cost of Capital." Quarterly Journal of Economics, pp. 433-445.

Barnea, Amir, Haugen, Robert, and Lemma Senbet (1981) "An Equilibrium Analysis of Debt Financing under Costly Tax Arbitrage and Agency Problems." Journal of Finance, vol. 36, pp. 569-581.

Barro, Robert. (1974) "Are Government Bonds Net Wealth?" Journal of Political Economy, pp. 1095-1117.

Bartik, Timothy J. (1985) "Business Location Decisions in the United States: Estimates of the Effects of Unionization, Taxes, and Other Characteristics of States." Journal of Business and Economic Statistics, vol. 3, pp. 14-22.

Benker, Karen M. (1986) "Tax Expenditure Reporting: Closing the Loophole in State Budget Oversight." National Tax Journal, vol. 39, pp. 403-417.

Bergstrom, Theodore C. and Robert P. Goodman, (1973) "Private Demands for Public Goods." American Economic Review, vol. 63, pp. 280-296.

Bloom, H.S., H. Ladd, and J. Yinger, (1983) "Are Property Taxes Capitalized into House Values?" in Local Provision of Public Services: The Tiebout Model after Twenty-Five Years. G.R. Zodrow, ed. Academic Press, New York.

Bond Buyer 1988 Yearbook. The Bond Buyer. New York.

Book of the States, 1982-1983, Council of State Governments.

Borcherding, Thomas E. and Robert T. Deacon, (1972) "The Demand for the Services of Non-Federal Governments." American Economic Review, vol. 62, pp. 891-906.

Buchanan, James (1967) Public Finance in Democratic Process. University of North Carolina Press, Chapel Hill.

Capeci, John. (1990) "Local Fiscal Policies, Default Risk and Municipal Borrowing Costs," Working Paper No. 259, Brandeis University.

Carlton, Dennis W. (1979) "Why New Firms Locate Where They Do: An Econometric Model," in Interregional Movement and Economic Growth. W.C. Wheaton, ed. Urban Institute.

Carlton, D.W. (1983) "The Location and Employment Choices of New Firms: An Econometric Model with Discrete and Continuous Endogenous Variables," The Review of Economics and Statistics, vol. LXV, pp. 440-449.

Clark, Phil and Tom Neubig (1984) "Private-Activity Tax-Exempt Bonds, 1983." SOI Bulletin, vol. 4, pp. 97-107.

Clark, Phil (1985) "Private-Activity Tax Exempt Bonds, 1984." SOI Bulletin, vol. 5, pp. 55-64.

Courant, Paul N. and Daniel L. Rubinfeld. (1987) "Tax Reform: Implications for the State-local Public Sector." Journal of Economic Perspectives. vol. 1, no. 1, pp. 87-100.

Cooner, James J. (1987) Investing in Municipal Bonds-Balancing Risks and Rewards. John Wiley and Sons, New York.

Cunningham, James P. (1989) "Determinants of U.S. State Debt." Unpublished Ph.D. dissertation, University of Chicago.

DeBartolo, Gil and Peter Fortune. (1982) "The Demand for Public Services: Inferences from Municipal Bond Referenda." National Tax Journal. vol. 35, pp. 55-69.

Eisinger, Peter K. (1987) "The Rise of the Entrepreneurial State in Economic Development." Proceedings of the Seventy-ninth Annual Conference ofthe National Tax Journal--Tax Institute of America. pp. 34-44.

Epple, Dennis and Chester Spatt. (1986) "State Restrictions on Local Debt." Journal of Public Economics, vol. 29. pp. 199-221.

Feenberg, Daniel and Harvey Rosen. (1986) "The Deductibility of State and Local Taxes: Impact Effects by State and Income Class," Growth and Change, vol. 17, pp. 11-29.

Feldstein, Martin. (1985) "Debt and Taxes in the Theory of Public Finance," Journal of Public Economics, vol. 28, pp. 233-245.

Feldstein, Martin, Green, Jerry, and Eytan Sheshinski. (1979) "Corporate Financial Policy and Taxation in a Growing Economy," Quarterly Journal of Economics, pp. 411-432.

Feldstein, Martin and Gilbert Metcalf. (1986) "The Effect of Federal Tax Deductibility on State and Local Taxes and Spending," Working Paper 1791, NBER, Boston.

Fisher, Ronald C. (1988) State and Local Public Finance. Scott, Foresman and Company. Glenview, IL.

Forbes, Ronald W. (1988) "The Tax-Exempt Securities Market," The Investment Banking Handbook. J.P. Williamson, ed. Wiley and Sons, NY.

Fortune, Peter (1973) "The Impact of Taxable Municipal Bonds: Policy Simulations with a Large Econometric Model." National Tax Journal, vol. 26, pp. 29-42.

Galper, Harvey and John Petersen. (1971) "An Analysis of Subsidy Plans to Support State and Local Borrowing." National Tax Journal. vol. 24, pp. 205-34.

Gordon, R.H and Joel Slemrod. (1986) "An Empirical Examination of Municipal Financial Policy." Studies in State and Local Finance. H. Rosen, ed. NBER.

Gramlich, Edward M. and Harvey Galper. (1973) "State and Local Fiscal Behavior and Federal Grant Policy." Brookings Papers on Economic Activity, pp. 15-65.

Hendershott, Patric and David Kidwell. (1978) "The Impact of Relative Security Supplies." Journal of Money, Credit, and Banking, vol. 10, pp. 337-347.

Hendershott, Patric and Timothy Koch. (1977) Empirical Analysis of the Market for Tax-exempt Securities. Monograph Series in Finance and Economics, New York University.

Holtz-Eakin, Douglas. (1986) "Unobserved Tastes and the Determination of Municipal Services." National Tax Journal, vol. 39, pp. 527-532.

Holtz-Eakin, Douglas and Harvey S. Rosen. (1988) "Tax Deductibility and Municipal Budget Structure," Fiscal Federalism: Quantitative Studies. H. Rosen, ed. NBER.

Hsieh, David D. (1983) "A Heteroscedasticity-Consistent Covariance Matrix Estimator for Times Series Regressions." Journal of Econometrics, vol. 22, pp. 281-290.

Industrial Development and Site Selection Handbook. (Jan.- Feb. 1985) pp. 52-54.

Inman, Robert P. (1978) "Testing Political Economy's 'As If' Proposition: is the Median Income Voter Really Decisive?" Public Choice, vol. 33, pp. 45-65.

Jensen, Michael C. and William H. Meckling, (1976) "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure." Journal of Financial Economics, vol. 3, pp. 305-360.
Kaufman, George (1981) Efficiency in the Municipal Bond Market: The Use of Tax-exempt Financing for "Private" Purposes. JAI Press.

Kidwell, David S. et. al. (1984) "The Impact of State Income Taxes on Municipal Borrowing Costs." National Tax Journal, vol. 37, pp. 551-561.

Kormendi, Roger and Thomas Nagle (1981) "The Interest Rate and Revenue Effects of Mortgage Revenue Bonds." in Kaufman (1981).

Lamb, Robert and Stephen P. Rappaport. (1986) Municipal Bonds, 2nd. edition, McGraw-Hill Book Co., New York.

Lindsey, Lawrence B. (1988) "Federal Deductibility of State and Local Taxes: A Test of Public Choice by Representative Government," Fiscal Federalism: Quantitative Studies. H. Rosen, ed. NBER.

Maddala, G.S. (1977) Econometrics. McGraw-Hill Book Co. New York.

Maxwell, James and J.R. Aronson (1977) Financing State and Local Governments. The Brookings Institution, Washington, D.C.

Metcalf, Gilbert E. (1989) "Federal Tax Policy and Municipal Financial Behavior." Proceedings of the Eighty-First Annual Conference of the National Tax Journal--Tax Institute of America. pp. 109-114.

_____,(1988). "Essays on the Financial Structure of State and Local Governments." Unpublished Ph.D. dissertation, Harvard University.

Nadeau, Serge. (1988) "A Model to Measure the Effects of Taxes on the Real and Financial Decisions of the Firm," National Tax Journal. pp. 467-481.

National Association of State Development Agencies (1986) Directory of Incentives for Business Investment and Development in the U.S.: A State by State Guide, The Urban Institute Press, Washington, D.C.

Netzer, Richard (1985) "The Effect of Tax Simplification on State and Local Governments," Economic Consequences of Tax Simplification, Federal Reserve Bank of Boston. pp. 222-258.

Papke, Leslie (1987) "The Location of New Manufacturing Plants and State Taxes: Evidence from Panel Data," Proceedings of the Seventy-ninth Annual Conference of the National Tax Journal-Tax Institute of America. pp. 44-55.

Peterson, George. (1984) "Financing the Nation's Infrastructure Requirements." Perspectives on Urban Infrastructure. National Academy Press.

Petersen, John E. (1981) "The Municipal Bond Market: Recent Changes and Future Prospects," in Financing State and Local Governments in the 1980's, Walzer, N. and D.L. Chicoine, eds., Oelgeschlager, Gunn and Hain.

Phares, Donald. (1980) Who Pays State and Local Taxes. Cambridge, MA. Oelgeschlager, Gunn and Hain.

Public Securities Association (1983) Statistical Yearbook of Municipal Finance. New York.

Ott, David J. and Allan Meltzer. (1963) Federal Tax Treatment of State and Local Securities. The Brookings Institution. Washington, D.C.

Rubinfeld, Daniel. (1973) "Credit Ratings and the Market for General Obligation Municipal Bonds." National Tax Journal, pp. 17-27.

Sales and Marketing Management Magazine, Survey of Buying Power. (1984) New York: Bill Publications.

Sjoquist, David L. (1981) "A Median Voter Analysis of Variations in the Use of Property Taxes Among Local Governments." Public Choice, vol. 36, pp. 273-285.

Sullivan, Dennis, and Robert Newman. (1988) "Econometric analysis of business tax impacts on industrial location: What do we know, and how do we know it?" Journal of Urban Economics, vol. 23, pp. 215-34.

Toder, Eric and Thomas Neubig (1985) "Revenue Loss Estimates: The Case of Tax-Exempt Bonds." National Tax Journal. vol. 38, pp. 395-414.

Tuccillo, John and John Weicher (1981) "The Impact of Mortgage Revenue Bonds on Securities, Markets, and Housing Policy Objectives." in Kaufman (1981).

U.S. Department of Commerce, Bureau of the Census (various years) Governmental Finances, Washington, D.C.

U.S. Department of Commerce, Bureau of the Census (1987, 1988) U.S. Statistical Abstract, Washington, D.C.

U.S. Department of Commerce, Bureau of the Census, (1986) State and Metropolitan Area Data Book, Washington, D.C.

U.S. Department of the Treasury, Internal Revenue Service. (1984, 1985, 1986) "Private Activity Tax-Exempt Bonds," Statistics of Income Bulletin. Washington, D.C.

U.S. Office of Management and Budget, Special Analysis H, Budget of the U.S. Government, various years, Government Printing Office, Washington, D.C.

Vitaliano, Donald F. (1988) "Evidence About Debt Equivalence From the Local Public Sector." Public Finance/ Finances Publiques. vol. 43, pp. 295-309.