The Provision of Public Goods by Government and Private Sectors: An Empirical Analysis

by

Maura P. Doyle

A.B., Economics and Mathematics, Mount Holyoke College, 1987

Submitted to the Department of Economics
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Author _____

Department of Economics
May 7, 1994

Certified by _____

James Poterba
Professor of Economics
Thesis Supervisor

Certified by _____

Jonathan Gruber
Assistant Professor of Economics
Thesis Supervisor

Accepted by _____

Olivier Blanchard
Professor of Economics
Chair, Departmental Committee on Graduate Students

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Abstract

In this thesis, I analyze several economic questions regarding the provision of public goods. The first chapter examines the long-run effects of stringent property-tax limitations on the provision of a primary local service: fire protection. I use detailed data for the post World War II period, including the insurance rating of the municipality's fire department, to measure the quality of fire protection. The results indicate that municipalities with property-tax limitations spent significantly less on fire protection resulting in significantly worse insurance ratings, longer workweeks for firefighters and higher rates of property loss, death and injury.

The second chapter quantifies the difference in productivity between private and public provision of fire services by comparing volunteers and paid employees using the insurance rating of a municipality's fire department. A typical volunteer provides approximately thirty percent of the fire protection of a typical paid employee. Equipping a volunteer costs only ten percent of the cost of paying and equipping a paid employee. Thus, while less productive in absolute terms than paid employees, volunteers are more productive per tax dollar. Additionally, it is found that the use of volunteer firefighters is significantly higher in cities constrained by property-tax limitations. The results also suggest that the decline in volunteerism in the post-war years may be explained by an increase in white collar jobs in centralized cities.

The final chapter examines the effect of fiscal policy on private donations for public goods. It improves upon past studies of related questions in several ways. First, I re-estimate the tax price elasticity and crowd-out parameters using disaggregated data and test for differences in giving behavior across categories. Second, I control for demographic information relating to religion, eliminating an important omitted variable bias which comes about because religious affilation is correlated with income, region of residence and giving to the church. Finally, I test and cannot reject that the Tobit methodology is consistent by comparing it to the more robust Symmetrically Censored Least Squares methodology.

I find that religious affiliation is a significant determinant of charitable giving. Correcting for the omitted variable bias, I find evidence of crowd-out for only one category, human services, where a government spending reduction of one dollar stimulates 12 cents of charity. The disaggregated data also show a relatively weak response to tax incentives for religious giving, implying that charitable deductions may not be revenue-efficient. The measured tax price

elasticity for other categories of giving have large standard errors and are consistent with previous estimates.

Thesis Supervisor: James Poterba
Title: Professor of Economics

Thesis Supervisor: Jonathan Gruber
Title: Assistant Professor of Economics

To my Parents

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This dissertation was made possible by the support, encouragement and guidance that I have received throughout my years. It is my privilege to extend my gratitude to the people who have influenced me and my work. First, I must thank my parents. They were the ones who first taught me that I could do tackle anything. (They probably taught me that lesson better than they had planned.) Their sacrifices opened up many opportunities for me. On a lighter note, I am also grateful for the many meals that saved me from malnourishment during my stressful periods. My sister, Stacy, and my brother, Steve, were also always on my side.

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me with advice on all of the essays here, but he taught me the writing and analytical skills that are important for any good empirical study. In that sense, he has made a lasting impression that will have a deep impact on all of my future work as well.

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Susan Case, my high school guidance counselor, gave me the opportunity to learn during my summer vacations rather than just earn money by making her husband hire me. Working for Chip Case for five summers on many interesting projects was an experience that definitely shaped my life. Since that time, the Cases have been a full of encouragement. My professors at Mount Holyoke, particularly Mark Montgomery and Irene Powell, prepared me for my work at MIT. I also benefitted from two years in the Economic Activity section at the Federal Reserve Board.

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Finally, Chris Snyder's contribution to this dissertation and to my experience at MIT is immeasurable. Chris has been a constant source of love, support and wisdom. He makes every task easier and every day brighter.

Biographical Information

Maura Doyle was born on March 23, 1965 in Everett, Massachusetts. She graduated from Stoneham High School in 1983 and enrolled in Mount Holyoke College in South Hadley, Massachusetts, majoring in Economics and Mathematics. During the summers, she worked as a research assistant for Karl Case, an economist at Wellesley College. After graduating from Mount Holyoke in 1987, she moved to Washington D.C., where she worked as a research assistant in the Economic Activity section of the Federal Reserve Board of Governers from 1987 until 1989.

In the fall of 1989, Doyle began her graduate studies at MIT. She specialized in Public Finance and International Economics and minored in Econometrics and Industrial Organization. Her studies were supported by fellowships from MIT, the Bradley Foundation, the Indiana Center on Philanthropy and Mount Holyoke College. She worked as a research assistant for Jeffrey Miron and Nancy Rose and as a teaching assistant for Peter Diamond's undergraduate Law and Economics class. In her final term she was an instructor at Wellesley College, teaching Public Finance and Microeconomics.

On May 29, 1994, Doyle will marry Christopher Snyder, a fellow graduate student in the MIT Economics Department. They will move to Washington D.C., where she will return to work at the Federal Reserve Board of Governors, now as an economist in the Industrial Output section.

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Preface

Public finance theory illustrates that one of the most basic economic functions for a government is to provide public goods. These are the goods that are under-provided by the private sector. In practice, the government almost never completely usurps the role of providing public goods, creating a complex interaction between the public and private spending. In addition, there may be substantial interplay between the federal, state and local levels of government in providing these public goods. The three essays comprising this thesis apply empirical analysis in order to examine some of the intricate interplay between the different parties involved in providing public goods.

The first essay analyzes the effects of a state-imposed law on local provision of services. Specifically, the first chapter examines the long-run effects of stringent property-tax limitations on the provision of a primary local service: fire protection. Advocates of property tax limitations argue that policymakers forced to cut spending can maintain a similar level of quality by improving productivity. Whether such limits do affect the quality of local public goods is central to evaluating their efficacy. Yet, there exists no direct empirical evidence on the effects of tax limits and the delivery local public goods. My study utilizes a unique measure of output, the insurance rating of a community's fire hazard. I use detailed data for the post World War II period, including the insurance rating of the municipality's fire department, to compare the quality of fire protection in cities with different revenue-raising constraints. The results indicate that municipalities with property-tax limitations spent significantly less on fire protection resulting in significantly worse insurance ratings, longer workweeks for firefighters and higher rates of property loss, death and injury.

The second chapter compares quantifies the difference in productivity between private and public provision of fire services by comparing fire departments with and without volunteers.

I again utilize the insurance rating of a municipality's fire department for this comparison. I find that a typical volunteer provides approximately 30 percent of the fire protection of a typical paid employee. Equipping a volunteer costs only ten percent of the cost of paying and equipping a paid employee. Thus, although less productive in absolute terms than paid employees, volunteers are more productive per tax dollar. Additionally, it is found that the use of volunteer firefighters is significantly higher in cities constrained by property-tax limitations. The results also suggest that the decline in volunteerism in the post-war years may be explained by an increase in white collar jobs in centralized cities.

The final chapter examines the effect of fiscal policy on private donations for public goods. It improves upon past studies of related questions in several ways. First, I re-estimate the tax price elasticity and crowd-out parameters using disaggregated data and test for differences in giving behavior across categories. Second, I control for demographic information relating to religion, eliminating an important omitted variable bias which came about because religious affilation is correlated with income, region of residence and giving to the church. Finally, I test and cannot reject that the Tobit methodology is consistent by comparing it to the more robust Symmetrically Censored Least Squares methodology.

I find that religious affiliation is a significant determinant of charitable giving. Correcting for the omitted variable bias, I find evidence of crowd-out for only one category, human services, where a government spending reduction of one dollar stimulates an increase of 12 cents of private charity. The disaggregated data also show a relatively weak response to tax incentives for religious giving, implying that charitable deductions may not be revenue-efficient. The measured tax price elasticity for other categories of giving have large standard errors and are consistent with previous estimates.

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Chapter I

Property Tax Limitations and the Quality of Fire Protection Services

Advocates of property tax limitations argue that policymakers forced to cut spending can maintain a similar level of quality by improving productivity. Citrin (1979) and Shapiro et al. (1979) both find that the main reason for voting for tax limits is to reduce the tax burden without a loss in services. Gramlich et al. (1981) reports that Michigan voters believed that voting for a tax limit would make local governments more efficient. However, anecdotal evidence suggests that property tax limits do hamper the ability of a community to provide services. In 1962, the Advisory Committee on Intergovernmental Relations (ACIR) survey found that 20 out of 32 state agencies indicated that most of their communities claimed to be hindered in their ability to provide services. Whether such limits do affect the quality of local public services is central to evaluating their efficacy. Yet, there exists no direct empirical evidence on the effects of tax limits and the delivery of local public goods.

There has been relatively little empirical work examining the impact of tax limitations, with most of this research focusing on the aggregate revenue and expenditure effects of the recent round of tax limitations. Preston and Ichniowski (1989) estimate the impact that limitations between 1976 and 1986 had on the growth of total municipal revenues and property tax revenue. They find evidence that many types of limitations lead to some falloff in the growth of property tax levies. Similarly, Elder (1992) analyzes 19 states with limit laws and finds strong evidence that both revenue and expenditure limitations reduce state and local tax burdens. Abrams

and Dougan (1986) study state and local spending in 1980. Their conclusions are consistent with the hypothesis that tax and spending limits are set at nonbinding levels, contradicting the results of the other two studies. In related work, Poterba (1993) finds that states with tax limitations are less likely to respond to a positive deficit shock by raising state taxes.

In this study, I examine the effect of property tax limits on local service provision by studying a primary local service, fire protection, during the two decades after World War II. Property tax limits have actually existed as early as 1870, over a full century before California's Proposition 13. By the immediate post-World War II era, some form of tax limitation affected communities in 42 states. Communities in twenty-one of those states were severely limited in their ability to raise property tax revenue by stringent tax rate limitations that resembled the limits imposed during the tax revolt of the late 1970s.

I study fire protection services during this period rather than more recent years because the available data, contructed from annual reports in the *Municipal Year Book*, are particularly complete and detailed. Fire protection is a useful service to study because approximately 15 percent of a city's budget is spent on fire protection and it is provided locally almost everywhere. Fire protection is also one of the only local services that has a measure of quality associated with it.

My study utilizes a unique measure of output, the insurance rating of a community's fire hazard to compare the fire protection in cities with different revenue-raising constraints. Insurance ratings based on investigations of the fire department, the water supply, and other potential hazards are used to set homeowner's insurance premia. I find that municipalities in states with property tax limitations spent significantly less in total and on fire protection, resulting in reduced levels of both labor and capital inputs. The firefighters also worked more hours per week with no salary increase in these municipalities. This led to significantly worse insurance ratings, and was associated with higher rates of property loss, injury and death. However, the cutbacks in spending on fire protection were less severe than for other services.

The paper is organized as follows. Section 1 details the development of property tax limits and describes the limits during the relevant time period. This section also provides anecdotal evidence of the limit-induced service cutbacks. Section 2 describes the history of the fire insurance industry and the practice of assigning insurance ratings, and presents empirical

evidence that the insurance industry rating is correlated with other observable measures the quality of fire protection. Section 3 summarizes the data from the *Municipal Year Book* and the *Census of Population* that are used in this study and presents the empirical methodology. Section 4 presents estimation results examining the impact of property tax limits on a municipal spending, in total and for fire protection, and the quality of fire protection. Section 5 concludes with some direction for future work.

1 History of Property Tax Limitations

Most of the features of contemporary property taxes emerged by the late 19th century [Brownlee (1979)]. The emergence of a comprehensive property tax system prompted the first of the three epochs of property tax revolt—the turn of the century, the Depression, and the late seventies.

The first round of property tax limits comprised several states with Ohio's 1911 "Smith One Percent Law" earning the reputation of being the most stringent; Winkler (1979) compares the Ohio law to California's Proposition 13. The 1911 law set a limit for tax revenues at 1.5 percent of the city's assessed value in conjunction with a limit on the amount of property reappraisal [ACIR (1962), p. 51]. As a result, many municipal services suffered; Cincinnati let its pavement crumble and Youngstown discontinued most services except for fire and police protection [ACIR (1962), p. 52].

By 1930, property tax revenues totaled four billion dollars and accounted for 89 percent of all local tax revenues [ACIR (1962), p. 72]. A wave of stringent property tax limitations emerged during the Depression, a period of property owner discontent. Property owners suffered a growing tax burden due to the fact that their property was rapidly losing value, while the assessed values remained unchanged because of lags in the assessment process. As a result, tax delinquency skyrocketed. Real-estate organizations soon began lobbying for relief for property owners, demanding a constitutional limit of one percent of assessed value as a tax ceiling. They were partly successful; in addition to the regulations already in place, seven states enacted property tax measures between 1932 and 1933 in an attempt to contain local government expenditures under the stress of depressed economic conditions.[1]

[1] Indiana, Michigan, Washington, and West Virginia adopted overall limits in 1932 and New Mexico in 1933.

Strict measures could either take the form of an overall limit or a specific limitation on taxes raised for a particular purpose. A property tax limit in this period generally meant a limit on the total tax rate on assessed property charged by all local governments.[2] The overall tax limits set during the Depression were very similar in nature to those set during the more recent tax revolt, including the measures passed in California and Massachusetts. No further major legislation on property tax limits occurred between 1940 and 1963, the period relevant for this study.

Many cities drastically curtailed essential local government services as a result of the property tax limitations. Municipalities in West Virginia facing an overall tax limit without provision for voting excess levies are one example; the local governments were forced to close schools and jails [ACIR (1962), p. 54] while streets and sewers were neglected [Thompson (1951)].

Survey evidence corroborates that cities were constrained. According to a survey of state governments in 1960, states with property limits reported that a majority of their communities charged their legal tax-rate limit [ACIR (1962), p. 69]. Twenty out of the thirty-two states in the survey reported that most municipalities were hampered in their ability to finance public services. The other twelve states did not find their communities constrained, mostly due to alternative methods of revenue raising.

The 1962 ACIR report divides states into four separate tax groups. One group includes the seven states that had no property tax limitations. The remaining states imposed some form of tax limit and are categorized into three groups. First, the ACIR splits the states into the two versions of limits, specific and overall. An overall limit stipulates a maximum rate for all taxing jurisdictions on the taxable assessed value of property within a given area [ACIR (1962), p. 28]. A specific limit sets a maximum rate for specified levels of government or for specific purposes. Examples of the relevant levels of government include counties, school districts, special districts, and municipalities. Much variation occurs within these two categories through the use of provisions allowing for exclusion of debt service or an excess levy vote. In principle, the overall limits are more stringent but the potential for a high tax rate ceiling or many provisions make the relative level of stringency between the two types of limits ambiguous.

Ohio and Oklahoma reduced their longstanding rate limits in 1933.

[2]Exceptions did exist for some states. Arizona, Colorado, and Oregon only capped the growth of the property tax revenue.

Twelve states imposed overall limits, henceforth called Complete Limits, and the 32 remaining states impose specific limits, referred to as Partial Limits. The ACIR further splits the Partial Limits into two separate categories based on the restrictiveness of the limits as determined by the rate limit and the number of provisions for exceeding the limit. The Flexible group contains 20 of the possible 32 states. The remaining states are in the Stringent grouping.

Table 4 presents some summary statistics for all municipalities grouped to illustrate some of the key differences between the tax regimes. One key difference is the rate limits. In the first column, the average rate limits demonstrate that states with stringent Partial Limits had a lower ceiling for the tax rate than the Flexible Limits. States with Complete Limits have an average rate limit that falls between the two other tax regimes which reinforces the ambiguity of the relative stringency between the two types. To illustrate this another way, the table also provides a breakdown of the states by effective tax rate groupings. Four of the five states with the highest tax rates are states facing no tax limits. Most of the states with Stringent Limits fall into the groups of lower tax rates, but two of the states that have overall limits, or Complete Limits, fall into a relatively high tax rate category.

To show the difference in tax burdens between the tax regimes, Table 4 also includes the city's per-capita property-tax revenue for 1957, a year within the *Municipal Year Book* (MYB) dataset. The group averages for tax payments show that residents pay more property taxes if the state has No Limits or Flexible Limits, compared to Partial and Complete Limit states with stricter tax limits. This is consistent with the hypothesis that property-tax limits curtail tax revenues and lower tax burdens. A more detailed description of the tax limitations by state appears in Table 13.

2 Property Insurance and Fire Protection

The development of the fire rating system was an attempt by the fire insurance industry to improve their estimates of expected losses. This section begins with a historical summary of the fire rating system and then describes the current practice.

2.1 Historical Development of Fire Ratings

Fire insurance companies have always struggled to remain solvent; most of the early American fire insurance companies, formed in the late eighteenth century, failed. These difficulties peaked during the post Civil War period, a time when the surge of immigration cramped cities and created severe fire hazards, threatening the entire fire insurance industry. A devastating fire in Maine, which left more damages than small fire insurance companies could manage, was a turning point for the property-insurance industry.[3] Word of bankruptcy and unpaid insurance claims had spread around the nation, reducing the perceived value of insurance policies to risk-averse consumers. In order to quell substantial loss of business, members of several fire insurance companies organized and created the National Board of Fire Underwriters (NBFU) and promised to pay all of the insurance claims from the Maine fire. One of the NBFU missions was to strengthen the industry by improving the estimation of fire losses. To more accurately predict expected losses, the NBFU encouraged companies to rate the dwellings and communities where policies were held. However, there was no national organization setting uniform standards for comparing fire risks.

The devastation of a Baltimore fire in 1904 prompted the officials of NBFU to explore a standardized accounting of community factors that might contribute to fire hazards.[4] The result was a project to develop the first grading schedule to be used across the country by examining over 500 cities. By 1916, inspectors were using the grading schedule established by the American Insurance Association (AIA) to measure the capabilities of a city's fire protection services.[5] The rating system designed then has remained in force with few changes.

2.2 The Fire Rating System

The purpose of the AIA rating is to provide guidelines for evaluating communities and setting premiums based on expected costs. Using the extensive set of AIA standards, investigators

[3]On July 4, 1866 in Portland, Maine, a stray firecracker sparked a major conflagration leaving 10,000 people homeless. Coleman and Granito (1988) provides more details.

[4]A major fire in Baltimore in 1904 became uncontrollable, and when outside help arrived, the firefighters found their hoses did not fit onto the hydrants making their equipment useless in fighting the blaze. The losses exceeded fifty million dollars. The fire highlighted the fact that certain characteristics of cities greatly affect the ability of the city to minimize fire damages. Coleman and Granito (1988) provides more details.

[5]The AIA is formerly known as the National Bureau of Fire Underwriters and is today referred to as the Insurance Services Organization.

assign deficiency points to communities by category. The investigators then assign the city a grade based on the sum of deficiency points over all categories. The grades range from one to ten. A rating of ten implies that the area meets no minimum standard of fire protection, while a grade of one means the community provides the highest quality protection.[6] The mapping from deficiency points to grades is determined by grouping every 500 points. For example, if the total number of deficiency points is between zero and 500, the city is in class one while a city with deficiency points in the 501 to 1,000 receive a grade of two. Table 5 shows the breakdown of the grade into category and the maximum number of possible deficiency points for each category.

Data availability allows for study of the overall grade, as well as of the deficiency point score for the fire department. The score for the fire department portion is based on the investigation of the number and qualifications of officers, apparatus, training, discipline, response to alarms and methods. Studying both measures of fire protection services is useful. The overall grade is a measure of the community's fire hazard while the fire department score is directly comparable to changes in spending on fire protection.

The overall community grade is comprised of grades for several components. Water supply, the component with the most weight in the final grade, receives a score based on the ability of the city's system to deliver adequate amounts of water to well-placed hydrants. The other fire department categories include the alarm system and any fire prevention procedure including inspections. These other categories, also possibly affected by property-tax limits, may be reflected in the total insurance score but have no specific deficiency-point score available for this study.

The investigators also assign additional points for extreme weather conditions including high winds, hot dry weather, extreme snowfalls, severe cold, hurricanes, or tornadoes. This schedule is periodically updated to reflect new technology in a way that should not affect a department that progresses with the times. To illustrate the rating scheme, Table 6 provides several examples of cities and their ratings.

The community's insurance grade is used to determine the premium for homeowner's insurance. The final premium also depends on the rating of the actual dwelling being insured.

[6]During this time period, no city achieved a score of one; such a score has only rarely been registered since the inception of the grading.

An improvement in the grade can mean a substantial reduction in the insurance premiums charged. For example, if a community in Wisconsin improved its grade from nine to eight, there would have been a 25% reduction in the homeowner's premium for fire insurance, and a 10% reduction for more general property insurance in 1967. A grade improvement at a better level means a smaller reduction; in the Wisconsin example a change from seven to six meant a 4-16% reduction in the fire insurance premium.[7]

To explore the relationship between AIA ratings and actual fire losses, I estimated several Tobit models for fire losses. The dependent variables include deaths, injuries, and property losses.[8] To estimate the link between grade and damage, I control for population size and median assessed home value, community factors which may contribute to the potential damages of individual dwellings and are not reflected in the city grade. Death and Injuries include both civilians and firefighters. Property Loss is the average loss in a community for 1970-74. All measures of fire loss are designated as losses per fire, making the loss variables a measure of the fire department's ability to minimize the damage of a fire. The insurance grade is based on a scale of one to ten, with one being the best.

The results from Table 1 suggest that the insurance industry measures are correlated with the capabilities of the city's fire protection services. A higher, and therefore worse, grade implies significantly higher expected damages in all forms: deaths, injuries, and property losses.[9] The link between the insurance grade and fire loss is strong for two measures of damages—deaths and property losses—where the effect of a one point improvement in the insurance grade implies a reduction in expected losses that is more than 10% of the average damage. Analysis of these data may underestimate the effect of quality fire protection on injuries because the fire departments' goal is both to reduce the number and the severity of

[7]See ICMA (1967) Chapter 2, which provides a more detailed description of the insurance grade.

[8]The data for this analysis is supplied by the Research Triangle Institute (RTI) which conducted a survey of fire chiefs and insurance organizations in 1974. The RTI data contains a measure of quality for fire protection, the Insurance Service Organization (ISO) rating—a rating used primarily by insurance companies in the determination of a property insurance premium. The National Fire Protection Association (NFPA) Quinquennial Survey, a data set encompassed in the RTI effort, provides information about some measures of fire damage such as deaths, injuries, and property loss for 1974. Note the property loss is actually the average value for five years, 1970-74, in real 1967 dollars. I merged the RTI data with other relevant data for cities and town from the 1970 Census.

[9]Note that the number of observations vary among types of losses since the data used are a compilation from several sources. The original sources of data differ between property and human loss categories.

Table 1: Insurance Rating and Fire Damage

Variable	Property Loss	Deaths	Injury
Insurance Grade	347 (76)	0.007 (0.001)	0.010 (0.005)
Observations	551	200	282
Mean of Dependent Variable	1598	0.08	0.12

fire injuries. The data contain no information about the severity of injuries.

Coupled with the fact that the expected number of fires for a mid-sized city is 171 fires per year, the results suggest that a one point improvement in the fire rating corresponds to a reduction in annual fire damage with a $59,337 reduction in expected property losses, a reduction in expected deaths by 1.2, and a reduction in expected injuries by 1.7.

3 Data and Methodology

This section begins with a discussion of the empirical methodology and then discusses the data from the post-war period.

3.1 The Empirical Framework

For property tax limitations to hamper a city's ability to provide services, they must restrict the city's the total expenditure. I first examine the effects of property tax limits on total operating expenses of cities, providing a basis for comparison to fire-protection services. Analyzing the portion of the city's budget that is devoted to fire protection provides some insight into the effect of tax limits on budget composition.

To examine the ultimate impact that property tax limitations have on a local government's fire protection services, measured by *Inputs* and *FireRisk*, I estimate regression equations of

the form

$$Inputs_{it} = \alpha_0 + \alpha_1 \cdot Limits_{it} + \alpha_2 \cdot Population_{it} + \alpha_3 \cdot Income_{it} + \epsilon_{it} \quad (1)$$

$$FireRisk_{it} = \beta_0 + \beta_1 \cdot Limits_{it} + \beta_2 \cdot Population_{it} + \beta_3 \cdot Income_{it} + \mu_{it} \quad (2)$$

where $Limits_{it}$ account for the type of tax constraints confronting city i in year t, and *Population* and *Income* control for basic city characteristics. I estimate these equations using panel GLS, the consistent and efficient estimator.[10] The remainder of this section describes the variables that are used in estimating in the above equations.

Inputs can be measured in terms of expenditure amounts or in terms of particular inputs. My measures of inputs include total fire-department expenditures, spending on salary and wages, employees and capital measures. Ladder trucks, pumpers, and pump ladders are the three major types of equipment needed for fire fighting.

Measures of labor compensation provide additional insight into the effect of fiscal restraints on labor inputs. The first measure of labor conditions, relative wage, is the ratio of wage earnings for a new full-time firefighter to the average full-time wage earnings in the manufacturing industries in the county. The second measure of labor conditions is the required hours for a full-time workweek.

Though the output of local public goods is always difficult to measure, there are several ways to measure the dependent variables for equation (2), *FireRisk*. This study employs the following measures:

Department Points: the specific grade for the fire department where a lower score means a better department. The scores range from one to 1500 with an average of approximately 842 and are based on periodic evaluations conducted by a rating team.

Insurance Grade: the overall grade of the community's fire protection. This score accounts for the water supply, structural conditions, adverse climate conditions as well as the fire department itself. The final score is mapped onto a scale of one to ten where one signifies the best departments.

Other variables—including loss per fire, deaths, and injury—are considered measures of

[10]The estimation is based loosely on the Borcherding-Deacon (1972) and Bergstrom-Goodman (1973) models.

the fire department's ability to suppress building fires quickly, minimizing the loss of life and property.

The policy variable, *Limits*, denotes dummy variables for the different tax regimes, defined by the ACIR commission report and described in earlier. No Limit equals one if no property tax limitations confront the city. This variable is generally excluded, and is therefore the basis for comparison. Flexible Partial Limit equals one if a state imposes specific property tax limitations with "considerable flexibility in the application of the limitations, or which provide relatively high maximum rates". Stringent Partial Limit equals one if a state imposes more stringent limitations "allowing for little flexibility, or providing relatively low maximum rates". Complete Limit equals one if a state imposes an overall limitations on all forms of property taxation. Finally, Any Tax Limit equals one if a state imposes any form of tax limitation; it is the sum of the three tax limit dummies.

City characteristics are included in the regression equations to reflect both the needs and resources of the municipality. Income is the median income of the muncipality in thousands of real 1967 dollars, one potential measure of the tax base. Population of the municipality is measured in thousands. Together, Income and Population reflect the total wealth of the community, while population also is a measure of the need of the community.

The cost of labor is also an important factor to control in estimation. Since no actual hourly wage data is available, the average wage earned in the manufacturing industry in the relevant county in a year is computed by dividing the total wages earned by the number of full-time workers.

Estimations of equations (1) and (2) may include other city characteristics to account for the effect that a source of volunteers might have on the fire services. It is important to account for the role of volunteers: a city with many volunteers may be relatively unaffected by fiscal pressures, especially since the labor costs of fire protection account for the majority of expenses. The potential supply of volunteers depends on the number of persons with a relatively low cost of volunteering. According to Hoetmer and Paul (1981), it is much easier for a person with a blue-collar job in the near vicinity to volunteer for firefighting. I therefore control for the percent of white-collar workers in the labor force of the municipality and the ratio of the number employed in the city to the number of residents, a measure which reflects

the nature of the town as an employing center or a "dormitory residence". A city with more industry and higher employment may also have an additional source of tax revenue or create particular fire hazards and demands on the community services.

3.2 The Data

This study uses data on fire protection from annual reports in the *Municipal Year Book* (MYB). Note that these estimates are for the subset of all municipalities with populations of 10,000 to 50,000. Because the MYB's fiscal survey involves only larger cities, the regression results for total expenditure are limited to a sample of the cities with populations of 25,000 to 50,000.

The statistics reported in the MYB from the late forties until the mid-sixties provide specific information not readily available today, including thorough data on fire department statistics. Their survey includes most of the municipalities with populations greater than 10,000. The sample in this study includes four of the available years of data for the fire department statistics: 1949, 1954, 1959, and 1964. The data on the social and economic characteristics based on census data of the municipality are only available in 1949 and 1959 restricting the empirical analysis to these two years.

The MYB data on insurance ratings include not only the locality's overall grade, but the department's grade and the total deficiency points assigned to the fire department. The overall rating is useful because it measures overall risk of fire damage, a measure of fire protection that most directly affects residents of the community. The fire-department deficiency-points measure is useful because it is not influenced by non-fiscal factors such as the climate. Consistent results for these two measures provide stronger evidence for the effects of tax limits.

Relatively little empirical work has used the insurance rating as a measure of service output. One notable exception is Brueckner's (1984) study of the congestion effects of local public goods. He uses a small cross-section of large communities in Midwestern states to estimate the strength of congestion effects using quality data on fire departments. Controlling for spending, he finds small congestion effects, suggesting substantial publicness of fire protection. In addition, he also finds that cities spending more on water supply and fire protection have a higher overall rating. The data used in the current study are substantially more detailed than

his data which included only the overall community score.[11]

The fire department statistics in the MYB annuals also include data on fire department expenditures for labor and in total, as well as the number of paid employees and the number of large equipment pieces such as trucks. Fire Department Expenditures, the total expenditure on fire protection in real 1967 dollars, is a measure of all inputs to fire protection. Fire Department Salary represents total spending on salary and wages in real 1967 dollars, an important measure because labor expenses are 80 percent of the fire department expenditures, and are a constant expense compared to the periodic purchases of capital. Employees represents all full-time employees, both civilian and the uniformed firefighters.

The data also provide information about the wage for a new employee. For cities in the sample with a population under 25,000, the reports include information on the number of volunteers. For cities over 25,000, there is additional information about property losses in some years.

The annual "Governmental Data for Cities over 5,000 Population" table in the *Municipal Year Book* provides economic and governmental data for all cities over 10,000, including population, metropolitan status, the percent white-collar, the ratio of employees to residents and the ratio of manufacturing to other types of employment. Income information is drawn from the *Census of Population* for 1949 and 1959. I use the wage data of the county of the municipality from the *County and City Databook* in 1952 and 1962.

Table 7 presents some summary statistics for fire protection services for municipalities split into two population categories. For the smaller cities, fire department expenditures more than doubled over the fifteen years between 1949 and 1964. Expenditures on salary and wages, which constitute over 80% of the total expenditure, move in a similar pattern to expenditures. Despite the steep upward trend in expenditures on labor, the number of full-time employees increased by only 30% over the fifteen year period. This disparity suggests that the increase in spending reflects mostly rising wages. During this period, the number of volunteers fell over 40% from its 1949 level, a decline that may be attributed to urban growth and the increasing number of commuting white collar workers [Hoetmer and Paul (1981)]. Simultaneously, as the number of volunteers fell and expenditures rose, the insurance score for the average fire

[11] Another study, Ahlbrandt (1973) used the fire rating in a comparison of different organizational forms.

department improved by 100 points.

Fire department expenditures also increased in the larger cities, but not as rapidly as the smaller cities. Again, the labor expenses accounted for over 80% of the department expenditures and followed a similar pattern to expenditures. However the number of employees did not show the same upward trend, nor did the score improve as drastically.

Table 8 presents means for measures of *FireRisk* and *Inputs* by tax regime. On average, cities in states with no tax limits have better ratings and higher expenditures. The cities confronted with severe limits, on average, have a rating that is over a point higher than the 4.6 grade for cities facing no limits and spend almost $40,000 less. This table suggests that limits bind. The empirical results below will assess whether those findings are robust to the inclusion of city controls.

4 Empirical Results

Estimating equations (1) and (2) can yield insight into several questions about property tax limits.[12] First, do limits only affect expenditures or do they hamper services such as the minimization of fire risk? Secondly, do more stringent limits have a larger impact on services than the less stringent ones? This section begins with the results for municipality overall spending and then presents results for fire department inputs and the quality of fire protection.

4.1 Property Tax Limits and City Spending

The results of Table 9 based on equation (1) demonstrate that property tax limits curtail a locality's expected overall operating expenses. Total operating expenditures fall by over a million 1967 dollars, or roughly half of the mean value for any type of property tax constraint. The implications of this table are consistent with the results of Preston and Ichniowski (1990) and Elder (1992). The point estimates in the first column suggest that more stringent tax limits force greater cuts in operating expenditures. In every case, the flexible Partial Limits

[12] I use a Hausman test [see Greene (1990)] to test the null hypothesis that the Pooled GLS estimator is the consistent and efficient estimator versus the alternative hypothesis that the fixed effects must be included for consistency. This is an important test because the variable of primary interest is not varying over time and cannot be estimated with the within estimates using the standard techniques. In almost all cases, I cannot reject the null hypothesis that the Pooled GLS estimates are consistent and efficient.

appear to force a smaller spending reduction than the more stringent Partial Limits. An F-test of the null hypothesis that the different forms of tax limit are equivalent, i.e. that $\gamma_1 = \gamma_2 = \gamma_3$, rejects at the seven percent level.[13]

I examine the impact of tax limits while controlling for income and population. In every case, the coefficients for both income and population are small relative to the mean value of the dependent variable. The purpose of re-estimating equation (1) in the second and third columns of Table 9 is to confirm that the results are robust to the inclusion of additional city characteristics. I control for the cost of providing fire protection by adding manufacturing wages to the specification. No measure of capital costs are included because most equipment is made by a few national companies so all localities face roughly the same price of capital. As the cost of hiring labor increases, communities spend more on operating services. The results for the coefficients on %White-collar and Employment/Resident, city characteristics which may capture the role of volunteerism in the city, are small and no conclusions can be drawn. The pattern of greater cuts with more stringent limits remains; however the F-test implies that the null hypothesis $\gamma_1 = \gamma_2 = \gamma_3$ cannot be rejected.

Because the tax limitations are all in force prior to the start of my panel, the identifying variation is cross-sectional. In the final column, I add regional dummies to potentially control for spurious cross-sectional variation due to outliers or region-specific fixed factors. The coefficients do not substantially change, though the point estimates for the tax limit coefficients do fall somewhat. In all cases, I can reject the null hypothesis that $\gamma_1 = \gamma_2 = \gamma_3 = 0$ at the five percent level.

Table 9 reports a parallel set of results in the last three columns in order to determine whether tax limits force cities to change the composition of local spending. Controlling for city characteristics and region, cities facing more stringent limits spend seven percent more of their budget on fire protection. Coupled with the evidence that, on average, the restrained cities are spending less, the evidence on budget composition suggests that cities curtailed other types of services more drastically than fire protection, a necessary service.

[13] I also test $\gamma_1 = \gamma_2$, i.e. that the flexible and stringent Partial Limits have the same effect, for every estimation. In every instance, the results are indistinguishable from the results from testing that $\gamma_1 = \gamma_2 = \gamma_3$ and so are not reported.

4.2 Property Tax Limits and Fire Department Inputs

Estimating equation (1) for fire protection services alone produces the results in Table 10. The dependent variable, total spending on fire protection, represents *Inputs* for the first three columns. The results indicate that cities facing any form of property tax limit spend significantly less on fire protection. In the third column, after controlling for region and city characteristics, any form of tax limits induces cutbacks in fire department spending of at least $66,000. Again, the reduction in spending is larger for the Stringent Partial Limit compared to the more flexible limit. In all cases, I can reject the null hypothesis that $\gamma_1 = \gamma_2 = \gamma_3 = 0$ at the five percent level. However, I cannot reject the null hypothesis that all tax regimes have similar effects.

In the last three columns of Table 10, I re-estimate equation (2) with more specific measures for *Inputs*. Specifically, the dependent variable in the fourth column is spending on salary and wages, in order to provide a check on the results for total spending on fire protection and has a consistent finding. The analysis of inputs suggest that the expenditure cuts induced by tax limitations result in both labor and capital reductions. Any form of limit significantly reduces the number of employees and ladder trucks according to the point estimates. Analysis for the other measures of capital proved inconclusive and are not reported.

Ehrenberg (1979) reports that the popular beliefs of overpaid government workers helped spur the recent tax revolt and that these beliefs are a misconception at the local government level. This study's data suggest that on average, full-time workers in manufacturing earn more wage income than entering firefighters. To test whether cities confronted with property tax limits squeeze public employees by reducing their wage, I estimate the effect on the ratio of firefighter earnings to the manufacturing worker's earning. The results show no indication of differences in wages for cities facing different tax regimes. Though they spend the same amount on full-time workers, restrained cities do reduce the wage by raising the number of hours per week that a fulltime firefighter must work. The coefficients in the second column of Table 11 suggest that firefighters in cities constrained by more stringent limits are required to work five to eight hours more per week. Cities were able to squeeze more from the firefighters during this period, a time when public employee unions were virtually nonexistent.

4.3 Property Tax Limits and the Quality of Fire Protection

Table 12 shows results for equation (2) and provides evidence on the relationship between tax limits and the quality of fire protection, *FireRisk*, utilizing department points and insurance grade as dependent variables. I repeat the pattern of three estimation equations, incrementally adding city characteristics and regional dummies to equation (2). The estimates from Table 12 imply that a locality restricted by a property tax limitation faces a higher level of fire risk. Any form of limitation generates an expected increase of at least 100 additionaly deficiency points assigned to the fire department, more than ten percent of the average score of 828. Imposing a stringent limit leads to an increase of almost 200 points. In all cases, I can reject the null hypothesis that $\gamma_1 = \gamma_2 = \gamma_3 = 0$ at the five percent level.

The coefficient for Complete Limits in the second column suggests that the response to a stringent tax limit appear even stronger. The expected grade for a particular city is 0.8 point higher with the enforcement of an overall tax limit, a result which translates into an expected increase of 400 deficiency points. However, the same policy increases the expected fire department score by 200 deficiency points, which only explains an expected increase in the insurance grade of 0.4 points. The discrepancy in scores implies that the tax limit is also hindering the provision of other services which factor into the city's final insurance grade. Examples include the fire alarm system, and the maintenance of the water supply system.

The signs and magnitudes of the other coefficients are, in general, consistent with the earlier results. For example, an increase in population by 1,000 results in only a five point improvement in the fire department score. This may be explained by the fact that population should have two offsetting effects; as the population rises, both the tax base and the needs for fire protection increase. Brueckner (1984) finds that the size of the city has the opposite effect on the insurance grade, but similarly finds a small coefficient. The income effect is also small. The results suggest that a $1,000 increase in median income only results in a 20 point improvement in the fire department's score.

Since higher costs of inputs with limited resources generally result in lower output, the expected sign of the wage coefficient is positive. The sign of the coefficient for wage is always opposite of expectations and significant. The unexpected result may be caused by the wage reflecting part of the income effect, an explanation consistent with the fact that the magnitude

of the coefficient for income falls substantially with the inclusion of the wage.

Table 2: The Effect of Any Tax Limit on Fire Protection

Variable	Fire Dept Expenditures	Total Expenditures	Department Points	Insurance Grade
Any Tax Limits	-72 (20)	-1457 (543)	152 (97)	0.6 (0.2)
Mean of Dependent Variable	150	2500	828	5.2

I re-estimate the equations (1) and (2) controlling for all the city characteristics to examine the general relationship between any tax limit and city service provision. I do this by including a dummy variable for any tax limit without distinguishing by tax regime. The standard errors are reported in parenthesis. The other city characteristics are included but not reported as they remain essentially unchanged from Tables 9 through 11. Table 2 presents the main result. The magnitude of the impact of a tax limit on insurance scores is slightly smaller than the previous estimates but the essential story linking service provision and tax limits is unchanged.

The information in this study permits analysis of the relationship between local spending and the quality of fire protection. Using the tax-limit regimes as instruments, I regress the quality measures on spending controlling for region and city characteristics. Table 3 demonstrates that an additional $1,000 of spending significantly reduces the measure of fire risk, prompting an expected reduction of 0.01 in the insurance grade and 1.8 deficiency points in the fire department's score. Enforcing any tax limit results in an expected spending reduction of $72,000. Using information in the below table implies an expected increase in the insurance grade of 0.72 and in the department score by 130.

Table 3: Government Spending and the Quality of Fire Protection: IV Estimates

Variable	Department Points	Insurance Grade
Fire Department Expenditure (1,000 $)	-0.01 (0.001)	-1.8 (0.9)
Mean of Dependent Variable	5.2	828

Conclusion

The principal finding of this paper is that property tax limits reduced local spending in the post-World War II period, translating into significant reductions in the inputs to fire protection, and a longer workweek for the firefighters with no salary increase. This resulted in significantly lower levels of fire protection. The imposition of any form of tax limit results in an expected increase in the city's insurance grade of fire risk by 0.6 points. Such an increase is associated with a $36,000 increase in expected property losses, an expected cost that offsets half of the expected reduction in fire department expenditures due to a tax limit.[14] To determine the net benefit of a property tax limit, a comparison of the tax savings and the additional fire damage must be made. A grade increase of 0.6 points is also associated with an increase in expected death and injury.

The tradeoff of interest is now the remaining $36,000 in tax savings with an increase of 0.7 expected deaths and 1.0 expected injuries. Ignoring injury, this suggests that a city spends $52,000 to save a life in expectation. Factoring in the increase in expected fire injury, the city actually spends less than $52,000 to save a life.

Graham and Vaupel (1980) survey the cost and benefits of life-saving policies providing a useful comparison to my tax limit results. They report that the median value of a policy's cost per life saved, in 1967 dollars, is $26,000 to $52,000 for the Department of Health and

[14]The value of property loss is likely an underestimate of the true loss to the victims because it ignores the sentimental value of personal possessions.

Human Services and the Consumer Product Safety Commission. However, for the Environmental Protection Agency, the median is 1.2 million dollars. Examples of policies considered in Graham and Vaupel (1980) include a ban on saccharin and control of carcinogens in the water supply. Cropper et al. (1992) find that the EPA policies reducing pesticide residuals cost a million 1967 dollars per worker's life saved. Saving a consumer's life costs $19,400. These comparisons make it clear that many policies exist that would spend more than $36,000 to save, in expectation, a 0.7 fraction of a life and prevent an injury. This suggests that in terms of fire protection, the benefits of a reduced tax burden may not outweigh the costs in terms of property loss, death and injury.

A natural direction for future work is to repeat this type of study using more recent data, after the rise of public employee unions. These unions may change how a city is able to respond to property-tax restraints. Unions and state laws regulating public employee unions can affect how a community's resources are utilized by a fire department because the presence of unions may change a city government's flexibility to lower wages or lay off their employees. The goal of firefighter unions is to improve the working conditions of their members. Ashenfelter (1971) finds that unionized firefighters earn more and work less. Unions also appear to eliminate indirectly the use of volunteers, the virtually free labor substitute, by demanding additional training of all firefighters in the name of safety.

The period studied here precedes an era during which firefighter unions grew stonger. In 1959, Wisconsin was the first state to pass a law allowing collective bargaining for public employees and it was several more years before that law included the police and firefighters [Coleman and Granito (1988), p. 273]. Between 1968 and 1980, firefighter unions proliferated. By 1980, seventy percent of all paid firefighters were unionized, higher than for any other public service [Coleman and Granito (1988) p. 277].

Employing fire-insurance data, in addition to revenue and expenditure information, may provide useful insights into other fiscal questions such as the changes in fiscal federalism during the eighties. In future research, I hope to construct a data set similar to the one used here in order to evaluate the more recent round of property-tax limitations.

Table 4: State Restrictions on Local Power to Raise Property Tax Revenue

Limits	Average Tax Limit	Property Taxes Per Capita 1957	Limit of States	Effective Property Tax Rate 0.0–1.0%	1.0–1.4%	1.5–1.9%	>2.0%
No Limits	-	99	7	0	0	3	4
Partial Limits:							
Flexible	2.2	80	20	4	12	4	1
Stringent	1.1	51	12	7	6	0	0
Complete Limits	1.4	66	9	5	2	2	0

Notes: ACIR Commission Report (1962), p. 58. The effective tax rate is the ratio of property tax revenues to actual property value, a measure of the tax burden.

Table 5: Breakdown of the Insurance Grading Schedule

Category	Relative Values	Percent of Total
Water Supply	1,700	34
Fire Department	1,500	30
Fire Alarm	550	11
Fire Prevention	350	7
Building Department	200	4
Structural Conditions	700	14
Total	5,000	100

Source: *Municipal Fire Administration* (1967), p. 23.

Table 6: Examples of City Fire Services

Variable	Population (000)	Department Expenditures	Insurance Grade	Fire Dept. Points
Large Cities				
Boston, MA	801	11,543	3	–
Chicago, IL	3621	25,200	3	289
San Francisco, CA	775	12,311	2	185
Washington, DC	802	6,768	2	148
Philadelphia, PA	2072	15,696	4	658
Wealthy Suburbs				
Palo Alto, CA	48	380	3	380
Scarsdale, NY	13	190	4	598
Shaker Heights, OH	28	384	3	483
Winnetka, IL	13	111	4	579
Communities with Poorer Ratings				
Bellaire, OH	13	68	7	1424
East Lansing, MI	24	145	7	1050
Pomona, CA	62	444	6	913

Notes: ICMA (1959). ISO is based on a scale of one through ten, with one being the best. Population is in thousands and Department Expenditures are in thousands of 1959 dollars

Table 7: Descriptive Statistics for Fire Protection

Variable	1949		1954		1959		1964		Total	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
					Cities of 10,000 to 25,000					
Dept. Expenditure	66	59	85	77	115	102	145	127	100	83
Salary and Wages	55	47	72	64	98	84	119	105	83	70
Volunteers	36	6	26	10	22	8	20	6	28	9
Paid Employees	17	15	18	16	22	19	22	20	22	20
ISO Grade	6.8	6	7.1	6	7	6	6.6	5	7	6
Department Pts.	949	919	897	906	874	884	829	838	884	886
					Cities of 25,000 to 50,000					
Dept. Expenditure	220	201	259	237	330	306	343	306	262	235
Salary and Wages	179	164	220	197	282	256	294	263	222	196
Paid Employees	52	50	52	49	58	56	53	47	54	50
ISO Grade	4.7	5.0	4.8	5.0	4.6	4.0	6.0	5.0	5.0	5.0
Department Pts.	744	748	741	746	726	718	752	747	740	740

Notes: *Municipal Year Book* (1949, 1954, 1959, 1964). All expenditure categories, the property loss figures and income are in thousands of real 1967 dollars, adjusted by the producer price index reported in *Statistical Abstract 1987*. The ISO grade is based on a scale of one to ten with one being the best.

Table 8: Summary Statistics by Type of Property Tax Limitation

Variable	No Limit	Partial Limits		Complete Limits
		Flexible	Stringent	
Insurance Grade	4.6	5.3	5.8	5.6
Total Deficiency Points	2138	2416	2683	2642
Department Points	702	820	928	918
Total Expenditures	2831	2398	1531	1817
Fire Dept Expenditures	170	127	95	132
Fire Salary & Wages	147	104	79	113
Paid Employees	32	24	23	26
Pumpers	2.9	2.3	2.6	2.2
Pump and Ladder Trucks	1.1	1.2	1.2	1.0

Source: *Municipal Year Book* (1959, 1963). Expenditure measures are in thousands of 1967 dollars. Partial Limits and Complete Limits are described in the text.

Table 9: Tax Limit Effects on Municipality Spending

Variable	Total Operating Expenses			Percent Spent on Fire Protection		
Partial Limit:						
Flexible (γ_1)	-1238	-1916	-1286	0.04	0.02	0.02
	(274)	(406)	(564)	(0.01)	(0.02)	(0.02)
Stringent (γ_2)	-1640	-2275	-1979	0.07	0.05	0.07
	(361)	(508)	(698)	(0.02)	(0.02)	(0.03)
Complete Limit (γ_3)	-1824	-2070	-1600	0.09	0.05	0.05
	(306)	(493)	(617)	(0.02)	(0.02)	(0.03)
Income	642	611	632	-0.007	-0.004	-0.002
	(50)	(157)	(160)	(0.003)	(0.008)	(0.008)
Population	53	43	43	0.0001	-0.0002	-0.0001
	(8)	(11)	(11)	(0.0004)	(0.0005)	(0.0005)
% White Collar	—	-17	-18	—	-0.0005	-0.0002
		(22)	(22)		(0.0009)	(0.0009)
Wage	—	91	83	—	-0.006	-0.006
		(181)	(180)		(0.009)	(0.009)
Employee/Resident	—	(16)	17	—	.000	.000
		(7)	(6.8)		(.000)	(.000)
Constant	-1532	-1419	-1472	-0.13	0.22	0.21
	(380)	(1110)	(1115)	(0.02)	(0.05)	(0.05)
P-Value($\gamma_1 = \gamma_2 = \gamma_3$)	0.07	0.72	0.43	0.02	0.20	0.07
Regional Dummies	no	no	yes	no	no	yes
Observations	310	148	148	240	120	120
Mean of Dependent	2,500	2,500	2,500	0.15	0.15	0.15

Notes: Panel GLS estimates with standard errors in parenthesis. Population is in thousands. % White Collar is the percent of the community work force made up by white-collar workers. Income is in thousands of 1967 dollars. Limits are described in the text.

Table 10: Property Tax Limits and Fire Department Inputs

Variable	Expenditures			Salary	Employees	Ladder Trucks
Partial Limit:						
Flexible (γ_1)	-47 (14)	-78 (17)	-71 (20)	-68 (17)	-14.3 (3.2)	-1.6 (0.4)
Stringent (γ_2)	-64 (16)	-82 (19)	-78 (23)	-68 (20)	-13.4 (3.4)	-1.6 (0.5)
Complete Limit (γ_3)	-37 (16)	-72 (19)	-66 (23)	-63 (20)	-12.0 (3.6)	-2.0 (0.49)
Income	27 (2.0)	13.6 (3.3)	13.5 (3.3)	10.8 (2.7)	0.6 (0.5)	0.000 (0.000)
Population	7.4 (0.3)	6.4 (0.3)	6.4 (0.3)	5.0 (0.3)	1.0 (0.1)	0.04 (0.01)
% White Collar	—	-0.02 (0.5)	-0.02 (0.5)	-0.12 (0.44)	-0.15 (0.15)	-0.02 (0.01)
Wage	—	26 (5.0)	27 .0 (5.0)	26 (3.9)	3.6 (0.8)	—
Employee/Resident	—	1.0 (0.2)	1.0 (0.2)	0.9 (0.2)	0.15 (0.03)	0.01 (0.004)
Constant	-118 (17)	-197 (34)	-194 (34)	-147 (29)	-5.0 (7.7)	4.2 (1.1)
P-Value($\gamma_1 = \gamma_2 = \gamma_3$)	0.13	0.78	0.73	0.91	0.80	0.65
Regional Dummies	no	no	yes	yes	yes	yes
Observations	811	446	446	448	458	428
Mean of Dependent	166	153	153	127	32	1.0

Notes: Panel GLS estimates with standard errors in parenthesis. Population is in thousands. % White Collar is the percent of the community's labor force made up by white-collar workers.

Table 11: Property Tax Limit's Effect on Public Wages

Variable	Relative Wage Earnings	Hours Per Week
Partial Limit:		
Flexible (γ_1)	0.04	5.6
	(0.04)	(2.8)
Stringent (γ_2)	0.05	8.3
	(0.05)	(3.1)
Complete Limit (γ_3)	-0.02	6.4
	(0.04)	(3.1)
Income	0.02	-1.6
	(0.01)	(1.4)
Population	0.001	-0.05
	(0.001)	(0.05)
% White Collar	-0.001	0.15
	(0.001)	(0.6)
Wage	—	-4.1
		0.5
Employee/Resident	0.001	-0.08
	(0.004)	(0.02)
Constant	0.71	84
	(0.06)	(4.1)
P-Value($\gamma_1 = \gamma_2 = \gamma_3$)	0.04	0.28
Regional Dummies	yes	yes
Observations	482	388
Mean of Dependent	0.87	66

Notes: Panel GLS estimates with standard errors in parenthesis. Population is in thousands. % White Collar is the percent of the community's labor force made up by white-collar workers.

Table 12: Property Tax Limits and The Quality of Fire Protection

Variable	Department Points			Insurance Grade		
Partial Limit:						
Flexible (γ_1)	111	181	140	0.7	0.9	0.6
	(56)	(93)	(97)	(0.1)	(0.2)	(0.2)
Stringent (γ_2)	185	250	210	1.2	1.3	0.9
	(60)	(96)	(101)	(0.2)	(0.2)	(0.2)
Complete Limit (γ_3)	192	256	198	1.0	1.2	0.8
	(57)	(96)	(100)	(0.2)	(0.2)	(0.2)
Income	-20.0	-7.3	-6.0	-0.1	-0.1	-0.05
	(4.0)	(9.0)	(1.0)	(0.0)	(0.0)	(.003)
Population	-4.8	-3.5	-3.5	-0.03	-0.02	-0.02
	(0.7)	(0.9)	(0.9)	(0.00)	(0.00)	(0.005)
% White Collar	—	-1.4	-2.1	—	-0.01	-0.01
		(1.3)	(1.5)		(0.01)	(0.01)
Wage	—	-26	-27	—	-0.1	-0.1
		(13)	(13)		(0.05)	(0.1)
Employee/Resident	—	-1.0	-0.8	—	-0.003	-0.003
		(0.5)	(0.5)		(0.002)	(0.002)
Constant	929	1013	1060	5.6	6.1	5.9
	(61)	(112)	(120)	(0.2)	(0.3)	(0.3)
P-Value($\gamma_1 = \gamma_2 = \gamma_3$)	0.01	0.03	0.15	0.00	0.00	0.08
Regional Dummies	no	no	yes	no	no	yes
Observations	828	458	458	926	538	538
Mean of Dependent	828	846	846	5.2	5.2	5.2

Notes: Panel GLS estimates with standard errors in parenthesis. Population is in thousands. % White Collar is the percent of the community labor force made up by white-collar workers. Income is in thousands of 1967 dollars. Insurance grade is on a scale of one to ten and the department points range from 0 to 1,500.

Table 13: State Restrictions on Local Power to Tax Property

State	Property Taxes Per Capita 1957	Form of Law	Rate Limit	Group
Alabama	20.47	Constitution	0.5	3
Arizona	69.18	Statutory	-	2
Arkansas	26.18	Constitution	0.5	3
California	102.00	Statutory	1.0	2
Colorado	88.60	Statutory	-	2
Connecticut	100.52	-	-	1
Delaware	33.33	Statutory	0.5	2
Florida	53.95	Statutory	1.0	2
Georgia	34.97	Statutory	0.5	3
Idaho	78.25	Statutory	2.5	2
Illinois	93.63	Statutory	0.3	2
Iowa	86.07	Statutory	0.7	3
Kansas	98.96	Statutory	1.3	2
Kentucky	36.04	Constitution	1.5	3
Louisiana	34.92	Constitution	1.0	3
Indiana	75.33	Statutory	1.2	4
Michigan	80.93	Constitution	1.5	4
Maine	68.93	-	-	1
Maryland	67.50	-	-	1
Massachusetts	110.43	-	-	1
Minnesota	93.54	Statutory	4.0	2
Mississippi	30.00	Statutory	1.5	3
Missouri	56.35	Constitution	1.0	3
Montana	110.27	Statutory	2.0	2
Nebraska	99.00	Statutory	2.0	3
Nevada	85.60	Statutory	1.5	4
New Hampshire	86.81	-	-	1
New Jersey	112.24	-	-	1
New Mexico	34.48	Statutory	0.5	4
New York	109.55	Constitution	2.0	2
North Carolina	28.59	Statutory	1.5	2
North Dakota	90.62	Statutory	2.0	2
Ohio	67.23	Constitution	1.0	4
Oklahoma	44.43	Constitution	1.5	4
Oregon	85.30	Constitution	-	2
Pennsylvania	52.17	Statutory	1.5	2
Rhode Island	74.94	Statutory	3.5	4
South Carolina	24.47	Statutory	4.5	2
South Dakota	95.31	Statutory	1.5	3
Tennessee	33.70	Statutory	1.5	2
Texas	63.71	Constitution	1.5	3
Utah	71.60	Statutory	3.5	2
Vermont	76.92	-	-	1
Virginia	36.37	Statutory	5.5	2
Washington	49.64	Statutory	1.5	4
West Virginia	29.72	Statutory	0.5	4
Wisconsin	90.74	Statutory	3.5	2
Wyoming	89.78	Constitution	.8	3

Source: ACIR (1962) p. 120

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Chapter II

The Role of Volunteers in Fire Protection

1 Introduction

Despite the fact that the estimated value of volunteer time far exceeds that of financial donations, empirical research has focused primarily on donations of money.[1] There is a plenitude of empirical studies on financial donations while only a handful of studies on volunteering exist, in part because of the lack of available data. Data on volunteerism is limited to a few surveys.[2] The research has focused primarily on the effect that wages, taxes, and government spending have on volunteer time. However, the actual implications of fiscal policy are still elusive because no accurate valuations of volunteer output are available. Proper valuation of a volunteer's contribution requires more study as the typical estimate, market wage per hour, is potentially an inaccurate measure. Such a valuation would be useful in evaluating regulations or union activity which may restrict the use of volunteers.

In this study, I examine the contribution of volunteers to local government provision of fire protection by comparing the costs and productivity of volunteer and paid firefighters during the decade after World War II. I study the role of volunteers in fire protection services during

[1] Both Weitzman (1983) and Weisbrod (1980) produce rough estimates of the value of volunteering using a market wage and a survey-based estimate of volunteer hours.

[2] For example, Brown and Lankford (1992) use a survey of Florida residents while several studies employ the National Survey of Philanthropy including Menchik and Weisbrod (1982, 1987).

this period because the available data, constructed from annual reports in the *Municipal Year Book*, are particularly complete and detailed. In particular, this data provides the ratings of fire departments used by insurance companies when setting property insurance fees as well as the number of volunteers.

To perform a cost-benefit analysis in order to measure the relative value of volunteer firefighters' output per tax dollar, my study utilizes a unique measure of output, the insurance rating of a community's fire hazard. The rating is a meaningful measure of output: as demonstrated in the previous chapter, a worse rating is correlated with a higher expected rate of property loss, death and injury. These insurance ratings, used to set homeowner's premia, are useful to quantify the difference in productivity between volunteers and paid employees in providing fire protection. I find that a typical volunteer provides approximately 30% of the fire protection of a typical paid employee. Equipping a volunteer costs only 10% of the expense of paying and equipping a paid employee. Thus, while they are less productive in absolute terms compared to paid firefighters, volunteers are more productive per tax dollar.

In addition, this study examines the relationship between demographic characteristics and the number of volunteer firefighters. On the supply side, the crowd-out hypothesis would suggest that a city with financial constraints would have a larger volunteer supply than the same city without. This hypothesis is consistent with the fact that volunteerism within the public sector has skyrocketed during the eighties, a period of fiscal tightness (see Figure 1). Theoretical models, such as Roberts (1984) and Warr (1983) predict a complete crowd-out; a change in government spending on a public good will be completely offset by the change in private donations. Andreoni (1987) develops a model of impure altruism which predicts only a partial offset or crowd-out.

On the empirical front, Abrams and Schmidt (1982), and Kingma (1987), find a significant crowd-out of the giving of money. Chapter III of this thesis finds mixed results. Menchik and Weisbrod (1987) have mixed results on the crowding out of volunteerism, actually finding some results suggesting the opposite, a crowding-in of volunteerism. Menchik and Weisbrod (1982) find a measure of crowd-out but it is not significantly different from zero. Both Chapter III and Menchik and Weisbrod (1987) find that giving in the human-service sector is associated with significant crowd-out. Due to lack of information, all empirical studies are forced to ignore an

alternative explanation from the demand-side; city managers faced with financial constraints may successfully increase efforts to solicite volunteers.

Because I am unable to distinguish supply and demand effects, a reduced-form estimation must be used. The results on firefighting show that, in expectation, the number of volunteer firefighters is significantly larger in cities constrained by property-tax limits though their volunteer supplies also decline more rapidly. The results are consistent with the crowd-out hypothesis though inconclusive as a demand-side explanation is possible. The results also suggest that the decline in volunteerism in the post-war years may be explained by an increase in white-collar jobs in centralized cities.

The paper is organized as follows. Section 2 presents a history of the volunteer firefighter in the United States and describes the role of the volunteer. Section 3 details the analysis of the use of volunteer firefighters. The section presents the empirical methodology and summarizes the data from the *Municipal Year Book* and the *Census of Population* used in this study. Estimation results for volunteer use end the section. Section 4 presents a cost-benefit analysis to compare the relative productivity of volunteers to paid employees. Section 5 concludes with some direction for future work.

2 A History of Fire Protection

Fire protection is a fundamental community service, and the one most noted for volunteer use. The history of fire departments described here illustrates that political and social factors may affect the supply of volunteers and hence a fire department's employment structure.

Originally, fire departments used volunteers, a tradition that continued for over two centuries. Volunteer fire departments existed all along the Eastern seaboard as competitive, tremendously politically influential, social groups where only a select few could join.[3] Eventually firefighters became competitive because of the lack of coordination between the many separate volunteer fire companies [Coleman and Granito (1981), p. 23]. The company rivalries spawned competitions to arrive first to a fire, eventually prompting the transition toward organizing salaried departments in the big cities.

Since fire company races were initially thought to be beneficial, insurance company prizes

[3]Boston was one exception to the rule, establishing the first American fire house with a paid captain.

exacerbated the competition. The fire company which was first to put water on a burning building received some prize money from an insurance company. However, these misguided incentives encouraged not only speedy arrivals, but great effort to deter other companies. Eventually brawls broke out as companies battled for hydrants while the buildings burned.

In Cincinnati in 1851, a mill burned to the ground alongside a riot of thirteen volunteer fire companies, an event which confirmed the volunteers' reputation as thugs. That year, fire loss doubled [Coleman and Granito (1981), p. 25]. The loss of the mill, along with the general increase in fire loss, prompted officials to action. Such unnecessary loss sparked energy toward the design of a steam power engine, whose advent meant that several firefighters and a truck could replace 100 volunteers. By 1853, Cincinnati replaced volunteer fire companies with fire engines and paid employees. During the next decade, other major cities followed suit while smaller communities held on to the volunteer tradition.

Over the next twenty years, the idea that the "lawlessness" of volunteers necessitated paying firefighters was popular. Many cities passed laws requiring firefighters to be paid employees. McChesney (1985) claims that the drastic change in employment was, in fact, not necessary and that small changes in incentives would have been sufficient. He argues that politicians created the perception of a need for change because it was advantageous to themselves, the insurance companies, and the firefighters. Clearly this change allowed firefighters to earn rents for previously unpaid work. It also saved the insurance company the cost of providing incentives. And the adjustment gave the city bosses new patronage positions to bestow. McChesney (1985) even intimates that the politicians were indirectly encouraging violence between volunteer companies to ignite the movement in order to switch employment structures. By the end of the nineteenth century, the controversy and the unfortunate insurance incentives had elapsed. Except for the larger cities affected by the controversy, communities continued to rely on the assistance of the volunteer firefighter. During the World Wars, volunteers were again essential for fire protection everywhere.

There are many possible arrangements for volunteer use with the most common being a practice of assigning volunteers to portions of the week when they are on call [Coleman and Granito (1988), p. 423]. Volunteers on call must be in some specified area where they can

easily be alerted by siren or short wave radio [ICMA (1967), p. 166].[4] One example of the successful use of volunteers in a large city is Bloomington, Minnesota, with a population of 85,000. During their time on call, Bloomington volunteers must back into all parking spaces in order to quickly respond and they must respond to a certain fraction of the alarms. [Coleman and Granito, p. 423].

Mostly volunteer departments generally are more informal in organization, with one leader compared to the multi-layered chain of command in many paid departments. The fire chief will use past experience to estimate the number of volunteers who will respond at any given time of the week. This is very different from a paid department where a set number respond to different alarms. Training required also differed. Prior to the mid-seventies, volunteers were merely required to enroll in a 12-hour training session, quite a bit less than the training of the contemporary paid firefighter.[5]

The end of World War II was the beginning of a trend from volunteer toward paid firefighting. The most likely candidates for volunteering were men who worked within their community in blue-collar jobs, particularly in manufacturing, as these men were able to hear and respond to alarms which meant leaving their job for a period. Hoetmer and Paul (1981) and Coleman and Granito (1988) both explain that volunteers supplies declined as cities grew and more Americans commuted to their white-collar jobs in the city making volunteering more difficult. By the late sixties, the growth of public-employee unions changed many elements of firefighting including volunteerism. Ashenfelter (1971) finds the unionized firefighters earn more and work less. To ensure a high wage and reduce competition from the volunteers, unions demanded strict standards for firefighters, including high levels of training for both paid and volunteer firefighters, increasing the time cost of volunteering.

3 The Supply and Demand of Volunteers

This section explores the link between city characteristics and volunteer firefighters. Because the standard measurable city characteristics affect both supply and demand, I estimate the link

[4]Radios are preferable because they do not notify the spectators.

[5]By 1988, there was 110 hours of required training. The increase in training requirements may have helped to reduce the number of volunteers during the seventies. This paper focuses on the earlier years and thus is not affected by large changes in training requirements.

in a reduced form. The first subsection is a description of the role of the relevant demographic variables. A discussion of the data of the post-war period and the empirical results follow.

3.1 The Empirical Framework

Certain city characteristics likely play an important role in the noticeable decline in volunteer firefighters during the post war years. The estimation equation here is based loosely on the empirical model used in Menchik and Weisbrod (1982) to study volunteerism at the individual level. A basic determinant of giving, income, should enter into any study of the supply of volunteers as any form of charitable giving is considered a normal good. In addition, the population of a city reflects the potential supply of volunteers. The characteristics of the city included in the regression equations reflect the resources of the municipality. The income variable represents the median income of the muncipality in thousands of real 1967 dollars. Menchik and Weisbrod (1982, 1987), as well as Brown and Lankford (1992), found donating time to be a normal good with a significantly positive coefficient on income. The population of the municipality is measured in thousands and reflects the total potential supply of volunteers.

The potential earnings, or opportunity cost of volunteering is also an important factor to control in estimation. Wages are the best available measure of the opportunity cost of giving time. Menchik and Weisbrod (1982) find that the income effect of higher wages dominates substitution effect and thus, wage has a positive coefficient on the supply of volunteer hours. Yet Menchik and Weisbrod (1987) find the opposite, a significantly negative effect of wage on volunteerism. Thus, on the supply side, the results are mixed. Since no actual hourly wage data is available, the average wage earned in the manufacturing industry in the relevant county in a year is computed by dividing the total wages earned by the number of full-time workers in manufacturing. The manufacturing wage is also a signal of the cost of a paid firefighter and therefore a signal of the tax-savings, or demand, for using volunteers instead.

Like wage, income and population are also variables necessary for any study of the demand for spending on local public goods, as described in Borcherding and Deacon (1972). Together, Income and Population, a measure of the total wealth of the community, stimulate the demand for spending on fire protection (see the previous chapter). The demand for higher spending manifests itself as demand for more paid firefighters, reducing the need for volunteers. The

factor's potential influence on demand for volunteers can not be separated from their effect on supply. Thus, the analysis of the link between demography and the volunteer firefighters must be a reduced-form estimation.

The choice of city characteristics is also tailored to insights in Hoetmer and Paul (1981) and Coleman and Granito (1988) regarding the relative ease of a person with a blue-collar job in the near vicinity to volunteer for firefighting. The potential supply of volunteers depends positively on the number of persons with a relatively low cost of volunteering. To capture some cost of volunteering, I therefore control for the percent of white-collar workers in the labor force of the municipality, the percent of manufacturing in the city and the ratio of the number employed in the city to the number of residents, a measure which reflects the nature of the town as an employing center or a "dormitory residence".

Another interesting issue is which cities abandoned using volunteers or otherwise changed their volunteer structure, for example switching from using only volunteers to a mixed organization. To address this question, I repeat the reduced-form estimation described above with other measures of volunteer firefighters—in particular, two indicator variables which signal whether the city uses any volunteers and whether the city uses only volunteers.

A policy variable, *TaxLimit*, denotes a dummy variable equalling one if a city is constrained by a state imposed limit as defined by the ACIR commission report and can be used to examine the effect of fiscal tightness on volunteerism.

To complement this analysis, I include a parallel study of paid employees. The demand for paid labor is estimated with the same determinants described above. *PaidLabor* represent the number of full-time employees, both civilian and the uniformed firefighters. Here, I assume that the labor supply is completely elastic for any wage above the manufacturing wage, with zero supply for a wage below the manufacturing wage. Studying the demand for labor is directly related to the supply and demand of volunteers.

I justify looking at the number of firefighters without normalizing by population size by noting that my study focuses on small cities, i.e. cities with fewer than 50,000 people. For populations of this size, there are general standards for the number of firefighters needed to put a fire apparatus into effective use [ICMA (1967), p. 162.]. For example, three firefighters are needed to place a single line of standard hose in service. One person must operate the pump.

With a foreman, five people are generally needed to run a pumper company unless there is an extremely large and tall building involved. Ladder companies have similar requirements. Additional firefighters are useful as a precaution in the event of injury. For larger cities, particularly cities with more than 100,000 people, further requirements are necessary.

3.2 The Data

This study primarily uses data on fire protection from annual reports in the *Municipal Year Book* (MYB) for the subset of all municipalities with populations of 10,000 to 25,000. The statistics reported in the MYB from the late forties until the mid-sixties provide specific information not readily available in data sets covering more recent years, including thorough data on fire-department statistics. Their survey includes most of the municipalities with populations greater than ten thousand. The sample in this study includes four of the available years of data for the fire department statistics. However, the data on the social and economic characteristics based on census data of the municipality are only available in 1949 and 1959 restricting some of the empirical analysis to these two years. For cities in the sample with a population under 25,000, the reports include information on the number of volunteers limiting this study to the smaller cities.

Data on the city characteristics necessary for this study are also found in the MYB. The annual table "Governmental Data for Cities over 5,000 Population" in the *Municipal Year Book* provides economic and governmental data for all cities over 10,000, including population, metropolitan status, the percent white collar, the ratio of employees to residents and the ratio of manufacturing to other types of employment. Income information is drawn from the *Census of Population* for 1949 and 1959. I use the wage data of the county of the municipality from the *County and City Databook* in 1952 and 1962.

A cost-benefit analysis is possible using this data. On the expenditure side, the fire department statistics in the MYB annuals also include data on fire department expenditures for labor and in total. Fire Department Expenditures, the total expenditure on fire protection in real 1967 dollars, is a measure of all inputs to fire protection. Fire Department Salary represents total spending on salary and wages in real 1967 dollars, an important measure because labor expenses are 80 percent of the fire department expenditures, and are a constant expense

compared to the periodic purchases of capital. Input factors include paid employees and the number of large equipment pieces such as trucks.

On the output side, MYB data provides information on the insurance rating of a community's fire protection. The development of the fire rating system was an attempt by the fire insurance industry to improve their estimates of expected losses by providing guidelines for evaluating communities and setting premiums based on this rating of expected costs. The financial incentives to accurately set premiums are also an incentive to measure fire protection correctly. To determine the grade, investigators apply an extensive set of AIA standards and assign deficiency points to communities by category. The investigators then assign the city a grade based on the sum of deficiency points over all categories. The grades range from one to ten. A rating of ten implies that the area meets no minimum standard of fire protection, while a grade of one means the community provides the highest quality protection.[6] The mapping from deficiency points to grades is determined by grouping every 500 points. For example, if the total number of deficiency points is between 0 and 500, the city is in class one while a city with deficiency points in the 501 to 1,000 range receives a grade of two.

Data availability allows for study of the overall grade, as well as of the deficiency-point score for the fire department. The score for the fire-department portion is based on the investigation of the number and qualifications of officers, apparatus, training, discipline, response to alarms and methods. The overall grade is a measure of the community's fire hazard while the fire-department score is directly comparable to changes in spending on fire protection.

To explore the relationship between AIA ratings and actual fire losses, the previous chapter estimates the relationship between deaths, injuries, and property losses with the insurance grade. The results suggest that the insurance industry measures are correlated with the capabilities of the city's fire protection services. A higher, and therefore worse, grade implies significantly higher expected damages in all forms: deaths, injuries, and property losses. (Refer to Table 1 in Chapter I for a more detailed analysis.) The link between the insurance grade and fire loss is particularly strong for two measures of damages, deaths and property losses, where the effect of a one point improvement in the insurance grade implies a reduction in expected losses that is more than 10% of the average damage. More specifically, the results imply that

[6]During this time period, no city achieved a score of one, a score rarely seen in any year during which rating were made.

a one-point improvement in the fire rating corresponds to a reduction in annual fire damage with a $59,337 reduction in expected property losses, a reduction in expected deaths by 1.2, and a reduction in expected injuries by 1.7. Analysis of these data may actually underestimate the effect of quality fire protection on injuries because the fire departments' goal is both to reduce the number and the severity of fire injuries. The data contain no information about the severity of injuries.

The overall rating is an important measure because it represents the entire risk of fire damage, a measure of fire protection that most directly affects residents of the community. The fire-department deficiency-points measure is also useful because it is not influenced by non-fiscal factors such as the climate. Despite its usefulness, few studies use the insurance rating as a measure of fire protection. Chapter I uses the MYB data to study the effects of property-tax limits on the quality of fire protection; this study suggests that cities constrained by property-tax limitations spend significantly less on fire protection, resulting in significantly worse insurance ratings and, thus, higher rates of property loss, death and injury.[7]

Table 1 presents summary statistics of fire protection services in municipalities during both 1949 and 1959, a time period noted for growth of government and a declining supply of volunteers. Fire department expenditures almost doubled over the ten years between 1949 and 1959. Expenditures on salary and wages, which constitute over 80% of the total expenditure, move in a similar pattern to expenditures. Despite the steep upward trend in expenditures on labor, the number of full-time employees increased by less than 30% over the ten year period. This disparity suggests that the increase in spending reflects mostly rising wages. In addition, during this period, the number of volunteers fell over 40% from its 1949 level. Simultaneously, as the number of volunteers fell and employment and expenditures rose, the insurance score for the average fire department improved by 100 points. The bottom half of the table presents the changes in city characteristics between 1949 and 1959. The percent of the community labor force that hold white collar jobs increases from about 38 to 45 percent. Compared to 1949, the

[7]Two other studies use this type of data. One, Brueckner (1984), studies the congestion effects of local public goods. He uses a small cross-section of large communities in Midwestern states to estimate the strength of congestion effects using quality data on fire departments. Controlling for spending, he finds small congestion effects, suggesting substantial publicness of fire protection. In addition, he also finds that cities spending more on water supply and fire protection have a higher overall rating. The data used in the current study are substantially more detailed than his data which included only the overall community score. Another study, Ahlbrandt (1973) used the fire rating in a comparison of different organizational forms.

residents earn a higher wage and enjoy a higher income in 1959, while the ratio of employment to residents falls as work becomes more centralized in larger urban centers. These demographic changes—urban growth and the increasing number of commuting white collar workers—may be the cause of the volunteer decline noted above [Hoetmer and Paul (1981)].

Table 2 contains the sample means for several fire-department and city characteristics split by employment structure in order to provide a comparison between cities using volunteers and those not using volunteers. On average, cities that use volunteers spend much less on salary and wages and hence, spend less in total. Cities with volunteers consistently demand fewer employees.

Cities with a positive volunteer supply in this sample appear capable of using tax dollars more efficiently; despite spending much less, cities with volunteers have, on average, the same grade, as cities without volunteers, namely 5.5. Simple summary statistics do not provide evidence that the quality of fire protection between the two types of provision of fire protection are markedly different. Figure 2 shows aggregate numbers which again suggest that the distribution of the quality of fire protection is not very different between cities with mostly volunteers and cities with mostly paid firefighters; the low scores on the left of the figure are the better scores. Both groups of cities have a median insurance grade of six. The information just presented suggests that volunteers can play a productive role in the provision of fire protection. However, it does appear that cities with a mostly volunteer department have a greater number of the worst scores—scores greater than seven.

3.3 Empirical Results

Estimating equations on volunteers can yield insight into several question about the role of city demographics in explaining a decline in volunteer firefighters. The first two columns of Table 3 presents results using Tobit methodology on censored data for the number of volunteers. The last four columns present a Probit model, first estimating the probability that a city has any volunteers, then estimating the probability that a city uses only volunteers.[8]

[8]It is important to note that a nonlinear regression model, such as the Tobit, produces coefficients that are not necessarily comparable to the marginal effects of a linear model. To make the coefficients comparable, they must be adjusted by a scale factor. The appropriate scale term is reported when necessary. See Greene (1990), Chapter 20, for more detailed explanation.

The results in Menchik and Weisbrod (1982, 1987) and Brown and Lankford (1992) suggest that volunteering is a normal good. Although not directly comparable, in the reduced-form, income also has a positive effect on all three measures of volunteering, but the results are not significantly different from zero. Wage also has a positive coefficient and is insignificant, adding no information to the mixed results of wage effects in Menchik and Weisbrod (1982, 1987).

The results of the role of city characteristics seems consistent with the hypotheses of Hoetmer (1981) and Coleman and Granito (1987). The percent of white-collar workers in the city have a negative effect on the number of volunteers. In the last four columns, it is also true that the %WhiteCollar is negatively correlated with the probability that a city uses any volunteers and the probability of using only volunteers. The %Manufacturing positively affects volunteerism. The Employee/Resident ratio does not significantly affect volunteers but it does have a significantly positive influence on the probability that a city can rely on only volunteers. The growth in the white collar labor force during this period and the simultaneous decrease employee-resident ratio and the manufacturing sector are all possible explanations of the declining volunteer force.

3.4 Results on the Crowd-Out of Giving

The crowd-out hypothesis suggests the property tax limits that curtail city spending will be partially offset through an altruistic or crowd-out mechanism which generates a larger supply of volunteers. Menchik and Weisbrod (1987) have mixed results on the crowding-out of volunteerism, actually finding some results suggesting the opposite, a crowding-in of volunteers. However they do find a significant crowd-out of volunteering to human service activities. Menchik and Weisbrod (1982) find a measure of crowd-out but it is not significantly different from zero. To address the question, I include the tax limit variable to the reduced-form estimations. A crowd-out effect would predict that volunteer supplies are negatively correlated with the financial resources of the city. Since the previous chapter finds that property-tax limits force severe cutbacks in local spending on fire protection, the crowd-out hypothesis predicts that volunteer supply would respond positively to the limits.[9]

[9]Note, however, that results in Chapter I imply property-tax limits lead to a reduction in spending, in turn leading to a decline in the quality of fire protection. Thus, the a crowd-out mechanism can, at best, only partially offset the curtailment of spending.

It is also possible that when a town faces a tight fiscal constraint, the city manager finds volunteers more attractive and increases recruitment efforts. Unfortunately, there is no information about recruitment efforts. However, it is also true that solicitation efforts are omitted in every study of the crowd-out effect. Table 4 demonstrates that the number of volunteer firefighters is greater in cities with state-imposed tax limits, but has no evidence whether this is a supply-induced or a demand-induced effect.

The first column of Table 4 estimate the number of volunteers while controlling for different sets of city characteristics. The results suggest that number of volunteers does respond positively to the financial constraints since cities with property-tax limits have significantly more volunteer firefighters. Cities of population 10,000 to 25,000 with property tax limits have approximately 13 more volunteers than an identical city without a property-tax limit.[10]

The second column of Table 4 reports a parallel set of results in order to compare results on volunteers with the demand for labor. Here, I assume that the supply of workers is completely elastic at the going manufacturer's wage. Controlling for city characteristics and region, cities with more stringent tax limits demand a smaller number of paid employees. For cities with tax limits, the predicted difference in demand for firefighters equals -4.5 workers. Population and wage were two city characteristics that factor significantly into estimated demand for paid labor. As population and wage increase, the demand for firefighters increases. The third column of Table 4 demonstrates that the ratio of volunteers to paid employees is greater in cities constrained by a property-tax limit, a result consistent with the first two columns.

Table 5 repeats the reduced-form estimation using a Probit model with two indicator variables as the dependent variables, the first indicator for fire departments which use no volunteers and the second for departments that use only volunteers. Though property-tax limits increase the expected number of volunteers, they have no discernible impact on the probability that a town has a positive volunteer supply. The first two columns show a coefficient that is insignificant and fluctuates in direction. A larger population, relatively more white collar workers, or a larger manufacturing industry depress the probability of volunteer use.

The pattern of coefficients is similar in the last two columns, where the dependent variable is now an indicator variable for purely volunteer fire departments. The one difference here is

[10]The number of additional volunteers is determined as the product of the scale term and the relevant coefficient.

that the measured effect of a property-tax limits is an increase in the probability that a city has a fire department comprised only of volunteers.

To utilize the ten-year span of the data, I use another dependent variable, the change in the share of the population that are volunteers from 1949 to 1959. This is one additional method of examining whether changes in city characteristics explain the decline in volunteerism. The results follow:[11]

$$\begin{aligned} \Delta\ Share\ Volunteer \quad = \quad & 5.9 - \underset{(1.6)}{0.4} \cdot Income - \underset{(0.2)}{0.05} \cdot Population + \underset{(0.05)}{0.02} \cdot \%WhiteCollar \\ & + \underset{(0.43)}{0.25} \cdot Wage + \underset{(0.01)}{0.01} \cdot \%Employee/Resident - \underset{(1.2)}{5.4} \cdot Limit. \end{aligned} \tag{1}$$

The only city characteristic that affects volunteerism is real income. The results suggest that greater growth in a city's median income implies a faster decline in volunteerism. It is possible that this is due to the fact that as income grows, the increase in the demand for fire protection causes hiring which reduces the need for volunteers. These results differ from the results of the previous tables. However, since real income, along with the white-collar sector, is growing during this period, it is also a possible explanation for the decline in volunteerism.

The results above illustrate another result; volunteerism falls significantly more sharply in cities with a property-tax-limit constraint. Earlier results suggest that the number of volunteers is higher in cities with property-tax limits. Though there have been several studies on the initial altruistic response of giving to fiscal cutbacks, no study has examined these effects over time and there are no well-developed theories. The results here are consistent with an altruistic response that fades over time.

[11]This is a Probit estimation with standard errors in parenthesis. Population is in thousands. % White Collar is in percent of the community labor force. Income and Wage in thousands of 1967 dollars. There are 167 observations.

4 Cost-Benefit Analysis

This section compares volunteers and paid employees in a simple cost-benefit framework to explore two questions. First, I use the expenditure data to estimate the expenditure per volunteer with the expenditure per employee. Then the insurance-rating information is used to determine the relative output of volunteers to paid employees. It is impossible to compare an hour of volunteer time to that of a paid firefighter given the nature of their duties. No hourly information is possible because volunteers are primarily on call while most paid firefighters must log a certain number of hours at the firehouse. The only comparison that is possible is the relative output of the different firefighters to their relative cost.

4.1 The Measure of Costs

To determine the relative costs of inputs, I use a standard budget equation—total expenditure as the sum of expenditures on each type of input. The following presents an equation that can be estimated using inputs and expenditure data described in the previous section

$$Expenditure_i = \beta_0 + w \cdot Labor_i + r \cdot Capital_i + \gamma \cdot Volunteer_i + \beta_1 \cdot Z_i + \mu_i. \quad (2)$$

The measures of expenditure include both total fire department expenditures and spending on salary and wages. Labor actually has two components, the paid labor and the unpaid volunteers: in spite of the notion that volunteers are free, they may require some expenditure for equipment and protective gear. The only measure of capital provided in the data is the number of trucks—the sum of pumper-ladder trucks, ladder trucks and pumpers.

Equation (2) is estimated using both ordinary least squares and instrumental variables (IV) while controlling for the key city characteristics affecting expenditure: income, population and wage. An IV procedure may be necessary because volunteering may be endogenous to fire department expenditure as implied by the crowd-out hypothesis. The instruments are variables used in estimating equation (1) including tax limits and city characteristics that affect volunteer supply, in particular % White Collar, % Manufacturing and the Employment/Resident ratio. In both cases, the over-identifying restrictions cannot be rejected at the five-percent level.

The first two columns in Table 6 contain regressions of expenditure solely on wages and

salaries. The results suggest that no significant wage is given to the volunteers. Paid employees earned roughly $4,000, earnings consistent with the data. The average beginning salary for a paid firefighter is $3,700.

The second two columns look at total expenditures. This additional information from total expenditure is important because labor inputs may cost more than their wage. There are additional costs due to equipment needs of each firefighter. Both columns three and four show that paid employees still cost over %4,000 more than volunteers. The IV estimates of the fourth column now imply that volunteers cost about $470 per year while a paid employee costs $4,700.

The coefficient for trucks varies and is actually negative and insignificant in the fourth column of Table 6. The sporadic results for trucks may be explained by the fact that fire department infrequently purchase large capital items, and thus the number of trucks may not affect annual expenditure for a given year.

4.2 The Measure of Output

The availability of insurance data provides a unique opportunity to compare output of the two types of labor inputs. The insurance grades are determined with a linear rating system, the sum of individual scores in several categories. Thus a linear approach, and not the standard Cobb-Douglas model, may be appropriate. I estimate the following equation:

$$InsuranceScore_i = \beta_0 + w \cdot Labor_i + r \cdot Capital_i + \gamma \cdot Volunteers + \omega_i. \quad (3)$$

The *InsuranceScore* includes two different measures. Department Points represents the specific point score for the fire department where a lower score means a better department. The scores range from one to 1500 with an average of roughly 840 and are based on periodic evaluations conducted by a rating team. The insurance grade is the overall grade of the community's fire protection. This score accounts for the water supply, structural conditions, adverse climate conditions as well as the fire department itself. The final score is mapped onto a scale of one to ten where one signifies the best departments.

I estimate equation (3) in a similar manner to that used for equation (2), employing an IV methodology. The over-identifying restrictions cannot be rejected at the ten-percent level.

Table 6 shows the results of this estimation for both insurance measures. The first two columns show relative contributions of inputs to the department score. The IV results show that additional volunteer improves the department score by 1.5 point when a paid employee improves the expected score by close to five points. In both cases, the expected score improvement of an additional volunteer is at least 30 percent of the score improvement of an additional employee. The number of trucks score has an unclear effect on the overall score with a relatively large standard error.

The lesson from the last two columns of results are virtually the same. Here, an additional volunteer reduces the risk score by 0.014 while paid employees reduce the sum by 0.044. Again, the results suggest that volunteers contribute at least 30 percent of a paid employee contribution. There is no information about the relative output of volunteer and employee per hour because their duties differ in a way to make an hour of volunteer time not comparable to an hour of employee time. The only possible comparison is on output per dollar spent.

Additional study of the productivity, in the form of insurance grades and fire loss, of the two labor inputs can be found in another data set on cities with population under 100,000. The data for this analysis is supplied by the Research Triangle Institute (RTI) which conducted a survey of fire chiefs and insurance organizations in 1974, merging these with some relevant data for cities and town from the 1970 Census. It also provides the insurance rating described above. The National Fire Protection Association (NFPA) Quinquennial Survey, a data set encompassed in the RTI effort, provides information about some measures of fire damage such as deaths, injuries, and property loss for 1974. Note the property loss is actually the average value for the five years 1970–74, in real 1967 dollars. Death and Injuries include both civilians and firefighters. Property Loss is the average loss in a community for 1970–74. All measures of fire loss are designated as losses per fire, making the loss variables a measure of the fire department'a ability to minimize the damage of a fire.

Table 7 reports the results of estimating equation (3) with the RTI data. The results for death, injury and property loss are weak, no significant effects are found, though the pattern of results suggest that employees are reducing fire loss while volunteers may not. The results on the insurance grade look different in absolute value from those of the previous table but again, the productivity of a volunteer is more that one-third of the productivity of a paid firefighters.

5 Conclusion

This paper utilizes the insurance rating as an output measure to perform a cost-benefit analysis of the volunteer firefighter. It costs a city $470 to equip a volunteer, amount equal to approximately 10% of the cost of equipping and compensating a paid employee. According to the insurance rating information from two different data sets, volunteers reduce the measure of fire risk by at least one-third the amount of a paid employee. Thus, volunteers produce more fire protection per tax dollar than paid employees. These results imply that a decrease in the number of volunteer firefighters makes local tax dollar less productive. The cost-benefit analysis is useful to analyze the impact of any policy that weakens the ability of a city to utilize volunteers such as regulations that strengthen the power of the firefighter unions.

The period studied here precedes the increase in the prevalence of firefighter unions. In 1959, Wisconsin was the first state to pass a law allowing collective bargaining for public employees and it was several more years before that law included the police and firefighters[Coleman and Granito (1988), p. 273]. Between 1968 and 1980, firefighter unions proliferated. By 1980, 70 percent of all paid firefighters were unionized, higher than for any other public service [Coleman and Granito (1988), p. 277]. One goal of firefighter unions is to improve the working conditions of their members. Unions appear to indirectly change the cost of volunteering and thus reducing this supply of a virtually free labor substitute, by demanding additional training of all firefighters in the name of safety which ultimately increases the cost of volunteering.

Additional results show that volunteer use is higher in cities constrained by property-tax limitations, a fact that is consistent with a crowd-out hypothesis but not conclusive as a demand-side explanation is also possible. The results also suggest that the decline in volunteerism in the post-war years may be explained by an increase in income and in white-collar jobs in centralized cities.

A natural direction for future work is to repeat this type of study using more recent data, after the rise of public-employee unions. In future research, I hope to construct a data set similar to the one used here in order to compare fire protection during the different periods. Employing more recent fire-insurance data may provide useful insights into the effect of the public employee union and its regulation on the number and productivity of volunteer

firefighters.

Figure 1: Ratio of Government Volunteers to Paid Government Employees

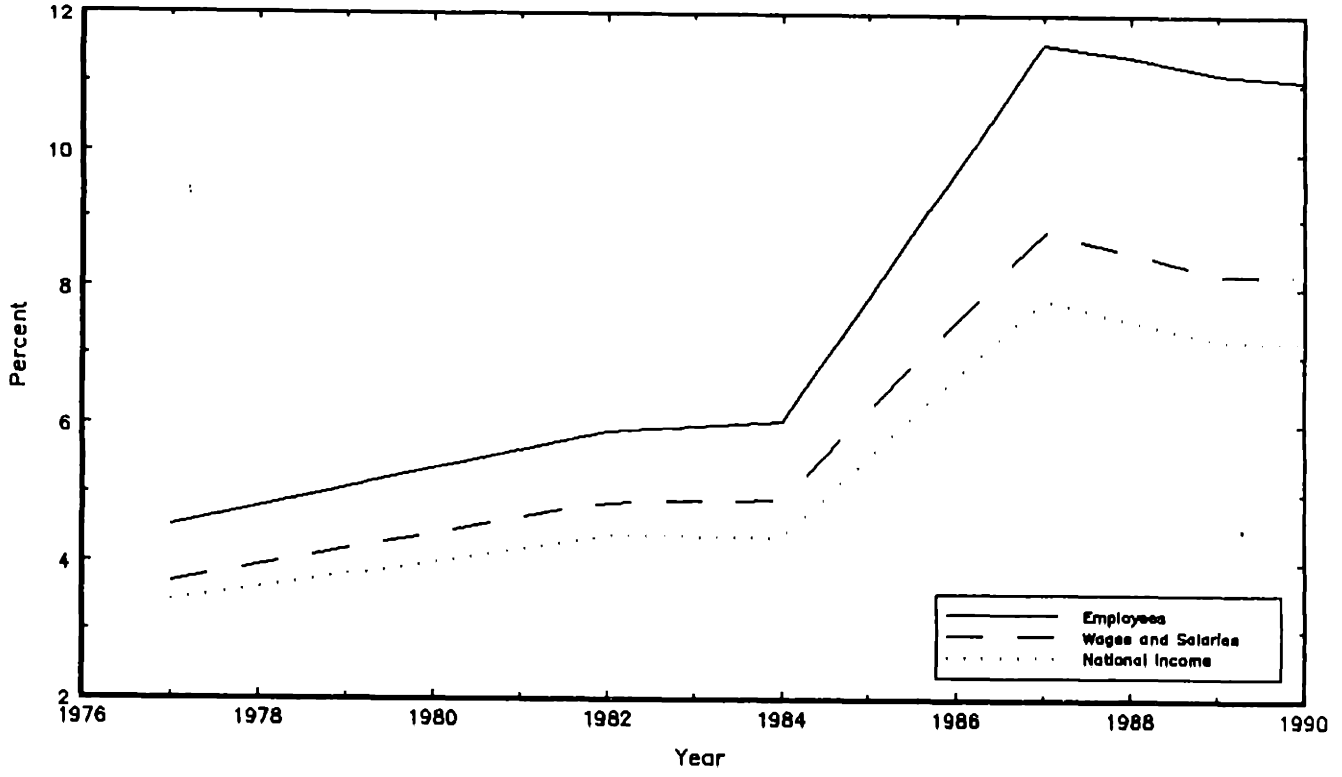

Table 1: Descriptive Statistics for Cities of Population 10,000–25,000

Variable	1949		1959	
	Mean	Median	Mean	Median
Department Characteristics				
ISO Grade	6.8	6	7	6
Dept. Points	949	919	874	884
Dept. Expenditure	66	59	115	102
Salary and Wages	55	47	98	84
Volunteers	36	6	22	8
Paid Employees	17	15	22	19
City Characteristics				
White Collar	38	37	47	45
Manufacturing	42	40	37	34
Population	19	18	19	18
Income	3538	3483	5484	5340
Employment/Resident	87	95	79	87
Wage	2.9	2.9	4.4	4.5

Notes: *Municipal Year Book* (1949, 1954, 1959, 1964. All expenditure categories, the property-loss figures and income are in thousands of real 1967 dollars, adjusted by the producer price index reported in *Statistical Abstract 1987*. The ISO grade is based on a scale of one to ten with one being the best.

Table 2: Summary Statistics by Employment Structure of the Local Fire Department

Variable	Volunteers	No Volunteers
Department Characteristics		
Insurance Grade	5.5	5.5
Department Points	896	892
Fire Dept Expenditures	78	105
Fire Salary & Wages	63	89
Paid Employees	15	24
Ladder Trucks	0.63	0.63
Pumpers	0.68	0.62
Pump and Ladder Trucks	3.2	2.7
City Characteristics		
White Collar	42	43
% Manufacturing	40	40
Income	4,603	4,289
Population	18	20
Employment/Resident	87	92

Notes: *Municipal Year Book* (1949, 1959, 1963). Expenditure, Income and Salary & Wages are all in thousands of 1967 dollars.

Figure 2a: Distribution of Fire Department ISO Class – Entire Sample

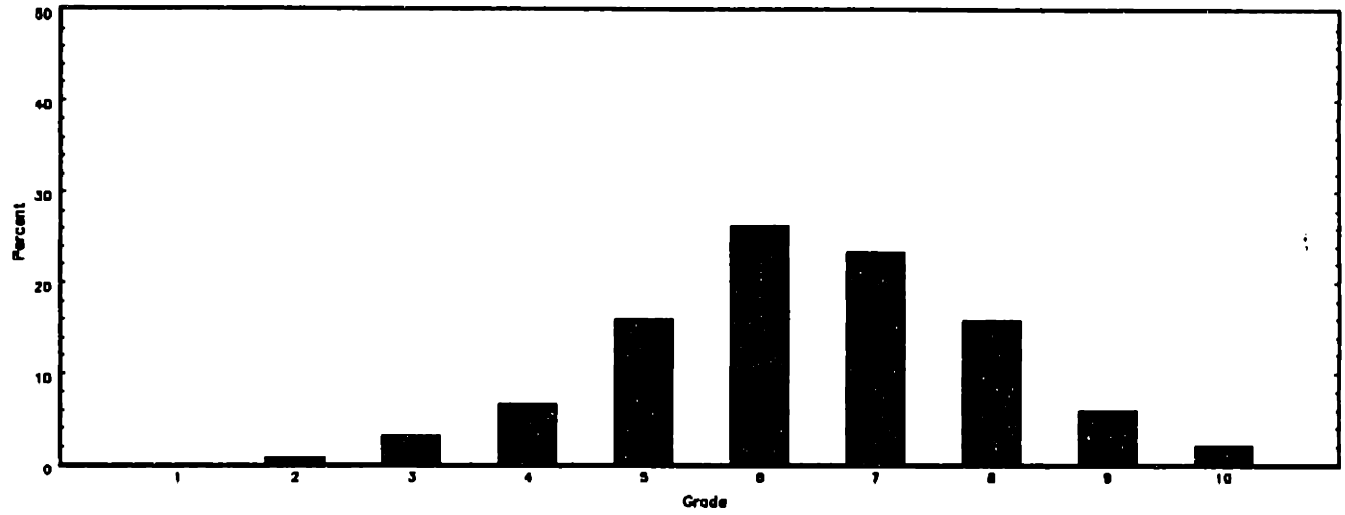

Figure 2b: Distribution of Fire Department ISO Class – Mostly Volunteers

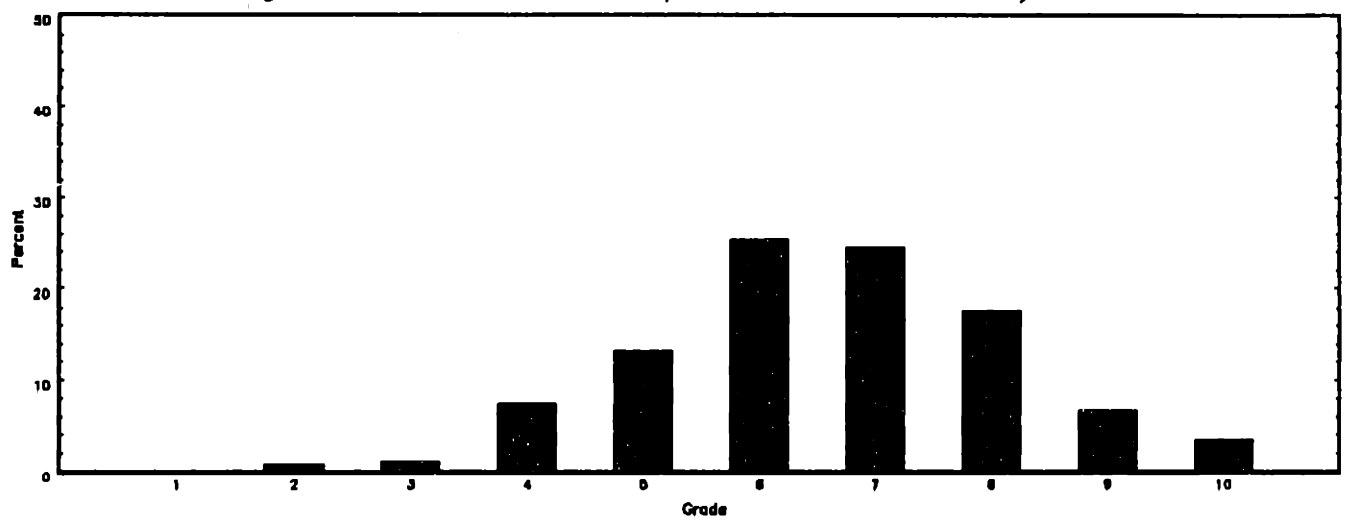

Figure 2c: Distribution of Fire Department ISO Class – Mostly Paid

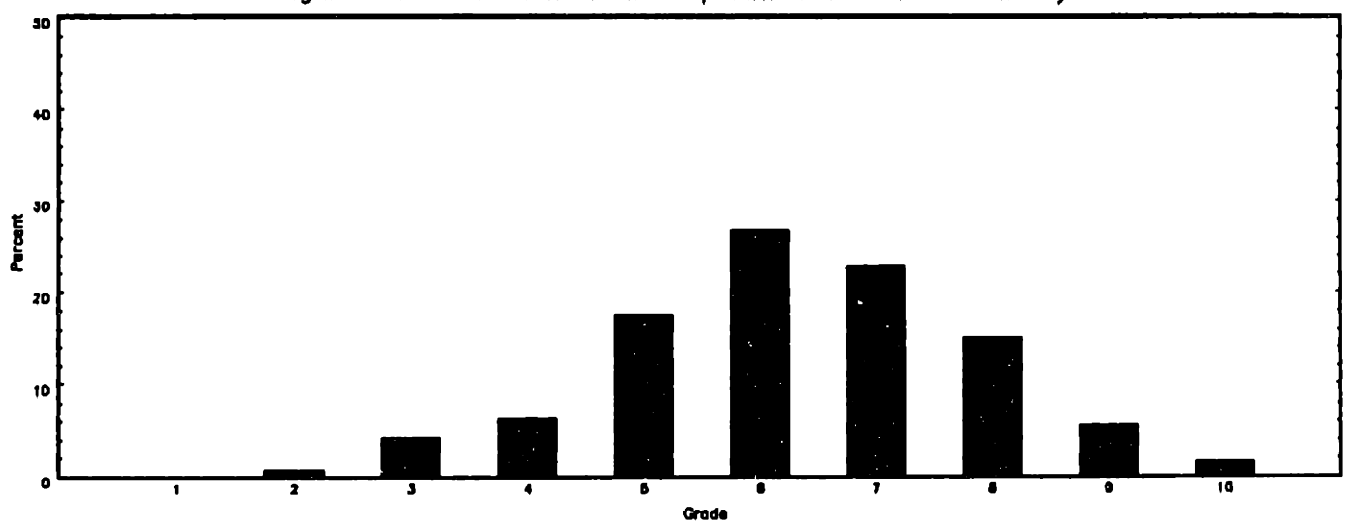

Table 3: The Volunteer Supply

Variable	Number of Volunteers		Any Volunteer		Mostly Volunteer	
Income	1.2	2.3	0.1	0.06	0.04	0.1
	(1.3)	(1.7)	(0.0)	(0.04)	(0.04)	(0.1)
Population	-0.4	-0.1	-0.05	-0.05	-0.04	-0.03
	(0.3)	(0.3)	(0.004)	(0.005)	(0.01)	(0.01)
% White Collar	—	-0.7	—	-0.012	—	-0.03
		(0.2)		(0.005)		(0.01)
Wage	—	2.8	—	0.17	—	0.1
		(2.6)		(0.06)		(0.15)
Employee/Resident	—	(0.1)	—	0.008	—	0.002
		(0.1)		(0.001)		(0.005)
% Manufacturing	—	-0.27	—	-0.008	—	-0.01
		(0.13)		(0.003)		(0.01)
Constant	-18	-7.4	0.2	0.2	-1.5	-1.3
	(13)	(23)	(0.2)	(0.5)	(0.5)	(1.1)
Observations	632	604	851	812	851	812
Mean of Dependent	28	28	0.29	0.29	0.05	0.05
Scale Term	0 .50	0.50	—	—	—	—

Notes: Tobit estimates with standard errors in parenthesis. The Marginal Effects are the product of the Scale Term and the coefficients. Population is in thousands. % White Collar is in percent of the community labor force. Income and Wage are in thousands of 1967 dollars. Regional dummies not reported.

Table 4: Fire Department Employment

Variable	Number of Volunteers	Number of Employees	Volunteers÷ Employees
Property Tax Limits	26 (13)	-6.5 (2.7)	12.7 (2.9)
Income	2.3 (1.6)	0.4 (0.4)	0.6 (0.4)
Population	-0.1 (0.3)	1.1 (0.04)	-0.12 (0.07)
% White Collar	-0.7 (0.2)	-0.00 (0.05)	-.16 (0.05)
Wage	2.9 (2.6)	1.3 (0.6)	.86 (.59)
Employee/Resident	(0.1) (0.1)	0.16 (0.02)	-.01 (.02)
% Manufacturing	-0.24 (0.13)	-0.02 (0.03)	-.08 (.03)
Constant	-34 (26)	-19.5 (5.7)	-9.0 (6.1)
Observations	604	861	604
Mean of Dependent	28	0.29	6.5
Scale Term	0.51	0.69	0.48

Notes: Tobit estimates with standard errors in parenthesis. The Marginal Effects are the product of the Scale Term and the coefficients. Population is in 1,000s, White Collar is in percent of the community population. Income and Wage are in thousands of 1967 dollars. Regional dummies included but not reported.

Table 5: Fire Department Employment Structure

Variable	Any Volunteers		All Volunteers	
Property Tax Limits	-0.03	0.04	0.1	0.2
	(0.17)	(0.26)	(0.0)	(0.1)
Income	0.08	0.01	0.06	0.1
	(0.02)	(0.01)	(0.4)	(0.1)
Population	-0.05	-0.05	-0.03	-0.03
	(0.003)	(0.01)	(0.01)	(0.01)
% White Collar	—	-0.013	—	-0.02
		(0.005)		(0.01)
Wage	—	0.17	—	0.12
		(0.06)		(0.15)
Employee/Resident	—	(0.00)	—	-0.00
		(0.00)		(0.01)
% Manufacturing	—	-0.01	—	-0.11
		(0.00)		(0.27)
Constant	-0.26	-0.13	-2.7	-3.1
	(0.27)	(0.54)	(0.7)	(1.4)
Observations	851	812	851	812
Mean of Dependent	0.29	0.29	0.05	0.05

Notes: Probit estimates with standard errors in parenthesis. Population is in thousands. % White Collar is in percent of the community labor force. Income and Wage in thousands of 1967 dollars. Regional dummies included but not reported.

Table 6: Fire Department Cost-Benefit Analysis

Variable	Expenditures				Insurance Ratings			
	Wage & Salary		Total		Department Points		ISO	
	OLS	IV	OLS	IV	IV		IV	
Volunteers	-0.001	0.04	-0.02	0.47	-1.5	-1.5	-0.01	-0.014
	(0.007)	(0.03)	(0.04)	(0.26)	(0.4)	(0.8)	(0.001)	(0.004)
Paid Employees	3.5	4.0	3.9	4.7	-4.6	-4.9	-0.026	-0.044
	(0.1)	(0.4)	(0.2)	(1.3)	(2.2)	(3.2)	(0.010)	(0.017)
Trucks	—	—	3.3	-9.4	—	-7.0	—	0.27
			(1.2)	(9.6)		(37.9)		(0.22)
Observations	808	507	423	300	486	350	542	400
Mean of Dependent	138	138	165	165	837	837	5.2	5.2

Notes: OLS and IV estimates with standard errors in parenthesis. Population is in thousands. Income is in thousands of 1967 dollars. For the expenditure panel, I also control for income, population, and wage as described in Boucherding and Deacon (1972). Instruments include tax limits, %White Collar, %Manufacturing and the Employment/Resident ratio used in Table 4. For the rating panel, IV estimates controlling for population are reported, with standard errors in parenthesis. Instruments include income, wage, region dummies, tax limits, and other city characteristics used in Table 5.

Table 7: Additional Output Measures—RTI data

Variable	ISO	Deaths	Injury	Property Loss
Volunteers	-0.0018	0.00006	0.0004	5.3
	(0.001)	(0.00008)	(0.0003)	(6.3)
Paid Employees	-0.0036	-0.00003	-0.00005	-2.7
	(0.001)	(0.00004)	(0.0002)	(5.4)
Observations	700	203	331	613
Mean of Dependent	6.0	0.08	0.12	1598

Notes: OLS regression for the ISO grade and Tobit estimation used for the fire-loss variables. The fire loss variables are measured as loss per fire. All regressions control for population size.

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Chapter III

Religious Affiliation, Fiscal Policy and Charitable Giving

1 Introduction

A key argument made by proponents of the charitable deduction in the tax code is that it is a revenue-efficient method of encouraging private funds for desired public purposes. This is equivalent to the statement that the price elasticity of giving is greater than one in absolute value. Before the Tax Reform Act of 1986 (TRA), the empirical literature on charity had reached a general consensus that giving was indeed responsive to tax subsidies, prompting the prediction that charitable giving would fall precipitously when TRA reduced these subsidies.[1] In fact, the tax-code changes did not affect charitable giving as anticipated; Auten et al. (1992) shows that average charitable contributions actually increased continually throughout the eighties. The poor predictive power of the early cross-sectional models is illuminated by this failure to explain the lack of response to TRA. These considerations suggest deficiencies in the current understanding of giving behavior.

Understanding the motivation for giving is important for evaluating the two instruments that the government can use to direct funds toward beneficial goods and services. The government can provide transfers directly or the government can provide tax incentives to spur private

[1] Clotfelter (1985) and Lindsay (1985) both predicted that philanthropic giving would fall by roughly 15 percent.

donations. An increase in the public funding of an institution may be offset by a reduction in private funding—the crowd-out effect. This limits the effectiveness of government transfers. The tax price elasticity is a measure of the response of charitable giving to tax incentives. The government's optimal policy may involve a complicated mix of the two instruments implying, as Roberts (1988) emphasizes, that measurement of both the crowd-out effect and the price elasticity are necessary to formulate a rational fiscal policy. The crowd-out estimates are also of independent interest since they provide evidence regarding theories of altruism.

This paper presents new estimates of the tax price elasticity and crowd-out effects, drawing on richer data sets than the previous literature. Specifically, the survey data from the Consumer Expenditure Survey, the Survey of Consumer Finances and the General Social Survey enable study of the importance of religious affiliation and church attendance in a consumer's charitable contributions. These influences may be crucial to studies of aggregate giving since two-thirds of total giving is comprised of donations to religious organizations. Including religious affiliation and attendance patterns reduces the residual variance and corrects a potential omitted variable bias in previous work. The bias stems from the correlation between religious affiliation and income, area of residence, and charitable giving to the church.

I am also able to examine differences in donor behavior by type of gift by disaggregating charity into categories. Disaggregated data is useful to for testing Roberts' (1984) assertion that previous measures of crowd-out are underestimated because total giving includes religious giving. Religious institutions do not receive government funds directly and thus religious giving should be unresponsive to government spending. Several previous studies, including Dye (1978) and Reece (1979), have used disaggregated survey data without controlling for religious affiliation. They appear to support the proposition that the responsiveness of charitable giving to fluctuations in price and income differs across categories of giving; however, they do not focus on the crowd-out issue.

Since data on charitable giving are censored at zero, log-linear models produces inconsistent estimates that can be corrected using the Tobit model. The Tobit model yields consistent parameter estimates assuming that the error terms are homoskedastic and normally distributed. However, there is no a priori reason to believe that these assumptions are valid; the Symmetrically Censored Least Squares method developed by Powell (1986) provides consistent estimates

regardless of their validity. I use both techniques to estimate models of charitable giving.

This paper is organized into six sections. Section 2 provides an overview of the public policy initiatives of the eighties and also summarizes the previous literature. The third section describes the three survey data sets that form the basis for analysis. Section 4 details the econometric specification.

Section 5 presents the empirical results and considers the interpretations of these findings. I find that religious affiliation significantly affects the amount of charitable giving. Specifically, Mormons, Methodists and Baptists tend to give more to their churches than Lutherans and Catholics. Excluding such variables has made religious giving, and therefore total giving, appear excessively responsive to fiscal policy. Accounting for this information, I find mixed results for the crowd-out of government spending, only the human service category has a significant crowd-out; a reduction of government spending on health and welfare by one dollar stimulates 12 cents of private charity to human service organizations. The disaggregated data show a relatively weak response to tax incentives for religious giving, implying that tax incentives are not a revenue-efficient method of directing money towards religious organizations. The evidence for educational and human service giving also implies a relatively weak response to tax policy but these estimates have large standard errors and do not significantly differ from previous work.

In addition, this paper finds insufficient evidence to reject the hypothesis that the Tobit procedure is an appropriate technique. The final section concludes and provides some direction for future research.

2 Charity and Government Policy

A consumer's decision to make a charitable contribution can be represented by the following maximization problem:

$$\text{Max } U(x_i, d_i, P) \tag{1}$$

subject to

$$p_x \cdot x_i + d_i = Y_i - \tau \cdot (Y_i - d_i) \tag{2}$$

$$P = G + \sum d_i \tag{3}$$

where x_i is i's consumption of a private good, p_x is the price of x, Y_i is i's income, d_i is i's charitable donation and P is the total supply of the public good, equivalent to the sum of private and public spending (D and G respectively). τ is the tax rate if the consumer is an itemizer and zero otherwise. Competing theoretic models specify different forms for the utility function U with wide range implications for consumer behavior. Conversely, different assumptions about consumer behavior can be mapped back to restrictions on the form of U. For instance, if consumers are perfectly altruistic, only the total amount of the public good P and not their donation, d_i, appears in U; in this case d_i should only appear in the budget constraint (2). On the other extreme, if consumers are not altruistic at all, but give instead to receive the private benefits of donating such as public approval or a name plaque, then d_i rather than P should appear in U.[2] Implicitly, studies focusing only on the tax-price elasticity and omitting government spending or giving by others have assumed that P receives zero weight in the utility function.

To demonstrate the joint importance of tax policy and government spending, Roberts (1987) examines the thought experiment of increasing the subsidy given for private donations and decreasing government spending on the same good so that total spending remains constant. He shows that subsidizing private spending is relatively more revenue-efficient; i.e. the policy minimizes revenue loss for an increase in the amount spent on a public service, than direct taxation and spending as long as

$$\frac{dD}{ds} > (1-c)\cdot\left(s\cdot\frac{dD}{ds}+D\right) \tag{4}$$

where D equals private spending, s the subsidy rate $(1-\tau)$, and c the crowd-out parameter [i.e., $c=\frac{dD}{dG}$]. The left hand side of (4) is the increase in private spending on pubic goods due to a subsidy increase; the right hand side is the forgone revenues which could have been spent directly by the government. Substituting in the expression for the price elasticity of giving, η, and noting that $\frac{dD}{ds}=-\frac{dD}{d(1-s)}$, and therefore that $\eta=\left[\frac{dD}{d(1-s)}\right]\left[\frac{1-s}{D}\right]$, condition (4) becomes

$$\eta < \frac{1-s}{s+\frac{1}{c-1}}. \tag{5}$$

[2]This phenomenon is coined the "warm glow" of giving by Andreoni (1989)

The presence of both η and c in the final expression implies that estimates of both the tax-price elasticity and the crowd-out parameter are necessary to determine the optimal public policy. The early literature on charity, described below, assumed that $c = 0$ arriving at the condition that tax subsidies are efficient regardless of the level of s if $\eta < -1$ (i.e., if charitable giving is price-elastic). Contrast this result with the implication of perfect altruism: if $c = 1$, then tax subsidies are optimal as long as $\eta < 0$.

The remainder of the section will detail the fiscal policies of the eighties and the related empirical literature, first for tax policy and then for government spending.

2.1 Tax Policy

The controversial tax reforms of the 1980s and their resulting changes in financial incentives had strong implications for private charity. The major tax bills of the decade, the Economic Recovery Tax Act (ERTA) of 1981[3] and the Tax Reform Act of 1986 (TRA), contained provisions that affected the tax price of giving.[4] The TRA revamped the tax incentives for giving, shrinking the range of marginal tax rates to 15–33 percent by 1988. In particular, tax rates for the high-income earners fell, increasing the effective price of giving. The increase in the standard deduction, which reduced the number of itemizers, and the elimination of the non-itemizer deduction further reduced tax incentives to give. Many, including leaders of charitable organizations and economists, expected a drastic falloff in charitable giving due to the reductions in tax incentives.[5]

However, TRA appears to have had a reasonably small aggregate effect, though small groups of recipients such as art museums may have been hurt substantially.[6] Both the average and median of total giving by income class during the eighties are shown in Figure 1, illustrating

[3]The ERTA reduced marginal tax rates proportionately, changing the schedule from a range of 20–70 percent to a range of 14–50 percent over a four year period. The tax rate changes only had a real impact on the price of giving for those in the highest bracket. The lower tax rates mean an increase in the cost of giving. At the same time, the ERTA provided an incentive for giving by non-itemizers by phasing in a non-itemizer deduction. See Auten et al. (1992) for more details.

[4]There were other tax policies that may also affect contributions such as the Deficit Reduction Act of 1984. This act contained stricter stipulations requiring thorough documentation of all contributions and more complicated filing for taxpayers who donate more than $500 in property. See Auten et al. (1992).

[5]See Clotfelter (1985) and Lindsay (1985).

[6]Actual giving numbers are still elusive.The *Giving USA* figures for years prior to 1988 are comprised of IRS figures plus some estimate of the giving by non-itemizers. The more recent numbers are less accurate, completely the result of a forecast. The figures for religious giving based on different surveys are also problematic because not all years are comparable.

the mild response to TRA.[7] For the entire sample, average and median gifts are relatively constant without pre-reform peaks, the same pattern as that of lower-income groups. Lack of pre-reform peaks suggest that people did not boost their giving just prior to the tax reform to maximize their tax savings. Only those in income groups over $200,000, the group with the largest tax effect show a large immediate response to tax reform and an overall downward trend in the mean gift, illustrating a small overall effect and different giving patterns from the lower-income groups.

In all cases, median giving appears low compared to the average gift, as well as more stable, a difference particularly striking for those earning more than $200,000. Such disparity between the median and mean implies that there is a minority of very charitable consumers and a majority that is less charitable but more consistent. Rudney and Rudney (1992) draw a similar conclusion about wealthy consumers.

Figure 2 furnishes the mean and median of contributions as a percent of income, a measure of generosity. Only the highest income group, those earning more than one million dollars, demonstrates a jump right before the reform and then a decline in generosity. Those in the second income group, comprised of households earning more than $200,000 but less than a million, show an earlier decline in giving. Again, medians are lower and demonstrate more stability. Notice that the median for the second income group demonstrates a steady decline throughout the eighties, not a sharp drop after the tax reform. Thus, only the millionaires in Figure 2b seem to have a noticeable reaction to the taxcode.

Though high-income earners tend to write bigger contribution checks, it is not true that the gifts of the less wealthy are insignificant. Table 2, utilizing the IRS data for the last year when non-itemizers could deduct, illustrates the importance of lower-income earner contributions. Tax filers earning less than $50,000 contribute 60 percent of the total reported gifts, or approximately $34.5 billion while those earning over $100,000 account for only 20 percent of total reported giving in 1985. According to IRS numbers presented in Auten et al. (1992), millionaires gave approximately 3.8 billion in 1985, only about seven percent of the total deductible contributions of 1985. This information coupled with the fact that only the highest income groups seem to respond to TRA imply a small dropoff in total giving during the 1980s.

[7]Both Figures 1 and 2 are composed using IRS tax data which is presented in table form in Auten et al. (1992).

The pre-1985 literature was the basis for the dire predictions of the effect of the TRA on charity. Clotfelter (1985) summarizes sixteen such studies with the general consensus that giving is price elastic and, thus, concluded that tax subsidies are a revenue-efficient method for providing public goods. In the more recent literature, summarized in Steinberg (1990), the once strong consensus is no longer. An early study with recently compiled panel data, Broman (1989), finds mixed results for the tax-price elasticity. Auten et al. (1992) uses panel data to show that giving responses to tax incentives appear weak compared to expectations based on a standard cross-sectional model.

2.2 Government Spending

Another policy debate of the eighties was the effect of government spending on charitable giving. In 1981, President Reagan, in his drive to reduce Federal programs, argued that much of federal social assistance could be provided by philanthropic efforts and, therefore, that the private sector could fill some of the gap created from spending reductions.[8]

Several papers analyze Reagan's claim about the intricate interaction between public and private provision of public goods, and attempt to measure the crowd-out effect. The early theoretical work of Warr (1983), Brennan and Pincus (1983) and Roberts (1984) suggest that at the margin increases in government spending on public goods are accompanied by a one-for-one reduction in private charity, the so-called crowd-out effect. For example, Roberts (1984) offers the coincidence of welfare-program introductions with private-charity reductions as historical evidence supporting his theory. The important practical implication of a complete crowd-out is that government policies towards privately-provided public goods may be neutral.

Bergstrom, Blume, and Varian (1986) and more recently Andreoni (1985, 1987, 1989) develop theories which can counter the conclusions of the above studies. Similar conclusions are reached by Feldstein (1980), Cornes and Sandler (1984), and Steinberg (1987). In particular, Andreoni explains the breakdown of neutrality by considering imperfectly altruistic agents,

[8]Charities spoke out against the notion that private philanthropy can replace government spending. Leaders of large private charities, such as the United Way, voiced concern at the apparent government reliance on charity because their small increases in contributions would not be able to offset the projected cuts in federal aid. Leaders of religious organizations, the biggest recipient of charity and also a large provider of charity, also argued against government reliance on church services; Archbishop Edmund Szoka of Detroit publicly proclaimed that his parishes were struggling and failing to meet needs created by cuts in federal and state budgets [Herbers (1981)].

who derive utility from the "warm glow" of donating as well as from the increase in social welfare from their gift. Their work implies that government spending only partially crowds out private charity.

Most empirical work on charity assumes a model of giving where contributors do not care about public provision, implying a zero crowd-out. One of the earlier papers to examine the possibility of a non-zero crowd-out is Abrams and Schmitz (1978) which supports the notion of a partial crowd-out. They analyze the impact of federal health, education and welfare expenditures on private charitable contributions, using pooled time-series data for 1948–72 tax returns from the IRS. They find that a dollar of government spending crowds out 28 cents of private contributions. Clotfelter's (1985) methodology follows Abrams and Schmitz (1978), adding a time trend to their basic regression; but he finds even stronger results against the notion of complete crowd-out: government spending has no significant effect on private charity. However, Abrams and Schmitz (1984) reestimate crowd-out with cross-sectional data; their findings support their earlier work. Andreoni's (1991) experimental results also support his impure altruism theory.

The conclusions from these empirical studies are problematic due to the aggregation of different types of giving. Charitable contributions include donations to diverse organizations ranging from the local church to Greenpeace. Anecdotal evidence suggests that the motivation driving religious giving may be very different from other types of giving; private contributions to these various groups are affected by different sets of exogenous circumstances. If government spending in one area affects private spending in that area alone, aggregation will conceal the relevant separate crowd-out parameters. In particular, Roberts (1984) argues that the findings of Abrams and Schmitz are not valid because the tax-return data they used combines religious giving and other forms of charity; since there is no direct government spending on religion, it is not surprising they found a less-than-complete crowding out.

Roberts' criticism does not, however, hold for Kingma's (1989) results. Kingma studies one public good—National Public Radio—and found only a partial crowding out, supporting Andreoni's impure altruism theory. However, there is no evidence that the crowd-out parameter for National Public Radio is representative for all expenditure categories. Another problem is that charitable responses to a change in government spending may not be just an altruistic

reaction but the result of an increase in solicitation efforts, two effects which are not measured separately. It is likely that this result is not informative about the crowd-out for other goods; radio stations are uniquely positioned to solicite given their capacity for free advertising. The data utilized in this paper allow for analysis of giving behavior for broader categories of giving than Kingma's paper but at a more disaggregate level than previous studies.

3 The Data

The breadth of information provided in the three surveys used here, the General Social Survey (GSS), the Consumer Expenditure Survey (CES), and the Survey of Consumer Finances (SCF) allows for a more comprehensive data analysis of charitable giving. These surveys are attractive because of the availability of detailed personal information such as religious behavior, age, education level attained, and marital status that have a large effect on giving behavior. In comparison, tax-return data supplies very limited personal information though reporting may be more accurate. The surveys also can be used to disaggregate total charitable giving into different categories to determine whether the tax-price elasticity and crowd-out parameters differ across categories and to understand religious giving, the largest component of giving. The improved controls for personal characteristics may help reconcile the strong results of past cross-sectional tax-data studies with the mixed results of more recent panel tax-data studies, as well as improve the current understanding of the crowd-out phenomenon. This section describes each of these surveys as well as other data needed for this study.

3.1 The General Social Survey

Most data on charitable giving provide no information about the religious affiliation of the respondent. The fact that giving to the church is roughly two-thirds of total giving and is the major recipient of most consumers' charity suggest that religious affiliation may be an important influence of giving behavior. The General Social Survey (GSS), a survey administered by the National Opinion Research Center (NORC), provides key religious variables including affiliation, attendance frequency, and donations to the church. The GSS is an annual cross-sectional sample of English-speaking persons over the age of 18, who are living in non-institutional arrangements in the United States. NORC completes approximately 1,500

interviews per year concentrating on the respondent's attitudes toward different social issues and provides enough information to examine the basic determinants of giving to one's church, the only form of charity included in this survey.

This study used the 1987, 1988, and 1989 surveys because it is only in these three years that NORC collects information on church giving. Some summary statistics—means, medians, 75th, and 90th percentiles—for the GSS data used in this study are presented in Table 2, first for the entire sample, and then split into contributors and non-contributors. On average, contributors are 6.5 years older and earn $3,000 more than non-contributors. The difference in educational attainment between contributors and non-contributors is small. The medians present a similar pattern but the amount of income earned and giving levels are much lower. The percentile information shows that at least 75 percent of the respondents give less than the average amount suggesting that the higher average is driven by a few who give large sums of money: the same pattern seen in the figures of IRS data.

Though the GSS data has the unique advantage of providing thorough information about religious affiliation and attendance, it does not provide any other charitable giving information to provide a complete picture of the respondent's giving behavior, an advantage the CES has.

3.2 The Consumer Expenditure Survey

The Bureau of Labor Statistics conducts the Consumer Expenditure Survey (CES) to derive the expenditure weights utilized in the construction of the CPI. The data set includes approximately 5,000 observations per year, collected from 85 different sampling areas corresponding mainly to Standard Metropolitan Statistical Areas as defined in 1970. Each observation pertains to a consumer unit, comprised of members of a household or other living group that shares at least two of three major expense categories: housing, food, or other living expenses.[9] Table 2 also presents summary statistics for the CES, and illustrates that the head of a consumer unit which makes charitable donations is, on average, more educated, older, and at a higher income level compared to non-contributors. In particular, the average contributor earns roughly $13,000 (or 75 percent) more, and is six years older than the average non-contributor. And like the GSS, the median levels of income and giving fall short of the mean value. How-

[9]For a description of these categories, see the U.S. Bureau of Labor Statistics (1985) p. 132.

ever, religious giving in the CES is lower than in every comparable group in the GSS. Also the non-givers are, on average, older and earn less than the corresponding GSS counterparts.

The CES has some advantages compared to other data sets. First, unlike itemized tax-return data such as that used by Abrams and Schmitz (1978, 1984) to measure crowd-out, it provides information about the recipient of each individual's charitable donation, dividing private gifts into different categories: religion, welfare, and education. The separate types of giving can be employed to study how the consumer response to government policy might vary by type of giving.

One characteristic is shared by both the CES and the GSS; they include lower-income people who are unlikely to itemize deductions and thus about whom tax return data provides little information. The inclusion of lower income observations is informative. *Giving USA* (1991) reports that efforts to convince Congress to restore the non-itemizer charitable deduction that was abolished in 1986 have not waned, making this policy question still worthy of evaluation. Information on the contributions of lower-income consumers, who are likely to be non-itemizers during this sample when non-itemizers can make a charitable deduction, might be useful in predicting the effects of such a policy change. And, as seen in Table 2, those earning under $25,000 make about 27 percent of the contributions.

As with most data sets, there exist difficulties with the CES which, like the GSS, has few very high-income earners who tend to make the larger donations. This implies that any estimates I obtain may not be applicable to the high-income contributors who are most likely to contribute to particular subsets of potential recipients: the arts and higher education. However, as mentioned in the previous section, these high-income givers account for a rather small percent of total charity.

A second difficulty with the CES data is that the respondent's state of residence is withheld to protect confidentiality. This problem is not trivial as I am trying to analyze the effect of fiscal policy on private charity—given that the CES is cross-sectional data, all of the variation in fiscal policy for the respondents comes at the state level. Without the respondent's state of residence, the desired right-hand-side variables are not directly available. However, for consistent estimation, expected values of the fiscal variables will suffice and fairly precise expectations can be computed using data from the CES and elsewhere using a method based

on Bayes' Rule.[10]

The expected value of state spending in a certain category for a given respondent can be computed by multiplying the probability of the respondent's living in a state by the spending level in that state and summed across states. Since state spending is publicly available, the problem reduces to estimating precisely the probabilities of residing in various states. The Bureau of Labor Statistics (BLS) documents which urban areas it surveys; and this information, coupled with information on the size of the respondent's area of residence significantly narrows down the possible states of residence. Other informative variables include the existence of income tax in the state and the state's population (and therefore the likelihood of its residents being surveyed). This information can be combined in the following way using Bayes' Rule. Suppose for simplicity that the CES has two informative variables, P and T. For concreteness, let P represent the event "respondent lives in area with some population", T the event "respondent pays state income tax" and st_i the event "respondent resides in state i." Applying Bayes' Rule, the probability of the respondent's living in state i given he paid state taxes and lives in a city of the coded size is

$$\begin{aligned}
\Pr(st_i|P \cap T) &= \frac{\Pr(st_i \cap P \cap T)}{\Pr(P \cap T)} \\
&= \frac{\Pr(T|st_i \cap P)\Pr(P|st_i)\Pr(st_i)}{\Pr(P \cap T)} \\
&= \frac{\Pr(T|st_i \cap P)\Pr(P|st_i)\Pr(st_i)}{\sum_j[\Pr(T|st_j)\Pr(P|st_j)\Pr(st_j)]}
\end{aligned}$$

Assuming $\Pr(T|st_i \cap P) = \Pr(T|st_i)$ implies

$$\Pr(st_i|P \cap T) = \frac{\Pr(T|st_i)\Pr(P|st_i)\Pr(st_i)}{\sum_j[\Pr(T|st_j)\Pr(P|st_j)\Pr(st_j)]} \tag{6}$$

which can be solved with information provided.[11] Appendix A provides a more thorough description of the Bayes' identification methodology.

[10] Alternatively, a multinomial logit approach for estimating the probability of state residence could be tried but the large number of possible outcomes make it computationally more difficult.

[11] It is natural to suppose that $\Pr(T|st_i \cap P) = \Pr(T|st_i)$; i.e., population size provides no information about the payment of state tax once the state is known.

3.3 The Survey of Consumer Finances

Because of the lack of information on state residence in the CES and limited giving information of the GSS, the Survey of Consumer Finances (SCF), conducted by the Federal Reserve Board in 1986, may provide a useful comparison. This survey of approximately 2,800 households is designed primarily to update the information obtained on the 1983 SCF. As in the CES and GSS, an observation in the SCF pertains to a consumer unit or household.

Table 3 summarizes key statistics for the entire sample, and contributor group.[12] Like the other surveys, contributors, on average, earn a slightly higher income and have more education but, unlike the CES, there is no notable age difference between givers and non-givers. The SCF sample has a higher mean income, $28,777 compared to $26,154 in the CES. The SCF does not topcode but conducts a separate high income sample which I must exclude due to lack of residence information necessary for a study that includes state policy measures. As in the CES, 60 percent percent of respondents in the SCF are contributors, compared to 70 percent in the GSS. The distribution of income for the entire sample looks like that of the other two surveys but giving is higher in the SCF from any viewpoint. As seen in the other surveys, the mean value of giving exceeds that of the median.

The SCF has some important advantages including information on the respondent's state of residence and detailed wealth information. The survey question for charitable giving is less clear than that of the CES, however; the survey asks only for total contributions over a three year period, 1983–85, if the total exceeds $300. Despite these problems, the addition of empirical evidence utilizing the advantages of the SCF may contribute to a more complete picture of charity.

3.4 Other Data Sources

Because the SCF and CES have no information regarding religious affiliation, regional religious makeup must act as a proxy. A regional proxy is made possible by the Glenmary Research Center survey which provides the number of adherents in a denomination by county and state for 1980. Adherents are defined as "all members, including full members, their children, and

[12]The survey asks only for total contributions over the three year period 1983–1985, if that total exceeds $300. For Table 3, one-third of the amount reported, (the expected annual contribution) is shown.

the other regular participants who are not considered as communicant, confirmed, or full members" [Quinn (1980), p. xiii].

Several sources provide state fiscal variables. *Government Finances* series GF5, produced by the Bureau of the Census, supplies information about state and local spending by state and broken into categories. Federal tax rates are found in the IRS publication *Tax Rates and Tables for Prior Years*, compiled in 1987. *Significant Features of Fiscal Federalism* make state tax rates available. Finally, the *Statistical Abstract* contains state population data.

4 The Methodology

A log-linear equation is the typical econometric model for empirical studies on charitable giving. However, consumers can make only non-negative contributions. This censoring of the dependent variable, charitable giving, necessitates implementing an appropriate form of estimation—the Tobit or the more robust Symmetrically Censored Least Squares model—to estimate the parameters of interest. Let $Gift_i$ represent the actual censored charitable giving and $Gift_i^*$ the underlying distribution of charitable giving, then

$$Gift_i = \begin{cases} 0 & \text{if } Gift_i^* \leq 0 \\ Gift_i^* & \text{if } Gift_i^* > 0. \end{cases} \tag{7}$$

It is usual to model the unobserved variables as a linear function of observables and an error term, $Gift_i^* = X_i\beta + \epsilon$. The coefficients presented in the next section represent the derivative of the contribution, $Gift_i^*$, with respect to the independent variables. The latent response may be the relevant information for answering questions from the altruism literature; but for actual policy implications, it is the marginal effect of actual giving that matters. Scaling the maximum likelihood estimates by $\hat{\Phi} = \text{cdf}(X'\hat{\beta}/\hat{\sigma})$ yields the actual marginal effect, which is a fraction of the marginal effect on $Gift_i^*$ for the Tobit model (the procedure is much more complex for the SCLS and is discussed in Appendix B). The scale term needed to compute the marginal effects is also presented in the following output tables. With this included, the marginal effects can easily be computed.

The Tobit model provides consistent estimates when the errors are homoskedastic and normal. Powell (1986) demonstrates that the SCLS methodology produces consistent estimates

if the error terms are symmetrically distributed, if $X'\beta > 0$ for a positive fraction of the sample, and if the independent variables are sufficiently variable to uniquely identify β, less stringent requirements than that of the Tobit.[13] Appendix B presents the methodology for the SCLS.

The dependent variable, $Gift_i$ is defined as the contribution of household consumer unit i. The CES giving information consists of several categories of giving: religion, welfare, educational, and total giving. Total giving, the only available data, is used for $Gift_i$ in the SCF equations. In the GSS, $Gift_i$ means giving to one's church.

The list of explanatory variables contains standard personal demographic information relating to the head of household i in Age_i, $Education_i$, and $Married_i$.[14] One of the most important determinants of giving is $Income_i$, household i's total before-tax income.[15]

Several explanatory variables are included to control for the influence of religious affiliation on the giving decision. The variables are:

Attend$_i$: the frequency of church attendance by the head of household i per year in the GSS. In the CES and SCF, regional proxies are constructed by using the GSS from 1972 - 1991. I compute an attendance proxy, the average value by state.

Religion dummies: these include *Cath*, *Bapt*, *Mormon* and *Jewish* among others. For the GSS, these are dummy variables which have a value of 1 if the head of household i belongs to that denomination. Due to lack of information in the CES and GSS, the probability of belonging to a religion must be used instead. These probabilities equal the religious composition of the state, reflecting the probability that a respondent is a member of that church. I use the survey data from the Glenmary Research Center to obtain the percent of a denomination residing in a given state.

The effect of fiscal policy on charitable giving is captured by the following exogenous variables:

Tax Price$_i$ is the price of the first dollar of a contribution to charity by respondent i.[16]

[13] See Greene (1989) for a derivation.

[14] Note that all three data sets provide a categorical variable for the education level attained by respondent. I translate these categories into the approximate number of years of education.

[15] Note that this definition is not crucial, the results do not change if income were measured by after-tax income.

[16] Note that there are other elements to the price of giving that are assumed away here as in most to the

With charitable deductions, the personal cost, or tax price, of a one dollar donation is one minus the savings from making a tax deduction. The amount of savings depends upon the respondent's itemizer status. Unfortunately none of the datasets indicate which respondents itemize. I must approximate itemizer status.[17] For the CES, I use the detailed expenditure information to calculate the potential itemized deductions, ID, which is computed as the sum of the consumer unit's expenditure on the following items: (a) other taxes, (b) mortgage interest, (c) other interest payments, and (d) health expenses over five percent of income. All units with ID greater than the standard deduction are considered to be itemizers. For the SCF, health expenditures are not available, so the remaining available information is used to predict itemizer status. For the GSS, no expenditure information is available, so homeowner status is used to predict the respondent's itemizer status. The relevant taxable income and predicted itemizer status are employed to determine the marginal tax price of giving the first dollar of a charitable contribution. I apply the federal and relevant state tax codes to this adjusted income measure to predict τ_i^F and τ_i^S, where τ_i^F is i's expected federal marginal tax rate, and τ_i^S is i's expected state marginal tax rate. Coupled with the fact that state taxes can be deducted on the federal income tax, the tax price is given by the formula

$$Tax\ Price_i = \begin{cases} 1 - \tau_i^F + (1 - \tau_i^F)\tau_i^S & \text{if } i \text{ itemizes} \\ 1 - \tau_i^F/2 & \text{if } i \text{ does not itemize in CES or SCF} \\ 1 & \text{if } i \text{ does not itemize in GSS} \end{cases} \tag{8}$$

Note that non-itemizers can still claim a deduction; in 1985 the tax code allowed non-itemizers to deduct half of their contributions without a dollar limit. For the CES, the expected state tax is computed by taking a weighted average of all the possible state tax rates within the region, where the probability weights are given by the Bayes' Rule methodology described in

literature. For example, transactions costs and solicitation expenditures may be considered part of the price of giving. It is less costly to make a donation when asked than to exert effort to seek an organization. This paper looks at the cost of making a dollar donation. Weisbrod and Dominguez (1985) examine a different measure of price, the price of purchasing a dollar of the nonprofit's output. With that measure, a higher fund-raising to output ratio means a higher price. Steinberg (1990) argues that this is a measure of average productivity, not the marginal, so that donors should not be concerned with the fund-raising share.

[17] A difficult question arises here concerning whether to include charitable deductions in the determination of itemizer status. Reece (1979) does include charitable deductions in his calculation but then faces an endogeneity problem. I follow Feenberg (1982) and Feldstein (1975) and use the actual price of the first dollar of giving, and not including giving in the determination of itemizer status.

the previous section.

$Gov'tExp_i$ is a measure of the various categories of government expenditure used to measure the influence of government spending on contributions. *Gov't Exp* includes state and local direct spending on welfare, health, and hospitals in household i's state in dollars per capita for all categories of $Gift_i$ except education and total. In the case of educational giving, *Gov't Exp* represents state and local spending on education, and in total giving equations, it is the sum of both spending categories. For the CES estimation, the variable is a probability-weighted average of state-of-residence figures calculated by the Bayes' Rule methodology. Since the GSS and SCF provide state residence information, actual fiscal figures are used.

It is possible that any crowd-out effect could be dominated by another influence and the results will show a positive relationship rather than the expected negative relationship. Heterogeneity in tastes may imply that certain groups may vote for high state government spending and also choose to make large donations.

If, as the theoretical papers on crowd-out such as Andreoni (1989, 1990) suggest, altruistic motives determine consumer's reaction to government spending, we might expect to see differences in giving across categories since the categories themselves may differ in altruistic content. For example, if human services is the most altruistic type of giving, then the largest response to changes in government spending should be in the welfare category. Clotfelter (1985) suggests that most of religious giving is eventually used for practical expenses including the operating costs at the religious institutions, and only a small fraction of their revenue goes beyond the church to outside charitable causes which would imply that religious giving should show little response to changes in government spending. However, that small fraction still adds up to billions of dollars.

5 Empirical Results

This section presents the main findings of my study, first for the standard empirical model and then with the inclusion of religious demographic information. In addition, the section provides some evidence on the role of religion in charitable giving.

5.1 The Standard Empirical Model

To serve as a baseline for comparison between the past literature and my results, I duplicate a standard estimation procedure, with the inclusion of government spending variables, using the Tobit model for all three data sets.[18] The results are presented in Table 4 with the SCF results in the first column, the CES results in the next three columns, and the GSS in the right column.

In general, past studies have found that the price elasticity is more than one in absolute value, implying that a decrease in net price of giving by one percent will encourage more than a one percent increase in gifts, and, importantly, the increase in contributions to non-profits is greater than the loss of tax revenues.[19] Clotfelter's (1989) choice of a benchmark estimate, for example, was a price elasticity of -1.27. Elasticity estimates from Table 4 show larger *Tax Price* effects in SCF, large compared to the benchmark and most other previous estimates while the GSS and CES elasticity estimates are low.[20] However, the standard errors are large making the results still consistent with earlier estimates.

All of the specifications present a crowd-out term that is negative and less than unity, supporting Andreoni's model of impure altruism. The first column in Table 4 implies that a consumer unit does respond to government spending changes; the desired contribution of household i decreases by 20 cents for a dollar per capita increase in welfare expenditure.

The estimates of total giving and religious giving are useful to test Roberts' (1984) assertion that crowd-out should be complete and that the only reason studies such as Abrams and Schmitz's (1984) found a partial crowd-out was that they aggregated religious-giving in total contributions. Roberts states that since no government funds go directly to churches, government spending will not affect religious giving; so this inclusion will dampen the true crowd-out, producing a downward bias; crowd-out should be approximately -1 with religious

[18]The more typical specification excludes government spending but I find similar results in either case.

[19]Under the assumption of a zero crowd-out, a price elasticity of greater than one implies revenue efficiency.

[20]Note that the itemizer status is determined without including charitable deductions, so this measure like many of the studies using tax data ignores the effect of the kink in the budget curve, i.e. the tax code has an additional effect in that giving can bump a respondent into the itemizer status. This effect seems more relevant for older citizens who have no mortgage and make big donations. Reece and Zieschang (1985) deal with this nonlinearity but they do not include the state tax subsidies in their calculation, so they do not have the true tax subsidy or an accurate budget curve. A kinked budget curve which attempted to account for state deductions would be extremely complicated and still imprecise.

giving excluded. In fact, the results in Table 4 show that apparently the opposite occurs. The crowd-out estimates for religious giving have the largest and most statistically significant crowd–out parameter of any giving category, contrary to Roberts' assertion that religious giving should be unresponsive to government spending changes. However these results suffer from an important omitted variable bias, the exclusion of religious demographic information.

The income-elasticity estimates range from 0.26–0.60, consistent with previous studies' findings of an elasticity which is positive and less than unity.[21] Clotfelter (1989) cites 0.78 as a benchmark estimate of the income elasticity which is higher than any of the coefficients reported in Table 4 though the literature is far from agreement on this parameter. Note that religious giving is the least responsive category to income.

The past literature has not employed adequate measures for permanent income. Some, like Reece (1979) have used a two-year average of annual income to proxy for permanent income. Interpreting charity as a form of consumption, macro-economic theory suggests that a change in permanent income may affect consumption (and giving) more than an equal change in transitory income. Leaving out permanent income and only modeling a yearly income may be a second source of omitted variable bias. To proxy for permanent income more accurately, it is possible to employ the CES and the SCF which both provide measures of the consumer unit's financial status besides annual income. For the CES, the value of the the family unit's consumption can be derived following Cutler and Katz (1991) methodology. For the SCF, a measure of total net wealth can be used. I estimated the model with the addition of these permanent income measures. The results are essentially unchanged and the coefficients for permanent income sporadic and so are not reported.

As expected from past results and the descriptive statistics of Table 3, the coefficients for *Age*, *Married*, and *Education* are always positive. For the dependent variable religious giving in the CES specification, the results imply that expected giving increases by $18 for every year of age, three times the effect for the other categories. This is noteworthy given

[21] Note that I have computed the elasticities from the coefficients for the $E(Y|X)$ where Y is the actual value of giving, distinct from the corresponding latent $Y^* = X \cdot \beta + \epsilon$. This point is sometimes missed but must be dealt with in a charity study because the observed value is what matters for policy. The latent variable may be relevant when giving evidence in support of an altruism theory: a standard approach is to solve for $E(Y|X)$ at the mean observation unit, $\bar{X}$. We have $\partial E(Y|X)/\partial X = cdf(\bar{X}\beta/\sigma) \cdot \beta = \gamma \cdot \beta$. Thus the desired elasticity is $\frac{\partial E(Y|X)}{\partial X} \cdot \frac{\bar{X}}{E(Y|X)}$ [see Greene (1990)]. The scale term, γ, the coefficients, and the elasticities are presented in the tables.

that the population in this country has been aging during the eighties. Being married also affects religious giving more than the other categories, increasing the expected religious giving by $351 ($424 in the GSS) in the CES results. Years of education have the biggest impact on expected giving to educational institutions, undoubtedly measuring the phenomenon that years of school affiliation increase the likelihood of supporting those places of learning.

5.2 Accounting for the Role of Religion

In this subsection, I offer a description of the role of religion and present results eliminating the potential problem of omitting religious affiliation. The influence of religion is a major omission in past studies of the determinants of charitable giving. Some have addressed it by including a dummy for Utah to control for the large contributions in the Church of Latter-Day Saints, but none have adequately controlled for religious affiliation. Since two-thirds of individual giving goes to religious organizations, any influence that religious leaders have on church contributions could notably affect total giving.[22] Evidence from the GSS presented in Table 5 illustrates that giving behavior may differ between religions. According to the GSS, Catholics give less than one percent of their pre-tax income to the church: low compared to the overall average of 1.4 percent. Baptists and Mormons are higher-giving religious groups giving 2.3 and 5.3 percent of their income respectively. Note that Baptists are generous despite having a lower average income compared to the other major religions.

Clotfelter (1989) attributes the relatively exiguous offerings of Catholics to conflicts with the strong positions of the Catholic Church on issues such as female priests, divorce, birth control, and homosexuality. It may also be true that potential givers may feel less inclined to help the very organized, highly structured, hierarchical religions as compared to the denominations that function more at the congregation level. This explanation is consistent, for example, with Baptists being more generous than Catholics. Other factors may be the services and collection methods of the different churches. A church that provides a social life, a safety net, and other benefits may be more able to demand higher donations.

A glance at a map of the U.S., marked by dominant religion in a county reveals major

[22] I use the estimate 2/3 as a middleground of the various reported estimates which range from 0.54–0.75. See *Giving USA* (1992), Clotfelter (1985), and Hodgekinson et al. (1986) for more details.

concentrations of denominations in various regions.[23] Roman Catholicism dominates in the Northeast, Southwest, the southern coastline and the Mexican borders. Baptists predominate the Southeastern states. The Mormons have a stronghold in Utah and some of its bordering states while Lutherans dominate the North Central region. Since giving behavior appears to differ among religions and there is a tendency for clustering of religions regionally, it is crucial to account for this effect.

Cross-sectional variation in charitable giving may really be correlated with regional differences in the religious makeup of the population. A scenario that is consistent with these results follows: regions with high-giving religions, such as Baptists and Mormons, will be characterized by high levels of religious giving. These religious groups tend to be conservative and they will vote for conservative government spending. On the other hand, some liberal states in the U.S., particularly in the northeast, are predominantly Catholic, and Catholics tend to give less to their church. At the same time, these Catholics may be electing big-spending, big-taxing policy-makers. Since religious giving is such a large component of total giving, this scenario may also hold for total giving but the story for other types of giving is less clear.

Indeed, the causation could work from religious affiliation to giving behavior rather than from tax level to giving as is usually supposed if religious makeup of a population and its tax price are correlated. Taking the case of charitable giving, state governments may or may not allow charitable contributions to be deductible. In a state with high levels of religious giving, such as Utah, it may be politically unpopular to not have a charitable deduction. This reasoning might explain why Massachusetts, a predominantly Catholic state, does not have a charitable deduction. The measured relationship between giving and the tax price when religious influence is excluded may stem from political pressure of particular religious groups, if dominant in the state, to maintain a lower price of giving.

To check if the religious composition of a state is correlated with the tax price in the state, I estimate the following Probit model with standard errors in parentheses,

$$\Pr(Deduction) = \underset{(5.0)}{-6.2} + \underset{(3.1)}{6.5} \cdot \%Mormon + \underset{(0.07)}{0.12} \cdot \%Baptist + \underset{(0.14)}{0.07} \cdot \%Catholic \tag{9}$$

[23] The Glenmary Research Center produces such a map.

$$+0.14 \cdot \%Lutheran + 0.4 \cdot \%Unaffiliated$$
$$(0.03) \qquad\qquad (5.0)$$

The dependent variable is a dummy for the probability of a state charitable deduction of giving computed from information in *Significant Features of Fiscal Federalism*, 1991. The explanatory variables include the percent of a state's population affiliated with particular religions using the regional data provided by the Glenmary Research Center. I exclude states that have no form of income tax. The coefficient for $\%Mormon$ has a strong positive significant effect on the probability of having a deduction. The $\%Baptist$ effect is also positive and significant at the ten-percent level. This supports the notion that the charity deductibility status is correlated with the religious composition of the state, which in turn affects the residents' price of giving. This implies that omitting the religious influence biases the estimation of the tax price elasticity and government spending and a more complete control than the Utah dummy is in order.

The motivations for giving to one's church are important for analysis. If religious giving is primarily a membership fee to the church, then the characteristics of the relevant religion and the giver's commitment to the church are the major determinants. If religious giving is also motivated by other reasons, such as altruism, then fiscal policy may be the more important determinant. Such motivation is possible if the church revenues above the minimum required to run the church are used for social services. It is an often neglected fact that churches are significant providers of public services, spending money on shelters, health centers, day care, schools and a range of other desirable services. According to a survey of congregations by the Independent Sector, roughly 17.4 percent of church expenditures are spent on charitable services which actually amounts to a sizeable expenditure of eight billion dollars in 1986, far more than either foundations or corporations spent on charity in 1985, $4.5 and $4.9 billion respectively.

It is also true that religious institutions tend to be trusted more than other institutions, according to Gallup survey results reported in Carson (1987). Beyond trusting the church, Carson (1987) reports that about one-fourth of the respondents believe that the church has

the greatest responsibility to care for the poor. Given the trust that many have for church, they may be willing to contribute their donation for the poor to the church because they believe the money will be well spent and because they prefer a large portion of the donation be used for church operations rather than give it to a charitable organization that spends much of its revenue on fund-raising. The scandal of United Way during the past year and its subsequent fall in donations illuminates the importance of trustworthiness (*Business Week*, January 1993).

If the governments' goal is to provide social services, then encouraging giving to religious organizations which only pass on 18 percent of their donations is unlikely to be the most revenue-efficient policy. However, it is possible that the government's goal is simply to direct funds toward churches because of a belief that religion is a social good.[24]

5.3 Correcting the Religion Omission: Tobit and SCLS Estimation

The results above suggest that religion is correlated with region of residence and fiscal policy, implying that religious influences should be considered in an accurate measure of the tax-price elasticity and crowd-out parameters. To control for previously omitted religious influences, indicator variables for some religions, Episcopal, Methodist, Catholic, Lutheran, Baptist, Mormon, Jewish and Presbyterian are added to specification of Table 6 for the GSS specification. These religions were chosen if their membership was a significant part of any state population. Anyone not in these groups, those in other religions or unaffiliated, are the basis for comparison. Church attendance is also included to proxy for the consumer's commitment to the church.

I estimate the model in two ways, implementing both the Tobit and the Symmetrically Censored Least Squares methodology (SCLS). For each specification, I use a Hausman Test comparing the two sets of results to test the null hypothesis that the error terms are normal and homoskedastic, the condition required for consistency of the Tobit estimates. The Hausman test rejects normality and homoskedasticity in only a fraction of cases and even in these cases, the policy results remain largely unchanged in the case of the SCLS estimates. Thus the

[24]Sociologists document that areas with more churched people tend to have less crime, suicide, and delinquency regardless of which denomination [Stark and Bainbridge (1985)], a fact which suggests that policymakers support church activity not just to encourage another provider of social services but to subsidize these other extended benefits.

summaries presented here concentrate on the Tobit results presented in Tables 6 and 7. Some SCLS results are provided in Table 8 for comparison, including two cases that rejected the null hypothesis.

The Tobit results including religious variables are presented alongside the previous GSS result in Table 6. The estimated coefficients for the religion variables in Table 6 are consistent with the anecdotal evidence. As expected, Mormons have a very large coefficient suggesting that Mormons give, on average, $1,263 more than the undesignated group, holding other factors constant. Being Baptist also has a positive significant effect on giving. Being Catholic reduces the expected gift relative to the undesignated group, though the parameter is statistically insignificant.

Controlling for religious determinants may improve the estimates of the tax price elasticity as it reduces the residual variance and corrects the potential omitted variable bias. The results show that the crowd-out effect falls in absolute value from -0.50 to -0.08 and is now insignificant while the tax-price elasticity falls in absolute value to -0.13 and the income elasticity increases to 0.46. However, for the tax price, the standard error is large making the change in the price elasticity alone relatively inconclusive.

Another way to control for the religion effect is to examine giving behavior within one religious group. Table 6 also presents results from estimating similar specifications for the specific groups, Catholics, Baptists, and Methodists, chosen because they are the largest groups. The results for both the tax-price elasticity and the crowd-out are varied but never significantly different from zero, consistent with the hypothesis that fiscal variables do not affect religious giving and only appeared to because of the omitted cross-sectional variation. The income elasticity remains positive and significant for all three religious groups.

The results of Table 6 support the notion that religious giving is determined primarily by personal characteristics, religious affiliation, and income, and that tax rates and government spending may not affect giving to the church. These results show that ultimately Roberts' intuition that religious giving is unresponsive was correct but still doesn't necessarily imply that other giving has a complete crowd-out.

The GSS analysis offers little information for giving behavior in other categories. The survey results in Hodgekinson and Weitzman (1986) suggest that the influences of religion

affect the charitable contributions outside the church. In many cases, those who give to their religion have characteristics that make them more likely to give outside their church. In order to proxy for the religion effect in the other data sets which have data on other forms of giving but no religious demography, I use the regional proxies described in the section 2. A better control would require a survey with the information of both the CES and GSS; however, these proxies will capture some of the regional religious variation that seems to confound the estimates of fiscal response.[25] I estimate the model with the inclusion of religious variables in all categories because of the evidence in Hodgekinson and Weitzman (1986). The results are unchanged for the educational giving category with this inclusion, but it does affect the results of human service giving.

Like the GSS results, for the SCF the inclusion of the religion proxies in the SCF estimation wipes out the crowd-out effect, reducing it to -0.01 in Table 7, much smaller in absolute value than the -0.20 value shown in Table 4. The taxprice and income elasticity remain relatively unchanged. The Catholic and Lutheran coefficients are negative and significant.

With the inclusion of the religion proxy variable in the CES estimation, the crowd-out of religious giving becomes smaller and insignificant while the crowd-out for human services increases to -0.32 and is now significant at the five-percent level. The tax price and income elasticities are little changed. The crowd-out effect for total giving is actually larger but now insignificant with larger standard errors. The crowd-out for education has remained small and inconclusive. According to Table 7, human services is the only category that has a clearly non-negligible crowd-out with families giving 32 cents more when government spending per capita falls by one dollar. In other words, people give more to human services in states where government spending is lower. Given that the average family size for the eighties is 2.7, the results suggest that at the margin, a one dollar reduction in government spending stimulates 12 cents of giving to human service organizations.[26] For the CES, the results are less clear for the size of the tax-price elasticity due to large standard errors. The total giving results for the SCF and CES diverge, but the aggregation masks the responses of many types of giving and thus is difficult to interpret. The parameter estimates of tax price elasticities in the specific

[25] A proxy will present a measurement error problem but it will still provide some of the cross-sectional variation previously missing.

[26] The figure on family size is reported in the *Statistical Abstract* (1989).

categories are all less than one, though the 95-percent confidence interval includes some values above unity.

Using the CES equations of table 7, I test whether the fiscal responses of the different types of giving are, in fact, different. Using a non-nested likelihood ratio test, I test the null hypothesis that the coefficients are the same across categories of giving for the case of the tax price and crowd-out parameters. I also test the null hypothesis for each restriction separately. I can reject the null hypothesis at the five-percent level for any cross-type comparison. In addition, I test the inclusion of religious variables in all specifications and find that I reject the joint hypothesis that the effect is zero at the five-percent level again.

Taking the parameter estimates at face value and using Roberts' comparison measure of equation (5), it appears that the tax incentives may not be revenue-efficient. Table 9 presents the maximum value for the price elasticity if tax subsidies were the revenue-efficient method of provision by employing the criteria described in equation (3). Using the estimates of Tables 4 and 7 and current rates of federal subsidy, the table shows that criteria values are all lower (or larger in absolute value) than the estimated price elasticities. The comparison suggests that tax subsidies are, in fact, not optimal; direct spending is more revenue-efficient. However, the price elasticity and crowd-outs for educational giving have larger standard errors and the range of possible parameter values easily include a range where tax subsidies are optimal. The policy implications for education are indeterminate. On the other hand, parameter estimates for religious giving are clearly suggest that the current tax subsidies for giving to the church are not revenue-efficient.

6 Conclusion

The results suggest that religious affiliation is a significant determinant of religious giving and, therefore, of aggregate giving. Controlling for religious affiliation, this study finds no significant response to tax policy for religious giving. Both human service and educational giving show tax-price elasticities less than one in absolute value. These weaker measures of response are consistent with the mild response of consumers to the 1986 TRA, though large standard errors for human-service and educational giving mean that the results are not inconsistent with previous estimates. Another principal finding of this study is that only giving

in the human-service category demonstrates evidence that altruism is a motive for giving with a significant crowd-out measure; the results find that reduction of a dollar of government support to health and welfare services stimulates about 12 cents of giving to human service organizations supporting the theories of "impure altruism". Only income is a consistent and constant economic determinant of giving for all categories.

In addition, giving behavior differs significantly between categories. This result suggests that analysis at a disaggregate level would aid policy debate on the merits of charitable deduction, or other changes to the tax subsidy and government spending, by identifying the potential winners and losers.

Finally, the crowd-out parameters estimates imply that tax subsidies may not be revenue-efficient for any of the categories studied here, particularly in the case of religious giving. The results imply that direct public spending is more revenue-efficient but other factors are also important to the policy debate. The direction of funds for a public service may be very different for the government versus a private organization. Lipsky and Stein (1989) state that increases in direct public spending means that government intrusions increase, altering the character of the American welfare state. They claim that a heightened role of the government in the non-profit sector limits the range of potential responses to any given social cause.

More detailed charity data is required to improve the present analysis. The survey data used here has the problem that there is no cost of an inaccurate report of giving. IRS panel data allows analysis of giving that is more precisely reported. However, the IRS panel would be a more useful data set if the data were disaggregated into categories as it was in 1962.

Future work will focus on the question of whether the measure of crowd-out is solely due to altruism or rather due to changes in solicitation efforts on the part of non-profits. If solicitation efforts did increase in response to TRA, it would be another explanation of the unexpectedly mild response of giving to the tax reforms. A change in solicitation efforts implies that a smaller portion of charitable donation is going to its desired destination.

Appendix A: Method of State Identification with the CES

Some *indirect* information regarding state of residence may be gleaned from several of the variables in the CES. Consider the following example. The CES lists the respondent's region of residence (Northeast, South, Midwest, West). Knowing the region gives some information about the state: e.g., if the respondent lives in the South, he must live in one of the southern states. The posterior probability the respondent lives in a given state in the region given random sampling from the region is a ratio of the population of the state to that of the region as a whole. These posteriors can be used to construct expected values of right-hand-side variables such as state spending on public goods.

Indeed, this first series of probabilities would provide only crude estimates of the expected value of fiscal variables since region of residence is a coarse classification; though this analysis already represents an improvement over the studies using national rather than state data. But we can achieve even more precise expected values by conditioning on other pieces of information. To wit: along with the *region* of residence, the CES codes population, here denoted n, of the respondent's SMSA as follows:

1. Urban (in an SMSA)

(1a)	$n \geq 4$ million	*(1d)*	.4 million $> n \geq$ 75 thousand
(1b)	4 million $> n \geq$ 1.25 million	*(1e)*	75 thousand $> n$
(1c)	1.25 million $> n \geq$ .4 million		

2. Rural (not in an SMSA)

The BLS surveys only a subset of United States urban areas: only 85 urban areas and a number of rural areas are used in the construction of the CES. Hence, SMSA population variable can be used to narrow down the possible states of residence for the urban dwellers.[27] For example, there is no SMSA with population under 75,000 in California that is surveyed, so a respondent living in the West whose SMSA is in the *(1e)* category must live in California with probability zero.

Besides region and population of SMSA, other variables are potentially informative, including variables indicating payment of a state income tax variable and giving the level of payments

[27] CES provides no regional information for the rural part of the sample and they have to be excluded for this study.

for registration, driver's license and inspection to the state. The subsequent example details a method, based on Bayes' Rule, that produces sucessively finer estimates of a respondent's state given indirect information from the CES. Suppose for simplicity that the CES has two informative variables, P and T. For concreteness, let P represent the event "respondent lives in area with some population", T the event "respondent pays state income tax" and st_i the event "respondent resides in state i." The probability of the respondent's living in state i given he paid state taxes and lives in a city of the coded size is derived and shown in equation (6).

Table 1 presents a first pass at computing state-residence probabilities to illustrate the use of the Bayes' Rule methodology with data on the region of residence and SMSA population. The data are split horizontally into the four regions: Northeast, Midwest, South, and West. Each column of probabilities sums to one within a region. These probabilities can be used to compute expected values of regression variables. For example, a respondent who lives in the Midwest in a sampling area of more than four million must live in Illinois or Michigan because no other Midwestern state has such large cities. (See the boxed figures in Table 1.) The probability of residing in Illinois is larger than one half, reflecting the greater population of Chicago versus Detroit (and therefore the greater chance of surveying someone from Illinois). The expected value of government spending can be computed as the weighted average of Illinois and Michigan spending where the weights are the boxed entries in Table 1.

State income tax information enables improvements to the first pass at computing state residence probabilities. In 1985, seven states did not tax income and three states did not tax wages. The variation in state tax policy makes the responder's report of state income tax payments useful information, i.e., if she resides in one of the seven states without an income tax, she is extremely unlikely to owe state income taxes. Making use of this clue in Bayes' formula requires computing Pr(pay tax$|st_i$). I calculate the probability with two pieces of information: state i's tax policy and the probability a consumer unit would owe state tax if it were levied. *Facts and Figures in Government Finance* (1990) provides the state tax policy for 1985, the first piece of information. Making the assumption that anyone who owes federal income tax would also owe state tax if it is collected, the percent of households that pay federal tax by income category approximates the second piece.

The resulting probabilities from my second pass, though too unwieldy to present in tables,

Table 1: Probability of Residing in State Given Region and Sampling-Area Population

		n = Size of Sampling Area (Millions)				
Region	State	$n \geq 4$	$4 > n \geq 1.25$	$1.25 > n \geq .38$	$.38 > n \geq .075$	$.075 > n$
Northeast	CT	.	.	.	0.16	0.19
	ME	.	.	.	0.22	.
	MA	.	0.31	0.11	.	0.25
	NH	.	.	.	.	.
	NJ	0.27	.	.	.	.
	NY	0.44	0.43	0.44	0.37	0.27
	PA	0.29	0.26	0.26	0.25	0.29
	RI	.	.	0.19	.	.
	VT	.	.	.	.	.
Midwest	IL	0.62	.	.	0.18	.
	IN	.	.	0.26	0.25	.
	IA	.	.	0.09	.	0.28
	KS	.	.	.	.	.
	MI	0.38	.	0.14	0.32	.
	MN	.	0.20	.	.	0.11
	MO	.	0.35	.	.	.
	NE	.	.	.	.	0.29
	ND	.	.	.	.	.
	OH	.	0.31	0.52	.	.
	SD	.	.	.	.	.
	WI	.	0.13	.	0.24	.
South	AL	.	.	.	0.22	.
	AR	.	.	.	0.06	.
	DE	.	.	.	.	.
	DC	.	0.04	.	.	.
	FL	.	0.19	0.10	.	.
	GA	.	0.12	.	0.08	.
	KY	.	.	0.15	.	.
	LA	.	0.07	0.08	.	.
	MD	.	0.19	.	.	.
	MS	.	.	.	0.05	.
	NC	.	.	0.09	.	0.24
	OK	.	.	.	.	.
	SC	.	.	.	.	0.21
	TN	.	.	0.29	.	.
	TX	.	0.34	0.18	0.38	.
	VA	.	0.06	0.11	.	0.55
	WV	.	.	.	0.22	.
West	AK	.	.	.	0.22	.
	AZ	.	.	0.24	.	.
	CA	1.00	0.64	0.42	0.37	.
	CO	.	0.13	.	0.41	.
	HI	.	.	0.34	.	.
	ID	.	.	.	.	.
	MT	.	.	.	.	0.30
	NV	.	.	.	.	.
	NM	.	.	.	.	0.19
	OR	.	0.10	.	.	0.32
	UT	.	.	.	.	0.19
	WA	.	0.13	.	.	.
	WY	.	.	.	.	.

are the weights used in my estimations. Future work may use yet more information to improve the probability weights. This methodology can be used in general to maximize the information obtained from data subject to confidential withholding or other missing information. The current project is but one application.

Appendix B: Symmetrically Censored Least Squares

The following is an outline of the SCLS procedure, a semiparametric estimation technique which handles censored data consistently when the error terms are not normally distributed or are heteroskedastic. Let Y^* represent the latent, unobserved, or desired dependent variable, in this case, charitable contributions. Y represents the observed dependent variable, which differs from Y^* due to censoring. With X representing the independent variables, β represents the SCLS estimates, and ϵ an error term, Y and Y^* are defined as

$$Y^* = X\beta + \epsilon, \tag{10}$$

$$Y = \begin{cases} Y^* & \text{if } Y^* > 0 \\ 0 & \text{if } Y^* \leq 0. \end{cases} \tag{11}$$

Solve for β by maximizing the following expression:

$$\sum_{t=1}^{T}(Y_t - \max(Y_t, X_t'\beta)) + \sum_{t=1}^{T} I\left(\frac{1}{2}Y_t^2 - [\max(0, X'\beta)]^2\right) \tag{12}$$

where

$$I = \begin{cases} 1 & \text{if } Y_t > 2 \cdot X_t'\beta \\ 0 & \text{otherwise.} \end{cases} \tag{13}$$

As with the Tobit, these β equal $\frac{\partial E(Y^*|X)}{\partial X}$, measuring the relationship between X and the unobserved dependent variable. The more interesting effect for policy implications is $\frac{\partial E(Y|X)}{\partial X}$, which is not determined using the SCLS methodology. Because the assumption of normality has been relaxed, computing the marginal effects is not as simple as in the Tobit procedure. The remainder of the appendix describes how to compute the marginal effects of the SCLS estimates. Equations (13) and (14) provide information to reduce equation (15) to equation (17).

$$E(Y|X) = E(Y^*|X, Y^* \leq 0) \cdot \Pr(Y^* \leq 0|X) + E(Y^*|X, Y^* > 0) \cdot \Pr(Y^* > 0|X) \tag{14}$$

$$= 0 + E(Y^*|X, Y^* > 0) \cdot \Pr(Y^* > 0|X) \tag{15}$$

$$= X\beta \cdot \Pr(\epsilon < -X\beta) \tag{16}$$

$$\equiv g(X\beta) \tag{17}$$

$$\equiv G(\frac{X\beta}{\sigma}). \tag{18}$$

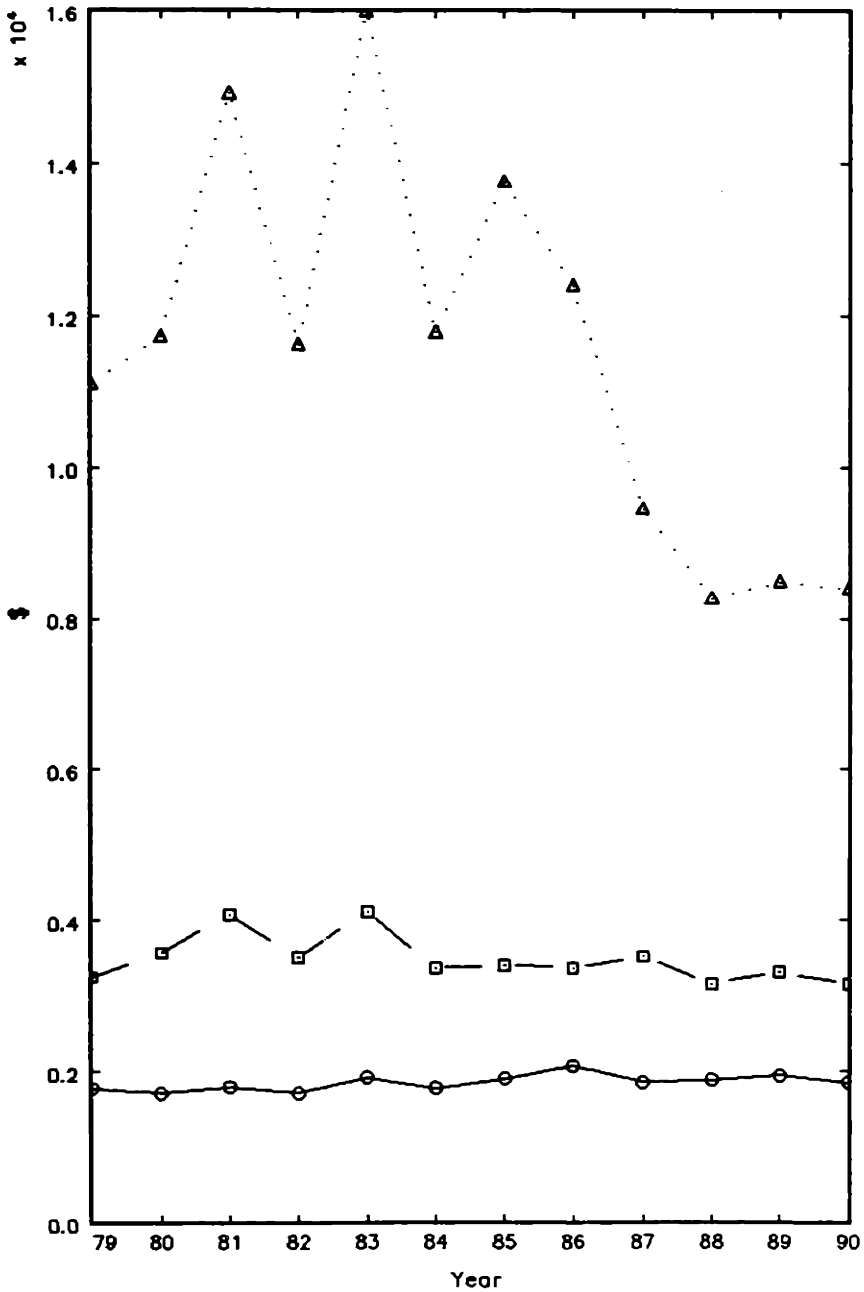
I compute $\frac{X\beta}{\sigma}$ from the SCLS estimates. Nonparametric techniques are used to estimate G. I chose the Nadaraya-Watson estimator, employing an Epanechnikov kernel and a Rosenblatt-Parson kernel density estimator. I compute the bandwidth for the kernel by the leave-out cross-validation method.[28] With a nonparametric estimation of G, its slope at any given value of X, can be determined. Solving for the derivative of interest at $\bar{X}$ yields

$$\frac{\partial E(Y|\bar{X})}{\partial X} = G'(\frac{\bar{X}\beta}{\sigma}) \cdot \frac{\beta}{\sigma} \tag{19}$$

$$\equiv \gamma \cdot \beta. \tag{20}$$

[28]See Härdle(1990) for details on these procedures.

Figure 1a: Average Gift During the 80's



Source: Auten et al. (1992).

Figure 1b: Median Gift During the 80's

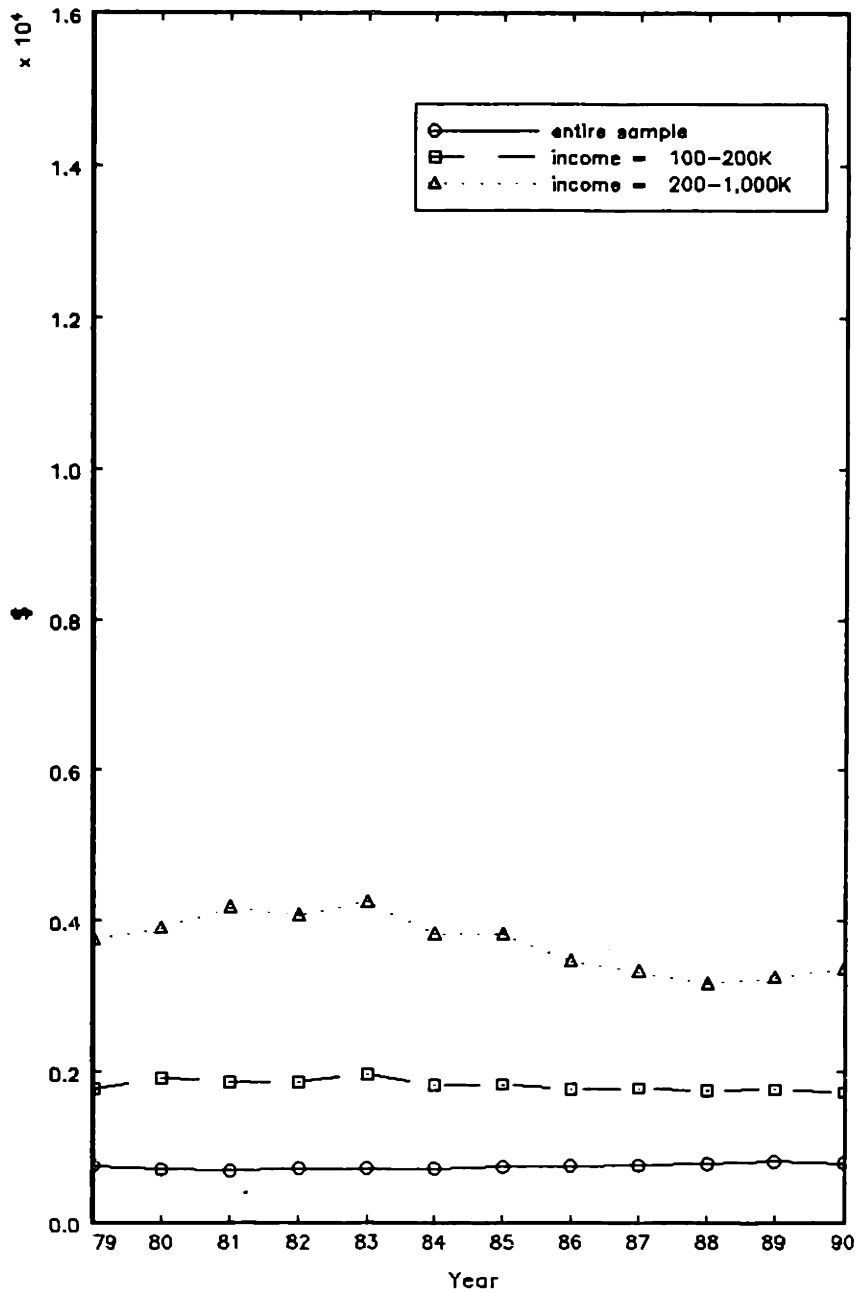
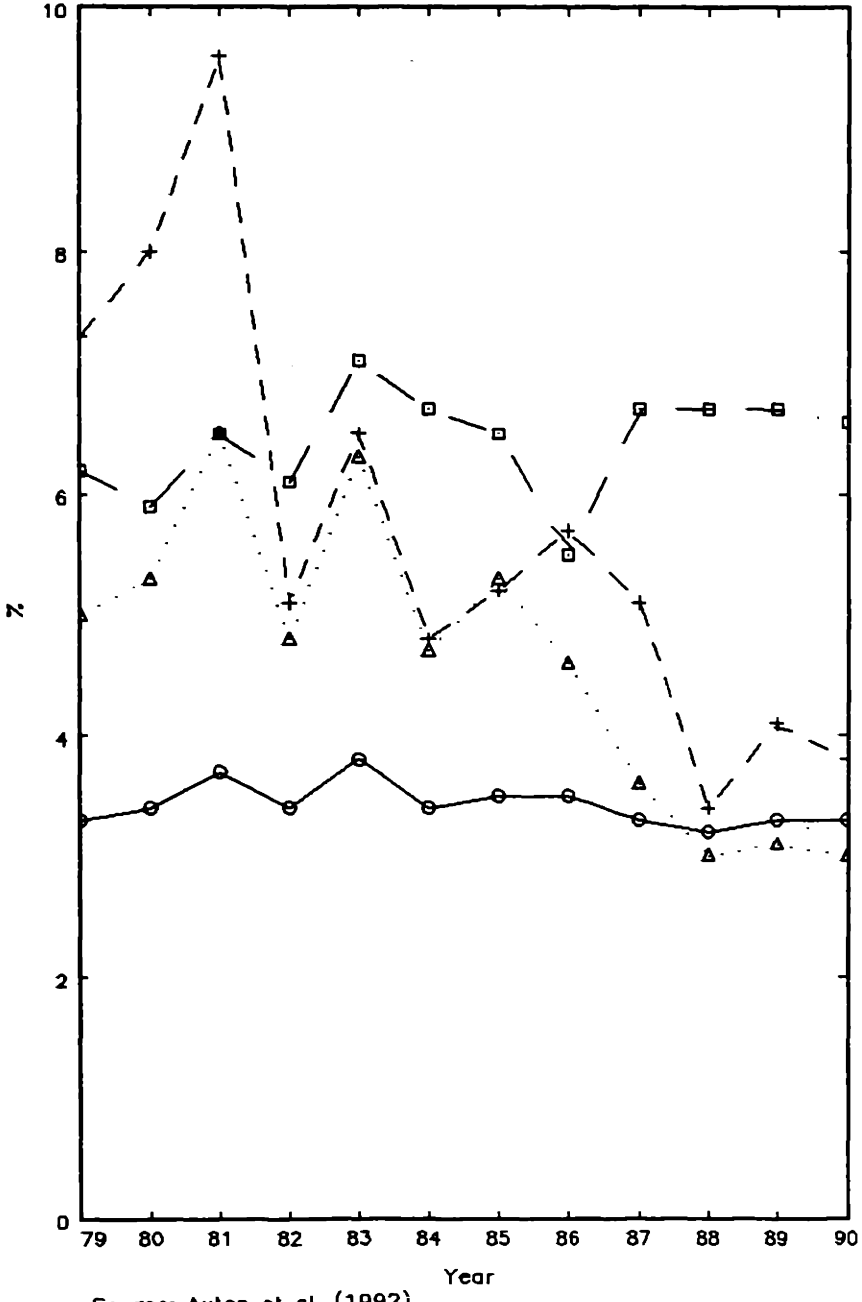


Figure 2a: Mean of Contributions/Income During the 80's



Source: Auten et al. (1992).

Figure 2b: Median of Contributions/Income During the 80's

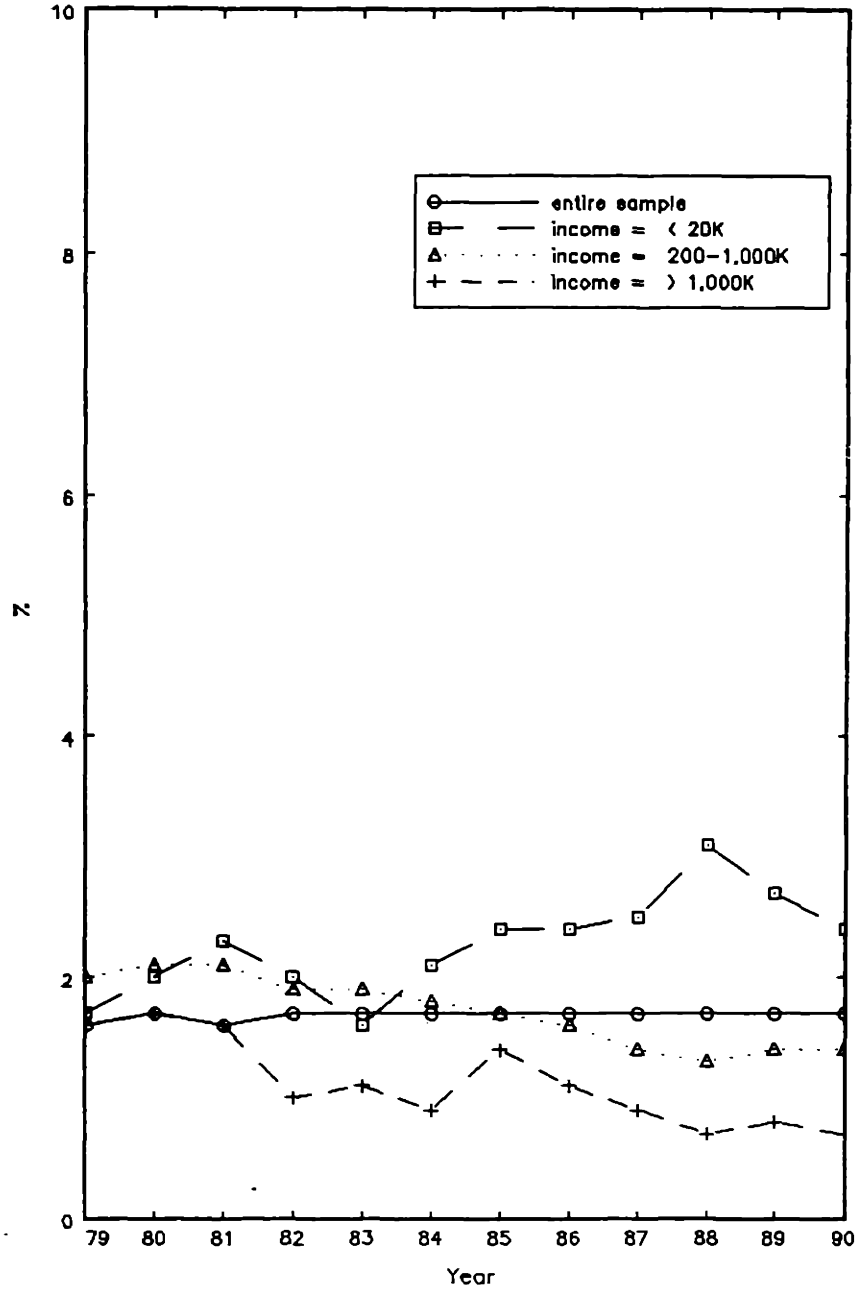


Table 2: 1985 Contributions By Income Class

Income Class ($000)	Average Gift ($)	Number of Givers	Total Gift ($000)	% of Total	Cumulative % of Total
< 15	398	17,483	6,958	12.1	12.1
15–24	600	14,094	8,451	14.7	26.8
25–50	855	22,375	19,128	33.2	60.0
50–100	1715	6,608	11,336	19.7	79.7
> 100	9764	1,185	11,688	20.3	100.0
Total	934	61,745	57,661	100.0	100.0

Source: *Giving USA* (1987), Tables 5–8 for Itemizers and Non-Itemizers, and author calculations.

Table 3: Summary Statistics for the Survey Data

Variable	GSS				CES				SCF			
	Mean	Median	75%	90%	Mean	Median	75%	90%	Mean	Median	75%	90%
AGE	44.7	41	58	71	46	43	61	73	49.4	47	62	73
INCOME	27,655	23,750	37,500	55,000	26154	20000	36000	54420	28,777	23274	36361	53000
EDUCATION	12	12	12	16	12.9	12	14	19	12	12	14	16
GIVING:												
Religion	446	100	400	1,000	294	0	250	800	-	-	-	-
Education	-	-	-	-	16	0	0	0	-	-	-	-
Welfare	-	-	-	-	88	0	50	200	-	-	-	-
Total	-	-	-	-	405	50	370	1085	568	166	500	1333
Contributors												
AGE	46.2	43	61	72	48.7	46	62	74	48.7	48	62	72
INCOME	28,377	23,750	45,000	55,000	30993	25417	42055	61050	35794	30000	42467	62000
EDUCATION	12.1	12	12	16	13.4	14	16	19	13	14	16	16
GIVING:												
Religion	621	200	600	1,500	474	150	500	1200	-	-	-	-
Education	-	-	-	-	26	0	0	15	-	-	-	-
Welfare	-	-	-	-	143	30	105	305	-	-	-	-
Total	-	-	-	-	655	250	700	1616	948	400	1000	2000
Non-Contributors												
AGE	39.7	35	48	66	42	51	64	71	45	45	63	74
INCOME	25,308	21,250	37500	55,000	18120	15313	33069	39220	18268	14541	24000	35000
EDUCATION	11.8	12	12	16	12.2	12	16	16	10.6	12	12	16

Notes: The data is based on author calculations on the respective datasets.

Table 4: The Traditional Charity Specification Including Government Crowd-Out

Explanatory Variable	Dependent Variables					
	SCF	CES				GSS
	Total	Total	Religious	Human Service	Education	Religious
			COEFFICIENTS			
Crowd-out	-0.20	-0.16	-0.62	-0.09	-0.13	-0.45
	(0.09)	(0.07)	(0.16)	(0.65)	(0.08)	(0.13)
TaxPrice	-28	-5.1	-2.4	-3.4	-2.0	-3.5
	(6.0)	(2.3)	(2.5)	(9.7)	(1.6)	(2.3)
Income	0.03	0.013	0.010	0.005	0.004	0.010
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
Age	22	18	18	6.4	6.0	17
	(2.4)	(1.0)	(1.1)	(0.44)	(0.88)	(1.5)
Married	408	219	346	38	14	403
	(84)	(38)	(42)	(16)	(31)	(52)
Education	122	75	59	35	67	57
	(13)	(6.1)	(7.0)	(2.6)	(5.4)	(9.4)
Constant	- 471	-1590	-1861	-744	-1785.	-1171
	(663)	(267)	(289)	(111)	(198)	(278)
N	2295	4874	4964	4979	5082	3207
Scale Term	0.48	0.49	0.38	0.33	0.04	0.55
			ELASTICITIES			
TaxPrice	-2.3	-0.50	-0.26	-1.01	-.092	-0.29
	(0.49)	(0.23)	(0.28)	(0.29)	(0.74)	(0.18)
Income	0.60	0.37	0.31	0.44	0.52	0.29
	(0.05)	(0.05)	(0.06)	(0.06)	(0.17)	(0.05)

Notes: All Specifications are estimated by the Tobit model described in the text. Marginal Effects can be computed as the product of coefficients and its scaleterm. Computing the elasticity is described in the text. Standard errors are reported in parenthesis. The dependent variable is the annual donation of a consumer unit in a particular category. *Taxprice* is the subsidy rate for the first dollar of contributions, and $Crowd - out$ is government spending in thousands of dollars per capita.

Table 5: Giving by Religious Affiliation

Religion	Number	Attendance Per Year	Average Income	Average Gift	Giving as % of Income
Baptists	1057	27	22,037	574	2.33
Catholic	1146	26	29,479	291	0.88
Episcopalian	110	13	35,454	413	0.94
Jewish	74	9	46,952	534	1.12
Lutheran	201	23	31,493	449	1.19
Methodist	430	19	29,608	367	1.07
Mormon	93	37	29,090	1713	5.30
Presbyterian	169	20	33,325	536	1.37
Unaffiliated	359	2	28,599	42	0.13
Total	4837	25	27,655	446	1.44
		ATTENDANTS ONLY			
Baptists	959	30	22,381	627	2.50
Catholic	1034	29	30,020	319	0.94
Episcopalian	97	14	35,642	467	1.05
Jewish	66	10	42,496	564	1.20
Lutheran	180	26	31,507	501	1.34
Methodist	376	12	30,315	419	1.18
Mormon	85	40	30,336	1847	5.57
Presbyterian	159	21	33,190	557	1.46
Unaffiliated	122	6	29,185	109	0.30
Total	4135	29	28,029	517	1.64

Source: Author calculations using information in the *General Social Survey* (1987–89).

Table 6: The Basic Charity Specification with Religion Effects

Explanatory Variable	Dependent Variable-Religious Giving				
	Full Sample		GSS Catholics	Methodists	Baptists
Crowd-out	-0.50	-0.08	-0.04	-0.27	0.02
	(0.13)	(0.11)	(0.11)	(0.24)	(0.41)
TaxPrice	-3.5	-1.4	0.20	-4.2	3.0
	(2.3)	(1.9)	(2.1)	(3.8)	(6.2)
Income	0.011	0.014	0.008	0.008	0.026
	(0.002)	(0.002)	(0.002)	(0.003)	(0.005)
Attendance	-	22	12	19	22
		(0.73)	(0.92)	(1.9)	(2.0)
Baptist	-	414	-	-	-
		(60)			
Catholic	-	-29	-	-	-
		(53)			
Lutheran	-	-132	-	-	-
		(99)			
Mormon	-	1263	-	-	-
		(136)			
Methodist	-	132	-	-	-
		(70)			
N	3207	3207	833	358	576
Scale Term	0.55	0.55	0.61	0.62	0.58
ELASTICITIES					
TaxPrice	-0.29	-0.13	0.03	-0.54	0.22
	(0.18)	(0.19)	(0.33)	(0.48)	(0.45)
Income	0.29	0.46	0.42	0.37	0.53
	(0.05)	(0.05)	(0.09)	(0.14)	(0.10)

Notes: All specifications include Age_i, $Education_i$, and $Married_i$ which are not reported as they are essentially unchanged. All Specifications are estimated by the Tobit model described in the text. Marginal Effects can be computed as the product of coefficients and its scaleterm. Computing the elasticity is described in the text. Standard errors are reported in parenthesis.

Table 7: The Basic Charity Specification With Inclusion of Religion Demographic Proxies

Explanatory Variable	Dependent Variables				
	SCF	CES			
	Total	Total	Religious	Human Services	Educational
		COEFFICIENTS			
Crowd-out	-0.01	-0.56	-0.43	-0.32	-0.14
	(0.14)	(0.37)	(0.41)	(0.16)	(0.11)
TaxPrice	-26	-5.3	-2.8	-3.2	-2.0
	(6.0)	(2.3)	(2.5)	(.97)	(1.6)
Income	0.028	0.013	0.010	0 .005	0.004
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Attendance	-0.47	-6.9	-11	-2.5	-3.6
	(13)	(26)	(29)	(11.2)	(19.6)
Baptist	-23	-12	-0.39	-3.2	-1.3
	(11)	(17)	(19)	(7.4)	(13.3)
Catholic	-25	-12	-6.9	-18	-1.8
	(8.8)	(8.2)	(9.0)	(3.5)	(7.1)
Lutheran	-35	31	-42	12.9	4.6
	(14)	(24)	(26)	(10.1)	(18.4)
Mormon	-8.0	15	31	-5.7	-2.9
	(7.9)	(15)	(16)	(6.4)	(9.9)
N	2295	4874	4964	4979	5082
ScaleTerm	0.48	0.49	0.38	0.33	0.04
		ELASTICITIES			
TaxPrice	-2.2	-0.53	-0.31	-0.98	-0.92
	(0.49)	(0.23)	(0.28)	(0.29)	(0.75)
Income	0.62	0.37	0.32	0.44	0.51
	(0.05)	(0.05)	(0.06)	(0.06)	(0.17)

Notes: All specifications include Age_i, $Education_i$, and $Married_i$ which are not reported as they are essentially unchanged. All Estimated by the Tobit model described in the text. Marginal Effects can be computed as the product of coefficients and its scaleterm. Computing the elasticity is described in the text. Standard errors in parenthesis.

Table 8: Results of Symmmetrically Censored Least Squares

Explanatory Variable	GSS	SCF	CES
	Coefficients		
Crowd-out	0.19	0.35	-0.87
	(0.79)	(0.41)	(0.90)
TaxPrice	-16	-19	-1.1
	(11)	(9.4)	(4.3)
Income	0.042	0.015	0.01
	(0.011)	(0.0038)	(0.004)
Attendance	36	20	-8.2
	(6.4)	(20)	(63)
Baptist	548	-13	26
	(331)	(16)	(41)
Catholic	-1291	-22	-1.7
	(324)	(12)	(16)
Lutheran	-502	-23	148
	(409)	(16)	(68)
Mormon	2216	-5.9	58
	(613)	(10)	(35)
Methodist	-259	-	-
	(363)		
N	3207	2295	4874
ScaleTerm	0.17	0.59	0.95
P-value	0.06	0.30	0.00

Notes: Estimated using the SCLS procedure described in Appendix B.

Table 9: Implications of Results using Robert's Model

	GSS Religious Giving	CES Human Services	CES Educational Giving
Estimated Crowd-Out:	-0.13	-0.32	-0.14
Estimated Price-Elasticity:	-0.13	-0.98	-0.92
Maximum Price-Elasticity:			
a) tax rate = 15	-1.10	-1.40	-1.17
b) tax rate = 28	-1.12	-1.51	-1.21
c) tax rate = 33	-1.12	-1.57	-1.22

Notes: Estimated parameters are based on the results of Tables 5 and 6. Maximum price elasticities are computed based on Equation 5 derived from Roberts (1987).

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